Transmission and Impact of the Financial Risk of the European, Asian and American Stock Markets in the Return of Mexican IPyC Index

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Abstract

This paper discusses the existing correlation between the risk and return of the shareholding indices of the stock markets in the United States (Dow, Nasdaq and SP500), Germany (Dax), France (CAC40), London (FTSE), Brasil (Bovespa), Hong Kong (Hang Seng), Mexico (IPyC), and Japan (Nikkei) from January 31, 1994 to March 27, 2006. The results suggest that conditional volatility is higher in the SP500 index and the Hang Seng index, whereas greater historical volatility corresponds to the Bovespa and the IPyC. The coefficient of variation considered for the Nikkei index and the Hang Seng shows a greater relative risk, since each unit of risk is minor to the return received. The statistical tests indicate that there is a considerable correlation between the indices of the European developed markets and the ones in the United States of America during the financial crisis of the Mexican peso and the Asian, Russian and Brazilian crisis. Meanwhile, the terrorist attacks to the WTC in New York increased the risk of the Dax and Nasdaq indices. Granger-Sims tests of causality show that a mechanism of transmission of volatility among the American and European markets that does not influence directly in the return of the Mexican stock market.

Keywords: Volatility Models, Stock Market, Financial Crisis, GARCH and Risk.

JEL Classification: C10, C22, C32 and C53

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1. Introduction

In the last fifteen years the financial crisis at world-wide level have become something recurrent, as a result of the economic globalization and the increasing mobility of capitals from one market to another. Development of new information technologies, the Internet, as well as the communications by satellite have been deepened the mobility of capitals, but also a greater sensitivity to the variations in the cash flow of short term, since these instruments produce changes in the financial transactions quickly.

The commercial opening also has brought with itself a distortion in the demand which has been reflected in a greater competition between companies and also in an excess of capacity no use due to the technological advances and to the improvement in the productivity at world-wide level. The free trade has been caused that the firm's utility and consequently its returns decreased during the process of opening fredom. Under this scenario the investors have transferred their capitals from the real economy (production of goods and services) to the organized stock market and overt the counter (OTC); they are searching for positive and extraordinary returns that the companies can not generate in an atmosphere of free market.

In recent years, a lot of money move to Asian's economics and Emerging Markets due to the high rates of yield. The raise of the capital flows have generated a great instability in the stock's price listed in the stock market, because of that the main indices of the American, European and Asian exchange markets have showed an increaed in the volatility. Theses changes in the stock indices have been affected to exchange rates, interes rate and cash flows in the short term. In 1990's years were characterized by more than 119 financial crisis of different intensity, some relevant crisis in this period were the Mexican peso crisis of December of 1994, the Asian crisis in Thailand in 1996-1997, the crisis of Brazilian real and the Russian default payments in 1998. Whereas the new century began with a terrorist attack to the twin towers of World Trade Center (WTC) in New York City, considered the financial heart of the United States of America. This not only generated uncertainty in the North American citizens, but also in all of the foreing investors.

The effect Tequila, Zamba and Vodka is a nick name use to identified the different crisis in Mexico, Brazil and Russia that generated a lot of inestability in the emerging market and development economics, because the volatility was transmitted to all international financial system. This particular situation increased the country risk, as well as the market or nonsystematic risk associated to the variations in the interest rates, inflation, gross internal product and other relevant macroeconomic variables that ended up affecting the performance of the companies and their investment decision.

The uncertainty or risk in the trend of the financial and economic variable throughout the time is a key element for the financial planning of the companies and all economic agents (families, firms and government). The financial instability of 1990's years affected the firms in a different way depending of the size, strategies and hedging program. In the case of the companies that quote in the mexican stock-market were exposed to high risk in the stock's price as a result of the negative indicators of the companies and the bad expectations on the future, in addition to the outflow of resources that caused an erratic behavior of the prices going down. Finally, the consequence was an impact in the Index of Prices and Quotations of Mexican stock market (Indice de precios y cotizaciones, PyC) and the stock returns of the public companies.

Volatility is a concept that describe a suddenly change in the trend of variable. Mathematically, the volatility is measured by the variance of the error of forecast, because the empirical evidence has demostrated that forecast of some variables are difficult to predict from a period to another when we use financial end economic series of time. This means that some periods of time, the error of forecast is relatively small and during others period of time the prediction errors are relatively high but during another period of time they become small again and so on.

The most relevant causes of volatility are the political and economic problems, also changes in monetary and fiscal policies, rumors and variations in the flows of capital in the real sector and financial sector. All of this suggest that the variance of the prediction errors are not constant, but it change from one period to another, this means that there is some kind of autocorrelation in the variance of the prediction of errors, that was catched in the conditional variance models developed in first instance by Engle in the year of 1982 and generalized by Bollerslev in the year of 1986. In the most important models of conditional variance are the autoregressive models of conditioned heteroscedasticity, also known as ARCH. The nickname of generalized autoregressive of conditional heteroscedasticity is calls GARCH Models.

The purpose of this *paper* is to estimate the volatility of the Mexican sotck market and analyze the correlation with other international indices from America, Europe and Asia stock markets; and its effects on the Index of Prices and Quotations (IPC) of Mexico stock market. In addition, I make statistical test in order to verify if the hypotesis that show the direct relation between the level of risk and return explain the mobility of capital flows that the investors generate in the market. Finally, I will try to look for the mechanism of transmission of the volatility between different stock markets.

2. Exposition of the Problem and Hypothesis

The question of this research is significant because most of the occasions the economic agents have a priori information of the return that they will have on a financial investment. For example, an investor could know the interest rate that will be quote in the future but not know in quantitative terms the amount’s exposure of risk that they are assuming. Because of that the risks is a random variable that could be model with the statistical tools. This situation cause that many decisions will be inefficient, affecting the financial performance of the firms and individuals and that in the worst case it could lost a lot of economic resources affecting the society as a whole.

A relevant variable in the economic and financial decision making of the economic agents is the risk that they effort throughout a period of time. Traditional literature indicates that the standard desviation is a statistical measurement to quantify the risk. Nevertheless, to obtain the historical standard desviation for all the period from study by a conventional formula has the disadvantage that it can not be compared with another measurement, so we can not know if the risk is high or low in a particular period of time or date. The econometrics models of conditional volatility like GARCH are an alternative to measure the level of risk associated to the stock return for each observation. This situation also allows using the coefficient of variation (CV) as a relative risk measurement.

Conventionally accepted financial literature, also indicates that there is a direct relation between the level of risk and the return of an asset, reason why a greater risk must be compensated by a level of greater returns. Nevertheless, the empirical evidence not necessarily is consistent with the theory, situation that would reflect that a greater degree of risk has an exogenous component that is not related to a level of return of a particular asset.

Hypothesis

The first hypothesis is that the correlation between the returns and the different markets' levels of risk exists.

Null Hypothesis 1 is:
Ho. The correlation of two markets i = 0
Ha. The correlation of two markets i ≠0

Where: i = Bovespa, CAC40, Dax, Dow, FTSE, Hang Seng, Nasdaq, Nikkei and S&P500.

A complementary hypothesis to the first one is to make a test of statistical causality denominated Granger-Sims, to see if the risk causes the changes in the market shareholding returns. The financial theory generally accepted and the analysis average-variance suggests that the causality direction must be unidirectional in the sense that to greater risk or volatileness a positive effect must correspond on the return of the company's stocks.

The Null Hypothesis to prove is:

Ho. Causality between the volatility and the stock return of the index (i) does not exist.
Ha. Causality between the volatility and the stock return of the index (i) exists

Where: i = Bovespa, CAC40, Dax, Dow, FTSE, Hang Seng, NASDAQ, Nikkei and S&P500.

A second hypothesis that is desired to verify if the level of stock return average of each market and the risk measured by mean and variance (variable *proxy*) are equal to the Mexican market Index and to each other.

Null Hypothesis 2 is:

Ho. The IPC return = the market return i
Ha. The IPC return ≠ the market return i

Ho. The IPC variance = the market variance i
Ha. The IPC variance ≠ the market variance i

Where: i = Bovespa, CAC40, Dax, Dow, FTSE, Hang Seng, NASDAQ, Nikkei and S&P500.

The set of raised hypotheses will be proven statistically at a significance level of 0.05, and using complementarily multiple regression techniques, from the weekly information of each stock market.

3. Data and Methodology

The sample using in this paper include weekly data of the 31 of January from 1994 to the 27 of March of 2006, which correspond to the following stock markets indices: Brazil (Bovespa, the United States of America (Dow, Nasdaq and Standar & Poor's, France (CAC40, Germany (Dax), London (FTSE, Hong Kong (Hang Seng), Japan (Nikkei) and Mexico (IPyC) taken from Finance.Yahoo.com. The data was taken weekly in order to count with a homogenous sample size of all the stock markets, avoid problems with the non operating days and guarantee the sample size (635 observations) big enough so that it could be possible to get robust econometric results and conclusions. In addition, the selected sample includes the years in which some of the most important financial crisis that the markets suffer during the 90's years and in recent years.

This study uses weekly series of time of different stock market returns that were considered by means of the rate of growth of the indices. With the returns a set of residual could be generated and this will be the basis to estimate the conditional variances with the GARCH econometric model that will be detailed. The set of conditional variances considered previously will be a *proxy* variable of the risk or volatility of the mexican stock market, since it is the standard desviation the one that measures the respective risk.

The conditional standard desviations and the returns were taken like independent variables to explain the variations in the Mexico's stock market return by a model of multiple regressions estimated under the technique of ordinary square minimums and additionally to estimate a simple regression to determine the relation between the risk and return of each stock market.

The coefficients of correlation between the market returns and risks were estimated by the coefficient of Pearson, and a significance test to the 0,05 was made by a *t* test. In addition, hypothesis tests were made to determine the difference of averages in the returns by means of the significance test t and the difference of variances by means of a F test.

The tests of statistical causality of Granger-Sims were used to verify if the direction of the causality between the risk and the return follows what the generally accepted financial theory synthesizes: to greater risk a greater return is due to generate, it means that it is unidirectional in the sense that the risk affects the return and not vice versa.

4. Conceptual Framework of the Risk and Stock's Indices

The risk of an investment is defined as the probability of receiving a return different from the expected one, that is to say, the variability between the returns. Reason why while greater it is the variability of the possible results, riskier the investment will be. That is why the estimation of the standard desviation is a measurement of the risk.

The market risk or nondiversifyable risk, has its origin in factors that affect systematically the assets, these factors could be wars, inflation, recession, discharges interest rates. The average-variance theory indicates that the expected return of an investment is positively related to the risk of the same one, that is to say, the great expected return represents the compensation that an investor receives for assuming a major risk.

The indices that are used in the article are those that show greater capitalization and are more representative of each continent. As for the markets of America five indices were taken two of which correspond to Latin America emergent markets, Bovespa of Brazil and the IPyC of Mexico, as well as three indices of the most dynamic market of the world that are the United States of America through the Standar & Poor's 500, Nasdaq Composite of Technology and Dow Jones of Industries 30.

The idea of intorducing three indices of the American market is to catch different sectors as it is the case of technology companies that quote in the Nasdaq Composite, whereas the Dow Jones of Industries includes 30 leader companies known as the "Blue Chips". Finally the Standar & Poor's 500 include the 500 more important companies.

As far as the European market refers, it has many stock-exchange systems, the most important are located in the western zone of Europe which monopolize most of the capitals and companies, between which the stock exchange of London, Germany and Euronext and Spain stand out. These stock exchanges concentrate 70% of European companies and 75% of the investment in stocks and long bonds. Considering the capitalization levels the main market is New York Stock Exchange followed by the NASDAQ, Nikkei and London, the first one of Europe.

The market of London is one of oldest of Europe and has the greater volume of operation, index FTSE 100 is one of the main indicators of the stock market. The Euronext system formed after the union of the Stock exchange of Ámsterdam, Brussels and Paris in September 2000. Index CAC40 of Paris is one of the most popular indices in Europe and weighs the 40 more representative values of this market. As for the German market, the Dax 30 index incorporates the 30 companies with the greater stock-exchange capitalization.

In relation to the Asian market's volume an emerging market with high capitalization is the Hang Seng index of the Hong Kong stock exchange and the Nikkei index of the Japanese market incorporates 225 stocks.

5. Statistical Tests and Models

The simplest tool to measure the volatility is the model ARCH that was elaborated by Engle in 1982. These models relax the hypothesis of constant variance and introduce the changes of volatility according to established patterns. The model supposes that the average equation of return (R) follows a simple lineal process:

$$R_t = \mu + \varepsilon_t$$

where: μ. is a constant and εt is a variable that describes a normal error. The model used makes a prediction on the return, reason why in many cases where the horizon is a very short term the hypothesis that the average is null is also added. The effort of the modeling is concentrated in the probability distribution of εt, which considers of average zero and conditional variance (ht) with the following normal pattern:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2$$

Where: the coefficients have the following restrictions in the parameters q > 0; $\alpha_0 > 0$ y $\alpha_1 \geq 0$. The conditional variance is the sum of a linear combination of the squares slowed down disturbances of the model, until the retardation q and a constant.

Model GARCH

The model ARCH was generalized by Bollerslev in 1986, giving origin to those denominated GARCH. The model of return used here is similar to the model use in the ARCH model, the only exception is that now the equation that describes the conditional variance ht has the following characteristic:

$$R_t = \mu + \varepsilon_t$$

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}$$

where the coefficients have the following restrictions $p \geq 0$; $q > 0$; $\alpha_0 > 0$; $\alpha_1 \geq 0$; $\beta_i \geq 0$. This model is a generalization of infinite order of model ARCH that converges in a geometric process that has the GARCH parameters (p,q). The advantage of this model is that it captures in a better way the information of the errors happened, without requiring a considerable parameters, situation that causes that the model fulfills the parsimony principle.

The computer package used to make the estimations is the E-views 5,0, the algorithm of optimization used was the Bernd, Hall, Hal, Hausman (BHHH), as well as a maximum of 500 iterations and a 0.001 of error margin for the convergence of the solutions those are the parameters that the package for estimations of conditional variance assigns automatically.

Model of Multiple Regression

The models of multiple regression have the objective of estimating the expected value of the dependent variable based on certain independent variables that try to explain the changes in the average value in joint with an error term that distributes as a normal aleatory variable of which the average is zero and the variance is constant.

The expression of the asset return i will be:

$$R_i = B_0 + B_1 X_1 + B_2 X_2 + \ldots + B_K X_K + \varepsilon_t$$

Where: i = Bovespa, CAC40, Dax, Dow, FTSE, Hang Seng, Nasdaq, Nikkei and S&P500.
R_i = Stock return in the market i
X_j = Factor or independent variable for j= 1,2,..., K
ε_t = Random term

The fundamental assumptions on which the regression model is based are that it is linear in the parameters and the errors are independent, that is to say, there is no correlation among them. In addition, the model is well specified and there is no multicollinearity. The most used and simple technique of estimation is the one called Ordinary Least Square (OLS), it looks for adjusting a line that diminishes the sum of squares of the dependent variable in relation to its explanatory variables. The coefficients obtained by this method have optimal properties to say of the theorem of Gaussian-Markov, since under the established assumptions the obtained estimators are BLUE, which means, the best linear, unbiases estimators.

Statistical Test of Causality Granger-Sims

Although the regression analysis tries to explain a dependent variable in relation to a set of explanatory variables, this not necessarily implies causality. There is a statistical test that can detect the direction of the causality, that is to say, the relation cause-effect considering the left behind between two variables well-known as Test of Grange-Sims. The test of causality of Granger-Sims uses the following equations to determine the direction of the causality:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i}^2 + \sum_{i=1}^{n} \beta Y_{t-i}$$

$$X_t = \sum_{i=1}^{n} \alpha_i X_{t-i}^2 + \sum_{i=1}^{n} \beta Y_{t-i}$$

It is possible to be observed that the test of Granger-Sims is reduced to a model of autoregressive vectors where the left behind stock return (x) is based on the volatility the IPyC return (y).

Coefficient of Pearsons's Correlation

The coefficient of Pearson's correlation measures the linear correlation between two variables, through following statistic, whose value is between -1 and 1:

r = Cov(Ri, Rj) / σi σj i ≠ j

r = Cov(Ri, Rj) / σi σj i ≠ j

Where: i = Bovespa, CAC40, Dax, Dow, FTSE, Hang Seng, Nasdaq, Nikkei y S&P500.

Cov(Ri, Rj) = Covariance of stock market i with the stock market j

σi = Standar desviation of the stock market return i and j.

It is important that one value of the correlation near to zero shows a null relation between the variables, whereas a value near to one shows a direct relation and a value near -1 shows an inverse relation. The way to make the test of hypothesis on the correlation coefficient is done by comparing the statistical T that is indicated next against value T of tables at a significance level of 0.05.

T= $r\sqrt{n-2}/\sqrt{1-r^2}$

Where: r = coefficient of correlation, and n = number of observations.

Coefficient of Variation

The coefficient of variation is a very useful measurement of relative dispersion when having different presence of units or scales, that in first instance they could make the variance higher. The coefficient of variation (CV) is considered as the reason between the standard desviation with respect to the average return. CV = Standard desviation of the Return / Return Average. In the case of the stock-exchange returns, to the coefficient of variation can be interpreted as a relative measurement of risk that shows the amount of risk by unit of free return of scales.

6. Econometric Analysis and Results

The volatility of the stock markets of Mexico, Brazil, the United States of America, Germany, France, Hong Kong, Japan and London was estimated by its respective weekly return indices using a model of conditional variance type GARCH(1,1) for the period 1994-2006.

Table 1 shows the econometrics results of models GARCH for the different indices, which were significant at a level of the 0.05. This reflects that the variance of the indices is not constant throughout the time. The sum of the coefficients of the models GARCH that estimate the variances conditional of each market return shows how risky is each market, that is to say, if the sum is greater to one the market is very risky and in opposite case it is less risky. In all the cases the sum of the coefficients is smaller then one; nevertheless, table 2 shows that the Standard & Poor's 500 index showed the greater variability between all the indices analyzed in the period of study.

Table 1 "Conditional Volatility Models GARCH(1,1)"

a)

Dependent Variable: BOVESPA
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 11 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.706348	0.176031	4.012639	0.0001
	Variance Equation			
C	1.123287	0.320964	3.499725	0.0005
RESID(-1)^2	0.101276	0.024155	4.19281	0
GARCH(-1)	0.851728	0.027744	30.69982	0

R-squared	-0.000196	Mean dependent var	0.783373
Adjusted R-squared	-0.004951	S.D. dependent var	5.511533
S.E. of regression	5.52516	Akaike info criterion	6.033518
Sum squared resid	19262.78	Schwarz criterion	6.061573
Log likelihood	-1911.642	Durbin-Watson stat	1.952984

b)

Dependent Variable: CAC40
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 13 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.237593	0.094615	2.511162	0.012
	Variance Equation			
C	0.091209	0.063453	1.437429	0.1506
RESID(-1)^2	0.101758	0.023268	4.373212	0
GARCH(-1)	0.889984	0.025385	35.05973	0

R-squared	-0.000617	Mean dependent var	0.167768
Adjusted R-squared	-0.005374	S.D. dependent var	2.813099
S.E. of regression	2.820648	Akaike info criterion	4.758816
Sum squared resid	5020.272	Schwarz criterion	4.78687
Log likelihood	-1506.924	Durbin-Watson stat	2.064958

c)

Dependent Variable: DAX
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 16 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.351487	0.099363	3.537416	0.0004
	Variance Equation			
C	0.170049	0.092775	1.832915	0.0668
RESID(-1)^2	0.120263	0.023665	5.081834	0
GARCH(-1)	0.866079	0.027301	31.72324	0

R-squared	-0.001966	Mean dependent var	0.211867
Adjusted R-squared	-0.006729	S.D. dependent var	3.151641
S.E. of regression	3.162228	Akaike info criterion	4.913525
Sum squared resid	6309.8	Schwarz criterion	4.941579
Log likelihood	-1556.044	Durbin-Watson stat	1.975418

d)

Dependent Variable: DOW
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 28 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.247723	0.080987	3.058795	0.0022
	Variance Equation			
C	0.304126	0.11755	2.587212	0.0097
RESID(-1)^2	0.143401	0.022169	6.468671	0
GARCH(-1)	0.801635	0.037631	21.30274	0

R-squared	-0.000683	Mean dependent var	0.189449
Adjusted R-squared	-0.005441	S.D. dependent var	2.231578
S.E. of regression	2.237641	Akaike info criterion	4.330939
Sum squared resid	3159.44	Schwarz criterion	4.358993
Log likelihood	-1371.073	Durbin-Watson stat	2.12729

e)

Dependent Variable: FTSE
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 15 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.198917	0.070107	2.837319	0.0045
	Variance Equation			
C	0.050772	0.035433	1.432914	0.1519
RESID(-1)^2	0.086541	0.017568	4.926112	0
GARCH(-1)	0.903832	0.018972	47.63938	0

R-squared	-0.001804	Mean dependent var	0.10887
Adjusted R-squared	-0.006567	S.D. dependent var	2.121682
S.E. of regression	2.128637	Akaike info criterion	4.196512
Sum squared resid	2859.121	Schwarz criterion	4.224567
Log likelihood	-1328.393	Durbin-Watson stat	2.057421

f)

Dependent Variable: HANG_SENG
Method: ML - ARCH
Sample: 1/31/1994 3/27/2006
Included observations: 635
Convergence achieved after 11 iterations
Variance backcast: ON
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.232241	0.108396	2.142536	0.0322
	Variance Equation			
C	0.057121	0.056374	1.013262	0.3109
RESID(-1)^2	0.071882	0.012088	5.946493	0
GARCH(-1)	0.923538	0.013234	69.78733	0

R-squared	-0.00112	Mean dependent var	0.114263
Adjusted R-squared	-0.00588	S.D. dependent var	3.527471
S.E. of regression	3.537827	Akaike info criterion	5.184649
Sum squared resid	7897.733	Schwarz criterion	5.212704
Log likelihood	-1642.126	Durbin-Watson stat	1.926852

Source: Estimation with data of Finance.Yahoo.com and using optimization with the algorithm BHHH at 5% level of significance.

Table 1 "Conditional Volatility Models GARCH(1,1)" (Continue)

Dependent Variable: IPYC					Dependent Variable: NASDAQ				
Method: ML - ARCH				**g)**	Method: ML - ARCH				**h)**
Sample: 1/31/1994 3/27/2006					Sample: 1/31/1994 3/27/2006				
Included observations: 635					Included observations: 635				
Convergence achieved after 13 iterations					Convergence achieved after 14 iterations				
Variance backcast: ON					Variance backcast: ON				
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)					GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)				
	Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.
C	0.508762	0.117653	4.32425	0	C	0.336892	0.094153	3.578115	0.0003
	Variance Equation					Variance Equation			
C	0.104343	0.071431	1.460757	0.1441	C	0.110915	0.056502	1.963012	0.0496
RESID(-1)^2	0.073518	0.017414	4.221735	0	RESID(-1)^2	0.09541	0.020554	4.641831	0
GARCH(-1)	0.920009	0.019496	47.18845	0	GARCH(-1)	0.897745	0.023906	37.55273	0
R-squared	-0.001334	Mean dependent var		0.374779	R-squared	-0.000834	Mean dependent var		0.234387
Adjusted R-squared	-0.006095	S.D. dependent var		3.671295	Adjusted R-squared	-0.005592	S.D. dependent var		3.552896
S.E. of regression	3.682465	Akaike info criterion		5.279732	S.E. of regression	3.562816	Akaike info criterion		5.013248
Sum squared resid	8556.708	Schwarz criterion		5.307786	Sum squared resid	8009.699	Schwarz criterion		5.041302
Log likelihood	-1672.315	Durbin-Watson stat		1.825808	Log likelihood	-1587.706	Durbin-Watson stat		1.991782
Dependent Variable: NIKKEI					Dependent Variable: SP500				
Method: ML - ARCH				**i)**	Method: ML - ARCH				**j)**
Sample: 1/31/1994 3/27/2006					Sample: 1/31/1994 3/27/2006				
Included observations: 635					Included observations: 635				
Convergence achieved after 25 iterations					Convergence achieved after 17 iterations				
Variance backcast: ON					Variance backcast: ON				
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)					GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)				
	Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.
C	0.073995	0.117218	0.631258	0.5279	C	0.244123	0.07503	3.253684	0.0011
	Variance Equation					Variance Equation			
C	0.579136	0.275822	2.099674	0.0358	C	0.02767	0.021085	1.312291	0.1894
RESID(-1)^2	0.067601	0.02195	3.079783	0.0021	RESID(-1)^2	0.057177	0.014137	4.044538	0.0001
GARCH(-1)	0.86205	0.049203	17.52015	0	GARCH(-1)	0.938706	0.014925	62.89695	0
R-squared	-0.000219	Mean dependent var		0.031577	R-squared	-0.000763	Mean dependent var		0.182847
Adjusted R-squared	-0.004974	S.D. dependent var		2.869792	Adjusted R-squared	-0.005521	S.D. dependent var		2.219772
S.E. of regression	2.87692	Akaike info criterion		4.93311	S.E. of regression	2.225891	Akaike info criterion		4.275425
Sum squared resid	5222.58	Schwarz criterion		4.961164	Sum squared resid	3126.347	Schwarz criterion		4.30348
Log likelihood	-1562.262	Durbin-Watson stat		2.145967	Log likelihood	-1353.448	Durbin-Watson stat		2.160031

Source: Estimation with data of Finance.Yahoo.com and using optimization with the algorithm BHHH at 5% level of significance.

In same table 2 is a ranking for the different indices being the Hang Seng the second more volatility indicator, and the IPyC of Mexico the third. As for the less volatility market one is the Dow index and the Nikkei, situation that is consistent with the theory since it is a development market with high capitalization. The most volatility were the emerging markets with the exception of the SP500 which corresponds to a development market and the explanation could be found in the fact that the index considers companies of diverse sectors that reflect their heterogeneity in the behavior of the indices, in relation to the other indices that are more homogenous because they consider companies of the same sector or with the same capitalization.

Table 2 also shows the estimation of the historical risk for the 10 estimated indices by means of the returns standard deviation. In this case the Bovespa was the index with greater volatility followed by the IPC of Mexico, whereas the indices with smaller movement were the FTSE of London and SP500, this situation is contradictory with the results of model GARCH, but remember that the historical risk is weighted equally the returns. Meanwhile, the model of different conditional variance shows a dynamics that reflects a different weight. That is, there is a differentiated effect in the short and long term and there could be an effect in the scale of the returns generated in each index; also the variance is not a coherent measurement of risk as it indicates Venegas-Martinez (2005). Because of that it was come to estimate the coefficient of variation to eliminate the scale effect and to have a relative risk measurement.

Table 2 "Comparative Risk and Return in some relevant Stock Market"

Market	Sum Coeficients GARCH	Ranking Volatility	Historical Risk	Average Return	Coefficient of Variation	Ranking CV	Ranking Total Risk	Clasification
SP500	0.9959	1	2.2198	0.1828	12.1401	7	2	
Nikkei	0.9297	10	2.8698	0.0316	90.8821	1	4	
NASDAQ	0.9932	4	3.5529	0.2344	15.1583	5	3	
IPyC	0.9935	3	3.6713	0.3748	9.7959	9	5	
Hang Seng	0.9954	2	3.5275	0.1143	30.8715	2	1	High Risk
FTSE	0.9904	6	2.1217	0.1089	19.4881	3	3	
DOW	0.9450	9	2.2316	0.1894	11.7793	8	7	
DAX	0.9863	7	3.1516	0.2119	14.8756	6	6	
CAC40	0.9917	5	2.8131	0.1678	16.7678	4	3	
Bovespa	0.9530	8	5.5115	0.7834	7.0356	10	8	Low Risk

Source: Estimation with data of Finance.Yahoo.com using a GARCH(1,1) model at 5% level of significance.

The coefficient of variation for the 10 indices were classified in a descending and the Nikkei index was the one that shows the greater relative risk, that means that each unit of risk assumed is greater than the return that the market granted (90.88). The second riskier market was the Hang Seng (30.87, whereas the Bovespa index (7.03) and the IPyC (9.79) are those that register a greater return by unit of risk assumed. It is possible to infer that the emergent markets are punished by having to pay a greater return by risk unit that is surely associated to the country risk.

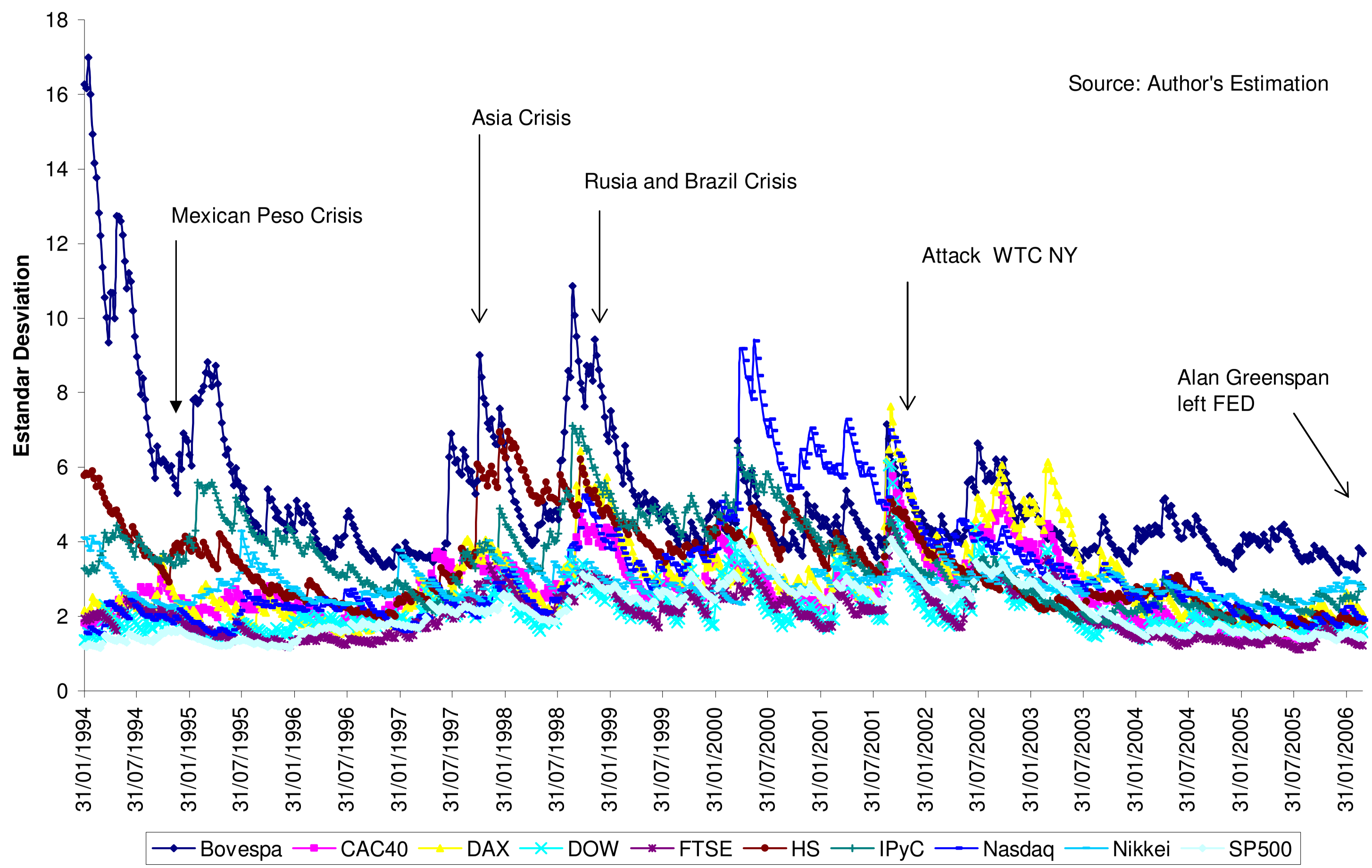
In order to combine the results of conditional volatileness with the relative estimated risk by means of the coefficient of variation of each index, every ranking place was summed and that one with the minor result means that it has a greater combined risk and vice versa.

The first place was the Hang Seng index corresponding to the market of Hong Kong and the last place was the Brazilian market through the Bovespa index.

In graph 1 is the conditional variance for the 10 indices considered in the article during the crisis of the Mexican peso, the Asian crisis, the Russian crisis and the crisis Brazilian's real, as well as in the terrorist attacks to the twin towers of the WTC in New York and the retirement of one of the most influential men in the International Financial Markets, president of the Council of the Federal Reserve of the United States of America.

In graph1 it is possible to observed that during the crisis of the Mexican peso, the Bovespa index showed the great volatility as result of the denominated tequila effect, followed by the IPyC index and finally by the Hang Seng index of Hong Kong. About the emerging markets the results are consistent because they are highly vulnerable to the outflow of national and foreign investors' capital. A result that surprises many people is that even though volatileness in Mexico was inferior to in Brazil the crisis was originated in Mexico. The explanation is in the authorized line of resources by the Federal Reserve and the International Monetary Fund which ascended to more than 50.000 million dollars, situation that partly tranquilized the markets before a potential suspension of payments and lack of liquidity of Mexico. As for the market that was less affected by the Mexican crises was the SP500 index.

Graph 1 "Sotck Market Risk with GARCH(1,1)"



Also in the Asian crisis the emergent markets were struck with volatility. In first place was the Bovespa index, followed by the Hang Seng and the IPyC. Again, SP500 showed the smallest volatileness. The explanation is based on the distrust of the countries denominated as Asian tigers which were for a long time an example to the emerging countries of the world but part of the international organisms had collapsed, reason why it was thought that incipient markets and with smaller structural reforms could face greater crises than those ones registered in the Asian continent.

The Russian crisis and the Brazilian Real showed a behavior equivalent to the registered one in the crisis of the Mexican peso, where the emergent markets continued showing greater volatility as in the case of the Bovespa, IPC and Hang Seng indices whereas within the less volatility markets were the SP500 and the Dow of Industrials (DJI).

As for the terrorist attacks of September 11of 2001, there is a significant change in the market that register discharge volatileness because the traditional and mature markets are the ones who register the greater changes. In first place is the German market by means of the Dax index, followed by the Nasdaq and Dow of the United States of America and the CAC40 of France. This reaction is explained by the logic of the investors' perception, they thought that the attack was directed to the financial and economic centers of one of the main military and financial powers. Reason why most of the markets of the allieS countries could be vulnerable with the exception of Japan that always have show a moderate support, but in practice is neutral, this situation is expresse by the nonintervention and therefore in a low level of volatility in the Nikkei index.

Finally, the retirement of Alan Greenspan one of the most influential businessman in the market to world-wide level and president of the Federal Reserve of the United States of America, did not have any effect in the emerging and traditional markets, since the indices has been a trend to the loss in the risk level from beginnings of the 2005. Nevertheless, the problems of countable information and the manipulation of the financial results of the Japanese company Livedoor that stopped operations in Japan stock-market has reflected in a greater volatility of the Nikkei index comparable to the emerging markets of Brazil and Mexico. In this period SP500 index and the FTSE of London are those that show the lowest variability.

As far as the first raised hypothesis the coefficients of linear correlation between the risk and return of the 10 estimated indices in the period were estimated and there was made a significance test for these coefficients at a level of 0.05 and having considered that the correlations are equal to zero according to the null hypothesis.

In table 3 shows the results of the correlations and the hypothesis tests that suggest that developed markets of the United States and Europe show a considerable correlation (superior or equal to 0.6) in their risk levels, that is, the volatileness of a market influences in the other market's volatility as it is the case of the Dax index with the CAC40, the Dow with Dax and CAC40; whereas index FTSE related to the Dax, CAC40 and Dow; SP500 index is associated positively with the CAC40, FTSE, Dow, NASDAQ and Dax; finally the index Dow and Nasdaq also moves jointly. This situation happens with less intensity in the emergent markets of Mexico and Hong Kong (Correlation of 678), situation that can be explained by the lowest integration of its markets, we remember that the markets of Europe are integrated in a commercial Union, monetary and political that justifies the greater correlation and coordination of policies. So it can be affirmed that in the Europe markets and in the United States markets a mechanism of transmission of volatility exists. It is important to indicate that all the coefficients of correlation were significant to the 0.05. With regards to the correlation between the yields of each market, only the developed markets show a positive correlation, whereas the emergent markets do not exists any association. Reason why it is clear that the emergent markets offer differentiated returns among them, whereas the developed ones are aligned, as it is the case of the German, French and English market and in the United States of America indices Dow, Nasdaq and SP500.

Table 3 "Coefficient of Correlation between Risk and Return in some relevant Stock Markets"

Riesgo=Risk	RIESGO_BOVESPA	RIESGO_CAC40	RIESGO_DAX	RIESGO_DOW	RIESGO_FTSE	RIESGO_HS	RIESGO_IPYC	RIESGO_NASDAQ	RIESGO_NIKKEI	RIESGO_SP500	BOVESPA	CAC40	DAX	DOW	FTSE	Hang Seng	IPYC	NASDAQ	NIKKEI	SP500
RIESGO_BOVESPA	1.000																			
RIESGO_CAC40	0.167	1.000																		
RIESGO_DAX	0.160	**0.898**	1.000																	
RIESGO_DOW	0.067	**0.758**	**0.718**	1.000																
RIESGO_FTSE	0.275	**0.901**	**0.873**	**0.781**	1.000															
RIESGO_HS	0.576	0.446	0.342	0.334	0.583	1.000														
RIESGO_IPYC	0.432	0.362	0.249	0.339	0.396	**0.678**	1.000													
RIESGO_NASDAQ	-0.073	0.488	0.508	**0.614**	0.564	0.336	0.433	1.000												
RIESGO_NIKKEI	0.309	0.344	0.329	0.222	0.371	0.467	0.271	0.310	1.000											
RIESGO_SP500	-0.082	**0.784**	**0.780**	**0.816**	**0.819**	0.359	0.350	**0.829**	0.288	1.000										
BOVESPA	0.210	-0.024	-0.005	-0.021	-0.014	0.041	0.014	-0.058	0.098	-0.061	1.000									
CAC40	-0.045	0.045	0.049	0.095	0.029	0.010	0.022	-0.030	-0.025	0.029	0.322	1.000								
DAX	-0.034	0.017	0.031	0.057	0.003	-0.004	-0.021	-0.055	-0.020	-0.010	0.357	**0.831**	1.000							
DOW	-0.010	0.041	0.025	0.091	-0.008	-0.001	0.028	-0.009	-0.009	0.026	0.101	0.234	0.324	1.000						
FTSE	-0.020	0.041	0.050	0.104	0.022	-0.012	0.031	-0.030	-0.029	0.011	0.297	**0.777**	**0.746**	0.272	1.000					
HANG_SENG	-0.017	0.026	0.035	0.064	-0.006	-0.016	0.066	0.015	-0.017	0.032	0.256	0.449	0.487	0.247	0.515	1.000				
IPYC	-0.034	0.026	0.029	0.033	-0.019	-0.058	0.008	-0.005	-0.005	0.012	0.480	0.439	0.430	0.174	0.428	0.381	1.000			
NASDAQ	0.010	0.095	0.069	0.108	0.052	0.013	0.033	-0.014	0.006	0.049	0.108	0.209	0.271	**0.647**	0.204	0.230	0.159	1.000		
NIKKEI	-0.029	-0.050	-0.038	-0.075	-0.065	-0.043	-0.057	-0.086	0.051	-0.074	0.161	0.082	0.102	0.046	0.098	0.096	0.103	0.080	1.000	
SP500	0.000	0.057	0.033	0.105	0.007	0.006	0.028	-0.025	-0.012	0.023	0.120	0.243	0.332	**0.925**	0.276	0.255	0.171	**0.817**	0.048	1.000

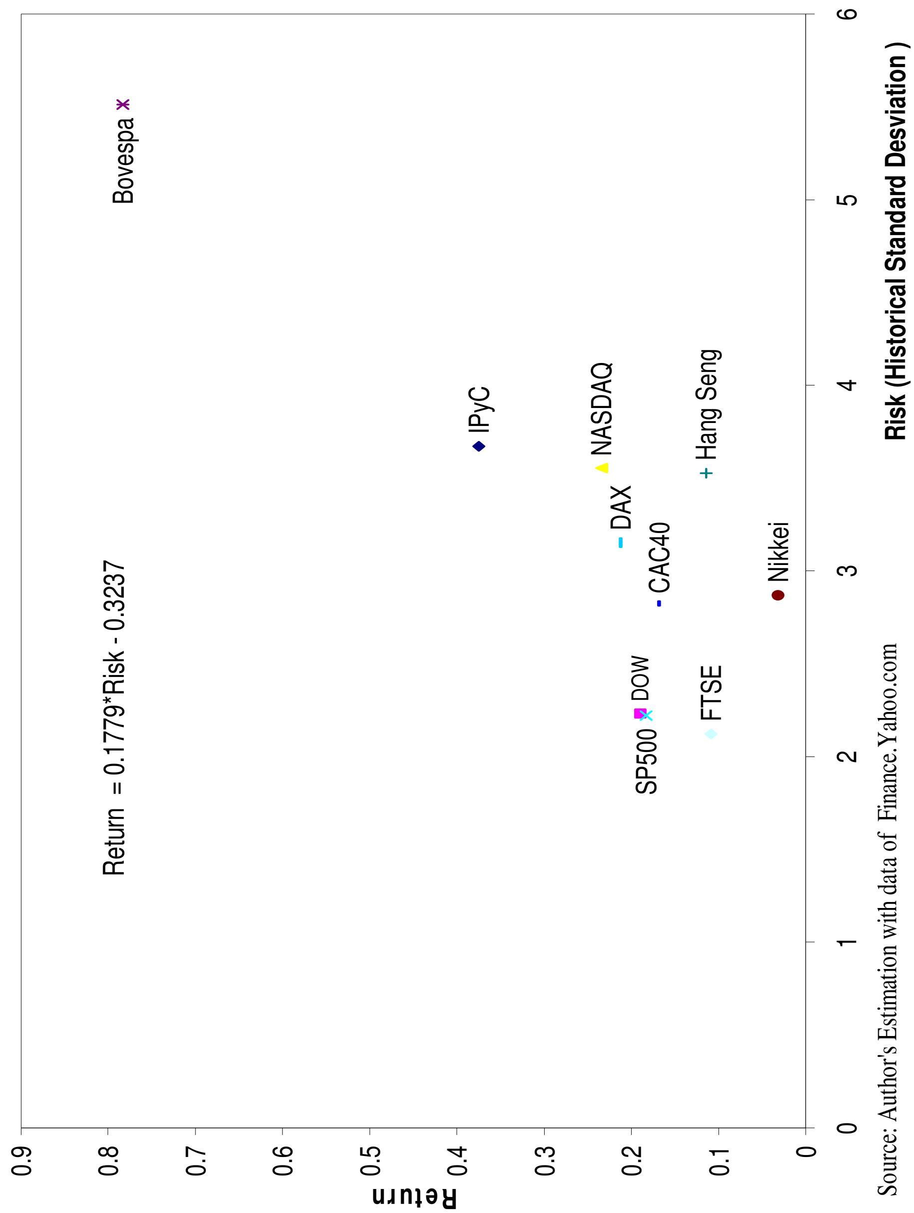
Distribution T-Value 1.964 Hypotesis Test for the Coefficient of Correlation

	RIESGO_BOVESPA	RIESGO_CAC40	RIESGO_DAX	RIESGO_DOW	RIESGO_FTSE	RIESGO_HS	RIESGO_IPYC	RIESGO_NASDAQ	RIESGO_NIKKEI	RIESGO_SP500	BOVESPA	CAC40	DAX	DOW	FTSE	HANG_SEN	IPYC	NASDAQ	NIKKEI	SP500
RIESGO_CAC40	RZ Ho.																			
RIESGO_DAX	RZ Ho	RZ Ho																		
RIESGO_DOW	No RZ Ho	RZ Ho	RZ Ho																	
RIESGO_FTSE	RZ Ho	RZ Ho	RZ Ho	RZ Ho																
RIESGO_HS	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho															
RIESGO_IPYC	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho														
RIESGO_NASDAQ	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho													
RIESGO_NIKKEI	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho												
RIESGO_SP500	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho											
BOVESPA	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho										
CAC40	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho									
DAX	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho								
DOW	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho							
FTSE	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho						
HANG_SENG	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho					
IPYC	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho				
NASDAQ	No RZ Ho	RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho			
NIKKEI	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho		
SP500	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	No RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	RZ Ho	No RZ Ho	

Note: The nule hypothesis is Ho: Coefficient of Correlation = 0 at 5% level of significance.

In graph 2 shows the risk and return relation of each stock market. The result shows a positive relation between risk and return as it indicates the theory, but in a very weak way, since the slope is of 0.1779. The results show that the greater risk of the emergent markets as Mexico and Brazil are compensated with a considerably greater return to the one of Hong Kong and the developed countries.

Graph 2 "Risk and Return in some relevant Stock Markets"



Source: Author's Estimation with data of Finance.Yahoo.com

The complementary hypothesis is to make tests of causality of Granger-Sims at a significance level of 0,05 to verify the risk causality of one market to another, as well as in the return. In table 4 the results suggest that only in the developed markets that have a significant correlation as London has causes volatileness changes in the Dow; whereas the risk of the Dow index finally causes changes in the CAC40 and Dax, the market risk of the SP500 causes volatileness in the CAC40, Dax and FTSE. This situation shows that the American and London market are the ones that transmit volatileness to the European and American market. As for the return level, the FTSE generated changes in the yield of the Dax index.

In the table 5 of the attachment multiple regressions for the IPyC by regions are showed by having as result that the return of Mexico IPC is explained by the risk and return of the Brazilian market and by the return of the Hang Seng which is consistent by being an emergent market. Whereas the United States of America indices do not influence. Nevertheless, the risk and return of the FTSE affect the stock-exchange indicator of Mexico, situation that can be explained by the fact that the economic agents of Mexico incorporate or discount the movements of the American indices, but not thus with the one of London which is of great relevance.

Table 6 of the attachment, shows simple regressions for the stock return of each index, in this case the Mexican market risk does not explain the returns of the same one. Only the return of the Bovespa is explained by the level of risk of this market as it suggests the conventional financial theory. The scatter diagrams with their respective equation for each market are in graph 3 attached in the appendix.

Table 4 "Granger-Sims Test"										
Riesgo=Risk	Effect									
Cause	RIESGO_BOVESPA	RIESGO_CAC40	RIESGO_DAX	RIESGO_DOW	RIESGO_FTSE	RIESGO_HS	RIESGO_IPYC	RIESGO_NASDAQ	RIESGO_NIKKEI	RIESGO_SP500
RIESGO_BOVESPA				Cause				Cause		Cause
RIESGO_CAC40				Cause	Cause	Cause		Cause		Cause
RIESGO_DAX				Cause		Cause		Cause		Cause
RIESGO_DOW		**Cause**	**Cause**		Cause				Cause	Cause
RIESGO_FTSE				**Cause**		Cause		Cause	Cause	Cause
RIESGO_HS	Cause			Cause				Cause	Cause	Cause
RIESGO_IPYC				Cause				Cause	Cause	Cause
RIESGO_NASDAQ									Cause	
RIESGO_NIKKEI										
RIESGO_SP500		**Cause**	**Cause**		**Cause**				Cause	
BOVESPA	Cause		Cause	Cause		Cause		Cause		Cause
CAC40	Cause	Cause	Cause	Cause	Cause		Cause			Cause
DAX	Cause	Cause	Cause	Cause	Cause		Cause			Cause
DOW	Cause	Cause	Cause	Cause	Cause		Cause	Cause		Cause
FTSE	Cause	Cause	Cause	Cause	Cause		Cause	Cause		Cause
HANG_SENG	Cause			Cause		Cause	Cause			
IPYC	Cause	Cause	Cause	Cause		Cause	Cause	Cause		Cause
NASDAQ	Cause	Cause	Cause	Cause	Cause	Cause	Cause	Cause		Cause
NIKKEI		Cause	Cause				Cause			
SP500	Cause	Cause	Cause	Cause	Cause	Cause	Cause	Cause		Cause
	Effect									
Cause	BOVESPA	CAC40	DAX	DOW	FTSE	Hang Seng	IPYC	NASDAQ	NIKKEI	SP500
RIESGO_BOVESPA	Cause									
RIESGO_CAC40					Cause					
RIESGO_DAX		Cause	Cause		Cause			Cause		
RIESGO_DOW				Cause				Cause		Cause
RIESGO_FTSE									Cause	
RIESGO_HS										
RIESGO_IPYC										
RIESGO_NASDAQ									Cause	
RIESGO_NIKKEI										
RIESGO_SP500									Cause	Cause
BOVESPA				Cause				Cause	Cause	Cause
CAC40			Cause	Cause		Cause		Cause	Cause	Cause
DAX				Cause		Cause		Cause	Cause	Cause
DOW				Cause					Cause	
FTSE			**Cause**					Cause	Cause	Cause
HANG_SENG				Cause			Cause	Cause	Cause	Cause
IPYC				Cause				Cause	Cause	Cause
NASDAQ									Cause	
NIKKEI									Cause	
SP500										

Source: Author's Estimation with data of Finance.Yahoo.com, the Granger-Sims Test is with 2 lags at 5% level of significance.

The hypothesis 2 verifies if there exists some difference between the return average of the IPyC of Mexico with the return average of the other 9 indices through a test of difference of averages that uses the statistical t and it compares it with a critical value at the significance level of 0.05. The empirical evidence of table 7 suggests that the IPyC return does not show a significant difference to them with the return of the other indices, the one that suggests the Mexican stock market is aligned with the prime give other markets.

Table 7 "Hypothesis Test for Return and Risk in the mexican Sotk Market"

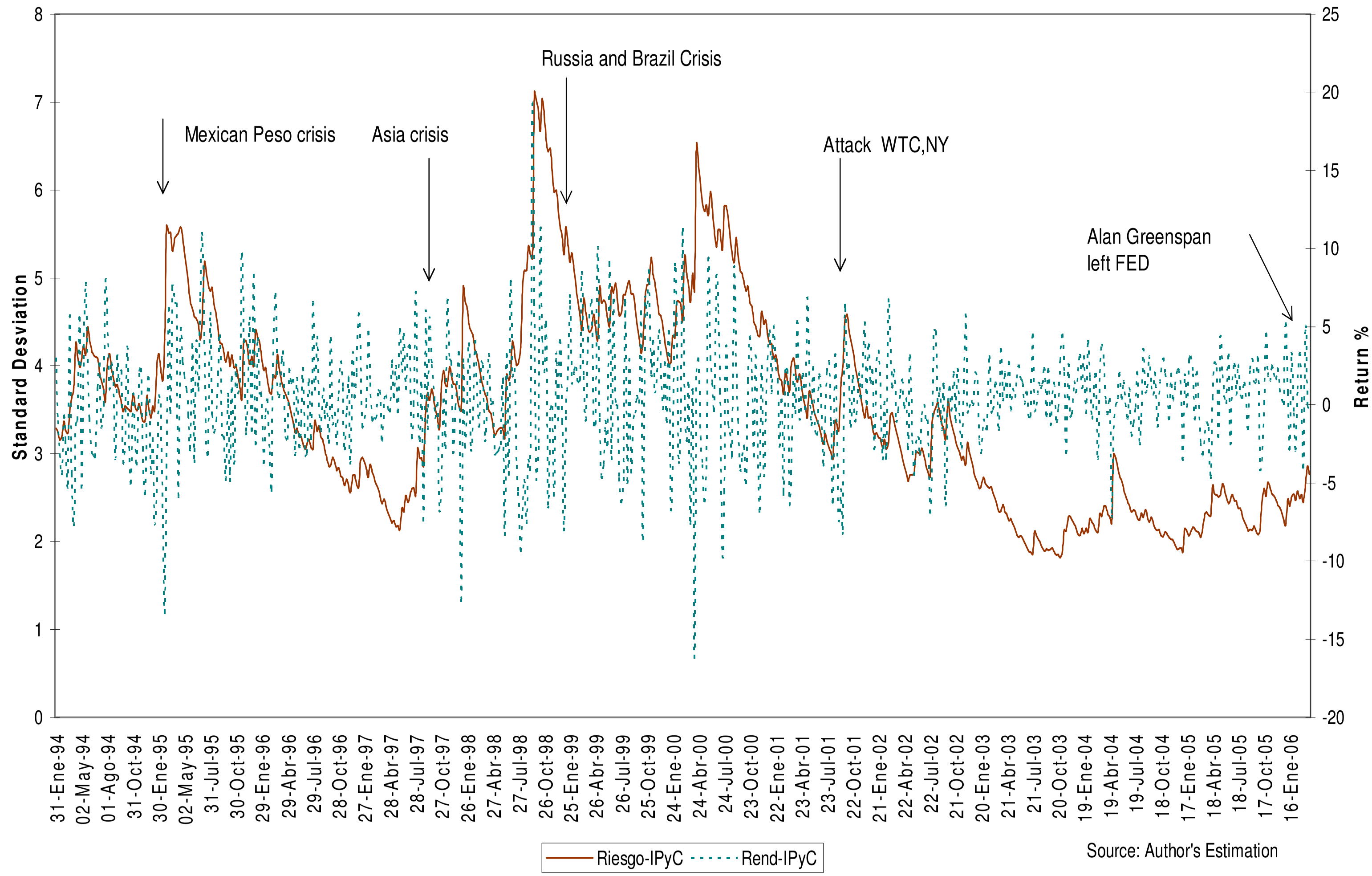
Index	IPyC	DOW	NASDAQ	SP500	Bovespa	Nikkei	Hang Seng	CAC40	DAX	FTSE
Average Return	0.3748	0.1894	0.2344	0.1828	0.7834	0.0316	0.1143	0.1678	0.2119	0.1089
Variance of Return	13.4784	4.9799	12.6231	4.9274	30.3770	8.2357	12.4431	7.9135	9.9328	4.5015
	Statistical Test: Ho: variance of Stock market i = variance mexican IPyC									
F Estimate		2.7065	1.0678	2.7354	0.4437	1.6366	1.0832	1.7032	1.3570	2.9942
F- at 0.05 level of significance		1.1686	1.1686	1.1686	1.1686	1.1686	1.1686	1.1686	1.1686	1.1686
Decision		*No accept*	*No Rechazo*	*No accept*	*Accept*	*No accept*	*Accept*	*No accept*	*No accept*	*No accept*
	Statistical Test: Ho: average return of Stock Market i = average return of mexican IPyC									
T-Estimate		1.0870	0.6925	1.1273	-1.5548	1.8559	1.2894	1.1279	0.8485	1.5802
T- at .05 level of significance		1.9622	1.9618	1.9622	1.9621	1.9619	1.9618	1.9620	1.9619	1.9623
Decision		*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*
	Source: Author's Estimation at 5% level of significance.									

Also it was verified if exists some difference between the risk of the stock market of Mexico in relation to the other indices using like *proxy* variable the variance of the return of each index by means of a test F with a significance level of the 0.05. The results suggest the risk of the IPyC is statistically different from the registered one by the Dow, SP500, Nikkei, CAC40, Dax and FTSE, but not with the indices of the emerging markets, which is consistent with which theoretically it would be expected.

In graph 4 the risk of the IPyC considered by means of the model GARCH(1,1) in relation to its return for the different periods from crisis appears. The regression equation of the Mexican market was not significant because of that the relation does not seem to be statistically direct as it indicates the theory. Before of the 2002 it seems to exist a direct relation between the return and the level of risk; nevertheless volatility has diminished in the last years as a result of the reached degree of investment, but the granted return continues being high as they indicate the results of the coefficient of variation.

Finally, volatility in the different periods from crisis and the terrorist attacks was significantly high, which reflects the sensitivity of the IPyC before exogenous and random shocks financial characteristic of an emerging market.

Gráfica 4 "Risk (Riesgo) and Return (Rend) Mexican IPyC"



Source: Author's Estimation

7. Conclusion

The conditional variance of returns for the 10 significant indices was given at a level of 0.05. Therefore the riskiest markets were the SP500 and the Hang Seng, whereas the less risky was the Nikkei. When considering historical volatileness the riskiest market was the Bovespa and the IPyC, whereas the less volatility was the FTSE. The coefficient of variation shows that the Nikkei index and Hang Seng index has a greater relative risk, since that for each unit of risk minor return is received.

During the financial crises of the peso and the Asian, Brazilian and Russian financial crises, the risk levels show that there is a considerable correlation between the indices of the developed markets of Europe and the United States of America. Whereas the Dax index and the NASDAQ showed greater volatility during the terrorist attacks.

Results of the correlations between the different indices risks shows that developed markets are highly associated in a positive way and emergent markets in a very weak way, as is the case of the Hang Seng and the IPyC. Additionally, the tests of causality of Granger-Sims show that in the developed markets a causality between the risks of the European market and the United States of America is generated, situation that indicates a mechanism of transmission of volatileness in both directions.

As far as the returns of the IPyC, these show that they are aligned with the developed markets, but the risk is not according to the equality tests of variances the risk is not associated. Finally, although the regression between the return of the IPyC and its level of risk is not significant it is clear that when making a test of structural change after the 2002, there is reflected a breach in the volatility levels and of returns that shows a smaller association. Also it explains that nowadays Mexico reaches the investment degree based on the best qualification of the sovereign debt.

By the previous thing, it is clear that there is a mechanism of transmission of volatility between the markets of the United States and Europe that does not influence directly in the

Mexican market stock returns, but FTSE index is the one that transmits the volatility of the developed markets, whereas the market of Hong Kong and Brazil are those that transmit the emerging markets volatility.

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Appendix

Table 5 "Risk's Effect in the Return of Mexican IPyC"

a)

Dependent Variable: IPYC
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOVESPA	0.343614	0.023509	14.6165	0
SQR(GARCH_IPYC)	0.249199	0.12476	1.997437	0.0462
SQR(GARCH_BOVESPA)	-0.317803	0.070832	-4.486719	0
C	0.871995	0.449233	1.941074	0.0527
R-squared	0.254295	Mean dependent var		0.374779
Adjusted R-squared	0.250749	S.D. dependent var		3.671295
S.E. of regression	3.177846	Akaike info criterion		5.156563
Sum squared resid	6372.282	Schwarz criterion		5.184618
Log likelihood	-1633.209	F-statistic		71.72625
Durbin-Watson stat	1.915802	Prob(F-statistic)		0

b)

Dependent Variable: IPYC
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOW	0.344349	0.195003	1.765862	0.0779
SP500	-0.21515	0.259934	-0.827711	0.4081
NASDAQ	0.131117	0.081062	1.617493	0.1063
SQR(GARCH_SP500)	-0.046704	0.537674	-0.086863	0.9308
SQR(GARCH_NASDAQ)	-0.040691	0.179025	-0.227294	0.8203
SQR(GARCH_IPYC)	0.005521	0.143821	0.03839	0.9694
SQR(GARCH_DOW)	0.1768	0.406923	0.43448	0.6641
C	0.146219	0.630501	0.231909	0.8167
R-squared	0.035444	Mean dependent var		0.374779
Adjusted R-squared	0.024676	S.D. dependent var		3.671295
S.E. of regression	3.625716	Akaike info criterion		5.426499
Sum squared resid	8242.425	Schwarz criterion		5.482608
Log likelihood	-1714.913	F-statistic		3.291471
Durbin-Watson stat	1.981014	Prob(F-statistic)		0.001909

c)

Dependent Variable: IPYC
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAC40	0.224777	0.091123	2.466746	0.0139
DAX	0.177994	0.077042	2.310355	0.0212
FTSE	0.302355	0.101056	2.991952	0.0029
SQR(GARCH_CAC40)	0.535327	0.410665	1.303563	0.1929
SQR(GARCH_DAX)	0.276326	0.28533	0.968443	0.3332
SQR(GARCH_FTSE)	-1.292157	0.511085	-2.528262	0.0117
SQR(GARCH_IPYC)	0.080251	0.129605	0.619196	0.536
C	0.350862	0.514814	0.681531	0.4958
R-squared	0.226124	Mean dependent var		0.374779
Adjusted R-squared	0.217484	S.D. dependent var		3.671295
S.E. of regression	3.247624	Akaike info criterion		5.206243
Sum squared resid	6613.007	Schwarz criterion		5.262351
Log likelihood	-1644.982	F-statistic		26.17251
Durbin-Watson stat	1.875399	Prob(F-statistic)		0

d)

Dependent Variable: IPYC
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NIKKEI	0.081654	0.047387	1.723113	0.0854
HANG_SENG	0.386471	0.038592	10.01415	0
SQR(GARCH_NIKKEI)	0.277668	0.390086	0.711812	0.4768
SQR(GARCH_IPYC)	0.132762	0.16428	0.808144	0.4193
SQR(GARCH_HANG_SEI	-0.283462	0.170579	-1.66176	0.0971
C	0.033076	1.032399	0.032038	0.9745
R-squared	0.153536	Mean dependent var		0.374779
Adjusted R-squared	0.146807	S.D. dependent var		3.671295
S.E. of regression	3.391118	Akaike info criterion		5.2896
Sum squared resid	7233.3	Schwarz criterion		5.331682
Log likelihood	-1673.448	F-statistic		22.81818
Durbin-Watson stat	1.939809	Prob(F-statistic)		0

Source: Author's Estimation, at 5% level of significance.

Table 6 "Estimation of Risk and Return in some Stock Markets"

Dependent Variable: BOVESPA
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_BOVESPA	0.570397	0.105616	5.400663	0
C	-2.17317	0.587788	-3.697203	0.0002
R-squared	0.044048	Mean dependent var		0.783373
Adjusted R-squared	0.042538	S.D. dependent var		5.511533
S.E. of regression	5.393035	Akaike info criterion		6.211238
Sum squared resid	18410.69	Schwarz criterion		6.225265
Log likelihood	-1970.068	F-statistic		29.16716
Durbin-Watson stat	2.040419	Prob(F-statistic)		0

Dependent Variable: CAC40
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_CAC40	0.146501	0.129564	1.130723	0.2586
C	-0.230893	0.369815	-0.624346	0.5326
R-squared	0.002016	Mean dependent var		0.167768
Adjusted R-squared	0.000439	S.D. dependent var		2.813099
S.E. of regression	2.812482	Akaike info criterion		4.909156
Sum squared resid	5007.063	Schwarz criterion		4.923183
Log likelihood	-1556.657	F-statistic		1.278535
Durbin-Watson stat	2.070484	Prob(F-statistic)		0.2586

Dependent Variable: DAX
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_DAX	0.085719	0.110677	0.7745	0.4389
C	-0.044212	0.353515	-0.125063	0.9005
R-squared	0.000947	Mean dependent var		0.211867
Adjusted R-squared	-0.000632	S.D. dependent var		3.151641
S.E. of regression	3.152636	Akaike info criterion		5.1375
Sum squared resid	6291.46	Schwarz criterion		5.151527
Log likelihood	-1629.156	F-statistic		0.59985
Durbin-Watson stat	1.980748	Prob(F-statistic)		0.438924

Dependent Variable: DOW
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_DOW	0.317329	0.138194	2.296249	0.022
C	-0.499623	0.312796	-1.597281	0.1107
R-squared	0.008261	Mean dependent var		0.189449
Adjusted R-squared	0.006694	S.D. dependent var		2.231578
S.E. of regression	2.224096	Akaike info criterion		4.439723
Sum squared resid	3131.201	Schwarz criterion		4.45375
Log likelihood	-1407.612	F-statistic		5.27276
Durbin-Watson stat	2.128903	Prob(F-statistic)		0.021987

Dependent Variable: FTSE
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_FTSE	0.072789	0.131685	0.552752	0.5806
C	-0.040427	0.282931	-0.142887	0.8864
R-squared	0.000482	Mean dependent var		0.10887
Adjusted R-squared	-0.001097	S.D. dependent var		2.121682
S.E. of regression	2.122845	Akaike info criterion		4.346536
Sum squared resid	2852.595	Schwarz criterion		4.360563
Log likelihood	-1378.025	F-statistic		0.305535
Durbin-Watson stat	2.061249	Prob(F-statistic)		0.580628

Dependent Variable: HANG_SENG
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_HS	-0.048992	0.119125	-0.411268	0.681
C	0.281657	0.430448	0.654333	0.5131
R-squared	0.000267	Mean dependent var		0.114263
Adjusted R-squared	-0.001312	S.D. dependent var		3.527471
S.E. of regression	3.529785	Akaike info criterion		5.363495
Sum squared resid	7886.787	Schwarz criterion		5.377523
Log likelihood	-1700.91	F-statistic		0.169141
Durbin-Watson stat	1.930157	Prob(F-statistic)		0.681016

Dependent Variable: IPYC
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_IPYC	0.026187	0.129606	0.202054	0.8399
C	0.28221	0.480778	0.586987	0.5574
R-squared	0.000064	Mean dependent var		0.374779
Adjusted R-squared	-0.001515	S.D. dependent var		3.671295
S.E. of regression	3.674075	Akaike info criterion		5.443625
Sum squared resid	8544.758	Schwarz criterion		5.457652
Log likelihood	-1726.351	F-statistic		0.040826
Durbin-Watson stat	1.827996	Prob(F-statistic)		0.839939

Dependent Variable: NASDAQ
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_NASDAQ	-0.032412	0.091471	-0.354339	0.7232
C	0.339216	0.327766	1.034933	0.3011
R-squared	0.000198	Mean dependent var		0.234387
Adjusted R-squared	-0.001381	S.D. dependent var		3.552896
S.E. of regression	3.555349	Akaike info criterion		5.377928
Sum squared resid	8001.439	Schwarz criterion		5.391955
Log likelihood	-1705.492	F-statistic		0.125556
Durbin-Watson stat	1.995668	Prob(F-statistic)		0.723203

Dependent Variable: NIKKEI
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

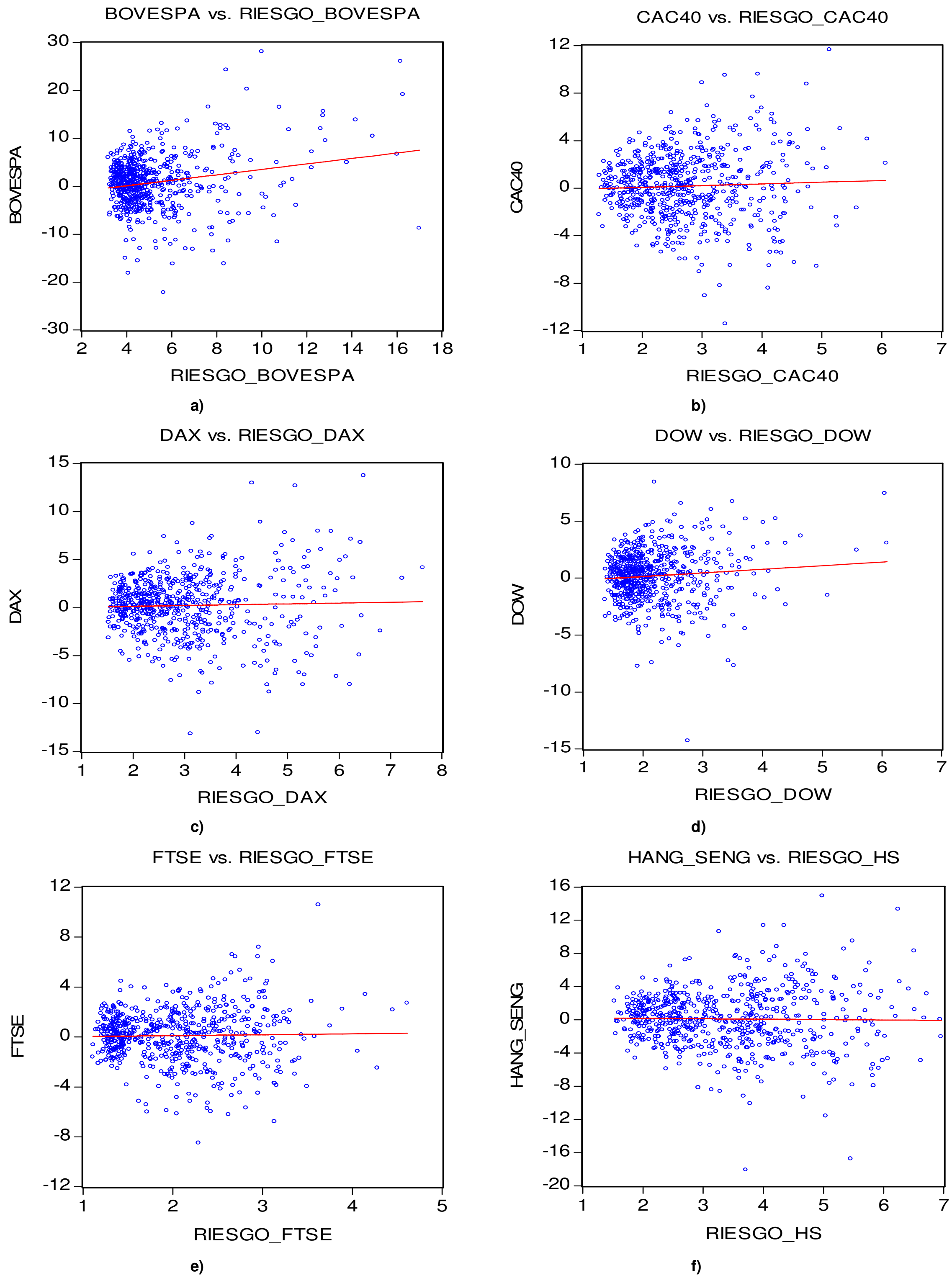
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_NIKKEI	0.370429	0.290069	1.277036	0.2021
C	-1.027926	0.83743	-1.227477	0.2201
R-squared	0.00257	Mean dependent var		0.031577
Adjusted R-squared	0.000994	S.D. dependent var		2.869792
S.E. of regression	2.868365	Akaike info criterion		4.948506
Sum squared resid	5208.019	Schwarz criterion		4.962533
Log likelihood	-1569.151	F-statistic		1.630821
Durbin-Watson stat	2.14944	Prob(F-statistic)		0.202058

Dependent Variable: SP500
Method: Least Squares
Sample: 1/31/1994 3/27/2006
Included observations: 635

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIESGO_SP500	0.074322	0.130572	0.569203	0.5694
C	0.02388	0.292857	0.08154	0.935
R-squared	0.000512	Mean dependent var		0.182847
Adjusted R-squared	-0.001067	S.D. dependent var		2.219772
S.E. of regression	2.220956	Akaike info criterion		4.436897
Sum squared resid	3122.365	Schwarz criterion		4.450924
Log likelihood	-1406.715	F-statistic		0.323992
Durbin-Watson stat	2.16104	Prob(F-statistic)		0.56942

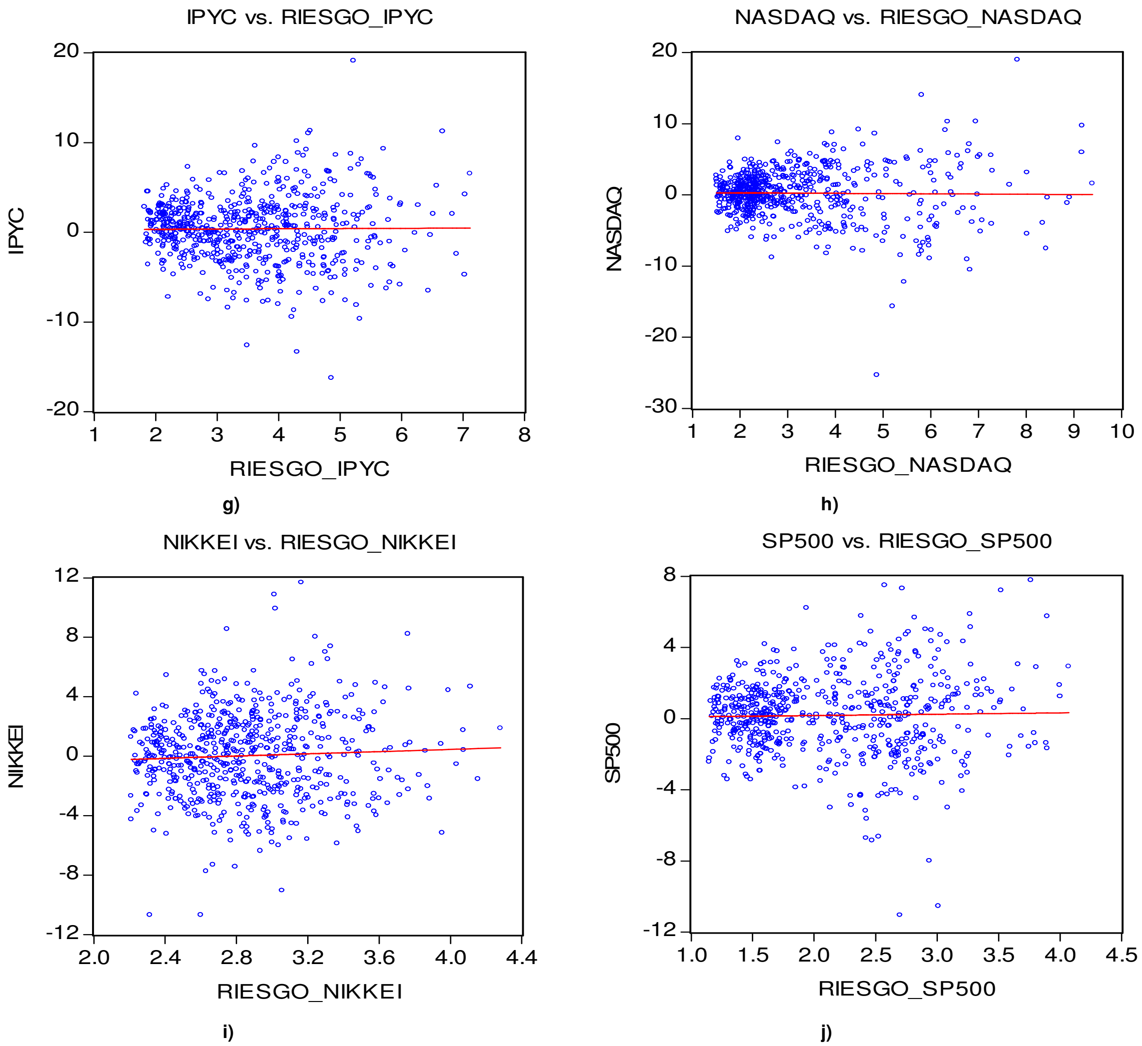
Source: Author's Estimation, at 5% level of significance.

Graph 3 "Regression between Risk and Return in some relevant Stock Markets"



Source: Author's Estimation with data of Finance.Yahoo.com

Graph 3 "Regression between Risk and Return in some relevant Stock Markets" (continue)



Source: Author's Estimation with data of Finance.Yahoo.com