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Traditional Methods to Measure Volatility: Case Study of Selective Developed and Emerging Markets

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Abstract
Importance of volatility in developed as well as emerging markets can never be under estimated. Volatility is measured by traditional measures such as standard deviation. This study measures volatility and examines the relative volatility during 1997-2009. Using global stock market indexes of countries categorized as an emerging and developed capital markets are utilized. All the selected stock returns shown non-normality. Emerging market indexes show more non-normality and higher kurtosis values indicate high peakedness of return distributions. Evidences during this time period highlight that volatility is not the only phenomena of emerging capital markets. Some developed capital markets are more volatile than emerging in the selected sample.
Keywords: Volatility, standard deviation, emerging markets; International diversification.

1 Introduction

Stock market volatility is a well-researched topic in academia and has vital importance for investor's decision making, thus has considerable influence on investor behavior in the market. As it gives just around the corner about risk reward trade off premises. With technological advancements financial markets have become global and easily reached to whole world for investment. This led to interdependence among worldwide stock markets. Such interdependence has implications for international diversification and even more during worldwide volatility. Eventually volatility in international capital markets has also become the key issue for international investment strategy. Particularly in emerging markets, due to its rising importance.

In this paper we compare volatility among a combination of developed and emerging capital markets globally. Motivating factor behind this study is emergence of financial markets' internationalization, which has become more central in academic world due to the fact that international diversification with combination of emerging capital markets is considered optimum investment strategy. We have discussed the basic methodology to measure volatility for these markets along with descriptive statistics for them. That highlights the volatility, non-normality of returns on worldwide stocks, which is key ingredient for evaluating and selecting the markets to include in diversification across different markets.

The paper is divided in five sections with section I as Introduction. Section II is literature review covering volatility and its significance regarding emerging capital markets. Section III describes data and methodology. In section IV we report results and lastly conclusion.

2. Literature Review

2.1 Volatility in Stock Markets

Literature on volatility is extensive, as volatility is the main consideration for individual, institutional and also international investors to make any investment decision. Du and (Budescu ,2007) while analyzing the investor conduct regarding volatility pointed out less confidence to high volatility and past volatility as a risk measure, so volatility analysis can provide insights to investors as volatility in the stock market quantitatively measures the risk which is key determinant in the assessment of cost of capital, investment and leverage decision (Chukwuogor & Freidan, 2007). In the modern era where world is called a global village, investors have opportunities for portfolio diversification internationally. Main objective behind the international investment is the hope of earning higher returns as compared to investing in single or local market. In this regard emerging markets are considered attractive. There is huge capital inflow to emerging markets as an alternative to diversification and emerging markets by and large offer higher return with high associated risk (Chang et al., 2004).

Similarly (Stevenson ,2001) argued that emerging markets are attractive on the basis of downside risk due to non- normality of market returns. Emerging markets only offer higher returns if less integrated with developed capital markets. Further equity risk premium is more in emerging economies as compared to developed one but extent changes from time to time (Salomons & Grootveld, 2003). Usually emerging markets are less correlated with developed markets due to shortage of functional competencies in comparison to well developed capital markets, as put forward by (Gupta & Donleavy ,2009) that emerging markets like Chile, Greece, India, Korea, Malaysia, and the Philippines have less correlation with Australian equity market returns.

Therefore emerging markets are of fundamental importance for international diversification; inclusion of emerging market can lead to optimum gains.

Another crucial issue is that return co-variances change over time (King et al, 1994), similarly (Makridakis & Wheelwright ,1974) and (Bennett & Kelleher ,1988) have documented about the changing correlations over time. So in this state of affairs, volatility trends in different international stock markets including emerging markets can make the clear picture (risk and return) of the international investment scenario that in due course becomes a torch bearer for international investors to make investment decisions in the different regions of the world. (Bekaert & Harvey, 1997) measured changing correlation of emerging markets with reference to the timing of capital market reforms and market liberalizations. Hassan et al. (2003) have analyzed the parameters of stock market volatility and efficiency in Dhaka stock exchange, find contradictory to portfolio theory. Thus emerging markets differ from developed equity markets notably on the basis of efficiency, correlation with other regional markets.

Moreover there are studies of comparative stock market efficiency between emerging and developed markets (Cajueiro &Tabak, 2004, Lim ,2007 and Kim & Shamsuddin ,2008). All such studies show the significance of emerging capital markets thus contributing to financial hubs for further investments. Moreover, they enclose themselves as part of the global portfolio strategy. Thus emerging capital markets gaining importance as investment destination along with developed markets due to less correlation. Ultimately volatility analysis across them is fruitful.

3 Data and methodology

3.1 Data

We are using closing prices of all major indexes of the countries chosen as sample from Europe, Latin America and Asia Pacific regions. Sample of chosen Countries from this region are developed and emerging markets. Our selection of developed and emerging markets was according to the classification[1] laid down by FTSE group in the sample time period although this classification is updated every year after the evaluation of markets. FTSE is an independent body owned by *The Financial Times* and the *London Stock Exchange*. FTSE, a country's classification depends upon the determinants stated in appendix Table 1.

In Table 2 , we have shown countries, their respective stock index, and their capital market type. We are using daily closing prices changes throughout in our study, excluding cash dividends of every global index. Time period covered in this study is starting from January 1997 to December 2009 which contains more than 3000 thousand daily observations for each index. Data is taken from reliable resources; mainly econstats[2], additionally also from yahoo finance, and market watch for collection of daily major index closing prices from different countries. The period of 1997-2009 constitutes the world largest financial crisis and periods of boom and recession regional economic integration, and also major financial liberalization took place in emerging markets. Notably collapse of many Asian economies took place in 1997.

3.2 Methodology

It is well known about the non-symmetric property of arithmetic mean of returns, geometric mean is symmetric as it takes into account the effect of continuous compounding. As a consequence just like so many other studies calculating the share price volatility in short run, we also use the standard measure daily prices/rate of change of indexes continuously compounded as follow:

$$R_{it}\% = 100 * \ln (P_t/P_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Here R_{it} is the continuous compounding return, P_t is the current day price and P_{t-1} is the price of previous trading day.

3.3 Descriptive Statistics

We are using descriptive statistics for comparative study and to underline the basic features of index daily logrithmatic return series. First the most common measure is mean of return series. This gives a good snapshot of return pattern in in particular capital market historically. The mean return is calculated in the same way average, adding rate of return divided by total number of observations during the specified time period. Second descriptive statistics is median that describes return series in arrayed form dividing the returns in higher and lower halves. Whereas skewness measures the degree of asymmetry of the return series around the means. Positive and negative skewness will indicate asymmetrical return tails towards positive and negative values respectively. While kurtosis of logrithmetic return series to measure the fat-tail degree of distribution. Kurtosis value more than 3 will indicate the presence of peakedness in the returns.

[1] FTSE categories capital markets namely advance emerging, second emerging and developed, we are considering both categories advance emerging and second emerging as an emerging market in this study.

[2] http://www.econstats.com/eqty/eq_d_la_6.htm

3.4 volatility measure

There are several measures used to measure stock market volatility, standard deviation at large found in literature. The historical volatility is the volatility of a series of stock prices where we consider the previous price path of logrethmetic rate of return of the particular stock. As the most common measure of volatility is the standard deviation. The daily volatility estimation is thus given by:

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(u_i - \bar{u})^2}$$

where μˆ is the mean defined by:

$$\bar{u} = \frac{1}{n}\sum_{j=1}^{n} u_j$$

4. Results

We present summarized statistics for all capital markets during 1997-2009 in Table 3 in appendix. Statistics are based on logarithmic percentage returns and number of observations in all markets is not the same in the specified time period. At the same time, as all these markets are economically, regionally, religiously and culturally diversified, trading days being different thus number of return observations are not the same. Some remarkable points can be observed from these statistics, as reported in Table 3 mean and median of logarithmic percentage return series for all capital markets do not coincide. Thus return series of any capital market does not support the general idea about normally distributed around mean, eventually same is reinforced by the values of skewness and kurtosis.

Value of skewness shows a discrepancy across the all the markets, with nine of them twisted to left and rest of the six to the right indicating non symmetric return series. While Mean and median values differ sharply in case of three emerging markets Mexico, India and Pakistan. Kurtosis values indicate that all series have leptokurtic distributions. Intensity is higher among emerging markets. Starting with China having the maximum value of kurtosis 91.55, that indicates severe non -normality and existence of return distribution peakdeness . In terms of kurtosis next to china place occupied by Malaysia 43.4 ,then stand Venezuela and Brazil with kurtosis value 20.2 and 11.95 respectively not surprisingly all four are emerging capital markets.

Other way around least value of kurtosis is observable among developed capital markets, In case of Sweden 3.103 which is almost near to normality, next Germany 3.63 and then Spain , France 4.093, 4.42 respectively. Moreover, most of the developed markets show stable kurtosis values than of developing. Accordingly we can say more fat- tail return distributions occurred in emerging markets and on the other hand less associated with developed capital markets in the sample during the specified time period. This is demonstration of more deviation from normality in the return series of the sample. This is sustaining general view about the more non-normality among the emerging capital markets.

Next in Table 4 we rank the capital markets according to volatility. As reported in Table 4 Turkey with standard deviation 2.833% ranked first having highest volatility in terms of standard deviation among the all capital markets in sample. Next to Turkey stands Brazil ranked second with standard deviation 2.351% then China 2.145%. Top three volatile capital markets measured by standard deviation are emerging markets and from all three regions Europe, Latin America and Far East. On the other end according to volatility ranked lowest are three developed capital markets of Europe Denmark lowest ranked on 15th with lowest standard deviation 1.345%, Spain 14th then France 13th with standard deviations 1.514% and 1.546% respectively. So we can conclude emerging markets are more volatile, but interestingly some developed capital markets are more volatile than emerging in the sample. For instance Hong Kong, japan, Germany occupy rank higher than some emerging markets. Generally speaking volatility is not the only phenomena of emerging markets in this time frame at least.

5 Conclusion and recommendations for future research.

This study has analyzed volatility during 1997-2009 across developed and emerging capital markets. Returns depict non-normality as explained by descriptive statistics. Most non-normality is reported in case of emerging market china. Volatility by standard deviation ranks Turkey the most volatile emerging capital market, while least volatile Denmark developed market. At large results advocate risk is not the issue in emerging capital markets only; developed capital markets are risky too. Highest kurtosis value of china index and high kurtosis in other emerging indexes suggest future research to have look on volatility from some other measures. Due to heavy-tailed distributions in emerging markets, it is appropriate to measure volatility through extreme value analysis. This can perhaps provide better escort for investing in emerging markets along with developed.

References

Bekaert, G. & Harvey C.R., 2003. Emerging Markets Finance. Journal of Empirical Finance, 10, pp. 3–55.
Bennett, P. and Kelleher, J., 1988. The international transmission of stock price disruption in October 1987. Federal Reserve Bank of NY Q. Rev. 12, pp. 17–33.
Butler, K.C. & Joaquin, D.C., 2001. Are the Gains from International Portfolio Diversification Exaggerated? The Influence of Downside Risk in Bear Markets, EFMA 2002 London Meetings, (Online SSRN).
Cajueiro, D.O. & Tabak, B.M., 2004. Ranking efficiency for emerging markets. Chaos, Solitons & Fractals, 22(2), pp. 349-352.
Chukwuogor, C. & Feridun, M., 2007. Recent Emerging and Developed European Stock Markets Volatility of Returns. European Journal of Finance and Banking Research, 1 (1), pp. 28-46, (online SSRN).
Diamandis, P.F., 2008. Financial liberalization and changes in the dynamic behaviour of emerging market volatility: Evidence from four Latin American equity markets. Research in International Business and Finance, 22(3), 362-377.
Du, N. & Budescu, D.V., 2007. Does past volatility affect investors' price forecasts and confidence judgements?. International Journal of Forecasting, 23(3), pp. 497-511.
Hassan, M. K., Islam A. M., and Basher S., 2003. Time-Varying Volatility and Equity Returns in Bangladesh Stock Market. Finance 0310015, (online EconWPA).
Gupta, R. & Donleavy, G., 2009. Benefits of diversifying investments into emerging markets with time-varying correlations: An Australian perspective. Journal of Multinational Financial Management, 19(2), pp. 160-177.
Kim, J.H. & Shamsuddin, A., 2008. Are Asian stock markets efficient? Evidence from new multiple variance ratio tests. Journal of Empirical Finance, 15(3), pp. 518-532.
Makridakis, S.G. and Wheelwright, S.C., 1974. An analysis of the interrelationships among the major world stock exchanges. J. Bus. Fin. Accounting 1, pp. 195–216
Salomons, R. & Grootveld H., 2003. The equity risk premium: emerging vs. developed markets. Emerging Markets Review, 4(2), pp. 121-144.
Stevenson, S., 2001. Emerging markets, downside risk and the asset allocation decision. Emerging Markets Review, 2(1), pp. 50-66.

Appendix

Table 1: Determinants of Country's classification

1	Wealth (GNI per capita)
2	Total stock market capitalization
3	Breadth and depth of market
4	Any restrictions on foreign investment
5	Free flow of foreign exchange
6	Reliable and transparent price discovery
7	Efficient market infrastructure
8	Oversight by independent regulator

Source: FTSE International Limited, 2009

Table 2: Countries, Stock Market Indices and Market Types

Country & Index used	Capital Market Type
Denmark (OMX Copenhagen 20 Index)	Developed
France (CAC 40 Index)	Developed
Germany (DAX 30 Index)	Developed
Spain (IBEX 35 Index)	Developed
Sweden (Stockholm OMX 30 Index)	Developed
Turkey (ISE 100 Index)	Second Emerging
China (Shanghai Composite Index)	Second Emerging
Hong Kong (Hang Seng Index - HSI)	Developed
Japan (Nikkei 225 Index)	Developed
India (Bombay SENSEX Index)	Second Emerging
Malaysia (KLCI Index)	Second Emerging
Pakistan (KSE 100 Index)	Second Emerging
Brazil (Bovespa Index)	Advanced Emerging
Mexico (IPC all share index)	Advanced Emerging
Venezuela	Second Emerging

Source: FTSE The Index Company, 2009

Table 3: Descriptive Statistics from Jan, 1997 to December 2009

Statistics are based on observations of daily changes from 1997 to 2009 for major stock indices (known as representative of whole market endorsed by international institutions). The basic formulae for the logarithmic percent change is Rit% = 100*ln (Pt/Pt-1). Number of total daily observations are not same among all different markets(emerging)

Capital Markets	Total Daily Observations	Mean	Median	Skewness	Kurtosis
Sweden(developed)	3261	0.022	0.063	0.134	3.103
Spain(developed)	3267	0.027	0.09	-0.123	4.093
Germany(developed)	3295	0.022	0.094	-0.031	3.625
Denmark(developed)	3246	0.028	0.063	-0.296	5.381
France(developed)	3305	0.017	0.046	-0.025	4.419
Turkey(emerging)	3183	0.125	0.118	-0.032	4.939
Brazil(emerging)	3213	0.071	0.146	0.33	11.811
Mexico(emerging)	3256	0.069	0.112	0.032	6.155
Venezuela(emerging)	3131	0.067	0.011	0.238	20.171
Hong Kong(developed)	3228	0.016	0.043	0.142	8.897
Japan(developed)	3190	-0.019	0.001	-0.207	5.286
Malaysia(emerging)	3208	0.001	0.016	0.429	43.374
China(emerging)	3347	0.03	0.008	-0.413	91.548
India(emerging)	3206	0.052	0.118	-0.122	5.002
Pakistan(emerging)	3150	0.061	0.123	-0.348	4.741

Table 4: Volatility Ranking as measured by Standard deviation

Rank	capital markets	Standard Deviation (in %)
1	Turkey(emerging)	2.833
2	Brazil(emerging)	2.351
3	China(emerging)	2.145
4	Hong Kong(developed)	1.883
5	India(emerging)	1.79
6	Venezuela(emerging)	1.786
7	Pakistan(emerging)	1.78
8	Sweden(developed)	1.685
9	Mexico(emerging)	1.659
10	Germany(developed)	1.652
11	Japan(developed)	1.63
12	Malaysia(emerging)	1.619
13	France(developed)	1.546
14	Spain(developed)	1.514
15	Denmark(developed)	1.345