EMERGING MARKETS' STOCK MARKET VOLATILITY AND IMPACT OF NEWS: IS IT REALLY OBSERVABLE?

C. Coşkun Küçüközmen[1]
IAM, METU
ODTÜ- Uygulamalı Matematik Enstitüsü -222
Phone: ++ < +90 312 210 56 15 >>
E-mail: <kcoskun@metu.edu.tr>

H. Dilek Oğuz[1]
IAM,METU
E-mail: <e122964@metu.edu.tr>

Abstract

We examine the structure of daily stock returns in 14emerging market countries with regard to their volatility patterns in general and their response to IMF-related news in particular. The countries were selected among 30 countries based on their four moments and outlier structures. Although problematic, allowing for extremes in estimation helps us to obtain more realistic findings. The estimation period covers 04.07.1994 - 27.02.2007. It is particularly investigated whether negative (positive) news decreases (increases) the volatility of daily stock returns. Volatilities of 14 countries' stock exchanges are modeled using a family of GARCH models with several distributions.

Key words: IMF, emerging markets, stock market volatility
JEL Classificiation: C-52, F-33, F-34

[1] Dr. C.Coşkun Küçüközmen (kcoskun@metu.edu.tr) is a part-time lecturer in the Department of Financial Mathematics, Institute of Applied Mathematics at Middle East Technical University. Dr. Küçüközmen is also working for the Central Bank of Turkey. H. Dilek Oğuz (dilek195@yahoo.com) is an M.Sc. candidate in Financial Mathematics. The opinions expressed herein are those of the authors.

1. INTRODUCTION

Prediction of emerging capital markets' volatility is of great importance in order to determine the cost of capital and to evaluate direct investment and asset allocation decisions. Higher volatility is an indicator of higher cost of capital and it delays investments increasing the option value of waiting (Huang and Yang, 2000). On the other hand, volatility of stock prices has more information than the prices themselves Kyle (1985).

It is well known that equities traded in emerging capital markets have different characteristics than the equities traded in developed capital markets. Distinguishing features of equities traded in emerging markets are (i) they exhibit higher sample average returns, (ii) low correlations with developed market returns, (iii) more predictable return patterns, and, (iv) higher volatility. Since high volatility implies higher cost of capital, Bekaert and Harvey (1996) point out that insight on this issue is especially important for policy makers in developing countries. Positive skewness and significant kurtosis indicative of fat tails are other features of emerging market volatilities (Aggarwal *et al.* 1999).

High volatility is marked by frequent sudden changes in variance, which may be affected by significant political events (Bailey and Cheng, 1995). However, Mei (1999), states that political risk is more important in explaining financial crisis than market contagion and political uncertainty could be a major contributing factor to financial crisis. Thus, politics is of great importance in emerging markets and hence, the IMF-related news has a significant effect since they have the potential to trigger political risks.

Although there are many studies regarding the impact of IMF-related news, many of them have analyzed the effects of news with respect to bond markets or financial sector stock sector returns. This study aims to explain the impact of IMF-related news on the emerging country indices that are selected on the basis of their volatility patterns with respect to their response to IMF-related news in particular and their four moments' outlier structure. Only the news about stand-by requests from the IMF and the related countries are included in this study.

Rest of the study is organized as follows: following section is on literature review on the impact of IMF-related news. In the third section; data, construction of news and methodology are provided. Empirical results are presented in the fourth section. The last section summarizes empirical results and concludes.

2. LITERATURE REVIEW

To limit the scope of the literature survey section of the study we provide literature focusing on particular IMF intervention and its effects. Kho *et al.* (1999) have investigated the IMF bailout news while Kho and Stulz (2000) investigated IMF program announcements and concluded that in total, the IMF program announcements increased bank shareholder wealth. Kaminsky and Schmukler (1999) and Ganapolsky and Schmuckler (1998) concentrate on debted country agreements with international organizations, including IMF agreements Their paper analyses what type of news moved the markets in those days of market jitters. They find that movements were triggered by local and neighboring-country news, with news about agreements with international organizations and credit rating agencies having the most weight. However, some of those large changes cannot be explained by any apparent substantial news, but seem to be driven by herd instincts of the market itself. The evidence suggests that investors over-react to bad news. Brealey and Kaplanis (2000) have focused on the progress of negotiations with the IMF by dividing news into two parts; namely bad news and good news and their findings suggest that neither the IMF announcements nor the FT news have a measurable effect on asset values. The exceptions are the announcements in the FT that suggest IMF support is less likely to be forthcoming. In those cases negative abnormal returns are observed.

Based on the study of Hayo and Kutan (2005), IMF related news has two possible roles to play in emerging financial markets; conveying of some information to market participants which was not known before and giving some signals to the participants about the IMF actions in response to a country crisis. The study of Evrensel and Kutan (2007) about the financial sector returns in Indonesia, India and Korea makes evident that the increase in the returns with both program negotiations and approval. Moreover Hayo and Kutan (2005) clarify the movements of the stock market returns by showing that the negative (positive) IMF news reduces (increases) daily stock returns by about one percentage point. The most influential event is determined to be the delay of the loans from IMF suggesting the liquidity concerns or solvency issues. Evrensel and Kutan (2007) also found that on the day of the program approval, the financial sector returns increased. This increase can be interpreted as the reflection of investors' expectation of the increased volatility in a sector in which existing implicit guarantees would continue.

Hayo and Kutan (2005), provide evidence on the positive influence of IMF news on the market returns by injecting liquidity to markets. Ganapolsky and Schmuckler (1998) examined the impact of IMF agreement announcement during Tequila crisis in Argentina and detected that this announcement had a positive impact on stock and bond returns. They also claimed that IMF news provides a convergence of market participants' expectations and therefore volatility might even decline by reducing the information asymmetry in the market and concluded that there is no strong evidence that IMF related-news increases market volatilities and IMF actions have an effect on returns but not on risk.

Brealey and Kaplanis (2000) looked at a broad sample of IMF programs, other than those implemented during the Asian crisis, and they covered a wider range of financial assets than those included in Kho and Stulz (1999) and Kho *et al*. (2000). They argued that IMF intervention could not be interpreted as successful in shifting financial markets from a bad to a good equilibrium: investors can not count on the IMF programs to remedy their losses

Apart from specific IMF related news issue, Andersen *et al.* (2003) use a high frequency exchange rate data set, 5-minute return series for U.S. dollar spot exchange rates versus German Mark, British Pound, Japanese Yen, Swiss Franc, and the Euro, to model announcement surprises (that is, divergences between expectations and actuals, or "news"). Andersen *et al.* (2002) use their high frequency data to isolate the impact on financial markets around an announcement. They find that announcement surprises produce conditional mean jumps and they characterize the speed and path of adjustment. They find that the market reacts to news in an asymmetric fashion: bad news has greater impact than good news. Pagan and Schwert (1990), Nelson (1991), Campbell and Hentschel (1992), Engle and Ng (1993), Glosten, Jagannathan and Runkle (1993), inter alia, provide evidence of asymmetry in equity return volatility using univariate GARCH models.

3. RESPONSE of STOCK RETURNS to IMF-RELATED NEWS

3.1. Construction of IMF News

Only the news on stand-by requests of those countries from the IMF is included in this study. The relevant information is collected from the website of the IMF.

3.2. Data analysis

Data is obtained from Datastream (RI) and log returns are calculated by $R_t=\ln(P_t/P_{t-1})$ where P_t are the daily prices. Data is daily and contains daily returns of 14 countries. Countries were selected on the basis of being an emerging market in general and their volatility patterns with respect to their response to IMF-related news in particular. The selection is made among 30 countries based on the criteria mentioned above. Also the preliminary statistical analysis such as four moments and outlier structure has been considered in selection process. The descriptive

statistics of selected countries is given in Table-1. We also include World Index and the US data as benchmark indices. The sample period covers 04.07.1994 -27.02.2007.

Table 1 Descriptive statistics

	Mean	Variance	Skewness	Kurtosis	St. Deviation	Maximum	Minimum	Jarque-Bera
Argentina	0,0003	0,0003	0,3159	9,2889	0,0174	0.1679	-0.1339	10129,75
Turkey	0,0016	0,0008	-0,0134	4,3632	0,0283	0.1703	-0.1946	2608,31
Hong Kong	0,0003	0,0002	-0,0014	11,7568	0,0151	0.1554	-0.1360	19011,44
Brazil	0,0007	0,0003	0,2394	12,2686	0,0163	0.1953	-0.1055	26441,70
Mexico	0,0007	0,0002	0,0645	5,2978	0,013	0.1060	-0.0993	3722,57
South Africa	0,0006	0,0001	-0,9986	11,9219	0,0114	0.0785	-0.1368	18602,69
Hungary	0,0007	0,0003	-0,8411	12,0134	0,0162	0.1109	-0.1795	19031,68
Indonesia	0,0004	0,0002	-0,4274	5,2066	0,0151	0.0873	-0.1259	3516,36
Thailand	-0,0001	0,0004	0,3913	7,5982	0,0189	0.1212	-0.1780	7848,67
Korea	0,0003	0,0004	0,0379	4,0224	0,0205	0.1134	-0.1269	2255,96
Philippine	0,0002	0,0002	0,7558	12,7225	0,0131	0.1481	-0.0856	23193,27
World	0.0003	0.0001	-0.2633	2.7164	0.0076	0.0403	-0.0442	1053.01
US	0.0004	0.0001	-0.1366	4.0980	0.0104	0.0536	-0.0702	2320.04

As can be traced from the Table-1, mean returns are positive in all countries except for Thailand. Turkey has the highest mean return. Standard deviation of the returns are comparatively higher in Turkey, Korea, Thailand, Argentina and China indicating that these countries are associated with high risk categories which are consistent with their country risk ratings. Based on the sample kurtosis figures, it may be argued that the return distributions in all countries are fat-tailed as suggested earlier by Mandelbrot (1963). These numbers also indicate the non-normality of the return series, which is confirmed by the statistically significant values of *Jarque Bera* test statistics. The sample skewness shows that the daily returns do not have a symmetric distribution (asymmetric tails extend more toward to positive values than negative ones).

The results are consistent with the previous studies. It is known that emerging market returns are not normally distributed, which is indicated by skewness and kurtosis in returns. Table1 also shows the highest and lowest one-day returns of the countries. Highest one-day returns are in China, Brazil, Turkey, Argentina and Hong Kong. While highest one day losses are in Turkey, China, Hungary and Thailand.

3.3. GARCH Estimations

As it is very-well known, linear models are not capable of explaining the leptokurtosis, volatility clustering and leverage effects of financial data. Campbell *et al.* (1997) defines a nonlinear data generating process as

$$\mathbf{y_t = f\,(u_t, u_{t-1}, u_{t-2},...)}$$

where u_t is an *iid* error term and f is a nonlinear function or more specifically

$$\mathbf{y_t = g\,(u_{t-1}, u_{t-2},...) + u_t\sigma^2(u_{t-1}, u_{t-2},...)}$$

where g is a function of past error terms only and σ^2 is a variance term.

To account for these characteristics of the financial data, the existence of leptokurtosis, volatility clustering and leverage effects have been investigated at the very beginning. Several tests are applied to the return series for diagnostic purposes. An AR(1) model is constructed since the results of the regression applied to the first three lags imply that the first lag is significant. It is unlikely in financial time series that the variance of errors will be constant

over time and hence it makes sense to consider a model that does not assume that the variance is constant. Once diagnosed that data displays heteroscedastic properties as well as significant autocorrelation[2], GARCH type models are generally used to address these problems. Since ARCH and GARCH models capture non-linearity, we have to check whether the data displays nonlinear characteristic or not. Therefore Ramsey's RESET test is applied and it is concluded that the residuals obtained from AR(1) model are nonlinear.

To select the appropriate model for each country, GARCH, EGARCH, GJR-GARCH models with a number of distributional assumptions such as normal, Student's t and GED are estimated by employing several lag combinations and best fitting models are selected on the basis of LR test. Due to leptokurtosis and fat tail properties of financial data, student-t and GED seemed well suited to capture fat tails.

EGARCH is developed by Nelson (1991), to capture the leverage effect taking account for the asymmetries in the financial data. An advantage of EGARCH model is that variance is positive for all choices of parameters. The EGARCH model is a good proxy to avoid the problem of negativity in variance. This model specifies conditional variance in logarithmic form, which means that we do not need to impose any estimation constraint in order to avoid negative variance.

GJR-GARCH model was developed by Glosten, Jagannathan and Runkle in 1993. It is GARCH (1,1) model with additional asymmetry parameter to capture leverage effect .The impact of bad news and good news on the conditional variance are assigned to be different. When asymmetry parameter is different form zero, the impact of the news on the volatility is not equivalent. Although both EGARCH and GJR-GARCH account for the asymmetric relationship between returns and volatility, they each do so in a particular way.

The results of model selection are reported in Table2. GARCH models are estimated by RATS software. BHHH algorithm was employed for maximization. Also residuals and squared residuals were checked for autocorrelation and ARCH effects. The results are consistent with the asymmetric structure of variance, covariance in asset returns.

Table- 2: Selected GARCH Models

HONG KONG	EGARCH-GED(1,1)
TURKEY	GJRGARCH-t(1,1)
ARGENTINA	GJRGARCH-t(1,1)
PHILIPPINES	GJRGARCH-t(1,1)
INDONESIA	GJRGARCH-GED(1,1)
THAILAND	GJRGARCH-GED(1,1)
HUNGARY	GJRGARCH-t(1,1)
BRAZIL	GJRGARCH-GED(1,1)
KOREA	GJRGARCH-GED(1,1)
SOUTH AFRICA	EGARCH-t(1,1)
CHINA	EGARCH-GED(1,1)
MEXICO	GJRGARCH-GED(1,1)
WORLD	GJRGARCH-t(1,1)
US	EGARCH-GED(1,1)

4. EMPIRICAL RESULTS

[2] The following tests were used to detect heteroscedasdicity and autocorrelation in returns: White, LM and Breusch Godfrey tests. All tests confirm significant existence of heteroscedasdicity and ARCH effect. The results are not provided herein to save place but available from the author upon request.

The returns on the days of the news are computed by taking into consideration the time-zone effects (i.e. hour differences). Only the relevant date is investigated since the financial markets react very quickly to news (Parker, 2007). Table 3 gives the IMF-related news, stand-by requests, and the corresponding returns.

Table- 3: IMF Stand-by request dates.

Argentina	12.04.1996	*1*(*)	0,019665	**Philippines**	27.03.1998	*1*	
	10.03.2000	*1*	-0,01811		30.03.1998		-0,00978
	22.09.2003	*1*	0,008798	**Thailand**	20.08.1997	*1*	
Hungary	15.10.1996	*1*	0,003236		21.08.1997		-0,00409
Brazil	06.09.2002	*1*	-0,0009	**Turkey**	29.04.2005	*1*	0,003439
	14.09.2001	*1*	-0,0185		06.05.2005	*1*	-0,00527
	08.03.1999	*1*	0,017675		11.05.2005	*1*	-0,00071
Indonesia	05.11.1997	*1*			12.04.2005	*1*	-0,01202
	06.11.1997		-0,0052		30.03.2005	*1*	0,003516
Mexico	06.01.1995	*1*	-0,00675		04.02.2002	*1*	-0,024
	26.01.1995	*1*	-0,01851		22.12.1999	*1*	-0,0025
	31.01.1995	*1*	0,0754	**Korea**	04.12.1997	*1*	
	01.02.1995	*1*	-0,03829		05.12.1997		0,074492
	15.06.1999	*1*	0,027417				

(*) *1* denotes the dates of the stand-by requests. In Indonesia, Philippines, Thailand and Korea, the returns are calculated on the next days of the stand-by requests due to time differences.

The returns are negative in general. Although IMF stand-by requests provide cash inflow, the returns do not seem to be affected by liquidity injections.

Mexico's relationship with IMF in terms of stand-by requests, corresponds to the preceding days of *tequila crisis*. Mexico's beta, measuring country risks in CAPM model, trends lower over the managed rate period, 1990-1994, but shifts up and becomes more volatile in the floating rate period, 1995 – 1999 (Goldberg and Veitch, 2002). When the economic and financial crisis hit Indonesia in mid August 1997, IMF came to assist to deal with the crisis (Silas, 1999).In January 1998, Indonesia failed to roll over its short-term foreign debt and declared moratorium. Therefore on the announcement days the country was thorough a crisis period, which explains the negative return. In Argentina, the return is negative on 10.03.2000, which is 2 days after heavy rains caused floods in Tucumán Province, which then expand to Santiago del Estero and Córdoba. On 24 August 2000, Economy Minister Jose Luis Machinea says the 2000 budget will over shoot the $5.2bn target by 10%. Argentina was going through a deep recession for the last three years.

On 12.04.2005, the returns decreased by -0,01202 despite the good news on the approval of the credit from the IMF and the interest rate cut by Central Bank of Turkey and the sale of Dışbank (a medium-size Turkish commercial Bank). According to Nefçi (2005) there are leading reasons for the decrease. One of them was the cautious movement of ISE (Istanbul Stock Exchagnge) since the news from the US on American external deficit figures which were expected to be high and consequently the emerging markets were thought to be negatively affected once declared. However the main reason was the ambiguous news about the European Union.

In June 1997, the Thai government declared its intention to abandon the policy of supporting/bailing out any financial institution. There was a strong speculative attack on the Thai baht and the authorities tried to defend the currency by increasing short- term interest rates. Nevertheless, the attacks continued and the baht was allowed to float on July 2,1997 which is the major turning point of the Asian crisis (Gençay and Selçuk, 2004). The baht

dropped very swiftly and lost half of its value. The baht reached its lowest point of 56 to the dollar in January 1998. The Thai stock market dropped 75% in 1997. The largest Thai finance company collapsed. Even though the IMF provided liquidity to Thailand market, this was just a permanent solution and the returns pursued their negative values.

On 04.12.1997 the announcement of the stand-by agreement is declared. This announcement is also hypothesized to contain significantly positive new information to South Korea's international lenders and to resolve any remaining uncertainties about the agreement. The remaining uncertainties as to when the final agreement would be reached were aggravated especially after the South Korean government backed off an earlier announcement saying that a final deal was not done, after its own unilateral agreement announcement (Zhang, 2001).

GARCH estimation results were provided in Table 4. As an output, the conditional variance graphics obtained from the GARCH estimation are provided in ANNEX. As can be seen from the graphs, in Argentina, Korea, Philippines, Indonesia and Hungary the conditional variances decreased on the stand-by request dates. In Brazil, the conditional variance decreased on 06.09.2002 and 08.03.1999, whereas it increased on 14.09.2001.Despite the fact that an observed extreme market movement occurred in 14.09.2001 we find no evidence to explain this situation. In Mexico, the graph suggests conditional variance decreased on the first two stand-by requests, but increased on the preceding ones. In Turkey, conditional variances decreased on the stand-by request dates except for 29.05.2005. However, the decreases and the increases are very small which is consistent with the findings of Hayo and Kutan (2005) indicating that the IMF news does not appear to have a significant impact on the volatility of stock markets, which may act as a proxy for risk. They therefore concluded that IMF actions primarily have an effect on investor wealth, but not on investment risk Hayo and Kutan (2005).

5. CONCLUSION

The impact of the IMF-related news (stand-by requests) on 9 emerging stock market returns has been analyzed for a period covering 04.07.1994-27.02.2007. The selected countries exhibited the prominent features of the financial time series data. Therefore, we utilized GARCH, EGARCH and GJR-GARCH models to model the volatilities of the stock returns to explain the news effect as well as to capture the asymmetric movements in the returns.

We selected stand-by requests since they provided liquidity injection, which can shift the markets. Hong Kong, South Africa and China are excluded since they had no relationship with the IMF by means of stand-by requests. After determining the news and the corresponding dates of the news, we computed the returns with regard to hour differences whose results are presented in Table3.

The conditional variance graphics that exhibit stock markets' volatilities are not significantly affected by the IMF related news, on the contrary they display decreasing trend. Therefore IMF news does not appear to have a significant impact on the volatility of stock markets, which may act as a proxy for risk. Thus it can be concluded that IMF actions primarily have an effect on investors' wealth, but not on investment risk. This result is also confirmed by Hayo and Kutan (2005) who claimed that IMF news provides a convergence of market participants' expectations and therefore volatility might even decline by reducing the information asymmetry in the market. So they concluded that there is no strong evidence that IMF related-news increases market volatilities and IMF actions have an effect on returns but not on risk.

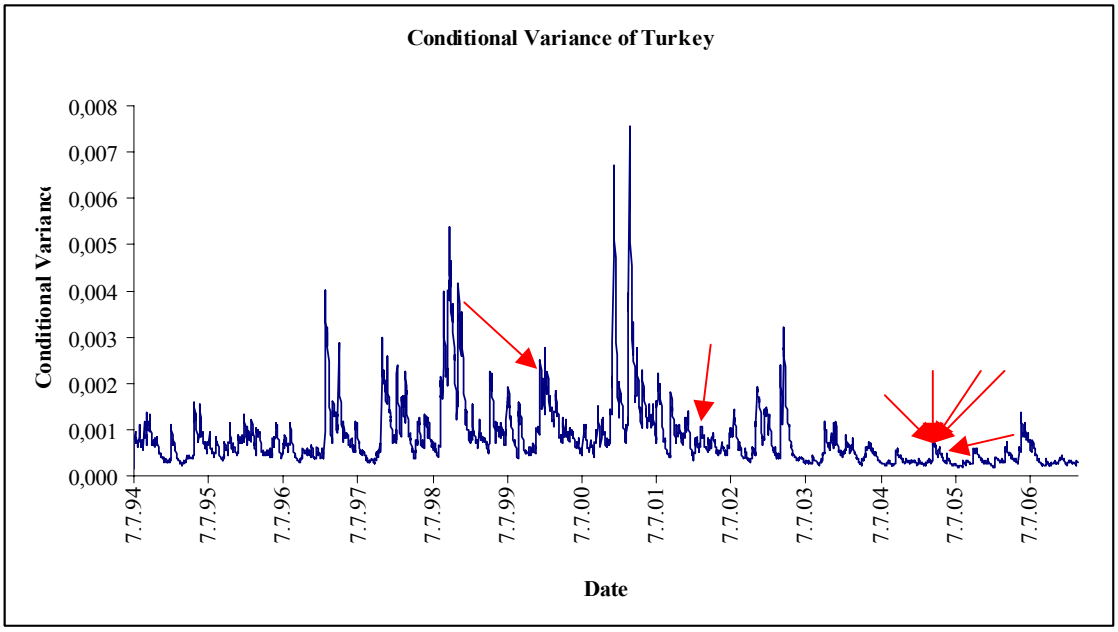
The results suggested that the IMF news is not as important as the macro economical conditions of the countries. Although they are the signals of cash inflow, they cannot provide solutions for the structural economical problems.

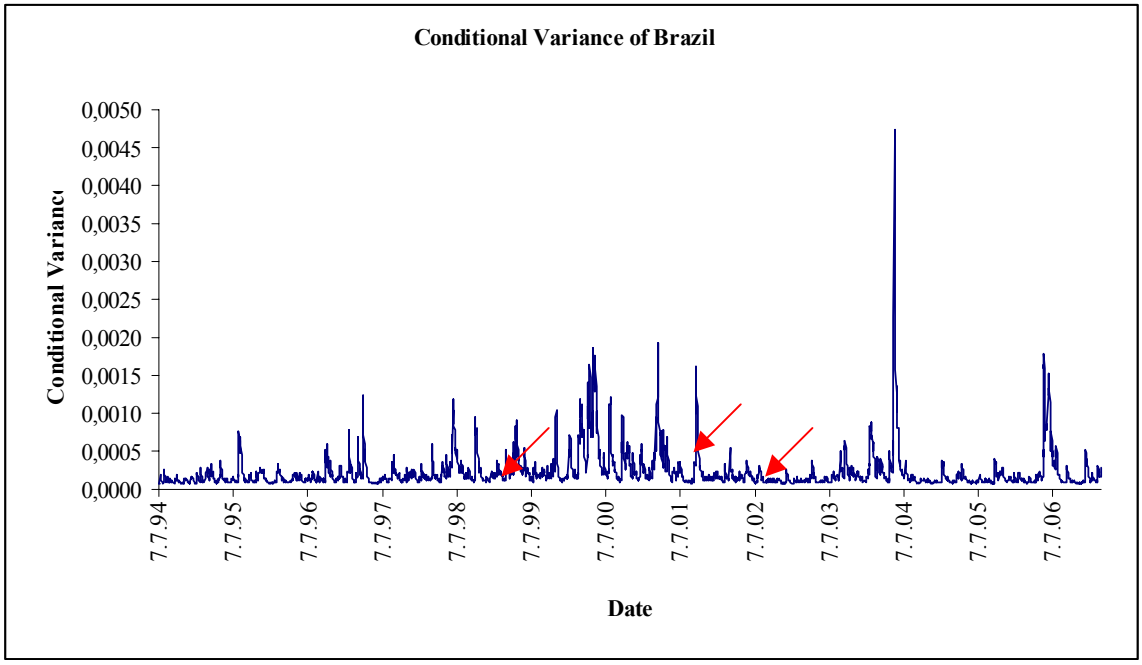
ANNEX

Table-4: GARCH Model Parameters

	GARCH Model	α_0	α_1	β	μ	φ	θ	Leverage	Log-L
Argentina	GJR- (t)	0.0000109	0.05105	0.8547	0.0005608	-0.0748	-0.1923	0.1261	9355.14
Brazil	GJR- (GED)	0.0000032	0.03471	0.8872	0.0008503	-0.1001	-0.2454	0.1224	10184.87
Turkey	GJR- (t)	0.0000140	0.07371	0.8935	0.0008232	0.5051	0.4762	0.0385	7512.51
Mexico	GJR- (GED)	0.0000032	0.03471	0.8872	0.0008503	-0.1001	-0.2454	0.1224	10184.87
Philippines	GJR- (t)	0.0000103	0.11510	0.7805	0.0000173	0.1366	-0.0421	0.1067	10275.29
S. Africa	E- (t)	-0.314861	0.22303	0.9656	0.0006066	0.2489	0.11068		10710.25
Korea	GJR- (GED)	0.0000011	0.02407	0.9532	0.0002687	-0.2178	-0.2636	0.0420	8804.36
Thailand	GJR- (GED)	0.0000082	0.07867	0.8693	-0.0001363	0.3024	0.2734	0.0732	9047.36
Indonesia	GJR- (GED)	0.0000134	0.08063	0.7926	0.0002829	0.3313	0.2144	0.1391	9695.25
Hungary	GJR- (t)	0.0000082	0.08791	0.8437	0.0006157	0.1123	0.02339	0.0797	9583.65
Hong Kong	E- (GED)	-0.101146	0.11605	0.9883	0.0002923	-0.3233	-0.3482		9928.25
China	E- (GED)	-0.296035	0.26437	0.9640	-0.000000	0.0403	0.0444		9316.91
World	GJR-(t)	0.000001	-0.01035	0.9162	0.000383	0.0705	-0.1789	0.1200	11973.23
US	E- (GED)	-0.151292	0.10712	0.9841	0.000649	-0.3352	-0.3591		10965.75

α_0 : the constant in the conditional variance equation
α_1 : coefficient refering to the first lagged squared residual
β : coefficient refering to the first lagged conditional variance
μ : the constant in the mean equation
φ : coefficient refering to the AR equation for the mean
θ : coefficient refering to the moving average term
Leverage : leverage parameter in GJR-GARCH model

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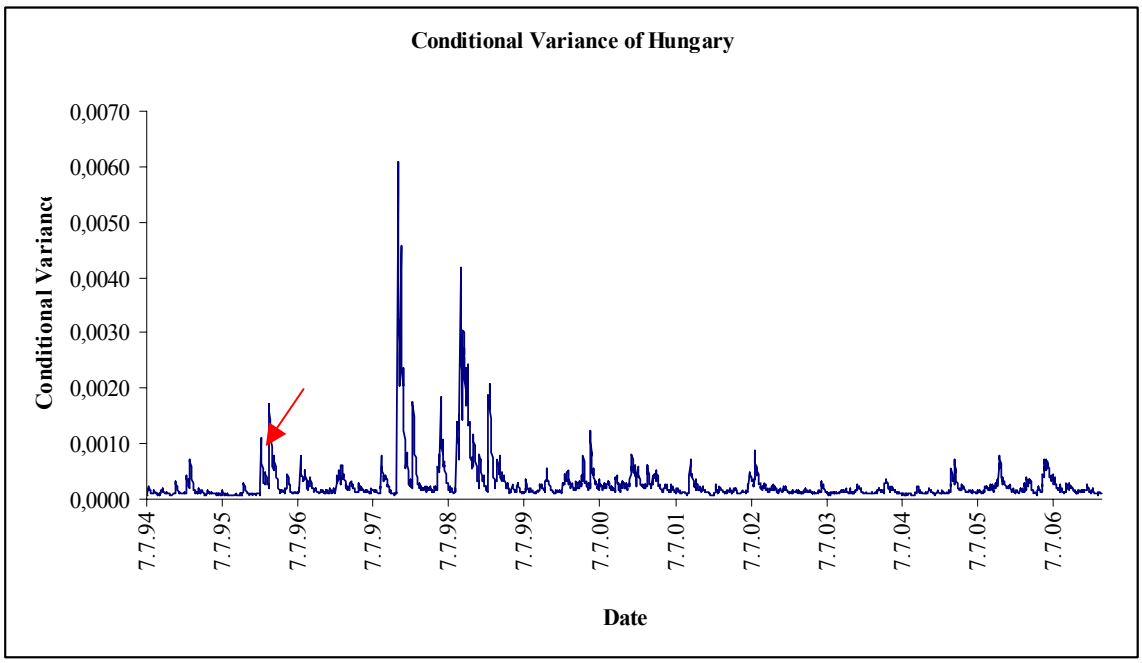
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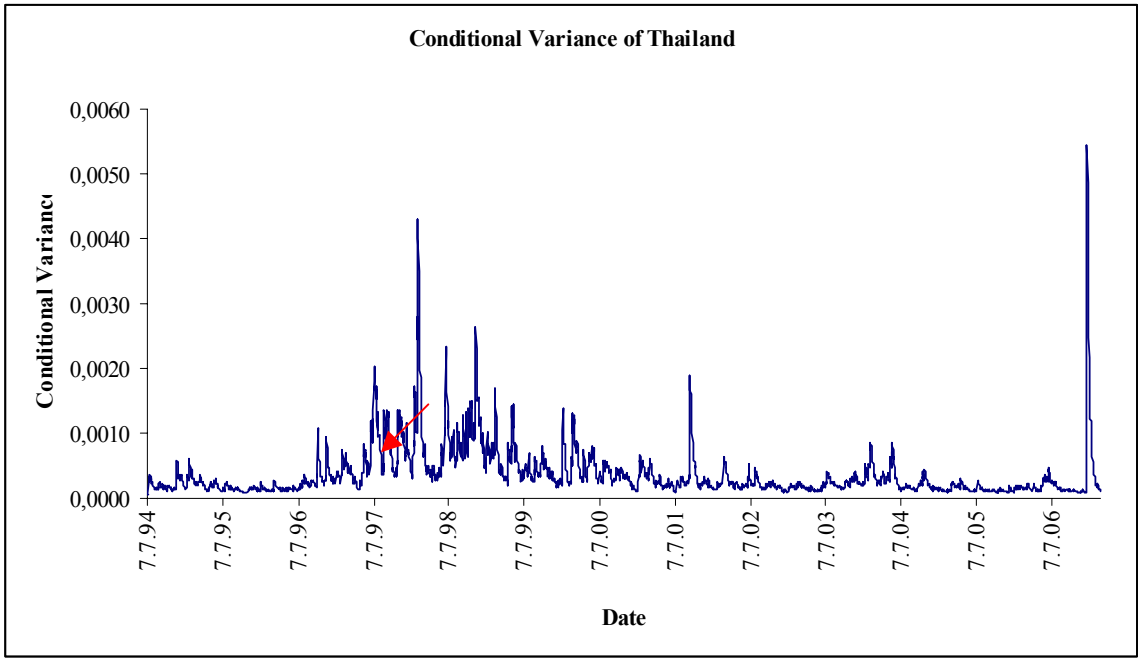
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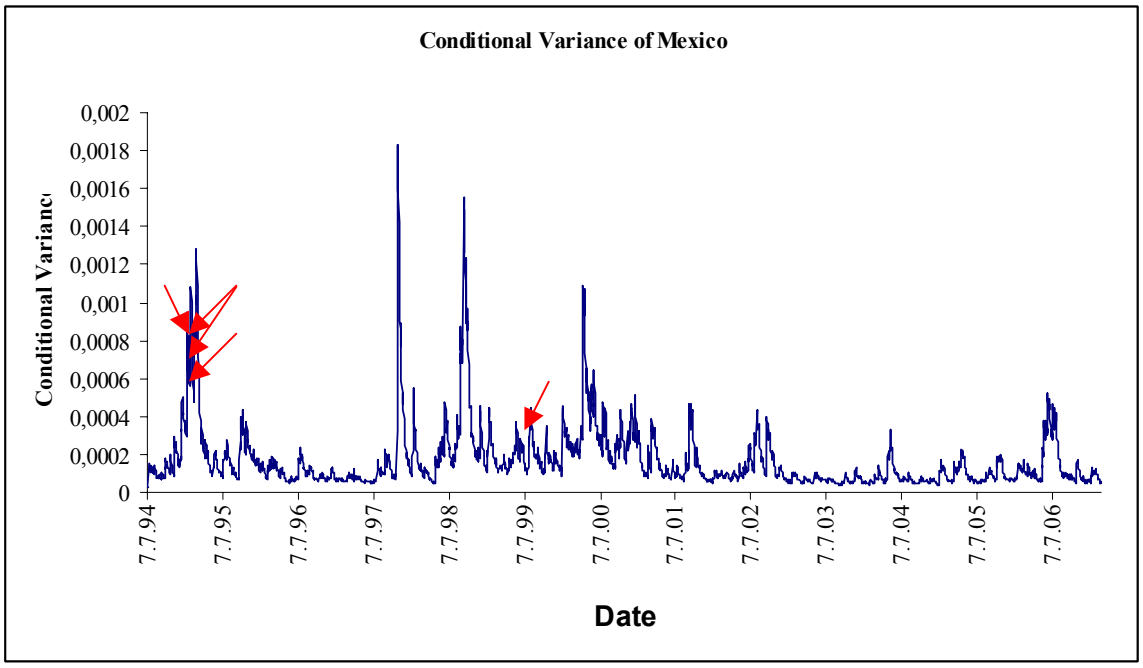
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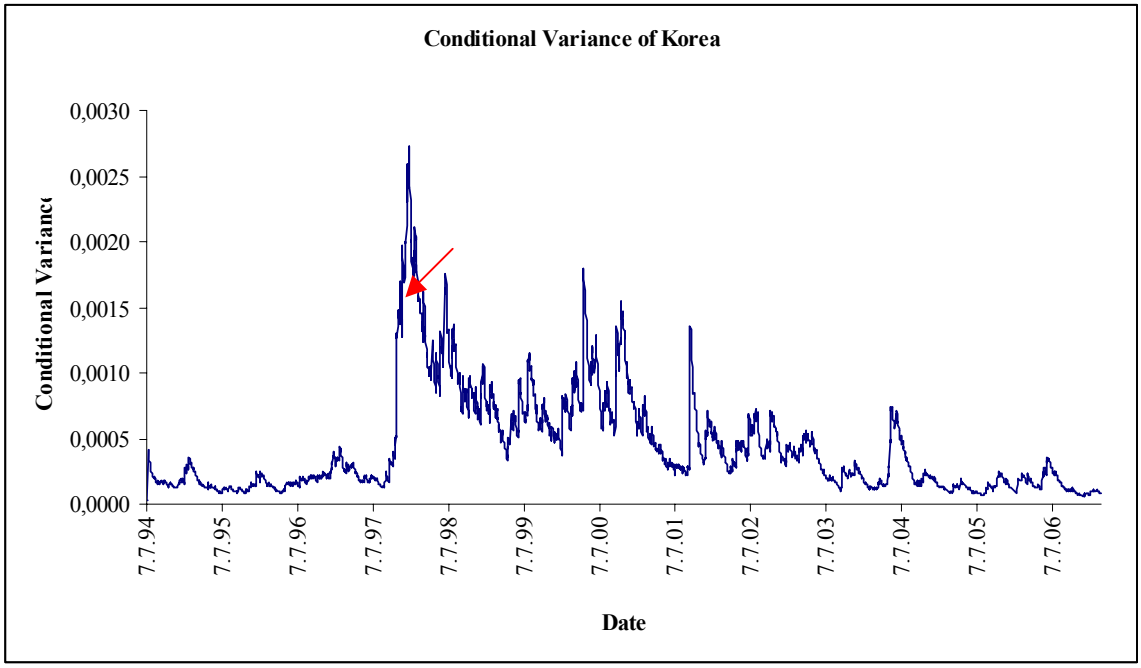
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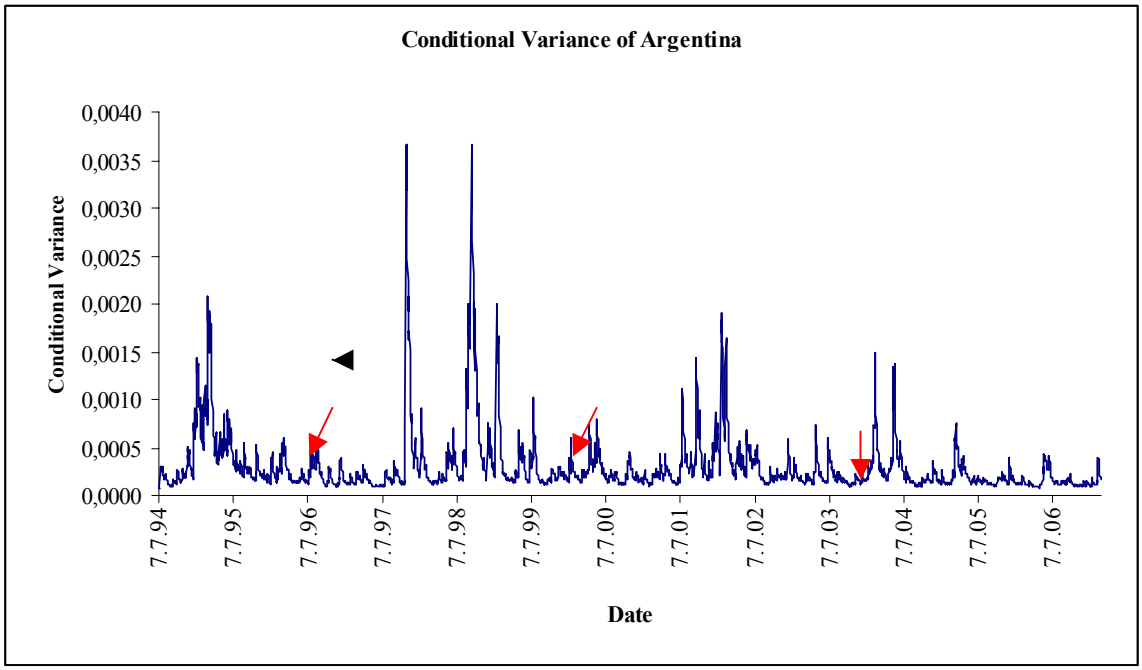
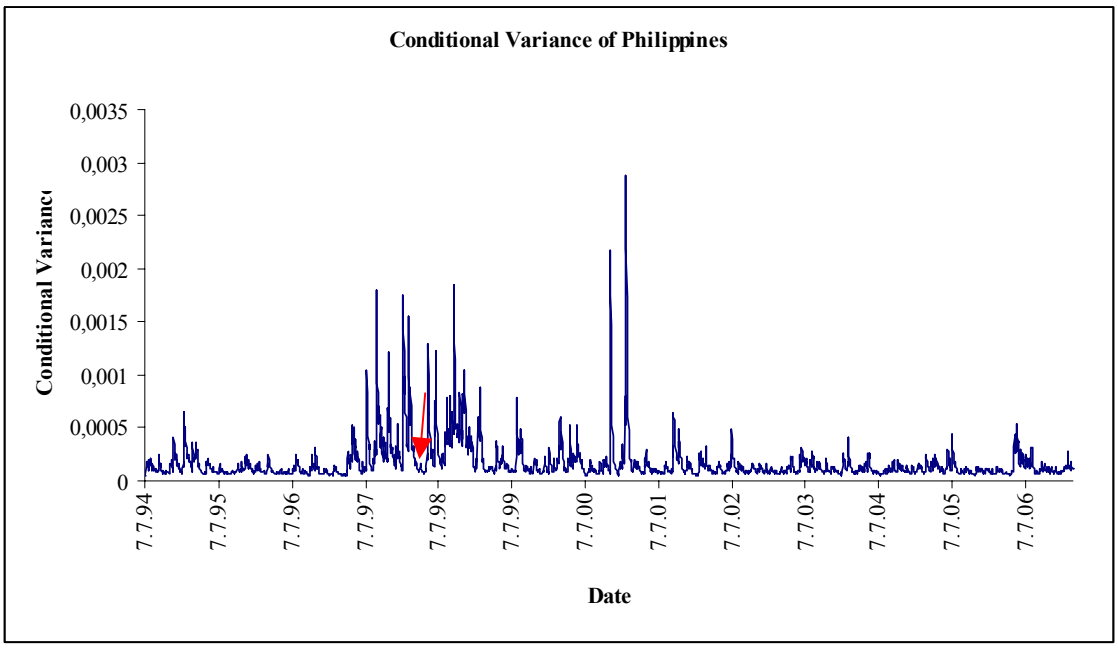
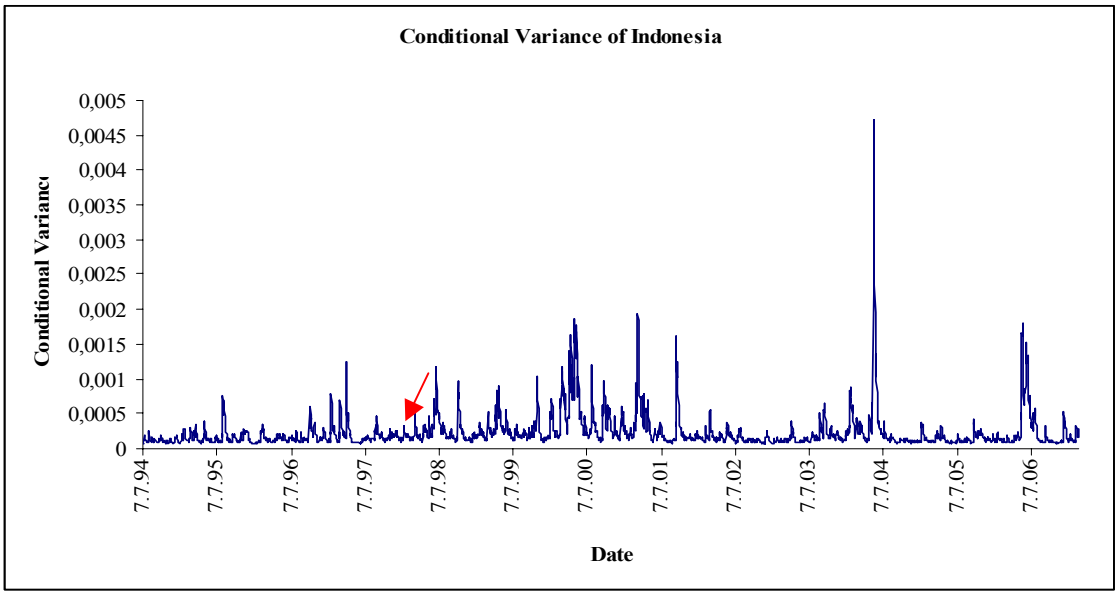
7.7.99
7.7.00
7.7.01
7.7.02
7.7.03
7.7.04
7.7.05
7.7.06
Date


Conditional Variance of Argentina
Conditional Variance
0,0040
0,0035
0,0030
0,0025
0,0020
0,0015
0,0010
0,0005
0,0000
7.7.94
7.7.95
7.7.96
7.7.97
7.7.98
7.7.99
7.7.00
7.7.01
7.7.02
7.7.03
7.7.04
7.7.05
7.7.06
Date





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