PORTFOLIO FORMATION: EMPIRICAL EVIDENCE FROM KHARTOUM STOCK EXCHANGE

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ABSTRACT

This paper investigates the validity of the capital asset pricing model CAPM, the arbitrage pricing theory APT, and the three factor model of Fama and French at Khartoum Stock Exchange KSE that is. Cross sectional data of seven banks and Telecommunication Company (compose 97 percent of the KSE) for the period 2005-2011 was used. Empirical results showed that volatility computed via TARCH indicates the impact of the bad news on the conditional is twice as good news; in addition to the preference of generalized least squares over covariate (fixed effects) model as an estimation technique. Results are against the CAPM because the CAPM's prediction that the intercept should equal zero has not been attained, and its main assumption i.e. the security market is efficient is violated. The APT showed no reaction to news from macroeconomic variables. Nevertheless APT out-performed Fama-French model and CAPM.

Key Words: *CAPM, APT, Fama-French, GLS. TARCH, news, portfolio*

INTRODUCTION

Asset return is used frequently instead of prices for two reasons: first the average investors' return of an asset is scale free summary of the investment opportunity, second return series are easier to handle (Tsay 2002). It refers to the rate that the investor should require from certain investment given its risk profile. The relative return philosophy is based largely on three theories: Harry Markowitz's Modern Portfolio Theory (1952, 1999), Eugene Fame's Efficient Market Hypothesis (1961), and Sharpe's Capital Asset pricing Model (1964). The size of a company is related to its expected return and risk. Investment managers select sound companies that are selling at a low Price/Earnings Multiple with little or no debt (Kewalramani 2008). Capital asset pricing model states that the return of stock depends whether the stock's price follows the prices in the market as a whole (Donovan & Weinraub 2007). The arbitrage pricing theory (Rubinstein 2006) postulates that the pricing of risky assets depends on a set of variables whose influence felt significantly by all risky assets together. The set of variable is known as the common factors of ATP and are not identified in the model and they have to be empirically determined. Asset returns follow a linear return generating process (Otuteye 1998). The main tools of arbitrage model is based on the existence of efficient market which could be interpreted under the idea Black – School model i.e. the possibility of non-risk transaction precondition when an option transaction is employed beside the basic assets (Roll & Ross 1984).CAPM estimates the risks encounter the investor in securities that is, asset specific risk and market risk. The Fama-French three factor model uses three variables, risk free, risk premium, low and high returns (Fama etal 2002).

The idea of establishing the Stock Market in Sudan dates back to 1962 when several studies were conducted by the Ministry of Finance and the Bank of Sudan in collaboration with the International Financing Board of the World Bank. In 1982 The Stock Market bill was passed by the People's Assembly (Parliament) and consequently the establishment of the Stock Market

began with setting up the preliminary market of the monetary issues in October 10, 1994. This was followed by establishing the secondary market, the stock exchange market, in January 1995, in which 34 companies were listed and grew to 53 in 2012. The Stock Market grew up steadily and reached its highest rate of exchange in 2010. The performance of the Khartoum Stock Exchange KSE was characterized, may be for the first time, by an inclusive exchange, covering all the Bourse sectors, including the agricultural and insurance sectors and the first monetary issue of Government Musharaka (participation) Certificates (GMC Shahamah). Khartoum Stock Exchange KSE plays a key role in the monetary industry field by offering innovative financial services and products of high quality, professionalism and credibility. The asset-backed debt securities overcome this constraint (Hearn, Piesse and Strange 2011). KSE will set-up the following markets: commodity market, real estate market, and hard currency market. According to the KSE Act listing of companies requires capital more than 120 thousand USD, number of share holder not less than 7, and should not participate less than 25% and not more than 75% of the capital. The ratio of individual share holder should be less than 10%.

The motivation of recently established African Security markets was that they can act both as a vehicle to promote privatizations of former state owned enterprises but would attract foreign investment to supplement shortfalls in domestic savings. However, despite the global interest in investment opportunities in emerging markets, levels of investment in Sub Saharan Africa (SSA), with the exception of South Africa, has remained low (Piesse 2008). The main question is that which one of commonly used techniques for calculating the required return CAPM, APT, and Fama-French models is valid in the Khartoum Stock Exchange Market? This paper aims to bring empirical evidence of formation from KSE stock returns of listed companies by estimating CAPM, APT, and Fama-French three Factor models and find out which is better.

LITERATURE REVIEW

The understandings of how investors evaluate the riskiness of financial assets and determine the premium for the risk borne has been intensively studied producing a plethora of empirical research. The CAPM, APT, and Fama-French model have been commonly used techniques for calculating the required return of a risky asst. Investors should hold diversified portfolios and the systematic risk or non-diversifiable risk will be the only important risk to investors. The diversification will reduce the other diversifiable risk. Reddy and Thomson (2011) tested empirical validity of CAPM for the South African share market for the period 30 June 1995 to 30 June 2009. Regression analysis was used to test hypotheses based on both individual sectoral indices and portfolios constructed from those indices according to their betas. It was found that while, on the assumption that the residuals of the return-generating function are normally distributed, the CAPM could be rejected for certain periods, and the use of the CAPM for long-term actuarial modeling in the South African market can be reasonably justified. Da, Guo and Jagannathan (2009) proposed method for estimating firms' project betas and project returns and find that there is a linear relation between the two. The findings support the use of the CAPM

along with real option valuation models in project evaluation. Chu (2007) showed that the market portfolio is not mean-variance efficient, and traditional CAPM fails in a model with owner-occupied housing as both a consumption good and a risky asset when covariances between housing and other risky assets are not zero; however, a conditional linear factor pricing model can still be derived. Eugene etal (2004) stated that the version of the CAPM developed by Sharpe (1964) and Lintner (1965) has never been an empirical success. Roll (1977) argued that the CAPM has never been tested and probably never will be. It is not theoretically clear which assets (for example, human capital) can legitimately be excluded from the market portfolio, and data availability substantially limits the assets that are included. As a result, tests of the CAPM are forced to use proxies for the market portfolio, in effect testing whether the proxies are on the minimum variance frontier.

The feasibility of Fama-French three factor model has been investigated by Benzefa (2012) using daily on Tokyo Stock Exchange (TSE) over the period 1990-2010. The empirical findings lend support to the three factor model. The size of small market capitalization minus big (SMB), and book to market ratio (HML) minus high absorb common variation in stock returns and thus proxy for the common risk factors. Further taking together the market factor and factor related to the size and book to market value explain the cross sectional variation in average returns. But contrary to the findings of Fama and French the book to market related to HML seems to less important for the explanatory power of the model than the two factors. Banz (1981) examined the empirical relationship between the return and the total market value of NYSE common stocks. He found that smaller firms have had higher risk adjusted returns, on average, than larger firms. This 'size effect' has been in existence for at least forty years and is evidence that the capital asset pricing model is mis-specified.

Empirical results indicate that the arbitrage pricing theory performs better than CAPM. Ismael (2011) found significant relationships between the stocks rate of returns: and the rates of success SU; stock-dividend yield D/P; the quality of earning EQ. Portfolios that were constructed based on the study variables are consistent with the above results and contrary to CAPM specification. The results also indicated that there are several factors affecting the rates of returns which are more consistent with the APT. Faruque (2011) investigated how APT performs in a frontier stock market. To address the common problem of multi-collinearity in macro variables, he used principal component analysis (PCA) as robustness check on the previous results. The results confirmed evidence of one significant macroeconomic factor in the Dhaka stock market - a frontier stock market of Bangladesh.

Dunis etal (2010) used a simple trading strategy to evaluate the profit potential of the data series and compare information ratios yielded by each of the different data sampling frequencies. The frequencies observed range from a 5-minute interval, to prices recorded at the close of each trading day. The analysis of the data series revealed that the extent to which daily data are cointegrated provides a good indicator of the profitability of the pair in the high-frequency

domain. For each series, the in-sample information ratio is a good indicator of the future profitability as well. Conclusive observations show that arbitrage profitability is in fact present when applying a novel diversified pair trading strategy to high-frequency data. In particular, even once very conservative transaction costs are taken into account, the trading portfolio suggested achieves very attractive information ratios (e.g. above 3 for an average pair sampled at the high-frequency interval and above 1 for a daily sampling frequency).

Akwimbi (2005) applied the multi-index (APT) to explore the relationship of NSE companies stock returns to selected market and industrial variables. He employed indices as well as unanticipated changes in economic variables as factors driving security returns. Regression results on the variables are mixed; in particular, interest on loans and interest on savings are positively related to NSE stock returns, but the relationships are not significant. The results suggest that a multi-index APT using selected economic and industrial variables provides additional power in explaining the variability of NSE stock returns over a single index model using the market index alone. It is therefore noted that the inclusion of economic variables to a large extent improves the explanation of the cross-section of expected returns.

RESEARCH METHODOLOGY

Investors should hold diversified portfolios and the systematic risk or non-diversifiable risk will be the only important risk to investors. The diversification will reduce the other diversifiable risk. Data were collected for Sudan Telecommunication Company (STS), and 8 banks constitute 97% of KSE capitalization i.e. Sudanese French Bank (FSB), Tadamon Islamic Bank (TIB), Faisal Islamic Bank (FISB), Bank of Khartoum (BOK), Alshamal Islamic Bank (AIB), Farmers' Commercial Bank (FCB), and Financial Investment Bank (FIB) for the period 2005-2011. Monthly data for the period Sep 2003-Dec 2008 were also collected from KSE.

Table 1: Study Variable Symbols

Variable	Symbol	Variable	Symbol
Number of shares	NOS	High book to market ratio minus Low	HLM
Share Value	SV	Small Market Capital minus Big	SMB
Market Portfolio	MP	Returns to share Value	R
Capital value of Company	CV	GDP Growth	G
Market value	MV	Debt Ratio	DR
Book Value	BV	Working Capital	WC
Share Returns	SR	Share Returns	SR
Government Musharaka Certificate	GMC	Overall Market Capitalization	KSC

The capital asset pricing model (CAPM) founded by Markowitz (1959) assumes that investors are risk averse and, their choice among portfolios depends on only the mean and variance of their one-period investment return. As a result, investors choose "mean-variance-efficient" portfolios, in the sense that the portfolios minimize the variance of portfolio return, given expected return,

and maximize expected return, given variance. Investors hold a portfolio that lies along the efficient frontier there exists riskless asset, they had identical preferences, had the same information, and hold the same portfolio, there is no uncertainty about expected inflation and capital markets are in equilibrium. Relaxing these assumptions implies the following: inclusion of skewness lead to three moment model, no riskless asset exist, there is zero lending but no riskless borrowing, different borrowing and lending rates lead to different CAPM, and different expectations lead to different CAPM lines and no general equilibrium pricing model. Treynor (1961, 1962) Sharpe (1964), Lintner (1965a, b) and Mossin (1966) worked independently, building on the work of Markowitz. Sharpe (1964) and Lintner (1965) added two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance-efficient. CAPM requires 3 data inputs: beta of the asset (how much it moves relative to the market); risk free rate or default risk (i.e. government bond yield e.g. GMC); and expected return of the market.

$$r_t = \ln(R_t/R_{t-1})$$

$$r_t = \beta_1 \ln(GMC_t) + \beta_2 ln(CV_t/GMC_t) + e_t \quad (1)$$

The CAPM attempts to determine the worth of an investor's financial assets when the behavior of all investors in the stock market is taken into consideration (Thomas etal 1982). The required return on an asset is that compensates for risk taken. The beta of the portfolio is the defining factor. It is mainly estimated by GLS or covariance model. The economic interpretation of the CAPM equation is as the base risk-free rate of return (Rf) plus the market-wide risk premium of (Rm - Rf) that is required to persuade investors away from exclusive investment in risk-free securities. It produces return estimates that should meet investors' opportunity costs. To choose between GLS and covariance model the following test should be held for the null hypothesis that the constant is fixes across units and time:

$$F_{N+T-2,NT-N-T} = \frac{ESS_1 - ESS_2}{N+T-2} \Big/ \frac{ESS_2}{NT-N-T} \quad (2)$$

Where ESS1 is the GLS sum of squared residuals, ESS2 is the sum of squared residual of the covariance model, N number of unit, and T the sample period. Although empirical studies have identified several anomalies in the CAPM it still remains the most favorite asset-pricing model for researchers as well as industry practitioners (Narasimhan and Pradhan 2002).

APT has very few assumptions i.e. all securities have finite expected values and variances, some agents can form well diversified portfolios, there are no taxes, there is no transaction costs.(combination of risky assets) The APT will give a theoretical justification for the use of empirical factor models in determining the “fair” rate of return. The APT is determined by a set of common factors - not just a monolithic market – influence returns, other common factors that

simultaneously affect returns, and the size factor at work. Factors can be specified a priori: they could be macroeconomic variables (e.g. inflation, output) that capture the systematic risk in the economy or portfolios proxying for these risks, or can be extracted via Principal Components or Factor Analysis. Companies possessing similar characteristics may, in a given month, show returns that are different from the other companies. The pattern of differing shows up as the factor relation (Rosenberg 1974). The arbitrage theory postulates that the expected rate of return is dependent on many factors as follows:

$$r_t = \beta_0 + \beta_1 ln(GMC_t) + \beta_2 ln(KSC_t/GMC_t) + \beta_3 DR_t + \beta_4 ln(No_t) + \beta_5 ln(CV_t) + e_t \quad (3)$$

The Fama-French three factor model uses three variables. Fama and French started with the observation that two classes of stocks have tended to do better than the market as a whole: (i) small caps and (ii) stocks with a high book to market (BtM), customarily called value stocks, contrasted with growth stocks). They then added two factors to CAPM to reflect a portfolio's exposure to these two classes (Fama, Eugene, French 1995):

$$r_t = \beta_1 R_f + \beta_2 (K_m - R_f) + \beta_3 SMB + \beta_4 HLM + e_t \quad (4)$$

Here r is the portfolio's rate of return, R_f is the risk-free return rate, and $K_m$is the return of the whole stock market. The "three factor" β is analogous to the classical β but not equal to it, since there are now two additional factors to do some of the work. SMB stands for "small (market capitalization) minus big" and HML for "high (book-to-market ratio) minus low"; they measure the historic excess returns of small caps over big caps and of value stocks over growth stocks. These factors are calculated with combinations of portfolios composed by ranked stocks (BtM ranking, Cap ranking) and available historical market data. Moreover, once SMB and HML are defined, the corresponding coefficients and β_3 and β_4 are determined by linear regressions and can take negative values as well as positive values. The signs of the coefficients suggested that small cap and value portfolios have higher expected returns than those of large cap and growth portfolios (Fama etal 1992). Griffin (2002) showed that the Fama and French factors are country specific and concludes that the local factors provide a better explanation of time-series variation in stock returns than the global factors.

Threshold ARCH (TARCH)

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 d_{t-1} + \beta \sigma_{t-1}^2 \quad (5)$$

$$d_t = 1 \; if \; \varepsilon < 0; d_t = 0 \; otherwise; \; \varepsilon_{t-1} > 0 \; good \; news; \varepsilon_{t-1} < 0 \; bad \; news$$

EMPIRICAL RESULTS

The market works under shariaa principles which dictate the nature of contracts traded, design of institutions to support market, and regulate the behavior of the participants. The market is fundamentally different from its western counterpart in terms of the institutional design promoting the concepts of information and allocation efficiency. The western model seeks to use the presence of arbitrage traders, who profit from price differences between the same security traded in different locations thereby acting to close pricing and information gaps persisting within the market (Hearn, Piesse, and Strange (Nov 2011). Profit and loss sharing is compatible with risk return and equity portfolio investment and the concept of risk free asset is not acceptable which can be a barrier to the application of portfolio investment theory. Many studies have found that Khartoum stock market is inefficient (Arabi 2011). The market capitalization as percentage of GDP is increasing steadily but lagging behind regional stock markets. The market's trading activity relative to the size of the economy i.e. total value of shares traded in the market to GDP is relatively low compared to African stock markets, turnover ratio measured by total value of shares trade scaled by total market capitalization measures the trading activity relative to the size of the market itself is thin and illiquid. The ratio of capitalization to quasi money is low indicating that the banking system is a better place for investment. The mean index is 2381.2 points with very high standard deviation 805.3; the mean of the share price is 1.25 Sudanese dinars worth half dollar, and standard deviation 4. The number of listed companies rose from 34 to 53 during the period 1996-2012. The ratio of companies with traded shares to non-traded shares is 0.61 annex (8). The average number of certificates and stocks constitutes only 2 percent of number of shares. There was a surge in the number of shares in the second quarters of 2006 and 2007. Share prices witnessed high jump in Jan-March and May-June 2008 as a result of increase in the volume of circulation.

To cater for volatility, the index of Khartoum stock market was estimated via Threshold ARCH using monthly data from Sep 2003 to Dec 2008 to be affected by financial variables i.e. capitalization, share prices, and number of certificates in circulation, and economic variables i.e. inflation rate. The impact of good news on the conditional variance is .022 while the bad news has an impact of 0.4. Since $\gamma \neq 0$ the impact is asymmetric annex (7). In crisis time investors forming volatility expectation are inclined to use current shock rather than past in updating their expectations.

The validity of Khartoum stock market as investment opportunities having the potential to improve risk-return tradeoffs facing the global investors is quantified by CAPM, ATP, and Fama-French model. The determinants of returns to stock value have been estimated in the context of CAPM, arbitrage pricing theory, and Fama- French three factors' model via fixed effects method and GLS (Cross Section Weights (Annex1-4).

Table 2: Summary of Results

Item/ Method	CAPM	Arbitrage	Fama-French
Constant	107.51**	122.2595**	-
LOG(GMC)	70.14**	65.09398**	33.48117**
AIB_MR	1.18**	-	-
BOK_MR	1.05**	-	-
TIB_MR	1.19**	-	-
STS_MR	0.99**	-	-
SFB_MR	1.18**	-	-
FCB_MR	1.14**	-	-
FIB_MR	1.16**	-	-
FIS_MR	1.14**	-	-
LOG(KSC/GMC)	-	-	6.369974**
LOG(?HLM)	-	-	1.201805**
LOG(?SMB)	-	-	-1.024255**
LOG(?NO)	-	-0.240054**	-
LOG(?CV)	-	0.162853**	-
R Squared	0.98	0.99	0.52
Durbin Watson	2.7	2.3	2.9
Residuals Sum of Squares	211.87	176.312	132.326

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

Where MR stands for market risk, and calculated in logarithmic form i.e. $\ln\left(\frac{CV_t}{GMC}\right)$. The estimated coefficients assigned to the default risk (risk free) got the right signs and were highly significant in the three models. The estimated CAPM, results show that the estimated coefficients of cross-section constant, default risk, and risk premium got the right signs. The entire estimated coefficients assigned to those variables are significantly different from zero. They measure the sensitivity of the asset's return to the return variation in the market return. That is how much extra return is got for each extra unit of risk of a portfolio. It can also be interpreted as the risk of the market portfolio as measured by the variance of its return (denominator), is a weighted average of the covariance risks of the assets (the nominator). They explain 98 per cent of reruns' variations. The squared sum of residuals is 211.87. Since the calculated F test is 0.05 less than 3.37 we accept the null hypothesis at 0.99 significance level, we admit the following betas.

Table 3: Regression Analysis

Unit	STS	BOK	**FIS**	FCB	**FIB**	AIB	**SFB**	TIB
Beta	0.99	1.05	**1.14**	1.14	**1.16**	1.18	**1.18**	1.19
R (mean)	-0.12	-0.20	**0.79**	-0.47	**0.17**	-0.21	**1.48**	0.14
R(STDEV)	3.35	2.27	**4.65**	4.12	**4.56**	0.313	**3.08**	0.264
MR (mean)	23.7	22.2	**20.5**	20.0	**20.2**	19.6	**20.9**	19.8

The risk premium (beta times the expected value of market portfolio-risk free asset i.e. MR).

The application of the arbitrage theory resulted in highly significant four coefficients including the constant. The variables are the risk free asset that is GMC, number of shares, and capital value. They explain 99 per cent of the return to share value variation. The estimated model is free from serial correlation. The sum of squared residuals is 176.312. The estimated F test is 0.133 less than 3.37 indicating the acceptance of the adequacy of GLS estimation method over the covariance model.

The estimated Fama-French model has resulted in highly significant estimated coefficient. The four variables explain only 52 percent of the returns' variations.

DISCUSSION

Results of this study are in line with the empirical results has been stated above indicating that the arbitrage pricing theory performs better than CAPM. The assumptions of the CAPM imply that the market portfolio reflects the universally preferred combination of risky assets, it ideally includes all assets but only 8 assets (companies) were selected as the market's most dominant assists and due to data availability consideration. Those companies constitute 97 percent of KSE capitalization. Moreover, there is limited number of companies that have traded shares in the Khartoum Stock Market due to restrictions in listing new companies. The appropriate expected rate of return of KSE investments in light of their riskiness relative to the risk of the market suggests that an investor can form his ideal portfolio from three banks i.e. Sudanese-French bank SFB, Financial Investment bank FIB and Faisal Islamic bank FIS according to CAPM security line. But the results are against the CAPM because The CAPM's prediction that the intercept should equal zero has not been attained, and the main premise of the CAPM that is the security market is efficient is violated. Moreover the correlation coefficient between beta and rate of return of risky asset is positive as has been postulated but not significant. The strengthening of infrastructure and enhancing transparency to avoid insider trading in urgently needed. On the other hand the arbitrage pricing theory has been proved empirically applicable nevertheless the estimated ATP showed no reaction of stock returns to the news regarding macroeconomic variables only financial variables. Investors will choose among companies on the basis of number of assets (cash-flow pattern), market capitalization, and risk free assets (GMC). Investors respond negatively to the number of assets. This can be attributed to the reduction of share return i.e. net profit divided by the number of shares. Fama-French model has the lowest fit among the models. It predicts that the size of small market capitalization minus big (SMB), and book to market ratio (HML) minus high absorb common variation in stock returns and thus proxy for the common risk factors. HLM and SMB are almost determine the investor choice in opposite directions these findings are compatible with Benzefa (2012). The estimated Fama-French model using KSE data asserts the findings of Griffin (2002 that is the local factors provide a better explanation of time-series variation in stock returns than the global factors. The choice between

APT and Fama- French model is in favor of former in terms of econometric criteria. The APT is not suffering from serial correlation – which cause least squares estimates to be inefficient and inferences based on these estimates is adversely affected. Data base is the main obstacle to thoroughly analysis of the KSE and adds to the market inefficiency. The information barrier, lack of transparency and inadequacies in infrastructure adds to the transaction costs of investors, delays of settlement, and can slow down the price sensitive information in the market. Uncertainty is salient feature of KSE reveals that the effects of bad news on the conditional variance are almost double as good news. It has been found by Hearn, Piesse, and Strange (Nov 2011) that while Islamic financial instruments have considerable potential in facilitating development finance through their emphasis on partnership this is better achieved through the banking system rather than the Khartoum stock exchange. Larger firms able to cross list elsewhere are likely to accrue considerable benefits from lower costs of equity and ability to attract investors although governance preferences are likely to be towards block shareholders through listing in regional Middle East and North African markets. It is worth mentioning that the Sudanese Telecommunication Company SUDATEL has been listed at Dubai Stock Exchange.

CONCLUSIONS AND RECOMMENDATIONS

The adequacy of the CAPM, APT, and Fama-French three factor model has been examined using expected return of the market (asset prices) for eight companies listed at Khartoum Stock Exchange via generalized least squares. CAPM was rejected due to attain its assumptions. APT is preferred to Fama-French models in terms of econometric criteria. KSE has been hindered by the lack of appropriate infrastructure. Stock Exchange Electronic Trading Shares has been launched in the year 2012. The stock market as a preferred source for development finance faces many obstacles, the combination of high costs of capital, lack of liquidity together with macroeconomic uncertainty cause firms to source capital either through internal means or from relationship based finance through the banking system. The stock market is constrained by its small size, with few brokers and a lack of appropriate institutions similar to Sub-Saharan countries SSA. There should be more awareness about an enabling environment for the market to perform vital liquidity and information production.

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Annex (1) Estimated Results of CAPM (Fixed Effects)

Dependent Variable: LOG(?R)				
Method: Pooled EGLS (Cross-section weights)				
Date: 12/03/13 Time: 04:46				
Sample (adjusted): 2008 2011				
Included observations: 4 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 32				
Iterate weights to convergence				
White diagonal standard errors & covariance (d.f. corrected)				
Convergence achieved after 24 weight iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	64.58453	37.33196	1.730006	0.1041
LOG(GMC)	59.09277	4.680784	12.62455	0.0000
AIB_--AIB_MR	0.376792	0.762265	0.494305	0.6283
BOK_--BOK_MR	-0.491962	0.528591	-0.930704	0.3667
TIB_--TIB_MR	0.465237	0.834950	0.557204	0.5856
STS_--STS_MR	1.391863	0.589666	2.360427	0.0322
SFB_--SFB_MR	36.59332	10.75843	3.401362	0.0039
FCB_--FCB_MR	3.366994	9.300758	0.362013	0.7224
FIB_--FIB_MR	-25.07138	2.302987	-10.88646	0.0000
FIS_--FIS_MR	-0.090916	1.374740	-0.066133	0.9481
Fixed Effects (Cross)				
AIB_--C	38.05041			
BOK_--C	56.22997			
TIB_--C	36.61640			
STS_--C	12.83513			
SFB_--C	-721.8877			
FCB_--C	-22.45188			
FIB_--C	552.2715			
FIS_--C	48.33614			
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.974127	Mean dependent var		0.319685
Adjusted R-squared	0.946529	S.D. dependent var		11.77444
S.E. of regression	2.722289	Akaike info criterion		7.374262
Sum squared resid	111.1629	Schwarz criterion		8.152934
Log likelihood	-100.9882	Hannan-Quinn criter.		7.632369
F-statistic	35.29718	Durbin-Watson stat		2.824990
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.584753	Mean dependent var		0.199617
Sum squared resid	111.1643	Durbin-Watson stat		2.867141

Annex (2) Estimated Results of CAPM (GLS)

Dependent Variable: LOG(?R)				
Method: Pooled EGLS (Cross-section weights)				
Date: 12/03/13 Time: 04:51				
Sample (adjusted): 2008 2011				
Included observations: 4 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 32				
Iterate weights to convergence				
White diagonal standard errors & covariance (d.f. corrected)				
Convergence achieved after 19 weight iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	107.5084	3.774965	28.47930	0.0000
LOG(GMC)	70.14385	1.211205	57.91248	0.0000
AIB_--AIB_MR	1.178688	0.215905	5.459284	0.0000
BOK_--BOK_MR	1.049118	0.180656	5.807278	0.0000
TIB_--TIB_MR	1.189987	0.213253	5.580164	0.0000
STS_--STS_MR	0.988193	0.160980	6.138628	0.0000
SFB_--SFB_MR	1.180524	0.198913	5.934872	0.0000
FCB_--FCB_MR	1.137670	0.189402	6.006650	0.0000
FIB_--FIB_MR	1.161972	0.194312	5.979930	0.0000
FIS_--FIS_MR	1.137143	0.219522	5.180076	0.0000
R-squared	0.984112	Mean dependent var		-0.193252
Adjusted R-squared	0.977612	S.D. dependent var		20.75534
S.E. of regression	3.103297	Akaike info criterion		10.08386
Sum squared resid	211.8699	Schwarz criterion		10.54190
Log likelihood	-151.3417	Hannan-Quinn criter.		10.23568
F-statistic	151.4071	Durbin-Watson stat		2.707994
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.208569	Mean dependent var		0.199617
Sum squared resid	211.8713	Durbin-Watson stat		2.826213

Annex (3) Estimated Results of ATP (Fixed Effects)

Dependent Variable: ?R				
Method: Pooled EGLS (Cross-section weights)				
Date: 12/03/13 Time: 05:04				
Sample (adjusted): 2008 2011				
Included observations: 4 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 32				
Iterate weights to convergence				
White diagonal standard errors & covariance (d.f. corrected)				
Convergence achieved after 15 weight iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	148.5846	2.69E-09	5.53E+10	0.0000
LOG(GMC)	59.03429	7.73E-10	7.63E+10	0.0000
LOG(?NO)	-0.649848	4.54E-11	-1.43E+10	0.0000
LOG(?CV)	-1.474772	1.78E-10	-8.28E+09	0.0000
Fixed Effects (Cross)				
AIB_--C	-5.893459			
BOK_--C	3.185587			
TIB_--C	-3.405572			
STS_--C	5.433326			
SFB_--C	0.336827			
FCB_--C	-0.878086			
FIB_--C	-1.614278			
FIS_--C	2.835656			
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	1.000000	Mean dependent var		-152640.9
Adjusted R-squared	1.000000	S.D. dependent var		11035064
S.E. of regression	2.994014	Akaike info criterion		10.24847
Sum squared resid	188.2465	Schwarz criterion		10.75232
Log likelihood	-152.9755	Hannan-Quinn criter.		10.41548
F-statistic	4.21E+13	Durbin-Watson stat		2.538960
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.196363	Mean dependent var		0.199617
Sum squared resid	215.1389	Durbin-Watson stat		2.614691

Annex (4) Estimated Results of ATP (GLS)

Dependent Variable: ?R				
Method: Pooled EGLS (Cross-section weights)				
Date: 12/03/13 Time: 05:09				
Sample (adjusted): 2008 2011				
Included observations: 4 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 32				
Iterate weights to convergence				
White diagonal standard errors & covariance (d.f. corrected)				
Convergence achieved after 10 weight iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	122.2595	2.410667	50.71604	0.0000
LOG(GMC)	65.09398	1.068270	60.93399	0.0000
LOG(?NO)	-0.240054	0.027209	-8.822583	0.0000
LOG(?CV)	0.162853	0.087265	1.866185	0.0725
Weighted Statistics				
R-squared	0.993855	Mean dependent var		-0.344963
Adjusted R-squared	0.993197	S.D. dependent var		30.44458
S.E. of regression	2.509353	Akaike info criterion		8.597625
Sum squared resid	176.3119	Schwarz criterion		8.780842
Log likelihood	-133.5620	Hannan-Quinn criter.		8.658357
F-statistic	1509.523	Durbin-Watson stat		2.311201
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.341399	Mean dependent var		0.199617
Sum squared resid	176.3119	Durbin-Watson stat		2.614406

Annex (5) Estimated Results of Fama-French (GLS)

Dependent Variable: ?R				
Method: GLS (Cross Section Weights)				
Date: 12/03/13 Time: 05:09				
Sample: 2008 2011				
Included observations: 4				
Number of cross-sections used: 8				
Total panel (unbalanced) observations: 31				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GMC)	33.48117	8.412319	3.980017	0.0005
LOG(KSC/GMC)	6.369974	1.620809	3.930121	0.0005
LOG(?HLM)	1.201805	0.586326	2.049722	0.0502
LOG(?SMB)	-1.02426	0.326354	-3.13848	0.0041

Annex (5) Estimated Results of Fama-French (GLS) (Continued)

Weighted Statistics			
R-squared	0.515409	Mean dependent var	0.089474
Adjusted R-squared	0.461565	S.D. dependent var	3.016996
S.E. of regression	2.213814	Sum squared resid	132.3263
F-statistic	9.572357	Durbin-Watson stat	2.90505
Prob(F-statistic)	0.000178		
Unweighted Statistics			
R-squared	0.455808	Mean dependent var	0.141471
Adjusted R-squared	0.395342	S.D. dependent var	2.968461
S.E. of regression	2.308269	Sum squared resid	143.8588
Durbin-Watson stat	2.810442		

Annex (6) TARCH Output

Dependent Variable: INDEX				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 11/23/13 Time: 21:59				
Sample (adjusted): 2003M10 2008M12				
Included observations: 63 after adjustments				
Convergence achieved after 39 iterations				
Bollerslev-Wooldridge robust standard errors & covariance				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(6) + C(7)*RESID(-1)^2 + C(8)*RESID(-1)^2*(RESID(-1)<0) + C(9)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
VOLUME/SHARES	-26.44894	3.256561	-8.121739	0.0000
CAPITALIZATION	0.000153	1.58E-06	96.32256	0.0000
CERTIFICATES	-5.41E-05	2.53E-05	-2.138127	0.0325
INF	37.87363	5.653359	6.699314	0.0000
AR(1)	0.982240	0.016563	59.30368	0.0000
Variance Equation				
C	146777.0	15710.52	9.342596	0.0000
RESID(-1)^2	0.219780	0.077189	2.847276	0.0044
RESID(-1)^2*(RESID(-1)<0)	0.182542	0.062868	2.903566	0.0037
GARCH(-1)	-0.912975	0.042672	-21.39497	0.0000
R-squared	0.928152	Mean dependent var		2403.741
Adjusted R-squared	0.923197	S.D. dependent var		791.1392
S.E. of regression	219.2508	Akaike info criterion		13.77694
Sum squared resid	2788114.	Schwarz criterion		14.08310
Log likelihood	-424.9736	Hannan-Quinn criter.		13.89736
Durbin-Watson stat	1.906610			
Inverted AR Roots	.98			

Annex (7) Summary Statistics

	INDEX	VOLUME/SHARES	CAPITALIZATION	CERTIFICATES	INF
Mean	2381.210	1.248277	6272111.	101552.0	9.154688
Median	2721.825	0.002363	7372980.	70491.00	8.400000
Maximum	3359.030	18.90112	10121605	452371.0	21.80000
Minimum	941.0400	4.18E-06	1852440.	468.0000	1.700000
Std. Dev.	805.2679	4.021024	2747257.	110911.0	4.493626
Skewness	-0.954698	3.307479	-0.516212	1.359019	0.661212
Kurtosis	2.273939	12.55271	1.695326	4.521919	3.176378
Jarque-Bera	11.12788	360.0316	7.381531	25.87726	4.746433
Probability	0.003834	0.000000	0.024953	0.000002	0.093181
Sum	152397.4	79.88972	4.01E+08	6499327.	585.9000
Sum Sq. Dev.	40852750	1018.624	4.75E+14	7.75E+11	1272.139
Observations	64	64	64	64	64

Annex (8) Heteroskedasticity Test: ARCH

F-statistic	0.469007	Prob. F(1,60)	0.4961
Obs*R-squared	0.480882	Prob. Chi-Square(1)	0.4880

Annex (9) BETA and SDEV Graphs