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Consumption Oriented Capital Asset Pricing Model and Capital Asset Pricing Model in the Nigerian Capital Market: A Comparative Study

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Abstract

In this study, we test whether the Consumption Capital Asset Pricing Model (CCAPM) is superior to the Capital Asset Pricing Model (CAPM) in explaining portfolio returns in the Nigerian capital market. The data collected for the study ranged from the third quarter (Q3) of year 2000 to the fourth quarter (Q4) of year 2009. In comparing both CAPM and CCAPM performance in the Nigerian capital market for the period of study, we conducted descriptive statistics, unit root test and ordinary least square (OLS) regression. In all, our result shows that CCAPM is not superior to CAPM in explaining variations in portfolio returns of quoted companies in the Nigerian capital market. In our results, we observed that both CCAPM and CAPM with lags can be used for pricing assets (portfolio's) in the Nigerian capital market. The use of consumption per head (C/P) in our CCAPM model was shown to be statistically insignificant in explaining portfolio returns in the Nigerian capital market. On the basis of the research findings, the study recommends that other measures of consumption proxies should be used to further test if the more recently developed CCAPM model would be better than conventional CAPM in explaining portfolio returns of quoted Nigerian companies. This could include consumption measures like consumption volatility, expectation and surplus, consumer durables, real estate acquisition and human capital utilization.

Key words: CAPM, CCAPM, Nigerian Stock Exchange, Portfolio Returns, Beta, Risk Free Rate, Stocks

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Introduction

The behaviour of share prices, and the relationship between risk and return in financial markets, have long been of interest to researchers. In 1905, a young scientist named Albert Einstein, seeking to demonstrate the existence of atoms, developed an elegant theory based on Brownian motion. Einstein explained Brownian motion the same year he proposed the theory of relativity. At that time his results were considered completely revolutionary. However, the theory of Brownian motion had been discovered five years earlier by a young French doctoral candidate named Louis Bachelier. He, too was trying to explain certain complex movements: stock prices on the Paris Bouse (Cagnetti, 2001). Bachelier was the first to study the fluctuations in the prices of stocks and shares and their probability distributions. His Ph.D. thesis contained remarkable results, which anticipated not only Einstein's theory of Brownian motion but also many of the modern concepts of theoretical finance. Bachelier received a respectable "mention honorable", but his theory did not receive much attention and he died in provincial obscurity in 1946 (Holt, 1997). The full potential of Bachelier's theory was only realized some 50 years later by Mandelbrot (1963) and Fama (1965). Their findings that the variance of returns is not constant over time (heteroscedasticity) and that the distribution of price changes were not Gaussian but leptokurtic, are among the foundations of modern financial theory. Fama (1965) concluded that the empirical distributions of share prices followed not a Gaussian but a Stable Paretian distribution with characteristic exponent less than two (2), that is, with finite mean but infinite variance.

However, it was only with the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) that one of the important problems of modern financial economics was formalized: the quantification of the trade-off between risk and expected return. Proponents of the CAPM argue that Beta (β), a measure of systematic risk relative to the market portfolio, is the sole determinant of return. Any additional variability caused by events peculiar to the individual asset can be "diversified away" as capital markets do not reward risks borne unnecessarily (Cagnetti, 2001). To date numerous versions, extensions and improvements upon the model have been observed in the empirical literature. They include the old CAPM model (frought with numerous weaknesses as a result of simplistic assumptions upon which it is based), the Inter-temporal Capital Asset Pricing Model (ICAPM) and the Consumption Capital Asset Pricing Model (C-CAPM) to name only a few.

Many attempts have been made to see which of them better reflects/determine assets prices in numerous developed and emerging markets worldwide. Analysts have used different related approaches and more tools and related models are being evolved in the literature to deal with this aspect of asset pricing. All the attempts are to see if any one particular model or method could prove to be the most appropriate model for pricing assets and portfolio's in the capital markets. In this regard, the Consumption Capital Asset Pricing Model (CCAPM), a newer variant of the CAPM has attracted latter day analysts and has been adjudged a possible tool of the future in both developed and developing economies. It has received a new impetus and is currently at the front burners of capital asset pricing in the empirical literature. It is against this background that the study test whether CCAPM is superior to CAPM model in explaining portfolio returns in the Nigerian capital market.

Capital Asset Pricing Model (CAPM): An Overview

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset pricing theory (resulting in a Nobel Prize for Sharpe in 1990). Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centerpiece of MBA investment courses. Indeed, it is often the only asset pricing model taught in these courses (Fama and French, 2004). The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relationship between expected return and risk. Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model. For example, the CAPM says that the risk of a stock should be measured relative to a comprehensive "market portfolio" that in principle can include not just traded financial assets, but also consumer durables, real estate and human capital. Even if we take a narrow view of the model and limit its purview to traded and financial assets, is it legitimate to limit further the market portfolio to common stocks (a typical choice), or should the market be expanded to include bonds, and other financial assets, perhaps around the world? In the end, we argue that whether the model's problems reflect weaknesses in the theory or in its empirical implementation, the failure of the CAPM in some empirical tests implies to such researchers that most applications of the model are invalid, though numerous dissenters still exist.

Indeed, CAPM has been one of the most challenging topics in financial economics. Almost any manager who wants to undertake a project must justify his decision partly based on CAPM. The reason is that the model provides the means for a firm to calculate the return that its investors demand. This model was the first successful attempt to show how to assess the risk of the cash flows of a potential investment project, to estimate the project's cost of capital and the expected rate of return that investors will demand if they are to invest in the project. The model was developed to explain the differences in the risk premium across assets. According to the theory these differences are due to differences in the riskiness of the returns on the assets. The model states that the correct measure of the riskiness of an asset is its beta and that the risk premium per unit of riskiness is the same across all assets. Given the risk free rate and the beta of an asset, the CAPM predicts the expected risk premium for an asset (Michailidis *et al*, 2006).

The Logic of the CAPM

The CAPM builds on the model of portfolio choice developed by Harry Markowitz (1959). In Markowitz's model, an investor selects a portfolio at time t-1 that produces a stochastic return at t. The model assumes investors are risk averse and, when choosing among portfolios, they care only about 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, thus, the Markowitz approach is often called a "mean-variance model".

The portfolio model provides an algebraic condition on asset weights in mean-variance-efficient portfolios. The CAPM turns this algebraic statement into a testable prediction about the relation between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market of all assets. Sharpe (1964) and Lintner (1965) add two key assumptions to the Markowitz model to identify a portfolio that must be mean-variance-efficient. The first assumption is complete agreement; given market clearing asset prices at t-1, investors agree on the joint distribution of asset returns from t-1 to t. and this distribution is the true one – that is, it is the distribution from which the returns we use to test the model are drawn. The second assumption is that there is borrowing and lending at a risk-free rate, which is the same for all investors and does not depend on the amount borrowed or lent (Fama and French, 2004).

Consumption Capital Asset Pricing Model (CCAPM): A Cursory Overview

In the last section we saw that CAPM identifies the risk of any security as the covariance between the security's rate of return and the rate of return on the market portfolio. According to the CAPM, the uncertainty associated with the return on the market portfolio is the sole source of risk in the economy but CAPM has no theoretical structure that allows us to readily identify what it is that causes the market portfolio to be risky. Macroeconomics does have such a theoretical structure. It tells us, for example, how the profits of firms are related to such things as overall economic activity (GDP) and the government's conduct of monetary and fiscal policies. Macroeconomics provides us with models that enable us to not only identify various sources of aggregate uncertainty but to also understand the mechanisms by which these affect security returns and prices.

The asset pricing model that is embedded in stochastic models of macroeconomics is called the Consumption Based Asset Pricing Model (CCAPM). The name derives from the fact that the equations that describe the behaviour of asset prices and returns in the CCAPM devolve from the consumption/saving and asset choice decisions of households. In the CCAPM the economy is assumed to be populated by a large number of households that are identical in all respects, including preferences and endowments. This assumption permits decision making to be analyzed by examining the behaviour of a single, *representative household*. No matter what the macroeconomic setting is, one consequence of the CCAPM assumption that all households are identical is that households will never exchange assets with one another. For instance it will never be the case that one household will borrow from another. Why? All households are identical; if one wishes to borrow, all will wish to borrow and there will be no household that wishes to lend. If there are any assets that exist in positive net supply, these must come from outside the household sector (e.g. from governments, businesses, or the rest of world).

Studies are replete on the empirical implications of the consumption-oriented capital asset pricing model (CCAPM), and its performance when compared with a model based on market portfolio. These empirical studies are dispersed and primarily focused on the performance of the model. Working (1960), used, quarterly returns on assets and the covariance of those returns in the spot consumption rate. He then derived the relation between the desired population covariance (and betas) of assets returns relative to changes in interval consumption. The empirical results showed a variance of interval consumption changes of 0.6667 the variance of spot consumption changes, while the autocorrelation of interval consumption of 0.25 due to integration of spot rates was reported. These results were generalized by Tiao (1972) to examine the empirical performance of CCAPM.

Lambert (1978) and Beaver, Lambert and Morse (1980) have also conducted empirical research on studies of stock prices and corporate earnings, using similar result on time aggregation. In other studies, Grossman, Melino and Shiller (1987) derived maximum likelihood estimated of CCAPM parameters. The empirical results explicitly accounting for time aggregation of consumption showed that CCAPM prices assets with respect to changes in aggregate consumption between two points in time. Marsh (1981) examining an alternative treatment for this measurement problem postulated a latent variable model to estimate the parameters of the CCAPM. The results validated the existence of assets return and individuals optimal consumption paths followed diffusion process. It also indicated that over a discrete time interval the joint distribution of assets returns and individual consumption path tends to assume normality. In the same vein, Breeden's (1979) derivation of the CCAPM justifies the use of betas measured relative to a portfolio that has maximum correlation with growth in aggregate consumption, in place of betas measured relative to aggregate consumption (Igbinovia and Uwubanmwen, 2012).

Exploring the implications of the CCAPM for a long sample period requires aggregate consumption data from different source. As a result of the difficulty in generating consumption data, which is not easy to come by, different researchers have been faced with the problem of measured consumption. Particularly, aggregate consumption data are not available except expenditures on non durables, Plus services, following Hall (1978). Basically, four measurement problems are associated with measured consumption. These problems are; reporting of expenditures rather than consumption (the durable problem), the reporting of an integral consumption rates, rather than the consumption rate at a point in time, infrequent reporting of consumption data relative to stock returns, and the problem of pure sampling error in consumption measures. This is because only a subset of the total population of consumption transaction is measured (Igbinovia and Uwubanmwen, 2012).

These measured problem have greatly limited the empirical robustness of CCAPM results and have led researchers to adopt varied econometric measuring techniques in order to minimize the problem, since the returns on many capital assets are available for a longer time and are reported more frequently than consumption. More precise evidence on the CCAPM can be provided if only returns were needed to empirically validate the theory. Since this is not the case, much controversy still exists in the empirical literature.

CCAPM and CAPM: A Comparison

Breeden (1979) and Lucas (1978) provided the foundation of the Consumption Capital Asset Pricing Model (CCAPM) leading to the award of a Nobel Laureate in economics to one of them. Their model is an extension of the traditional capital asset pricing model CAPM. It is best used as a theoretical model, but it can help to make sense of variation in financial asset returns over time and in some cases, its results can be relevant than those achieved through the CAPM model. While the CAPM relies on the market portfolio return in order to understand and predict future asset prices, the CCAPM relies on the aggregate consumption. In the CAPM, risky assets create uncertainty in an investors wealth, which is determined by the market which creates uncertainty in consumption. What an investor will spend becomes uncertain because his or her wealth is uncertain as a result of a decision to invest in risky assets (Igbinovia and Uwubanmwen, 2012).

The CCAPM prices assets with respect to changes in aggregate consumption between two points in time. In contrast, the available data on aggregate consumption provide total expenditure on goods and services over a period of time. These differences between consumption in theory and its measured counterpart suggest the first two problems. First, goods and services need not be consumed in the same period that they are purchased.

Second measured aggregate consumption is closer to an integral of consumption over a period of time than to “Spot” consumption (at a point in time). The “Spot” consumption is also known as instantaneous consumption. The second problem creates a “summation bias”. In a more succinct term, the CCAPM is based on the notion that the aggregate capital consumption and return on all assets tend to follow an optimal path of normal distribution.

On the other hand, the capital asset pricing model (CAPM) is a market oriented capital asset pricing model. The CAPM model by Sharpe (1964) used the beta coefficient to ascertain the riskiness of stock. A beta coefficient equal to one indicates that a particular stock or capital asset has the same amount of systematic risk with the entire portfolio of securities. Hence there would be no need to adjust the portfolio. If all securities in the portfolio have unitary beta coefficients, equilibrium is attained and security prices are rational with little tendency to fluctuate. On the other hand, a beta coefficient greater than unity indicates that the security in question has become riskier, while a coefficient less than unity implies that the security has become safer. These cases are deviations from equilibrium position, which imply that security prices would also be out of equilibrium values.

According to Sharpe (1964), this price behavior could also be viewed from the perspective of expected returns on the security and the covariance of such security. If the covariance is zero, it implies that the price of security reflects the expected returns on it, which is an equilibrium situation that makes price stable. A negative covariance depresses the price below the fundamental value, while a positive covariance would raise it above its fundamental value. The movement of security price above and below the fundamental value creates speculative transactions that tend to redirect the price towards equilibrium level. Thus, if the fundamental value (returns) is higher security price would rise, but it would fall if the value becomes lower. Thus, while the capital asset pricing model CAPM is market oriented, the consumption oriented capital asset pricing model is consumption driven.

Methodology and Research Design

Data

The nature of this study necessitated the use of secondary data. The data include our constructed selected companies stock portfolio returns (i.e. equal weighting of the changes in share price was used in computing the weighted average portfolio returns), companies beta and market premium was sourced from Cashcraft Asset management website while the consumption per head (C/Y) was sourced from Central Bank of Nigeria (CBN). The quarterly data used in this study ranged from 2000 Q3 to 2009Q4.

Data Analysis Techniques

The econometric techniques adopted in this study include unit root test and OLS regression analysis. We conducted unit root test based on the possibility of non-stationarity in the collected time series data. The fundamental justifications for the less reliance on non-stationary data in this study is that there exist a high tendency for most time series variables to be non-stationary and OLS results also become spurious when time series data are non-stationary. In this study we therefore compare the CAPM and CCAPM under the context of stationary time series data. We also conducted preliminary statistical analysis such as descriptive statistics. In conducting this analysis we used EViews 7.0 econometric software. Before estimating the CAPM and CCAPM models, the dependent and independent variables are separately subjected to some stationarity test using augmented Dickey fuller (ADF) test.

CAPM Regression Model

This model examines how market premium $(E(R_m)-R_f)$ relates to the selected quoted companies expected stock returns $E(R_i)$ using quarterly data;

$$E(R_i)=R_f+\beta_i(E(R_m)-R_f)+\varepsilon \text{ ………….. (13)}$$

CCAPM Regression model

This model examines how market premium $(E(R_m)-R_f)$ and consumption per head (C/P) relates to the selected quoted companies expected portfolio returns $E(R_i)$ using quarterly data;

$$E(R\ )=R_f+\beta\ (E(R_m)-R_f)+\eta(C/P)+\varepsilon \text{ ……….. (13)}$$

Where;

$E(R_i)$ = Expected portfolio returns, this value is computed by taking the log of the ratio between weighted average current stock price and previous stock prices of the selected companies. This represent the dependent variable for both the CAPM and CCAPM regression models.

E = error term.

R_f = Risk free rate proxied by Treasury bill rates

$(E(R_m)-R_f)$ = Market premium, this is measured as the difference between the Treasury bill rate and the rate returns of the entire stock market (computed from all share price index). Apriori, we expect this variable to positively relate to the quoted companies portfolio returns (+)

C/P = Per capital consumptions sometimes called consumption per head

η = coefficient of C/P

β_i = CAPM beta = this measures firms undiversified risk and can be measured as covariance between selected companies portfolio returns to overall stock market returns divided by the square of stock market returns. This coefficient can be easily obtained from the CAPM regression model. The coefficient shows the impact of market premium on the portfolio returns.

Empirical Findings

In this study, we compare the conventional CAPM and Consumption-Based CAPM in explaining our constructed equity portfolio returns. The study uses per capital consumptions (C/P), selected quoted companies equity portfolio returns (PORTRETUNS) and market premium (MKPREMIUM) which is the difference between market returns (MARKRETUN) and Treasury bill rate (TBRATE). The quarterly data used in this study ranged from 2000 Q3 to 2009 Q4. To this end, this section of the paper focus on finding out if Consumption-based CAPM is relatively better in explaining portfolio returns in the Nigerian capital market than the conventional CAPM. Before explaining the main analysis in this study we first discuss the trends, descriptive statistics and unit root test of the portfolio returns. The results obtained are presented and analyzed as follows;

Descriptive Statistics

Figure 1 is a line graph that shows the performance of our constructed portfolio returns. The graphs show that there is some movement in the portfolio returns of the sampled companies.

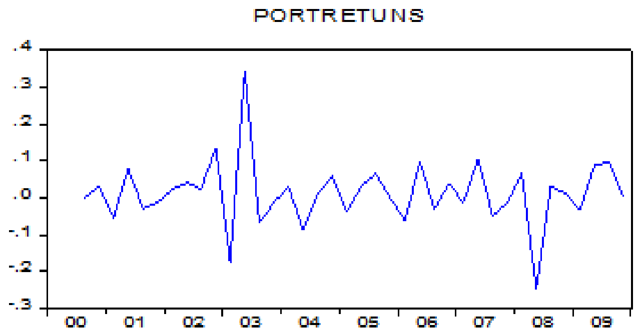

Figure 1: Line graph of portfolio returns

Table 1: Descriptive Statistics of Portfolio returns

Returns	Mean	Std. Dev	Skewness	Kurtosis	Jarque-Bera	N
PORTRETUNS	0.013	0.092	0.509	7.18	29.3(0.0)	38

Source: Author (2012)

Table 1; shows that the mean value of the portfolio returns of the sampled quoted companies was 0.013 while the standard deviation was 0.092, the portfolio returns was positively skewed (0.509) while the kurtosis shows that the portfolio returns was playtokutic (7.18). The Jaque-bera(JB) test value of 29.3 shows that the portfolio returns was not normally distributed. This therefore implies that there is some form of abnormal returns in our constructed portfolio.

Unit Roots

The unit root test based on the ADF was conducted in this study to identify the variables order of integration and to find weather its' best studying their relationship at levels or first difference. This is shown in Table 2.

Table 2: Unit Root results

Variables		**ADF**	**Remark**
MKPREMIUM	Level	-1.54	
			Stationary
	First difference	-4.34*	
	5% critical value	-2.95	
PORTRETUNS	Level	-10.22*	
	First Difference	-10.90*	Stationary
	5% critical value	-2.95	
C/P	Level	-0.19	
	First Difference	-4.011*	
	5% critical value	-2.97	Stationary

*significant at 5% levels

The unit root results based on ADF reveal that market premium (MKPREMIUM) and consumptions per head (C/P) where not stationary at levels since their ADF statistic at levels where less than the ADF 5% critical values in absolute term. At first difference all the variable becomes stationary. This therefore implies that the CAPM and CCAPM would be best compared using a first difference regression model. The Augmented Dickey-Fuller (ADF) Unit Root test results for the time series is also presented in Table 2.

Regression Results

Table 3: CAPM and Consumption CAPM Regression Results

Variables	CAPM MODEL	Consumption CAPM MODEL
C	0.002	0.001
	(0.38)	(0.10)
Δ(C/P)	-	0.00001
	-	(0.17)
Δ(MKPREMIUM)	0.004	0.005
	(0.79)	(0.75)
	-1.18	-1.18
AR(1)	(-8.41)	(-8.28)
	-0.64	-0.63
AR(2)	(-4.52)	(-4.45)
Adj R	0.68	0.67
F-statistic	25.6(0.0)	18.6(0.0)
DW	2.18	2.18
AIC	-1.81	-1.76
SBC	-1.64	-1.53

In selecting the best model of stock portfolio returns in Nigeria we subject both the CAPM and CCAPM models to the R-squared, SBC and AIC selection criteria. The results in Table 3 shows that the CAPM model is relatively more preferred to the CCAPM since it have a lower absolute value of SBC and AIC and a higher adjusted R-squared (0.68). A critically look at the results, shows that the introduction of consumption per head in the CCAPM as against the conventional CAPM did not contribute meaningfully to explaining portfolio returns. The consumption per head(C/P) coefficient of 0.0001 and t-value (0.17) clearly shows that the variable was statistically insignificant even at 10% level of significance. In both models it was observed that market premium (CAPM= 0.004, CCAPM=0.005) had a positive relationship with the portfolio returns but the relationship was statistically insignificant. The introduction of AR(1) and AR(2) for both model as a way of solving for the problem of autocorrelation, indicates that current portfolio returns is statistically related to past portfolio returns. The relative high adjusted coefficient of determination in both models (CAPM=68% and CCAPM=67%) shows that both models with inclusion of autoregressive lag of 1 & 2 have a good fit and might be relatively relevant for portfolio returns prediction. The F-statistics for both models at 1% level was statistically significant.

Following the above, the conclusions from our empirical analysis that are specific to the aim of our study are outlined as follows;

1. CCAPM is not superior to CAPM in explaining variations in portfolio returns of quoted companies in Nigeria capital market. Though its results seem better, there is no clear statistically significant difference upon which to arrive at any form of valid conclusion to the contrary.
2. Both CCAPM and CAPM with lags can be used for pricing asset portfolio in the Nigerian capital market
3. The use of consumption per head (C/P) in CCAPM is statistically insignificant in explaining portfolio returns in the Nigerian capital market. This study on the basis of our finding suggests that other measures of consumption proxy should be used to test if the CCAPM would explain returns better than the conventional CAPM. This could include consumption measures like consumption volatility, expectation, surplus, consumer durables, real estate acquisition and human capital utilization. This could be the basis for future research.

Researchers' Conclusion

The study attempted to determine on a comparative basis if CCAPM is superior to the more traditional CAPM using a pool of locally available data in the Nigerian capital market. The whole essence was to determine if the CCAPM will yield superior results compared to the CAPM when subjected to locally available Nigerian data. This expectation was not justified from our empirical findings. The results suggests that while both the CAPM and CCAPM can be used for pricing assets in the Nigerian bourse, the CCAPM is not statistically superior to CAPM in explaining variations in portfolio returns of publicly quoted Nigerian companies. While suggesting that this research work expresses a highly intelligent guide in comparing the CCAPM with the older CAPM model in the Nigerian bourse (Stock Exchange); interested researchers are hereby advised to conduct more research on this area, as improvements will be highly appreciated.

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APPENDIX

Descriptive Statistics

	MAKRETN	C/Y	PORTRETUNS
Mean	0.009876	20109.64	0.012762
Median	0.008215	20867.61	0.011171
Maximum	0.32099	31737.1	0.343561
Minimum	-0.38001	5903.06	-0.246623
Std. Dev.	0.128609	8864.111	0.09184
Skewness	0.04828	-0.029476	0.509939
Kurtosis	4.93447	1.61972	7.179248
Jarque-Bera	5.939874	3.022028	29.30158
Probability	0.051307	0.220686	0
Observations	38	38	38

Unit Root Test

Null Hypothesis: MAKRETN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.72948	0
Test critical values:	1% level	-3.62102	
	5% level	-2.94343	
	10% level	-2.61026	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(MAKRETN) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.25938	0
Test critical values:	1% level	-3.63941	
	5% level	-2.95113	
	10% level	-2.6143	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: C/Y has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.19197	0.9289
Test critical values:	1% level	-3.67932	
	5% level	-2.96777	
	10% level	-2.62299	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(C/Y) has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.011404	0.0044
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: PORTRETUNS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.2213	0
Test critical values:	1% level	-3.62102	
	5% level	-2.94343	
	10% level	-2.61026	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(PORTRETUNS) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.9049	0
Test critical values:	1% level	-3.6329	
	5% level	-2.9484	
	10% level	-2.61287	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: MKPREMIUM has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.54371	0.5007
Test critical values:	1% level	-3.62102	
	5% level	-2.94343	
	10% level	-2.61026	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(MKPREMIUM) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.34487	0.0015
Test critical values:	1% level	-3.62678	
	5% level	-2.94584	
	10% level	-2.61153	

*MacKinnon (1996) one-sided p-values.

DIFFERENCE CAPM

Dependent Variable: D(PORTRETUNS)
Method: Least Squares
Date: 09/19/12 Time: 23:44
Sample (adjusted): 2001Q2 2009Q4
Included observations: 35 after adjustments
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002121	0.005571	0.380683	0.7060
D((MARKRETUN-TBRATE))	0.004765	0.006011	0.792754	0.4339
AR(1)	-1.179590	0.140323	-8.406246	0.0000
AR(2)	-0.635161	0.140337	-4.525959	0.0001

R-squared	0.712778	Mean dependent var	0.001528
Adjusted R-squared	0.684982	S.D. dependent var	0.165049
S.E. of regression	0.092636	Akaike info criterion	-1.813066
Sum squared resid	0.266025	Schwarz criterion	-1.635312
Log likelihood	35.72866	Hannan-Quinn criter.	-1.751706
F-statistic	25.64350	Durbin-Watson stat	2.183146
Prob(F-statistic)	0.000000		

Inverted AR Roots	-.59-.54i	-.59+.54i

Table: CAPM and CCAPM data

Year/Quarter	MARKRETUN	C/P	PORTRETUNS
Q3	0.00698	5903.06	-0.0003491
Q4	0.02758	6347.44	0.0312680
2001Q1	-0.08793	7018.45	-0.0538738
Q2	0.11458	7663.73	0.0802884
Q3	0.01535	8379.29	-0.0298504
Q4	-0.01676	9182.42	-0.0133672
2002Q1	-0.03552	10418.41	0.0231743
Q2	0.11353	11227.48	0.0414075
Q3	0.03701	11960.16	0.0235967
Q4	0.10316	12644.44	0.1363409
2003Q1	-0.15742	13006.10	-0.1731881
Q2	0.30855	13672.34	0.3435614
Q3	-0.04925	14368.82	-0.0672244
Q4	-0.01873	15126.37	-0.0127710
2004Q1	-0.00039	15855.37	0.0301765
Q2	-0.03464	16726.19	-0.0871558
Q3	0.02890	17651.94	0.0106333
Q4	0.02920	18669.39	0.0613637
2005Q1	-0.05191	20425.02	-0.0383336
Q2	0.05128	21310.19	0.0327378
Q3	0.10051	21984.09	0.0640031
Q4	0.02233	22497.11	-0.0023612
2006Q1	-0.14289	21398.21	-0.0617728
Q2	0.32099	22122.70	0.0971245
Q3	0.01484	23210.41	-0.0303368
Q4	0.02431	24702.55	0.0384895
2007Q1	-0.12786	28587.38	-0.0125972
Q2	0.15866	29996.07	0.1037417
Q3	-0.07368	30948.40	-0.0500333
Q4	-0.16419	31516.72	-0.0139228
2008Q1	0.26893	30672.43	0.0652444
Q2	-0.38001	30829.83	-0.2466227
Q3	-0.04506	30958.76	0.0318282
Q4	-0.04359	31121.69	0.0117091
2009Q1	0.00945	31297.40	-0.0327561
Q2	0.07901	31451.57	0.0895014
Q3	-0.02380	31577.30	0.0956619
Q4	-0.00622	31737.10	-0.0003952

Table : Selected companies for portfolio returns

Year/Quarter	FIRSTBANK	GSK	NIGER INSUR	CI LEASING	GUINNESS	NBL	OKOMU
Q3	24.50646	2.14585	4.92046	1.36015	37.80185	27.67369	9.43415
Q4	24.00091	2.02939	4.33000	1.31152	35.96788	34.62606	9.46697
2001Q1	26.73525	3.26814	6.22951	1.49475	33.26803	27.93984	12.59852
Q2	24.70508	1.74787	3.33311	1.28492	43.44230	43.81115	8.66934
Q3	22.16742	2.24788	3.33030	1.08955	50.99894	31.58212	7.67091
Q4	19.53949	3.15172	2.34220	1.00847	43.93356	29.11983	7.07525
2002Q1	23.43413	1.72524	3.67571	1.22667	34.41159	36.33683	10.52841
Q2	27.01596	3.79982	4.02281	2.81368	61.10281	31.90158	5.81772
Q3	20.73477	4.95677	3.96831	1.48785	76.18892	37.83400	5.26815
Q4	24.02387	7.11317	3.82700	1.78317	91.64635	60.72183	9.90017
2003Q1	24.84483	5.01672	3.31897	1.45948	51.72155	33.24517	6.19500
Q2	29.21859	8.93938	3.96828	2.63234	129.36375	100.91266	14.62125
Q3	25.47924	8.17515	4.10000	1.54076	125.05000	50.12227	13.58197
Q4	23.97870	7.97185	3.87241	1.49500	112.12509	41.77056	14.34093
2004Q1	24.07422	10.38953	3.95953	2.42984	101.66297	75.60594	16.32188
Q2	28.06525	8.04426	3.40262	1.36839	86.32295	29.37262	16.14443
Q3	29.91551	8.63735	2.66783	1.24507	93.67725	31.22058	15.49841
Q4	32.00000	10.42917	3.09444	1.25424	100.49683	43.42333	17.44857
2005Q1	23.43070	8.41281	3.28579	1.46439	93.64982	36.80772	16.41070
Q2	46.86328	9.26197	3.30311	1.31131	102.05803	33.63262	20.59672
Q3	49.99077	12.86545	2.58277	1.27015	140.50385	42.48031	31.60015
Q4	33.99492	16.59274	2.51311	1.17344	115.42538	38.35508	33.67369
2006Q1	35.00695	10.14220	3.40610	1.19237	101.21559	35.82763	18.33797
Q2	40.32586	23.00138	4.86845	4.46724	128.01190	38.63103	41.16190
Q3	43.53169	19.09954	4.54046	5.27723	123.06215	42.43815	31.23908
Q4	41.13627	19.41847	4.42983	6.03271	128.50966	46.50610	33.11661
2007Q1	37.40803	19.84623	3.83262	2.30082	118.05934	38.30967	39.19852
Q2	42.53492	23.02095	7.10619	13.37286	130.01968	51.21381	30.24206
Q3	35.20313	21.83094	5.88625	11.12344	35.20313	49.32266	28.31469
Q4	23.10393	19.33098	4.68033	11.10000	95.39541	37.43000	32.82377
2008Q1	46.23016	26.26197	7.95279	11.74049	130.04246	51.65967	37.90787
Q2	18.59754	17.78787	2.28590	4.25700	109.30934	46.21607	28.87639
Q3	16.05141	18.80531	1.45969	2.48563	135.60156	54.68547	26.01500
Q4	14.44508	23.92525	0.98230	2.47033	132.64508	53.90000	5.36836
2009Q1	16.90339	12.78274	1.91226	9.86016	80.68855	34.81419	29.80258
Q2	15.03133	26.87917	1.11367	3.34250	155.23367	67.19450	16.77250
Q3	12.63391	28.72141	0.99656	2.74063	165.16922	69.08203	13.01156
Q4	12.77967	27.55361	0.68016	1.83672	180.57426	76.89213	14.09344

Year/Quarter	FLOURMILL	AG LEVENTIS	BERGER	CADBURY	NESTLE	UNILEVER	AIICO	BERGERPAINT
Q3	14.15631	1.17948	3.73613	23.31292	56.92828	24.25846	3.22117	2.58000
Q4	15.26712	1.10576	3.19984	27.71955	63.89492	27.06803	2.86970	2.75394
2001Q1	11.17328	1.17756	6.79719	25.74256	48.43215	21.45541	3.20672	3.21869
Q2	22.71230	0.71049	6.07230	28.55049	63.22143	31.28705	2.12049	2.47574
Q3	19.64106	0.61939	6.84710	28.63803	62.95820	19.22848	1.89212	2.38818
Q4	15.64899	0.59000	10.89934	29.52864	68.84758	15.23763	1.38898	2.34169
2002Q1	17.03746	0.93016	4.00000	28.71508	64.16652	28.95968	3.06741	5.94254
Q2	14.21088	0.78965	15.42048	32.81772	94.01000	13.95386	1.63526	2.71509
Q3	12.84108	0.63692	15.33443	39.15000	82.23368	15.43862	1.95169	2.46785
Q4	12.86867	0.65000	7.71068	57.63017	91.27462	18.17233	2.48000	2.87417
2003Q1	17.16776	0.65724	12.76281	37.51362	76.16356	14.91948	2.21362	2.83569
Q2	20.84531	1.52250	7.40759	80.73469	158.64969	18.34297	2.04734	4.13672
Q3	18.78500	1.23318	4.96443	61.38879	169.72188	15.22076	1.78197	3.99561
Q4	16.61000	1.05545	3.47138	59.15561	166.65197	15.08944	1.78255	4.39236
2004Q1	15.92469	0.77453	6.88185	82.18016	115.99567	20.61719	2.54203	4.21281
Q2	15.91836	0.86033	3.16836	50.74426	144.00789	14.44492	1.83344	3.73803
Q3	16.94507	0.87174	3.71034	50.51536	139.93016	16.68257	1.73942	3.79986
Q4	22.99508	1.26000	4.23419	62.46923	189.80270	21.01700	1.97758	4.22968
2005Q1	16.61000	1.04930	3.21738	53.70947	158.26148	15.99386	1.90789	4.81825
Q2	34.05508	1.11033	3.75623	55.01410	191.55311	16.39705	2.39000	3.16197
Q3	51.67231	1.29554	4.82632	58.25554	209.49477	15.23338	2.61308	3.22831
Q4	63.25623	1.74369	4.38582	55.64206	229.03525	13.90385	1.65754	3.46609
2006Q1	27.85644	1.20492	3.78493	61.22068	192.07915	19.74371	2.29288	3.70119
Q2	77.43672	4.12586	4.13672	34.45190	230.79741	17.50772	4.61224	7.40759
Q3	76.10600	3.84094	4.13672	32.73446	212.51308	19.14154	3.72615	6.88185
Q4	77.27695	3.68102	4.21281	32.74441	231.50119	18.56186	3.37966	7.71068
2007Q1	73.02033	2.91672	3.99561	38.19164	270.90738	13.36984	3.16328	4.96443
Q2	88.11111	13.08365	2.46785	38.34127	233.32063	23.52857	5.14635	15.42048
Q3	68.76188	9.67797	2.71509	32.63859	213.42422	22.19563	4.21734	12.76281
Q4	49.92377	8.48082	2.83569	31.90738	211.73672	14.85000	2.55164	10.89934
2008Q1	90.33902	9.99410	2.87417	43.86115	271.63426	24.15557	5.11721	15.33443
Q2	23.61705	5.35131	2.38818	12.73049	168.39590	11.14082	1.20803	6.07230
Q3	22.31078	2.47594	2.47574	13.54000	191.62250	14.51266	1.00438	4.00000
Q4	31.59197	2.69689	5.94254	12.78049	226.28328	17.63443	0.87770	3.19984
2009Q1	17.12806	7.39661	2.34169	12.52032	144.36871	7.17129	1.22871	6.84710
Q2	70.52633	4.19917	2.58000	26.27883	328.58333	25.85233	1.38483	7.21983
Q3	69.22047	3.32172	2.80672	27.02016	362.08594	24.04719	1.07438	6.79719
Q4	68.57033	2.80574	3.21869	28.03164	385.08721	27.15705	0.91492	8.40754

Year/Quarter	WAPCO	OANDO	UNIVERSITY PRESS	MOBIL	TOTAL	CAP	VITA FOAM	NASCON	ACADEMY	GTBANK
Q3	23.61262	41.23569	3.48062	63.53615	66.89015	2.41723	4.15569	0.68692	0.87908	5.69017
Q4	24.34121	48.06030	3.20288	65.24909	67.68106	2.69212	4.46894	0.68697	0.79773	5.70000
2001Q1	20.80967	26.88000	3.55984	64.38311	64.10934	1.39098	3.97934	0.81213	0.92803	5.72591
Q2	20.65344	53.61426	2.86787	63.73230	62.24852	3.02475	3.73377	0.69000	0.80066	5.97455
Q3	18.54985	49.04182	2.21045	64.69030	66.09864	3.38682	3.94833	0.69000	0.78076	6.79571
Q4	14.93661	51.41271	2.01610	62.34966	67.05627	3.62966	4.73322	0.69000	0.54051	6.50639
2002Q1	19.49762	49.93333	3.46667	67.43349	66.54254	2.29348	4.01476	0.69000	0.82159	5.51338
Q2	15.03035	45.78070	1.64737	76.48544	75.78175	3.52000	3.92596	0.67368	0.91877	5.09780
Q3	15.20462	43.69354	1.48031	77.16077	93.75800	3.52400	3.94754	0.67615	0.92538	6.07603
Q4	17.66933	73.62250	1.37050	113.79850	151.92317	4.00950	4.13117	0.63000	1.49783	5.76509
2003Q1	16.01466	52.11052	1.73069	69.19052	71.54793	3.24207	5.27121	0.69000	0.56034	11.94000
Q2	17.65266	109.58484	1.71250	170.46531	219.22172	6.58094	3.97156	0.72000	3.07594	8.24067
Q3	13.57955	108.00000	1.65970	153.75106	189.82667	6.32091	3.28955	0.72000	2.79242	14.53859
Q4	1.49500	109.01667	1.27056	175.32296	189.79963	6.88444	3.36611	0.71259	1.93564	13.98469
2004Q1	19.72906	90.23000	1.63484	152.51906	245.38984	5.92656	4.30234	0.66469	2.55125	10.54103
Q2	10.35000	86.99033	1.29951	164.30705	170.10967	6.63525	3.17754	0.69000	1.85820	11.76273
Q3	10.46913	84.26544	1.56464	154.74623	192.49754	7.22261	3.99957	0.69000	1.72957	10.68579
Q4	17.47333	98.90233	1.40873	162.37127	190.37413	8.64000	4.48841	0.69000	1.50780	9.77492
2005Q1	10.86947	93.98316	1.66211	176.35105	177.19667	6.87263	3.35842	0.69000	1.91193	17.30823
Q2	22.79213	78.05656	2.56508	162.60770	187.67459	10.31197	3.47131	0.69000	1.26246	14.14836
Q3	47.55615	74.45000	2.79477	177.68046	196.93785	17.36108	4.05892	0.69000	1.23585	13.92303
Q4	56.56836	69.75569	3.20815	183.86000	190.31443	23.81581	4.12361	0.69000	1.35839	13.66763
2006Q1	18.15220	90.46153	1.71288	162.01881	187.51831	9.23780	5.07780	0.69000	1.47559	12.17833
Q2	67.06810	77.29293	7.03741	171.08534	172.82397	39.21310	6.20603	24.01810	4.82569	33.20190
Q3	25.61131	76.51031	8.17892	163.32062	161.37692	42.51385	7.64031	20.03415	5.90108	32.68462
Q4	66.68729	89.40051	7.11610	177.84339	166.52407	53.41000	8.26610	16.90559	5.44339	30.70576
2007Q1	67.75738	74.20689	3.20000	182.78590	187.03033	30.43754	4.22721	2.72541	2.17393	26.74885
Q2	57.31984	214.13714	11.58381	220.82603	237.94016	55.78794	11.52619	16.11698	11.74222	31.78286
Q3	43.22453	168.46484	8.30234	293.28078	238.42219	51.56766	9.93141	11.52281	7.30625	24.16016
Q4	29.45623	118.63311	6.95918	347.36721	232.64492	47.10508	7.20656	7.57721	5.62803	15.70131
2008Q1	70.43902	173.82820	12.49574	208.07820	209.71639	68.45230	11.39049	17.43541	7.43902	35.73049
Q2	20.97721	82.08082	6.11426	105.65115	150.81426	33.63820	4.42344	4.73049	5.75426	11.80836
Q3	29.95203	91.16391	6.68031	109.08813	146.56750	29.92547	4.06625	3.78906	4.75563	13.47328
Q4	29.98459	93.22869	4.84852	99.13705	154.32492	29.12918	5.04492	3.92148	4.87475	15.41590
2009Q1	16.66484	69.08984	4.39742	231.24129	148.73677	38.61435	4.31177	4.60339	5.41984	10.16952
Q2	41.24433	7.15667	7.15667	7.15667	220.12333	30.09550	6.57417	8.85650	6.11567	18.25433
Q3	38.74484	65.72719	7.15156	165.54641	248.25469	32.20266	6.33234	6.97484	16.10016	16.10016
Q4	40.34672	64.92967	6.39984	142.52230	225.02328	32.44459	6.14377	5.96918	3.86689	16.47574