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CAPITAL ASSET PRICING MODEL TESTING IN WEST AFRICA ECONOMIC AND MONETARY UNION STOCK MARKET: THE CASE OF IVORIAN LISTED FIRMS

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Abstract

This paper investigates the validity of Capital Asset Pricing Model (CAPM) for the West African Economic and Monetary Union (WAEMU) stock market using monthly stock returns of twenty Côte d'Ivoire's listed firms from January 2002 to December 2011. We split this interval into different time periods. Each one of them has also been divided into two different sub-periods among which one served as estimation mean and the second one helped to test the estimated parameters obtained using a times series regression. Afterwards some statistical tests have been conducted to see whether the CAPM's hypotheses hold or not. The findings showed that higher risk is not associated with higher level of return within the study area. Also, there was no relation between stock return and non-systemic risk except for one period where we found evidence that stock returns were affected by other risk than the systematic risk. On the contrary the stock expected rate of return had a linear relationship with the systematic risk. The study suggested that the listed companies consider other factors and variables which could explain their returns.

Keywords: Capital Asset Pricing Model; Portfolio Returns; Systematic Risk; Risk Free Rate.

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1. Introduction

One of the most important developments in modern capital theory is the Capital Asset Pricing Model (CAPM) as developed by Sharpe (1964), Lintner (1965) and Mossin (1966). CAPM suggests that high expected returns are associated with high levels of risk. Simply stated, CAPM

postulates that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk as measured by the asset's beta.

The model was developed to explain differences in risk premium across assets. According to the theory these differences are due to differences in the riskiness of the returns on 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 (Fama and French, 2004).

Critics and various academic debates pertaining to the usefulness and validity of this model have been done for more than thirty years. In general, the empirical testing of CAPM has two broad purposes. Firstly, it intends to see whether or not the assumption suggested by the model should be rejected. Secondly it aims to provide information that can aid financial decisions.

One of the earliest empirical studies that found supportive evidence for CAPM is that of Black, Jensen and Scholes (1972). Using monthly return data and portfolios rather than individual stocks, they tested whether the cross-section of expected returns is linear in beta. Findings show that data were consistent with the predictions of the CAPM i.e. the relation between the average return and beta is very close to linear and portfolios with high (low) betas have high (low) average returns.

Another classic empirical study that supports the theory is that of Fama and MacBeth (1973); they examined whether there is a positive linear relation between average returns and beta. Moreover, the authors investigated whether the squared value of beta and the volatility of asset returns can explain the residual variation in average returns across assets that are not explained by beta alone (Fama and MacBeth, 1973).

Since the birth of the Capital Asset Pricing Model (CAPM), enormous efforts have been devoted to studies evaluating the validity of this model, a unique breakthrough and valuable contribution to the world of financial economics. Some empirical studies conducted, have appeared to be in harmony with the principles of CAPM while others contradict the model. These differences in previously conducted studies as well as the lack of studies dealing with such technique in west Africa serve as a major stimulating factor motivating the present paper.

2. Model Description

2.1.Data and Methodology

This paper investigates the validity of Capital Asset Pricing Model in West Africa stock market by using securities portfolio of twenty Côte d'Ivoire's firms listed from January 2002 to December 2011.

To start our investigation, we estimate stock price returns and stock market returns. Then some tests will be conducted as per the validity of CAPM hypotheses (Elbannan, 2014). To do so we split the study period into different periods. Each period is also divided into two different sub-

periods. The first period is used as estimation mean and the second one helps to test the estimated parameters. Table 1 illustrates the process.

Table 1: Periods divisions

Periods	Sub-period	
	Beta estimation period	*Testing period*
2002-2007	2002-2004	2005-2007
2003-2008	2003-2005	2006-2008
2004-2009	2004-2006	2007-2009
2005-2010	2005-2007	2008-2010
2006-2011	2006-2008	2009-2011
Whole period 2002-2011	2002-2006	2007-2011

In the estimation period, beta is estimated by running a regression of realized returns of an asset against market returns. The resulting beta of the first regression is used to proxy for the true beta of the asset and is regressed against the excess return of the asset.

We only consider one single portfolio A for the twenty (20) stocks because our sample is small and to simplify our analysis. Thus, we do not have to estimate the portfolio beta anymore since the stocks' individual betas will be used (Rink, 2010; Gupta, 2010).

2.2.Hypotheses, Tests and Decisions Criteria

- Test for the relationship between risk and expected return called Security Market Line (SML)

    Hypothesis: Higher risk is associated with higher level of return.

    Equation test:

$$\mathbf{R}_i - \mathbf{R}_f = \gamma_0 + \gamma_1 b_i + u_i \tag{1}$$

R_i : equally weighed average return of stocks

R_f : risk free rate

b_i : estimate true beta for stock i

u_i : error term which is assumed to be random

    Decision criteria: γ_0 equal the risk-free rate equal zero and γ_1 equal the risk premium and is strictly positive.

- Test for nonlinearity between total stock returns and betas

    Hypothesis: Higher risk is associated with higher level of return.

Equation test:

$$r_i = \gamma_0 + \gamma_1 b_i + \gamma_2 b_i^2 + \varepsilon_i \tag{2}$$

γ_2 measures the potential nonlinearity of the return

Decision criteria: Our hypothesis holds if γ_0 and γ_2 equal zero. As per γ_1, it should be different from zero and equal to the average risk premium.

- Test of non-systematic risks

Hypothesis: Expected returns on securities are only determined by systematic risk and independent on the nonsystematic risk, as measured by the residuals variance.

Equation test:

$$r_i = \gamma_0 + \gamma_1 b_i + \gamma_2 b_i^2 + \gamma_3 v(\varepsilon_i) + \varepsilon_i \tag{3}$$

γ_3 is the power of non-systematic

$v^2(\varepsilon_i)$ measures the residual variance of portfolio

Decision criteria: Our hypothesis holds if γ_0, γ_2 and γ_3 equal zero. As per γ_1, it should be different from zero and equal to the average risk premium.

- General decision criteria: The validity of the CAPM is statically tested by using the t-test at a confidence level of 95%. Thus for any gamma (γ), if its p-value is inferior to 5% (0.05) or t-value superior to t-test value then this gamma is significantly different from zero. On the contrary if p-value is superior to 5% or t-value inferior to t-test value, this means that gamma is not significantly different from zero.

The validity of the CAPM required that all the assumptions and hypotheses be verified.

3. Results, Analysis and Interpretation

Looking at table 2 and recalling that the CAPM prediction for the intercept is that it should be equal to zero and the slope of SML equals to the risk premium, it is obvious that the findings of the test contradict the above hypothesis. In other words, our study's findings are not supportive of the CAPM basic hypothesis that higher risk is associated with higher level of return.

The CAPM hypothesis also predicted that a stock expected rate of return has a linear relationship with its systematic risk. The results meet this hypothesis for all the sub-period but not for the whole period of our study.

Table 2: Tests results

Periods	1**	2	3	4	5	Whole Study Period (2002-2011)
Tests						
Relationship Risk-Return	R***	R	R	R	R	R
Non-Linearity	H****	H	H	H	H	R
Non-Systematic Risk	H	H	H	H	R	H

**Period 1 (2005-2007), Period 2 (2006-2008), Period 3 (2007-2009), Period 4 (2008-2010), Period 5 (2009-2011)

***Hypothesis Rejected; ****Hypothesis Holds

As for the CAPM hypothesis about non-systematic risk effects on stock's return, there is no relation between return and non-systematic risk except the sub period five where we found evidence that the stocks return during this period are affected by other risk than the systematic risk. This shows that the operating activities of the firms have an effect on their stocks returns during this period.

Considering the study period as a whole, the CAPM predictions that stocks with higher/lower risk will yield higher/lower expect rate of return is not confirmed. The results obtained do not also support the linear relationship between return and its beta. Moreover, the non-systematic risk has no effect on the return. The appendices give more details pertaining to the results.

4. Conclusion

This study examined the empirical validity of CAPM within the west African regional stock market called Bourse Regional des Valeurs Mobilières (BRVM). We used monthly market prices (market composites) and monthly stock prices from twenty Ivorian companies listed on this stock exchange from January 2002 to December 2011.

A time series regression of excess portfolio return against excess market return as been done, then we estimated the security market line by another regression against portfolio return and portfolio's beta. After these steps, we run some specific tests to verify the state of all the assumptions surrounding CAPM in our study context.

The results do not fully support the CAPM. However, many implications can be point out concerning the validity of CAPM. For instance, the fact that the period five revealed an impact of non-systematic risks on the return implies that the listed companies should consider some other factors and variables which could possibly affect their return such as the profitability ratios, the dividend policy ratios, government policy, etc.

Further studies can be conducted to investigate and analyze the real impact of these variables on the listed companies. This will probably shed more light on the reason behind the findings of the present paper.

References

[1] William Forsyth Sharpe. (1964). "CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK." The Journal of Finance, 19(3), 425-442. https://dx.doi.org/10.2307/2977928.

[2] John Lintner. (1965). "THE VALUATION OF RISK ASSETS AND THE SELECTION OF RISKY INVESTMENTS IN STOCK PORTFOLIOS AND CAPITAL BUDGETS." The Review of Economics and Statistics, 47(1), 13-37. https://dx.doi.org/10.2307/1924119.

[3] Jan Mossin. (1966). "EQUILIBRIUM IN A CAPITAL ASSET MARKET." Econometrica, 34(4), 768-783. https://dx.doi.org/10.2307/1910098.

[4] Eugene Francis Fama and Kenneth Ronald French (2004). "THE CAPITAL ASSET PRICING MODEL: THEORY AND EVIDENCE." The Journal of Economic Perspectives, 18(3), 25-46. Retrieved from http://www.jstor.org/stable/3216805.

[5] Fischer Black, Michael Jensen and Myron Scholes. (1972). "THE CAPITAL ASSET PRICING MODEL: SOME EMPIRICAL TESTS". In Studies in the Theory of Capital Market, edited by Michael Jensen. New York: Praeger,79-121. Available at SSRN: https://ssrn.com/abstract=908569.

[6] Eugene Francis Fama and James MacBeth. (1973). "RISK, RETURN, AND EQUILIBRIUM: EMPIRICAL TESTS." Journal of Political Economy, 81(3), 607-636. Retrieved from http://www.jstor.org/stable/1831028

[7] Mona Elbannan. (2015). "THE CAPITAL ASSET PRICING MODEL: AN OVERVIEW OF THE THEORY." International Journal of Economics and Finance, 7(1), 216-228. http://dx.doi.org/10.5539/ijef.v7n1p216

[8] Kevin Rink. (2010). "THE INFLUENCE OF SAMPLE SIZE ON THE DYNAMICS OF BETA FACTORS." Munich: Grin Verlag.

[9] Nikhil Gupta. (2010). "THE SIZE EFFECT AND THE CAPITAL ASSET PRICING MODEL." Award Winning Economics Paper, paper 9. http://digitalcommons.macalester.edu/econaward/9.

APPENDICES

APPENDIX A: Summary of the results for period 1

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	0.017716	0.037686	0.470104	0.643926
	γ_1	-0.03464	0.095364	-0.36326	0.720643
Non-linearity test	γ_0	0.035201	0.039594	0.889057	0.38638
	γ_1	0.100395	0.142422	0.704914	0.49041
	γ_2	-0.2803	0.222383	-1.26044	0.224537
Test for non-systematic risk	γ_0	0.001955	0.067691	0.028879	0.977319
	γ_1	0.143926	0.16163	0.890462	0.386412
	γ_2	-0.3811	0.280184	-1.36018	0.19263
	γ_3	3.754587	6.1384	0.611656	0.549359

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APPENDIX B: Summary of the results for period 2

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	-0.42371	0.060995	-6.9466	1.72E-06
	γ_1	0.711732	0.353501	2.013378	0.059275
Non-linearity test	γ_0	-0.42763	0.063746	-6.70841	3.67E-06
	γ_1	0.839218	0.536507	1.564226	0.136188
	γ_2	0.421373	1.306841	0.322436	0.751054
Test for non-systematic risk	γ_0	-0.36529	0.082385	-4.43388	0.000417
	γ_1	0.855757	0.530767	1.612303	0.126443
	γ_2	0.310975	1.295812	0.239984	0.81339
	γ_3	-4.31403	3.669805	-1.17555	0.256972

APPENDIX C: Summary of the results for period 3

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	0.349162	0.101695	3.43341	0.002964
	γ_1	-0.46371	0.25043	-1.85167	0.080549
Non-linearity test	γ_0	0.547964	0.145336	3.770326	0.001526
	γ_1	-0.32925	0.247108	-1.33242	0.200307
	γ_2	-1.28385	0.706105	-1.81822	0.086695
Test for non-systematic risk	γ_0	0.539092	0.216996	2.48434	0.024431
	γ_1	-0.32716	0.257375	-1.27113	0.221854
	γ_2	-1.30018	0.783008	-1.66049	0.116282
	γ_3	0.617241	10.9223	0.056512	0.955634

APPENDIX D: Summary of the results for period 4

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	0.005338	0.017793	0.300021	0.767598
	γ_1	-0.0037	0.024946	-0.14825	0.883793
Non-linearity test	γ_0	0.006408	0.02388	0.268335	0.79167
	γ_1	-0.0036	0.025702	-0.1402	0.890149
	γ_2	-0.00215	0.030801	-0.06974	0.945211

Tests	Beta	Value of Beta	Std error	t-value	p-value
	γ_0	0.024109	0.02363	1.020266	0.322782
Test for non-systematic risk	γ_1	0.027856	0.028274	0.985213	0.339184
	γ_2	0.098238	0.057055	1.721812	0.104376
	γ_3	-2.23532	1.102889	-2.02678	0.059686

APPENDIX E: Summary of the results for period 5

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	-0.08212	0.056359	-1.45714	0.162303
	γ_1	-0.03191	0.060373	-0.52858	0.603555
	γ_0	-0.08144	0.057943	-1.40544	0.177902
Non-linearity test	γ_1	-0.0146	0.091662	-0.15932	0.875297
	γ_2	-0.01222	0.047663	-0.25639	0.800725
	γ_0	0.091859	0.086572	1.061068	0.304414
Test for non-systematic risk	γ_1	-0.02959	0.0806	-0.36717	0.718306
	γ_2	0.045622	0.047896	0.952532	0.354996
	γ_3	-6.81524	2.756738	-2.47221	0.025034

APPENDIX F: Summary of the results for whole period

Tests	Beta	Value of Beta	Std error	t-value	p-value
Relationship between beta and return	γ_0	0.32382	0.05122	6.32112	5.88E-06
	γ_1	1.10579	1.61918	0.68293	0.50334
	γ_0	0.45630	0.05104	8.93902	7.8E-08
Non-linearity test	γ_1	0.75312	1.21147	0.62165	0.54241
	γ_2	-129.741	33.1337	-3.91567	0.00111
	γ_0	0.462037	0.04952	9.33031	7.14E-08
Test for non-systematic risk	γ_1	-0.35831	1.39296	-0.25723	0.80028
	γ_2	-85.0431	44.1005	-1.92839	0.07174
	γ_3	-10.1464	6.87799	-1.4752	0.15956

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