



The Capital Asset Pricing Model:

Test of the model on the Hanoi Stock Exchange

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Table of contents

01

Introduction

02

**Theoretical
background &
Literature Review**

03

**Data Selection &
Methodology**

04

**The two-pass
regression test**

05

**Black, Jensen &
Scholes Test**

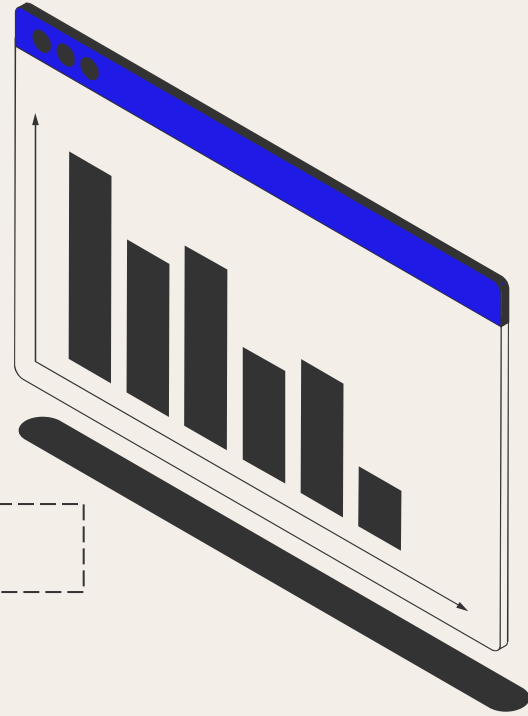
06

**Conclusion &
Limitation**

01

Introduction

Introduction of HNX, Function of HNX, Purpose of the study



Introduction:

1. Hanoi Stock Exchange:

Operated markets including: Listed stock market, Government Bond Market, Unlisted Public Company market (UPCoM) and Derivatives market.

2. Function of Hanoi Stock Exchange:

- Financial raising system
- Redistribution of shares
- Measure of the economy

3. Purpose of the study:

- Uses the assets traded on the Hanoi Stock Exchange to examine the accuracy of the Capital Asset Pricing Model.





02

Theoretical Background Literature review

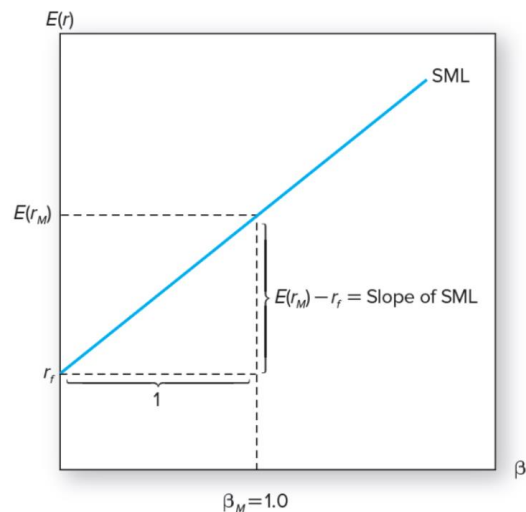
Model concept, Model assumptions, Data

01 Beta coefficient

$$\beta_i = \frac{Cov[r_i, r_m]}{Var[r_m]}$$

02 Model concept:

$$R_i = R_f + \beta_i \times (R_m - R_f)$$



We can express it in terms of an expected excess of returns on an asset or portfolio over the risk – free return:

$$E(z_i) = \beta_i E(z_m)$$

Where

$$E(z_i) = E(r_i) - r_f$$

$$E(z_m) = E(r_M) - r_f$$

Figure 1. The Capital Asset Pricing Model

03

Model assumption:

1. Perfect market:

- No investors in the market large enough to influence stock prices
- Borrow and lend at risk-free rates, no transaction fees, all assets are divisible and market-traded, tax-free, short-sold.

2. Efficient market:

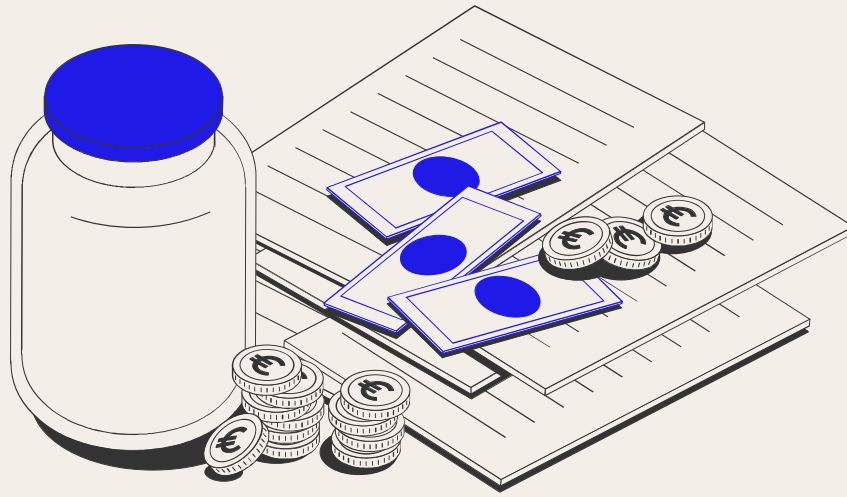
- Investors are risk-averse, making decisions based on expected returns and standard deviations of returns.
- Investors have equal access to investment opportunities.
- Investors have uniform periods of return and risk (standard deviation, variance) of an investment opportunity.
- Investors have two ways to invest: risk-free securities and market portfolios.
- The risks mentioned in the model are systematic risk.



Literature review

| STUDY | FINDING | MAIN RESULT |
|----------------------------------|---|--|
| Treynor (1962), Sharpe (1964) | The original Capital Asset Pricing Model (CAPM) | The relationship between the expected return of an asset and its risk. |
| Black, Jensen and Scholes (1972) | The relationship between portfolios betas and their average returns. | The relationship between portfolios betas and their average returns was linear with a positive and significant slope. |
| Fama and MacBeth (1973) | The relationship between expected returns and exposure to (priced) risk factors | A linear relationship between expected returns and exposure to (priced) risk factors. |
| Fama and French (1992) | Value and small-cap stocks outperform markets on a regular basis | Result is supportive for CAPM. |
| Hasan et al. (2011) | The relationship between beta and return of stocks | The intercept term was significantly non-zero and there was a positive relationship between beta and return of stocks. |

03



Data Selection Methodology

Two – pass regression test
Black, Jensen and Scholes Test

Data Selection

Closing stock price of 50 companies

- Period: 1 January 2021 – 30 June 2022, daily
- Number of observations: 370
- Listed on Hanoi Stock Exchange (HNX)

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

R_m is the expected return of the market portfolio

R_t is the risk-free return (government bond yields)



Source data: tvsj.com.vn

Testing Equation:

Two-pass regression test:

| | |
|--|--|
| <ul style="list-style-type: none">• Intercept = 0 | $z_{ti} = \alpha_i + \beta_i z_{Mt} + \varepsilon_{ti}$ |
| <ul style="list-style-type: none">• Slope = average risk premium | $\bar{z}_i = \gamma_0 + \gamma_1 \beta_i + \varepsilon_i$ |
| <ul style="list-style-type: none">• Non - linearity | $\bar{z}_p = \gamma_0 + \gamma_1 \beta_p + \gamma_2 \beta_p^2 + \varepsilon_p$ |
| <ul style="list-style-type: none">• Non – systematic risk | $\bar{z}_p = \gamma_0 + \gamma_1 \beta_2 + \gamma_2 \beta_p^2 + \gamma_3 RV_p + \varepsilon_p$ |

Black, Jensen and Scholes Test

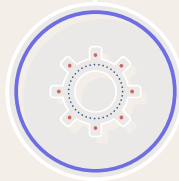


Estimated stock beta

Based on daily returns from 2nd quarter to 4th quarter of 2021

Ranked stock

Stocks will be ranked and 10 portfolios will be created based on stocks' betas



Computing daily return

The daily returns on these portfolios will be computed in 4th quarter of 2021

Portfolio reconstructed

The portfolios will be reconstructed and the daily returns in the 1st quarter of 2022 will be computed.

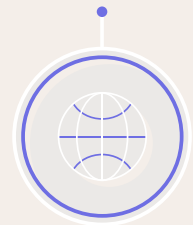


Estimated the portfolio beta

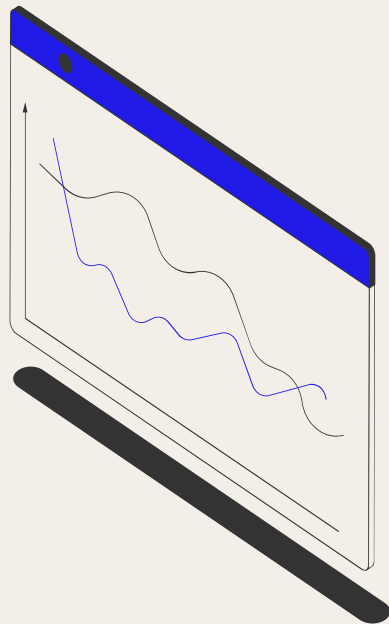
The portfolios betas will be estimated by regressing returns

Estimated beta and reconstructed the portfolio

The portfolios will be reconstructed again, and their returns will be computed for 2nd quarter of 2022.



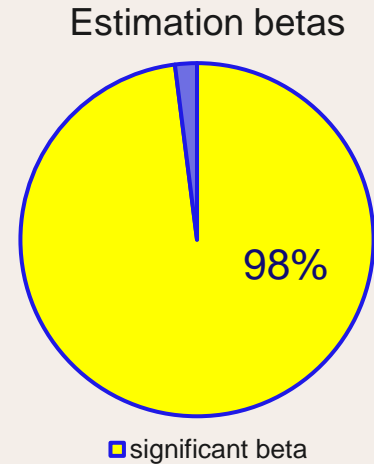
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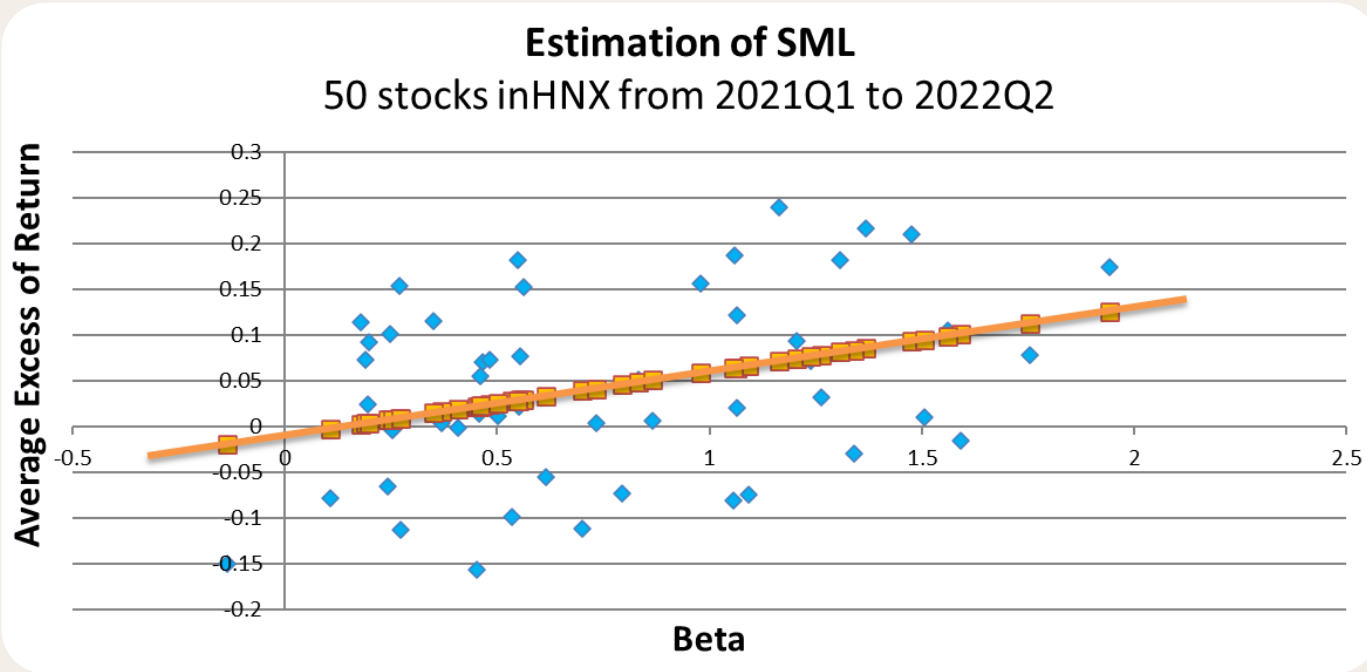
Two-pass regression test

Estimating 50 beta value of 50 assets:

- The range of estimated betas is from -0.136 to 1.941
- 98% of all estimated betas are significant with 95% confidence
- 0% of estimations exhibited an intercept significantly different from zero



SML Estimation



Line intercept is nearly zero, but the SML is upward sloping which supports the idea of CAPM that expected returns are positively and proportionally related to beta.

SML Estimation

| | Regression results | <i>t</i> -value | <i>p</i> -value | CAPM predicted values |
|----------------|--------------------|-----------------|-----------------|-----------------------|
| γ_0 | -0.009678 | -0.391 | 0.6976 | 0 |
| γ_1 | 0.069608 | 2.561 | 0.0136 | 0.0740154 |
| R-square | 12.02% | | | |
| Standard Error | 0.09475 | | | |

The estimated SML supports the CAPM theory, the γ_0 is equal to 0. The slope of the estimated SML is positive and significant.

Non-linearity test

| | Regression results | t -value | p -value | CAPM predicted values |
|----------------|--------------------|------------|------------|-----------------------|
| γ_0 | -0.011355 | -0.301 | 0.764 | 0 |
| γ_1 | 0.075346 | 0.752 | 0.456 | 0.0740154 |
| γ_2 | -0.003275 | -0.060 | 0.953 | 0 |
| R-square | 12.03% | | | |
| Standard Error | 0.09575 | | | |

The slope of SML γ_1 is positive and statistically significant. No linear relationship between stocks' beta and return.

Non-systematic risk test

| | Regression results | t -value | p -value | CAPM predicted values |
|----------------|--------------------|------------|------------|-----------------------|
| γ_0 | -0.045297 | -0.999 | 0.323 | 0 |
| γ_1 | 0.076640 | 0.771 | 0.445 | 0.0740154 |
| γ_2 | -0.011860 | -0.216 | 0.830 | 0 |
| γ_3 | 0.003241 | 1.322 | 0.193 | 0 |
| R-square | 0.1525 | | | |
| Standard Error | 0.095 | | | |

This result supports the CAPM. All the risk is captured by beta and non-systematic risk has no influence on stocks' returns.

05

Black, Jensen and Scholes Test

SML Estimation

Non – systematic test

Non – systematic risk test



Stocks' betas calculated in each of the 3 sub-periods



82
%

Of estimated betas are
significant

Q1 2021 – Q3 2021



76
%

Of estimated betas are
significant

Q2 2021 – Q4 2021



82
%

Of estimated betas are
significant

Q3 2021 – Q1 2022

SML Estimation

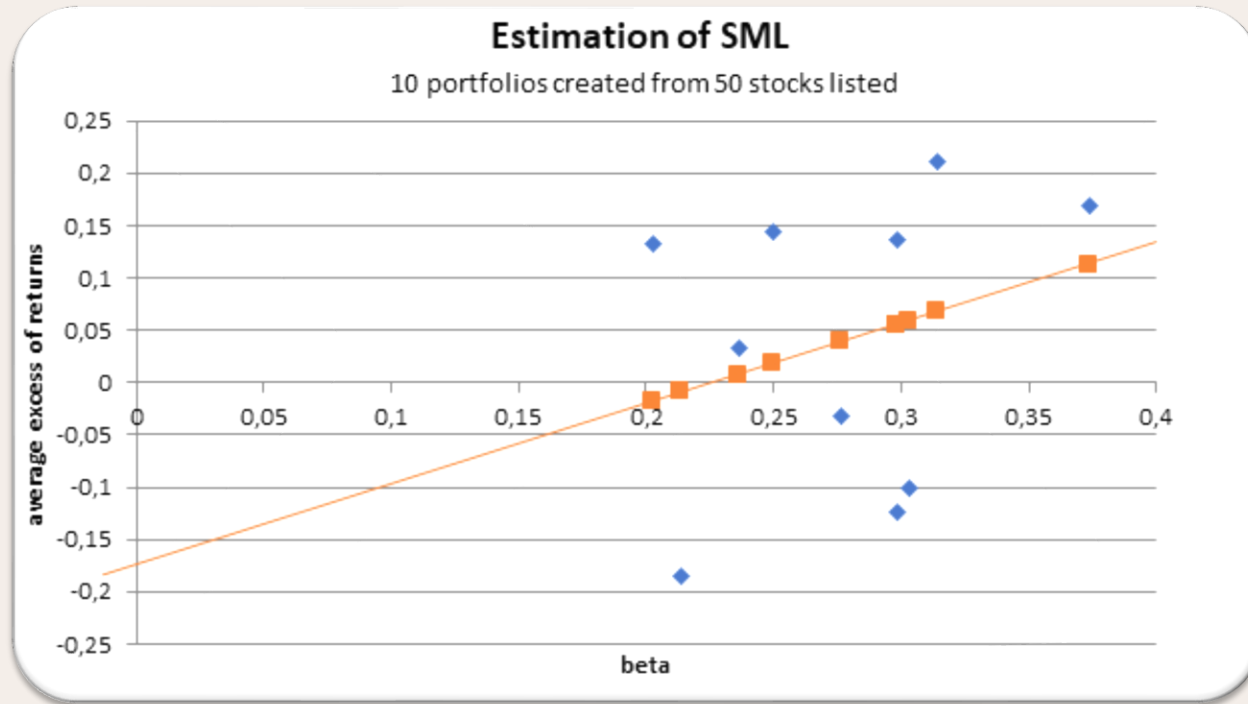


Figure 2. Estimation of the Security Market Line on Hanoi Stock Exchange

SML Estimation

| | Regression results | <i>t</i> -value | <i>p</i> -value | CAPM predicted values |
|----------------|--------------------|-----------------|-----------------|-----------------------|
| γ_0 | -0.1730 | -0.669 | 0.522 | 0 |
| γ_1 | 0.7629 | 0.830 | 0.431 | 0.0740154 |
| R-square | 7.92% | | | |
| Standard Error | 0.1431 | | | |

The estimated SML supports the CAPM theory, the γ_0 is equal to 0. The slope of the estimated SML is positive but insignificant.

Non-linearity test

| | Regression results | <i>t</i> -value | <i>p</i> -value | CAPM predicted values |
|----------------|--------------------|-----------------|-----------------|-----------------------|
| γ_0 | 0.6538 | 0.497 | 0.634 | 0 |
| γ_1 | -5.3188 | -0.558 | 0.431 | 0.0740154 |
| γ_2 | 10.7807 | 0.641 | 0.542 | 0 |
| R-square | 13.04% | | | |
| Standard Error | 0.1487 | | | |

The slope of SML γ_1 is negative and insignificant. Have linear relationship between stocks' beta and return.

Non-systematic risk test

| | Regression results | t -value | p -value | CAPM predicted values |
|----------------|--------------------|------------|------------|-----------------------|
| γ_0 | -0.2015 | -0.080 | 0.939 | 0 |
| γ_1 | -3.0922 | -0.269 | 0.797 | 0.0740154 |
| γ_2 | 7.6636 | 0.395 | 0.707 | 0 |
| γ_3 | 0.2196 | 0.414 | 0.693 | 0 |
| R-square | 15.45% | | | |
| Standard Error | 0.1584 | | | |

This result supports the CAPM. All the risk is captured by beta and non-systematic risk has no influence on stocks' returns.

06

Conclusion Limitation

Conclusion

| | Two-pass Technique | Black, Jensen and Scholes |
|------------------------------|---|--|
| Intercept = 0 | Passed | Passed |
| Slope = average risk premium | Significantly positive and nearly equal | Positive but much higher and insignificant |
| Non-linearity | Passed | Passed |
| Non-systematic risk | Passed | Passed |

The above study shows that the excess return of the stocks under test depends on the excess return of the market, the beta estimate is suitable to measure the systematic risk of the stock. However, testing by Black, Jensen and Scholes methods shows that the data in this study do not support the theory of CAPM.

Limitation



The assumptions of CAPM theory may not completely match the current reality of the market.



The price level accounts for only a minor portion of the business, owing to the influence of supply and demand on the stock of speculators.



The HNX-Index currently does not represent the market portfolio because there are insufficient business lines and significant firms.

Thanks!

Do you have any question?

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