The Men Behind Capital Asset Pricing Model

****

School of Mathematical Sciences

28th March 2017

Outline

Capital Asset Pricing Model

Formula

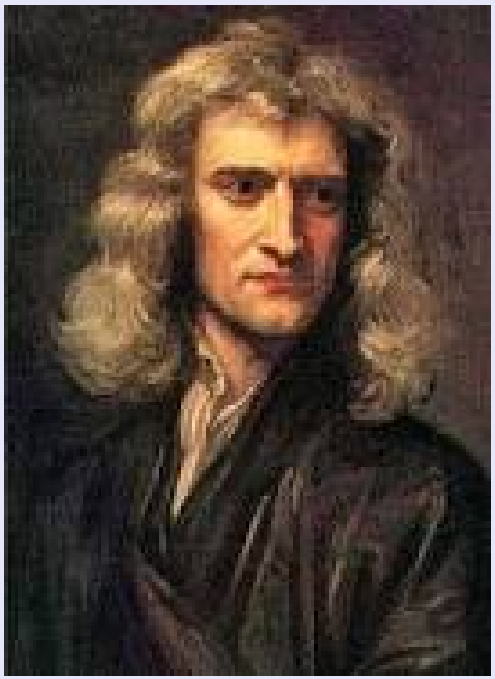
$$E[\tilde{r_q}] - r_f = \beta_{qm}(E[\tilde{r_m}] - r_f)$$

where

$E[\tilde{r_q}]$	the expected return on the capital asset
$E[\tilde{r_m}]$	the expected return of the market
r_f	the risk-free rate of interest
β_{qm}	$\frac{Cov[\tilde{r_q}, \tilde{r_m}]}{Var[\tilde{r_m}]}$

Coincidence in Scientific Thought

In the 17th century...



Isaac Newton

Gottfried Leibniz

Coincidence in Scientific Thought

In the 20th century...

Jack Treynor(1962)

William F.Sharpe(1964)

John Lintner(1965)

Jan Mossin(1966)

Coincidence in Scientific Thought

1990 Nobel Memorial Prize in Economics

William F.Sharpe

Markowitz

Merton Miller

Coincidence in Scientific Thought

why?

Markowitz's work

Portfolio Selection(1952)

PORTFOLIO SELECTION*

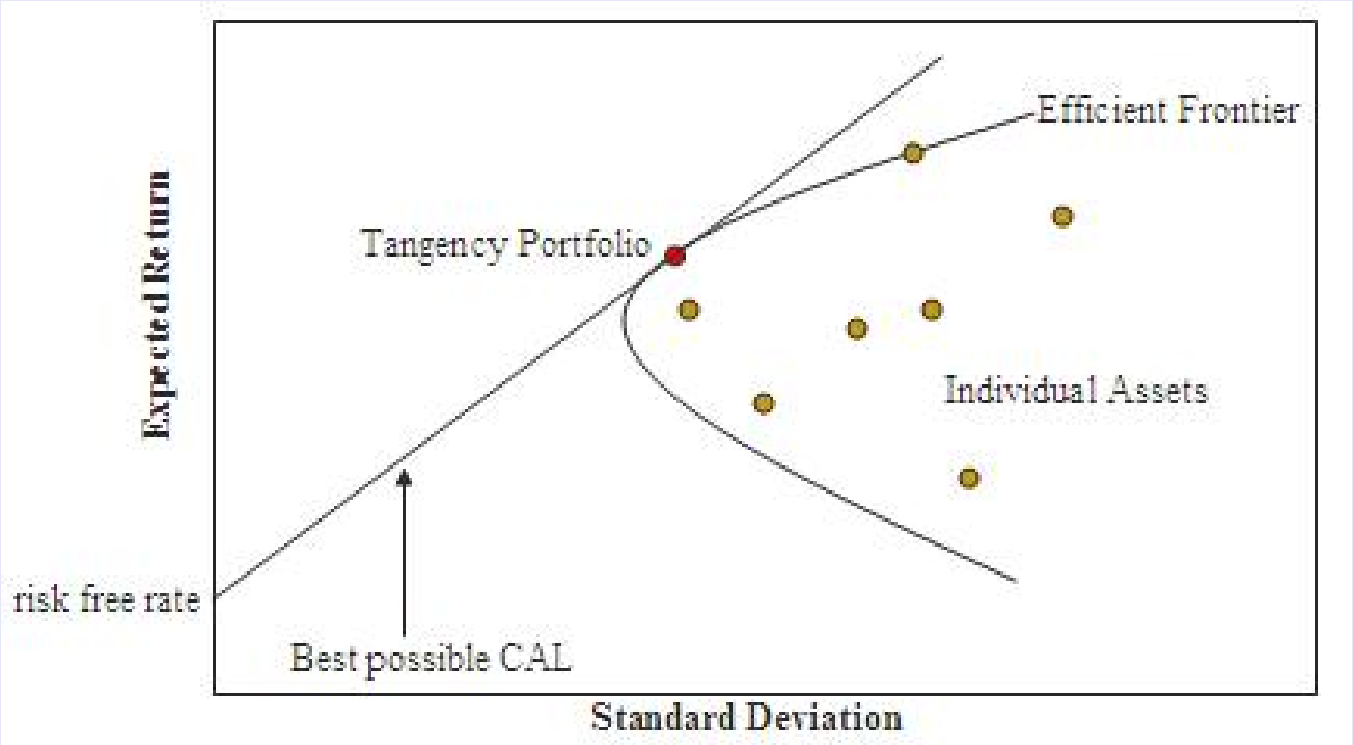
HARRY MARKOWITZ
The Rand Corporation

THE PROCESS OF SELECTING a portfolio may be divided into two stages. The first stage starts with observation and experience and ends with beliefs about the future performances of available securities. The second stage starts with the relevant beliefs about future performances and ends with the choice of portfolio. This paper is concerned with the second stage. We first consider the rule that the investor does (or should) maximize discounted expected, or anticipated, returns. This rule is rejected both as a hypothesis to explain, and as a maximum to guide investment behavior. We next consider the rule that the investor does (or should) consider expected return a desirable thing *and* variance of return an undesirable thing. This rule has many sound points, both as a maxim for, and hypothesis about, investment behavior. We illustrate

Markowitz's work

Modern portfolio theory(mean-variance analysis)

assembling a portfolio of assets such that the expected return is maximized for a given level of risk, defined as variance.



Franco Modigliani and Merton Miller's work

Franco Modigliani and Merton Miller's work

- "The Cost of Capital, Corporation Finance, and the Theory of Investment."

Franco Modigliani and Merton Miller's work

- "The Cost of Capital, Corporation Finance, and the Theory of Investment."
- the connections between a firm's capital structure and its cost of capital or discount rate.

Franco Modigliani and Merton Miller's work

- "The Cost of Capital, Corporation Finance, and the Theory of Investment."
- the connections between a firm's capital structure and its cost of capital or discount rate.
- need to determine the correct discount rate

Jack Treynor(1962)

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper
2. 1960/1961,"Market Value, Time, and Risk", and show it to John Linter.

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper
2. 1960/1961,"Market Value, Time, and Risk", and show it to John Linter.
3. studies economics at MIT

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper
2. 1960/1961,"Market Value, Time, and Risk", and show it to John Linter.
3. studies economics at MIT
4. "Toward a Theory of Market Value of Risky Assets"(CAPM)

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper
2. 1960/1961,"Market Value, Time, and Risk", and show it to John Linter.
3. studies economics at MIT
4. "Toward a Theory of Market Value of Risky Assets"(CAPM)
5. exchange papers with Sharpe

Jack Treynor(1962)

1. 1958, read Modigliani and Miller's paper
2. 1960/1961,"Market Value, Time, and Risk", and show it to John Linter.
3. studies economics at MIT
4. "Toward a Theory of Market Value of Risky Assets"(CAPM)
5. exchange papers with Sharpe
6. "I thought that if Sharpe was going to publish, what's the point of my publishing my paper?"

William Sharpe(1964)

William Sharpe(1964)

1. work at the RAND Corporation and began his PhD studies

William Sharpe(1964)

1. work at the RAND Corporation and began his PhD studies
2. study Markowitz's work

William Sharpe(1964)

1. work at the RAND Corporation and began his PhD studies
2. study Markowitz's work
3. asked Markowitz for a dissertation topic

William Sharpe(1964)

1. work at the RAND Corporation and began his PhD studies
2. study Markowitz's work
3. asked Markowitz for a dissertation topic
4. the final chapter of the dissertation(CAPM)

William Sharpe(1964)

1. work at the RAND Corporation and began his PhD studies
2. study Markowitz's work
3. asked Markowitz for a dissertation topic
4. the final chapter of the dissertation(CAPM)
5. "Although Harry was not on my committee, he filled a role similar to that of dissertation advisor. My debt to him is truly enormous."

John Lintner(1965)

John Lintner(1965)

1. 1960/1961, Treynor show his work to John Linter.

John Lintner(1965)

1. 1960/1961, Treynor show his work to John Linter.
2. 1965, Lintner' s independent development of CAPM

John Lintner(1965)

1. 1960/1961, Treynor show his work to John Linter.
2. 1965, Lintner’ s independent development of CAPM
3. Did Treynor feel that Lintner stole his work?

John Lintner(1965)

1. 1960/1961, Treynor show his work to John Linter.
2. 1965, Lintner' s independent development of CAPM
3. Did Treynor feel that Lintner stole his work?
4. How closely do the two papers resemble each other?

John Lintner(1965)

1. 1960/1961, Treynor show his work to John Linter.
2. 1965, Lintner' s independent development of CAPM
3. Did Treynor feel that Lintner stole his work?
4. How closely do the two papers resemble each other?
5. the most mathematically impressive

Jan Mossin(1966)

Jan Mossin(1966)

1. 1966, “Studies in the Theory of Risk Bearing”(CAPM)

Jan Mossin(1966)

1. 1966, “Studies in the Theory of Risk Bearing”(CAPM)
2. when he began work on CAPM?

Jan Mossin(1966)

1. 1966, "Studies in the Theory of Risk Bearing"(CAPM)
2. when he began work on CAPM?
3. did he know about the other three men's work?

Comparison

- Treynor: capital budgeting, cost-of-capital issues
- Sharpe: optimum portfolio selection
- Linter: the concern of a firm issuing equities.
- Mossin: specifying equilibrium conditions in the asset market.

Why only one Nobel Prize...

The Nobel Prize is not awarded posthumously.

Why only one Nobel Prize...

The Nobel Prize is not awarded posthumously.

- If John Lintner NOT died in 1983

Why only one Nobel Prize...

The Nobel Prize is not awarded posthumously.

- If John Lintner NOT died in 1983
- If Jan Mossin NOT died in 1987

Why only one Nobel Prize...

The Nobel Prize is not awarded posthumously.

- If John Lintner NOT died in 1983
- If Jan Mossin NOT died in 1987
- If Jack Treynor published his work in 1962

What's more

Black CAPM(zero-beta CAPM)

Fischer Black

- NOT assume the existence of a riskless asset
- more robust!

Black CAPM(zero-beta CAPM)

Formula

$$E[\tilde{r_q}] - E[\tilde{r}_{zc(m)}] = \beta_{qm}(E[\tilde{r_m}] - E[\tilde{r}_{zc(m)}])$$

where

$E[\tilde{r_{zc(m)}}]$	the expected return on the zero-covariance asset
$E[\tilde{r_q}]$	the expected return on the capital asset
$E[\tilde{r_m}]$	the expected return of the market
β_{qm}	$\frac{Cov[\tilde{r_q}, \tilde{r_m}]}{Var[\tilde{r_m}]}$

References I

Thank you!