

Introduction

- Harry Markowitz: Father of modern portfolio theory (MPT). His dissertation at the University of Chicago in 1952 “Portfolio Selection” will become the basis for his Nobel Prize in 1990.



- MPT: would have been relevant 1000 years ago and it will be relevant 1000 years from now...
- Diversification: How to manage and reduce risk.
“Don’t put all your eggs in one basket!”
- Portfolio: a group of assets.
- Idea of diversification is not new. For example, in Shakespeare’s “Merchant of Venice” written around 1600 for someone that lived around 1400-1500, the merchant Antonio was asked why he was sad. Antonio was asked “is your business not doing so well”? And Antonio replied:

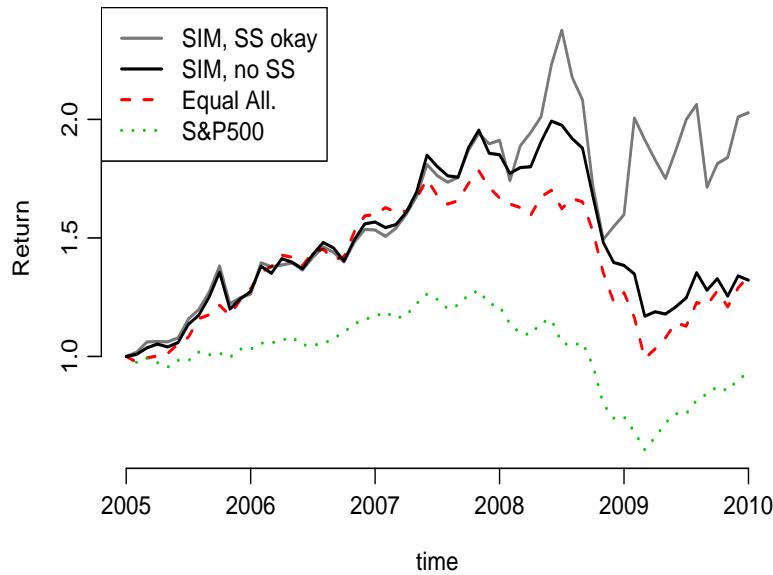
My ventures are not in one bottom trusted,
Nor to one place; nor is my whole estate
Upon the fortune of this present year;
Therefore, my merchandise makes me not sad

“Against the Gods - The remarkable story of risk”, Peter Bernstein (1998), Wiley.

- Before 1952 the fact that stocks are correlated was not taken into account.
- This course is not about which stocks to select. Not an easy question!
- Given a set of stocks we wish to find the optimum combination of these stocks that will minimize risk.
- It is an optimization problem: It can be solved easily under different conditions and assumptions.
- We will discuss several models:
 1. Classical Markowitz model.
 2. Single index model.
 3. Constant correlation model.
 4. Multi-group model.
 5. Multi-index model.

Short sales not allowed, short sales allowed, and investors have access to the risk free asset.

- By the end of the 5th week we will be able to test the performance of the various portfolios and compare them with the market:



- It helps to be familiar with: Random variables, expected value and variance of a random variable, mean and variance of a sum of random variables, covariance and correlation, simple and multiple regression, differentiation, maximizing or minimizing a function subject to a set of constraints, basic analytic geometry, basic linear algebra, statistical inference (χ^2, t, F) distributions.
- Stock market data will be obtained from <http://finance.yahoo.com/> and we will mainly use monthly close prices. In particular, we will use the following app that was built in R by Stephen Smith (graduate student - UCLA Department of Statistics):
<http://shiny.stat.ucla.edu:3838/c183c283/> .
- Objectives of a portfolio analysis: Depends on the investor. But two objectives are common for all investors:
 1. They want “return” to be high: prefer more than less.
 2. They want this return to be stable, not subject to uncertainty (risk).

This material is not for investors who prefer uncertainty!

- However, the highest return portfolio is associated with the highest uncertainty (risk) and the lowest uncertainty (risk) is associated with lowest return. Between these two extremes we find “efficient portfolios”.