Lesson XI: Overview

1. International Portfolio Investment
2. To sum up (Exercises, Q&A…)

LIUC Università Cattaneo

International Portfolio Investment

Terminology

Portfolio Investment: investment in equities and bonds where the investor's holding is too small to provide any effective control (Could you define what a FDI is?).

Rust Off I

Diversification means building multi-asset portfolios, such that <u>**only**</u> a **portion of total wealth is invested** in each **individual asset**. This allows in turn to **spread out exposure to security-specific factors**, so as to **reduce** the overall level of **risk**.

Even common wisdom suggests that putting all eggs in one basket can be very risky!

Rust Off II

Diversification thus helps reduce **"Asset-Specific Risk"** (a.k.a. "Non-Systematic Risk" or "Diversifiable Risk").

The risk that remains even after extensive diversification is called **"Market Risk"** (or, equivalently, "Systematic Risk" – "Non Diversifiable Risk"

Terminology

Systematic risk: risk that cannot be diversified away

Systemic risk: risk of collapse of an entire financial system or entire market

Insight into the benefits of diversification I

$$E[r_p] = \sum_{i=1}^{n} x_i E[r_i]$$

$$\sigma_p^2 = \sum_{i=1}^{n} x_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j \neq i=1}^{n} x_i x_j \sigma_{ij}$$

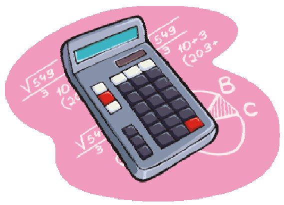
Insight into the benefits of diversification II

The **benefits of diversification** for risk reduction (for a given E[r]) are closely related to the **correlation term**.

The portfolio standard deviation is reduced if the correlation terms are **negative**, but, even when they are **positive**, the portfolio standard deviation is still less than the weighted average of the individual securities standard deviations

Insight into the benefits of diversification III

	Equity 1	Equity 2
E(R)	.08	.055
Risk(σ)	.15	.1
Weights	.75	.25



	$E(R_p)$	Risk	*Wrisk*
ρ(Equity1;Equity2) = -1	.07375	**.0875**	.1375
ρ(Equity1;Equity2) = -.5	.07375	**.1023**	.1375
ρ(Equity1;Equity2) = -.2	.07375	**.1103**	.1375
ρ(Equity1;Equity2) = 0	.07375	**.1152**	.1375
ρ(Equity1;Equity2) = .2	.07375	**.1200**	.1375
ρ(Equity1;Equity2) = .5	.07375	**.1269**	.1375
ρ(Equity1;Equity2) = 1	.07375	**.1375**	.1375

Insight into the benefits of diversification IV

Portfolios of less than perfectly correlated assets always offer **better risk-return opportunities** than the individual constituent securities on their own.

What about perfect positive correlations?

Getting started I

Assuming **risk aversion**, investors demand **higher returns** for taking on **higher risk**.

Risk relates to returns' volatility - variability over a given time period (generally defined as standard deviation of returns)

Getting started II

How to select the most suitable **combination of assets** so as to maximize portfolio return for a given level of risk?

Adopted Selection Criteria:

RETURN – RISK – CORRELATION

Portfolio Investment (Risky Assets) I

Suppose there are only 2 risky assets on the market ($Equity_1$ and $Equity_2$) and assume further that:

	$Equity_1$	**$Equity_2$**
E(R)	.08	.055
Risk(σ)	.15	.1
$\rho(Equity_1;Equity_2)$	**-.5**	

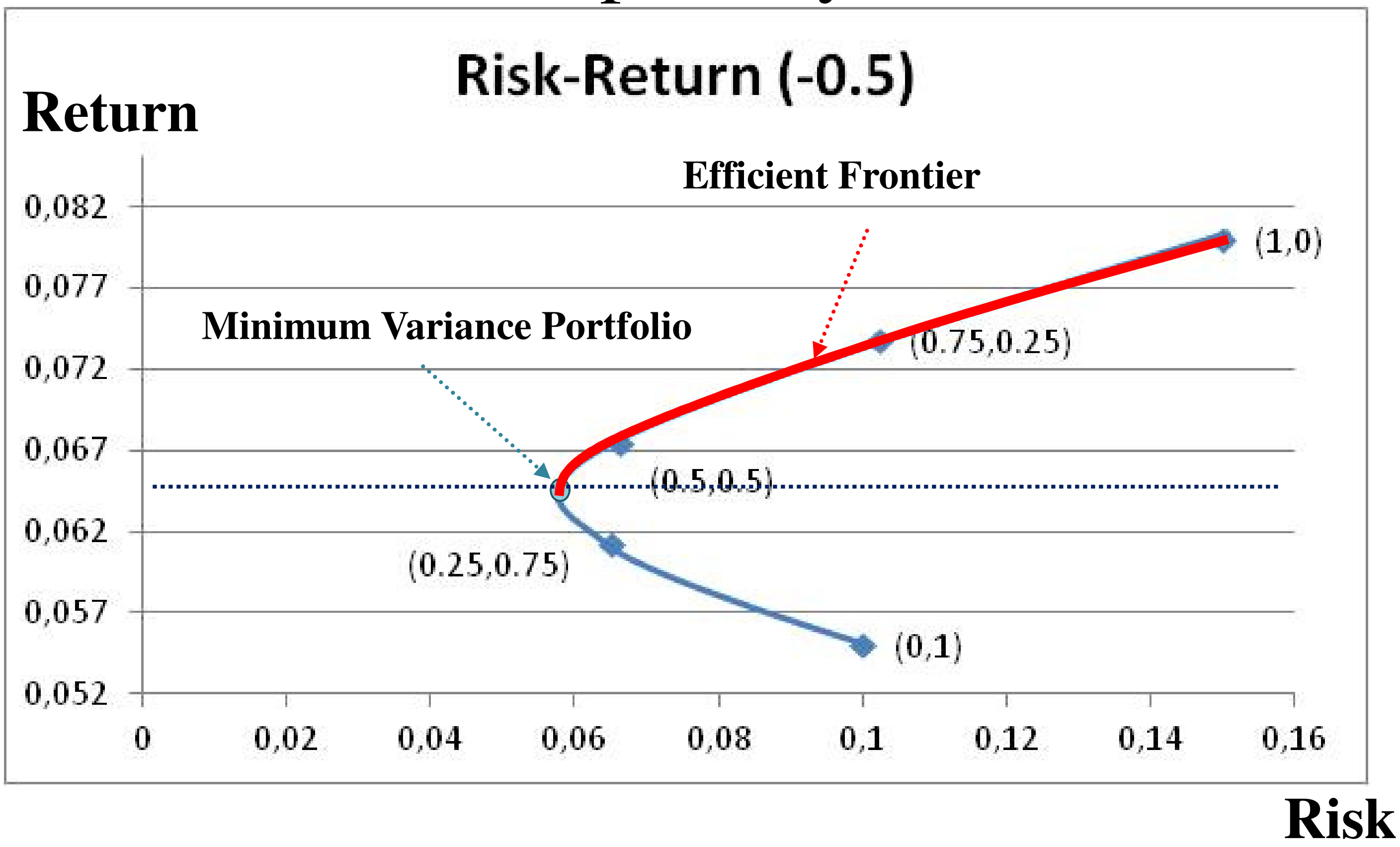
Portfolio Investment (Risky Assets) II

Depending on the different weighting schemes, we would have…

	Equity 1	Equity 2	*E(R$_p$)*	*Risk*	Wrisk
Weighting Scheme	x_1	x_2			
1	1	0	.08	.15	.15
2	.75	.25	.074	.102	.138
3	.5	.5	.068	.066	.125
4	.25	.75	.061	.065	.113
5	0	1	.055	.1	.1

Portfolio Investment (Risky Assets) III

Graphically…



Portfolio Investment (Risky Assets) IV

Assume now that:

	Equity $_1$	Equity $_2$
E(R)	.08	.055
Risk(σ)	.15	.1
$\rho(\text{Equity}_1;\text{Equity}_2)$	**.2**	

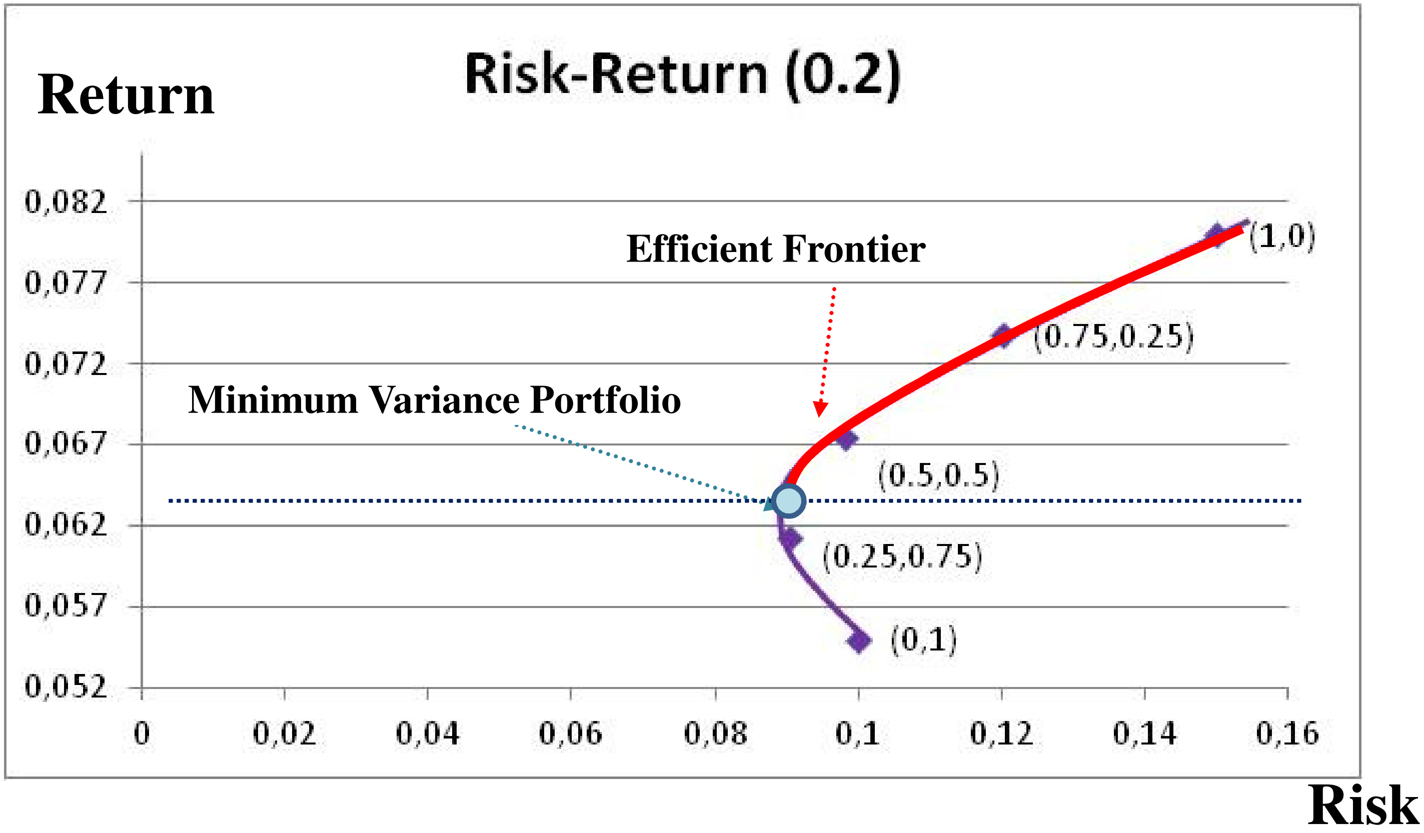
Portfolio Investment (Risky Assets) V

Depending on the different weighting schemes, we would have…

	Equity 1	Equity 2	*$E(R_p)$*	*Risk*	Wrisk
Weighting Scheme	w_1	w_2			
1	1	0	.08	.15	.15
2	.75	.25	.074	.120	.138
3	.5	.5	.068	.098	.125
4	.25	.75	.061	.090	.113
5	0	1	.055	.1	.1

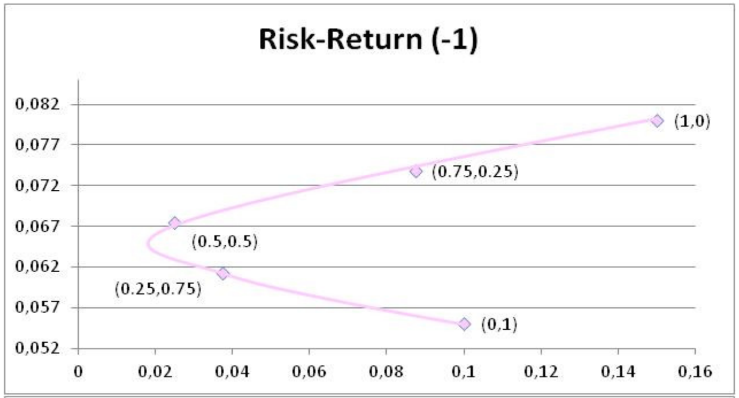
Portfolio Investment (Risky Assets) VI

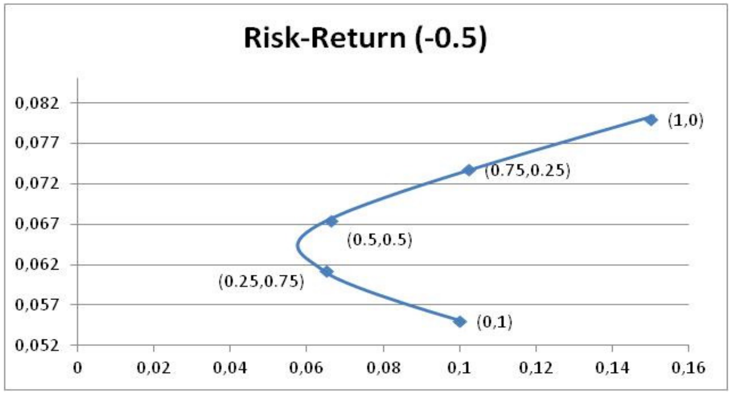
Graphically…

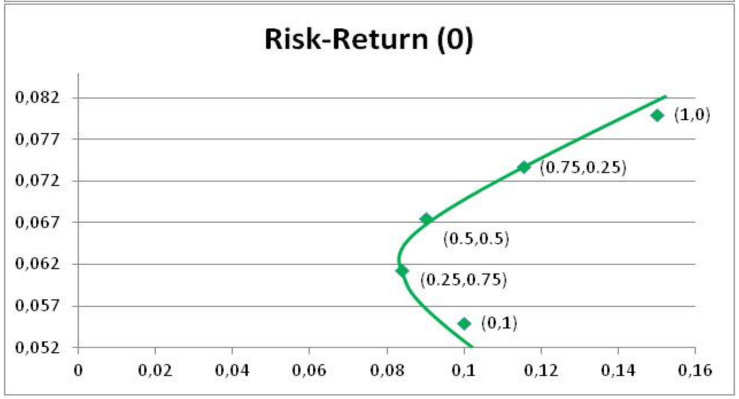


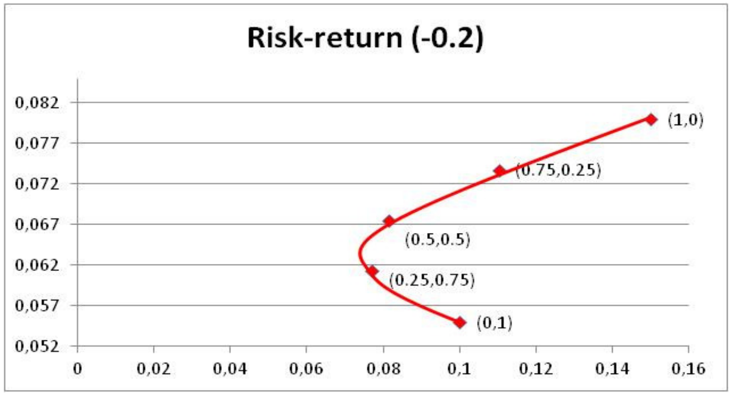
Portfolio Investment (Risky Assets) VII

The **shape of the Efficient Frontie**r varies depending on **inter-assets correlation**.



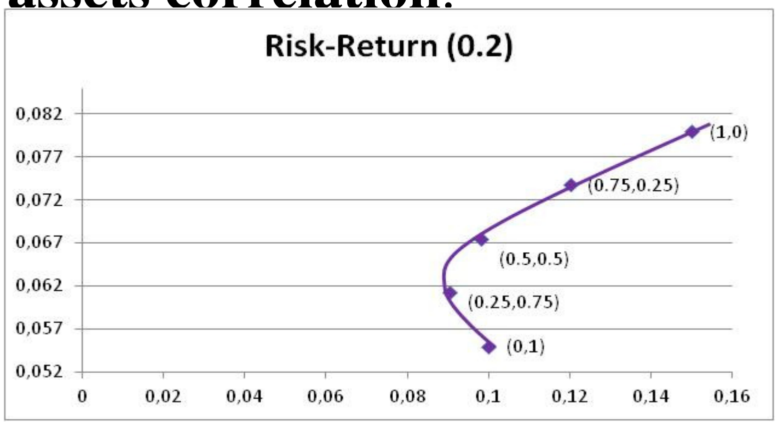


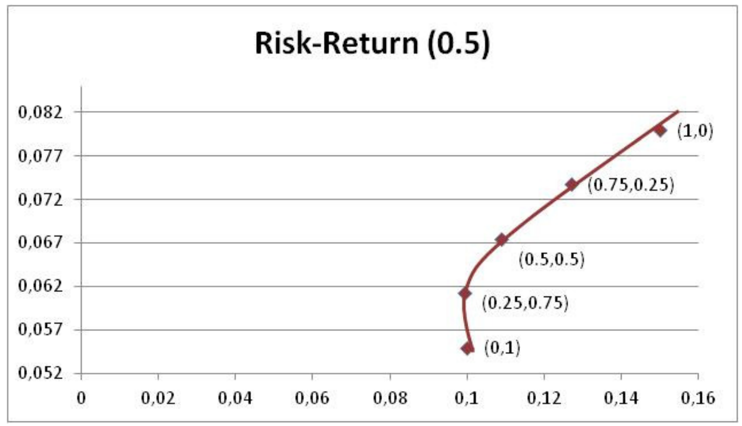


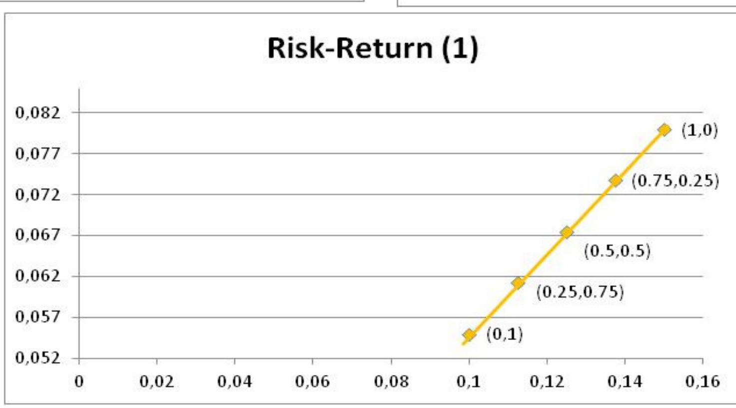


Portfolio Investment (Risky Assets) VIII

The **shape of the Efficient Frontie**r varies depending on **inter-assets correlation**.

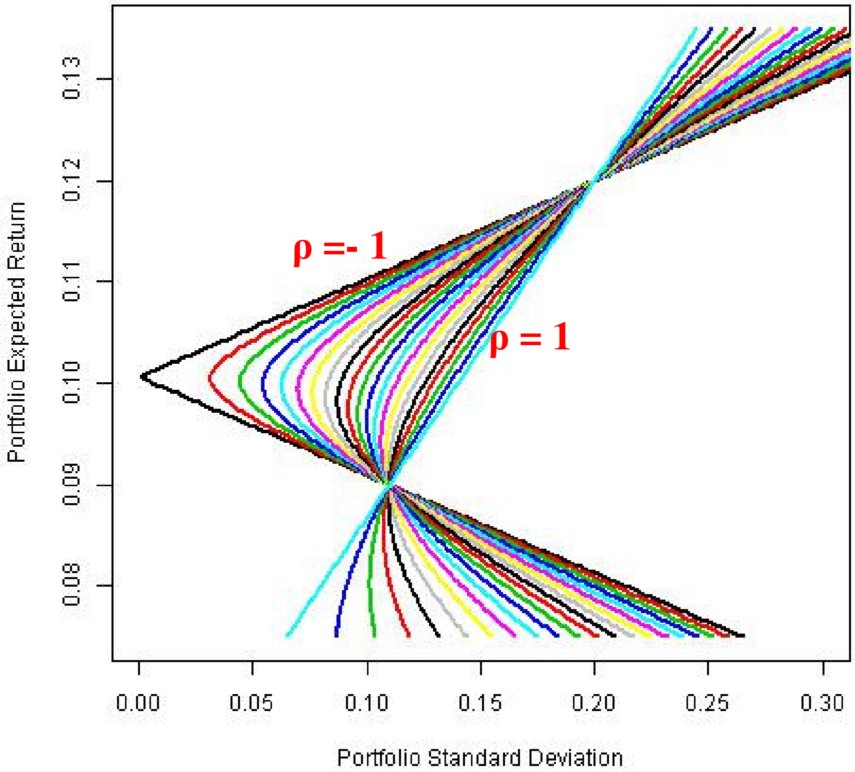






Portfolio Investment (Risky Assets) IX

Source: www. complete-markets.com



The **final portfolio selection** will exclusively depend on **individual risk appetite**

What if we added a **risk-free asset**?

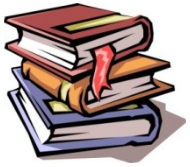
Terminology I

Efficient Frontier (Markowitz, 1952): optimal set of portfolios that offer the highest expected return for a specific level of risk.

Terminology II

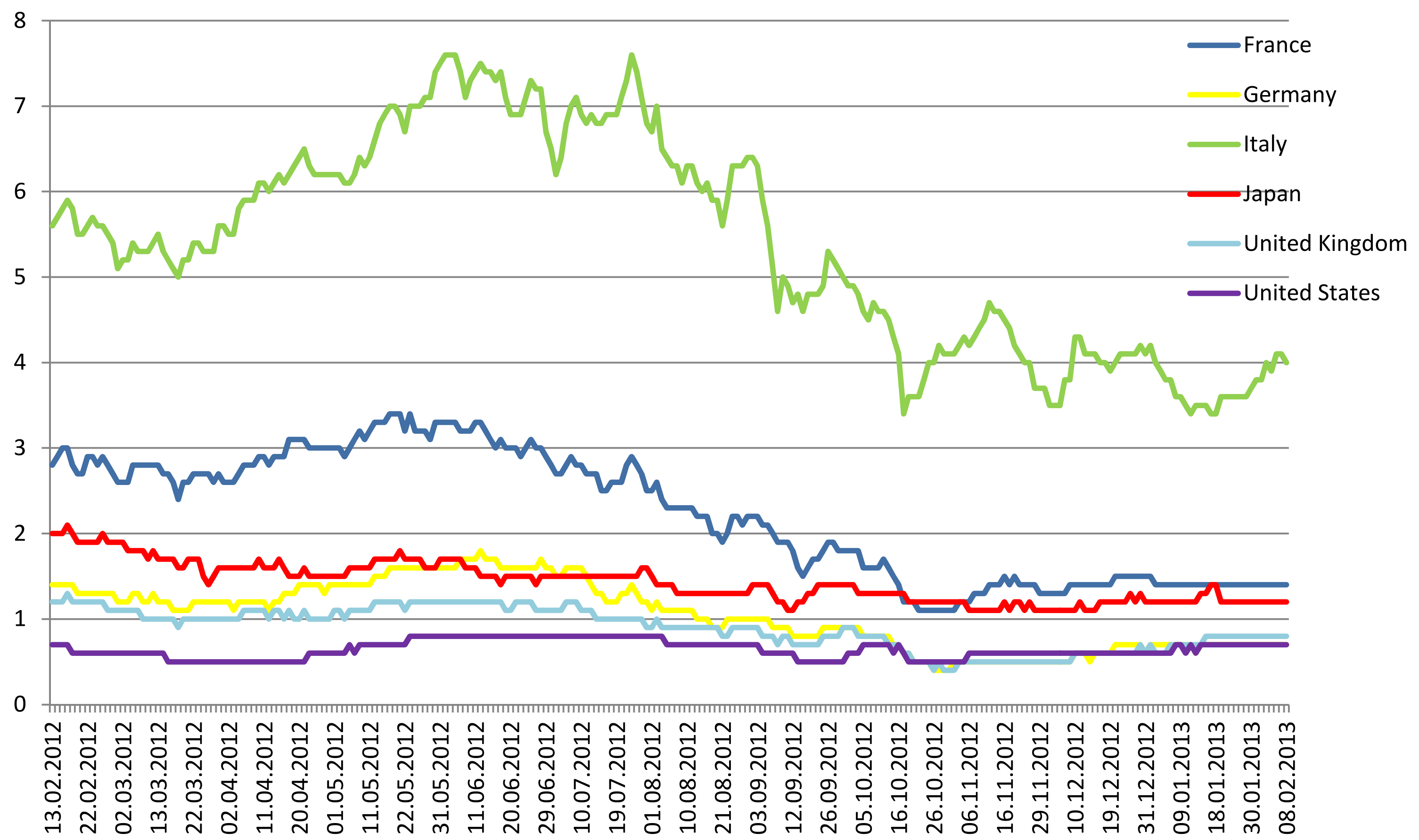
Risk-free assets: financial instruments that have a certain future return (MM securities, Government bonds…).

Are they truly (and completely) risk-free in practice?



Looking behind the scenes…

Annual Probability of Default from 5 years CDS (Source: www. dbresearch.com)



Portfolio Investment (Risky and Risk-free Assets) I

Suppose there are only 2 risky assets on the market ($Equity_1$ and $Equity_2$) and a risk-free portfolio (made up of MM instruments and Govt Bonds), yielding 3.5%. Assume further that:

	$Equity_1$	**$Equity_2$**
E(R)	.08	.055
Risk(σ)	.15	.1
$\rho(Equity_1;Equity_2)$	**-.5**	

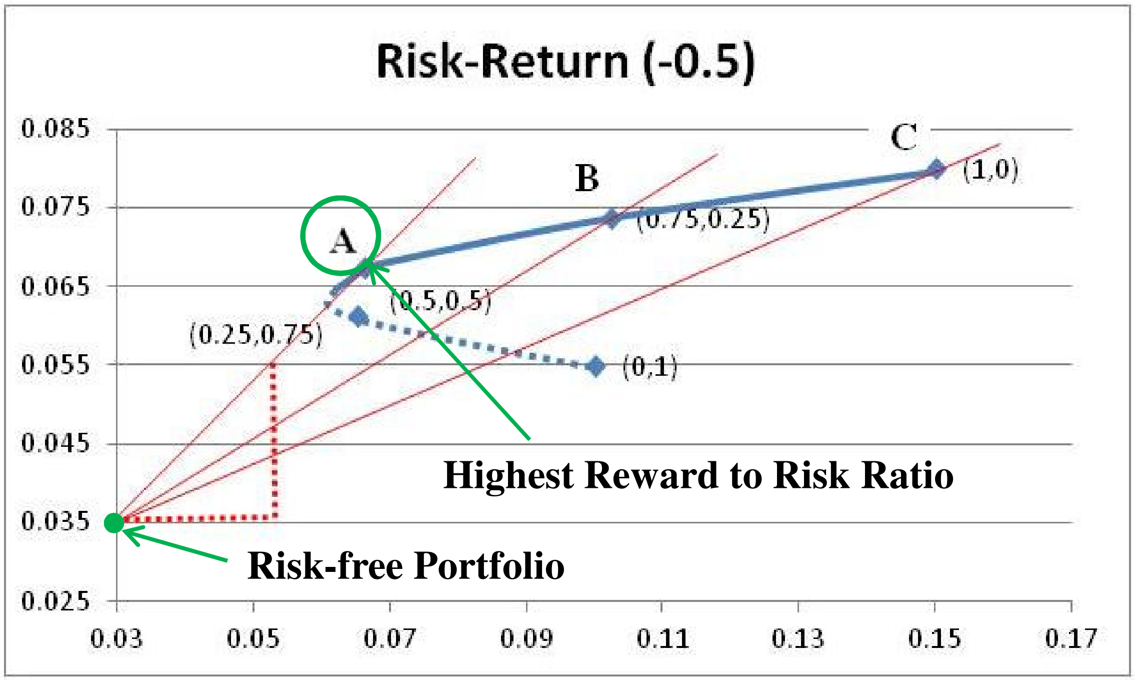
Portfolio Investment (Risky and Risk-free Assets) II

How to determine which **optimal risky portfolio** is to be **best combined with the risk-free** security basket?

Adopted Selection Criteria:

Max[REWARD to RISK]

Portfolio Investment (Risky and Risk-free Assets) III



A is the **optimal risky portfolio** to be **combined with the risk-free asset set.**

Can you understand why the Risk-free portfolio lies on the vertical axis?

Portfolio Investment (Risky and Risk-free Assets) IV

Assume now that x_r = % of total wealth invested in the risky portfolio and x_{rf} = % of total wealth invested in the risk-free assets ($x_r + x_{rf} = 1$),

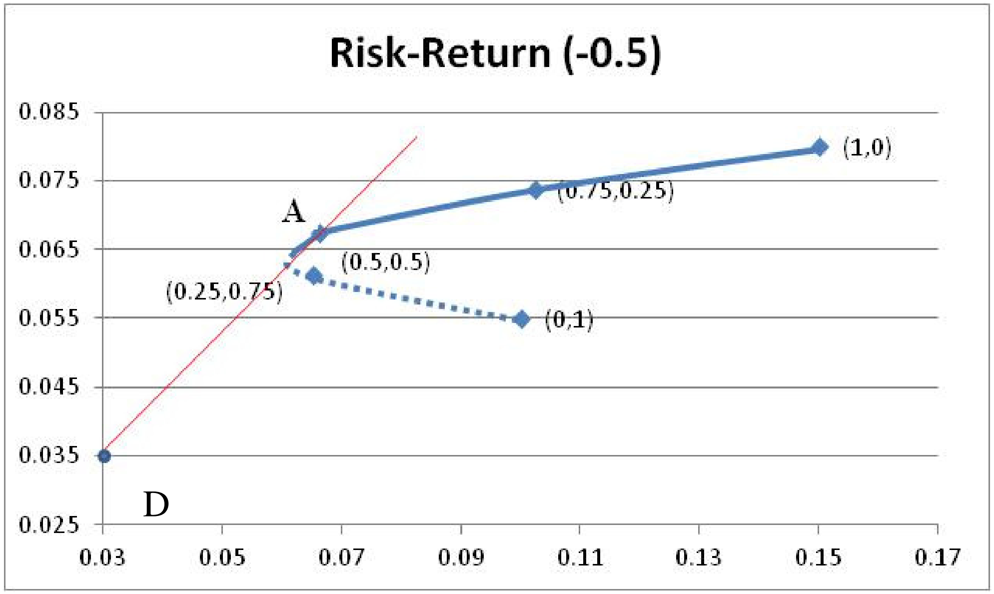
$$E[r_p] = x_r E[r_r] + x_{rf} E[r_{rf}]$$

$$\sigma_p^2 = x_r^2 \sigma_r^2$$

Depending on x_r and x_{rf}, we will move along the **straight line** spanning from the risk-free portfolio to point A.

Capital Allocation Line

Portfolio Investment (Risky and Risk-free Assets) V



Which **point** on the line represents $\mathbf{x_r = 0, x_{rf} = 1}$?

Which **point** on the line represents $\mathbf{x_r = 1, x_{rf}} = 0$?

What about the other **intermediate weighting schemes**?

The final **choice of** $\mathbf{x_r}$ **and** $\mathbf{x_{rf}}$ depends on **individual risk appetite**.

A broader perspective

What about international portfolio management?

The underlying rationale is exactly the same, but the **benefits of international diversification** can be **much larger**...

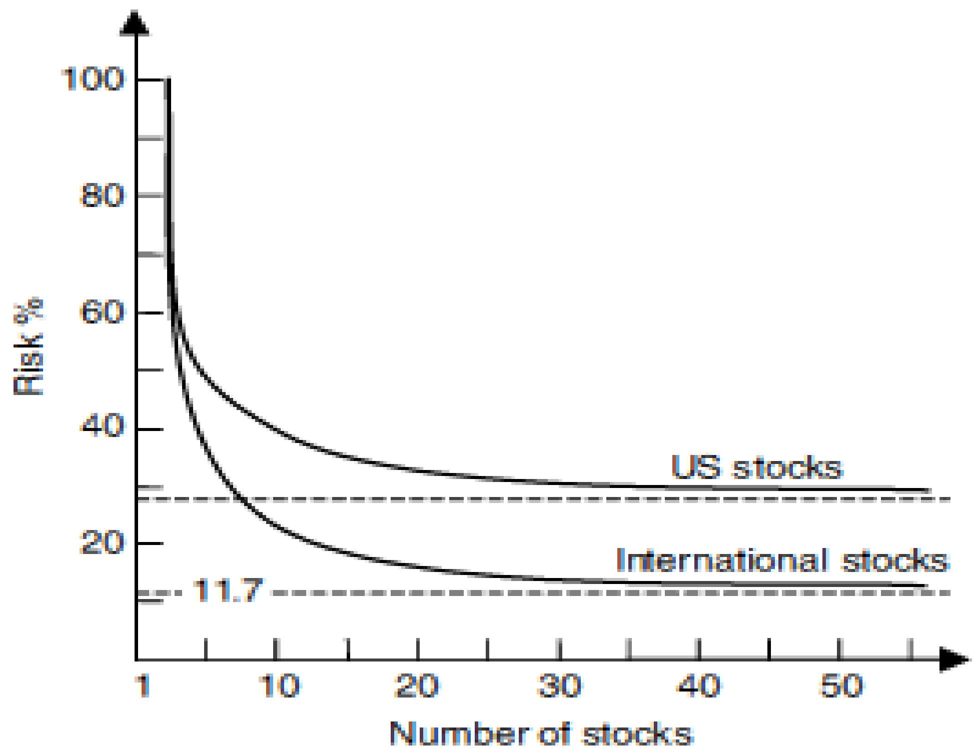
"International" correlations

Correlation coefficients computed on monthly USD returns (1994-2002)

	Correlation coefficient										
	Aus	Can	Fr	Ger	Ind	Ital	Jap	Holl	Sing	Swed	UK
Australia											
Canada	0.66										
France	0.46	0.59									
Germany	0.50	0.62	0.85								
India	0.43	0.41	0.21	0.21							
Italy	0.37	0.47	0.70	0.68	0.31						
Japan	0.57	0.44	0.37	0.32	0.25	0.28					
Holland	0.54	0.60	0.87	0.88	0.27	0.67	0.37				
Singapore	0.63	0.53	0.40	0.41	0.36	0.28	0.41	0.44			
Sweden	0.59	0.71	0.80	0.83	0.38	0.68	0.39	0.76	0.45		
UK	0.55	0.64	0.75	0.74	0.13	0.50	0.34	0.76	0.49	0.70	
USA	0.57	0.76	0.67	0.74	0.25	0.49	0.43	0.72	0.54	0.71	0.82

Source: IMF, *International Financial Statistics*, December 2003

The benefits of worldwide diversification



Source: B.H. Solnik, "Why not diversify internationally rather than domestically?", *Financial Analysts Journal*, 1974

Watch out

International diversification

Rewards

Risks

Lower σ_p^2

Unanticipated changes in FX rates

The Exchange Rate Risk I

The risk arising from unexpected changes in FX rates depends **both** on:

1. The **σ^2 of exchange rates**;
2. On the existing **relationship between exchange rates and security prices**

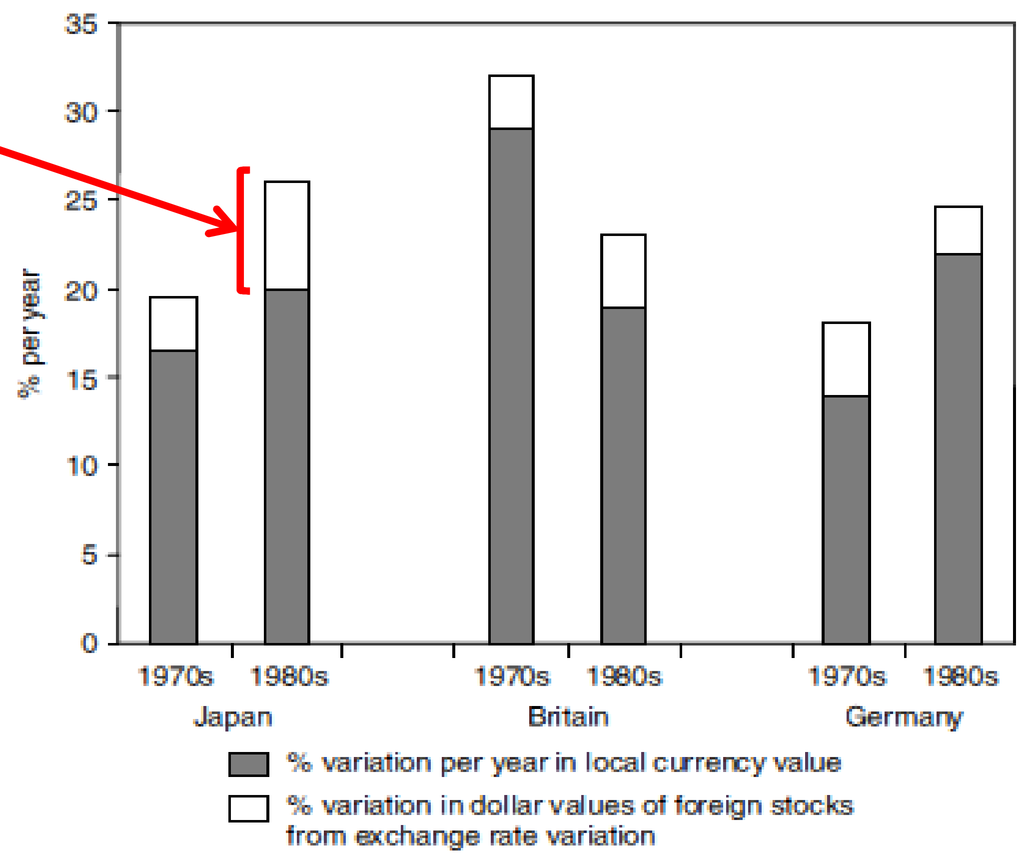
The exchange rates contribute a fraction of the total portfolio returns' volatility via the **direct effect** of the exchange rate volatility and via the **indirect effect** of positive covariance between exhange rates and (local) stock mkt returns

The Exchange Rate Risk II

The potential risk deriving from exchange rates fluctuations can be judged by comparing the σ^2 of stocks values measured in local currencies to the σ^2 of stocks prices expressed in domestic currency terms (assume the USD is our home currency)

The Exchange Rate Risk III

The difference between the two σ^2 can be conceived as the σ^2 contributed to the $ value by variations in FX rates→**relatively SMALL contribution**



Source: *International finance*, M. D. Levi, 2009

The Exchange Rate Risk IV

Expected \$ return on a foreign stock:

$$E[r] = r_F + \Delta S\,\frac{F}{\$}$$

Variance of the \$ return on a foreign stock:

$$\sigma^2 = \sigma^2 \Delta S\,\frac{F}{\$} + \sigma^2{}_r + 2\sigma(r_F; \Delta S\,\frac{F}{\$})$$

The Var of the USD rate of return on the foreign stock depends on…

…the Var of the FX rate…

…the Var of the returns on the foreign stock…

…and the Cov between the FX rate and r.

The Exchange Rate Risk V

Composition of US dollar weekly returns on individual foreign stock markets, 1980–85

Country	Percentage of variance in US dollar returns from		
	Exchange rate	Local return	2 x Covariance
Canada	4.26	84.91	10.83
France	29.66	61.79	8.55
Germany	38.92	41.51	19.57
Japan	31.85	47.65	20.50
Switzerland	55.17	30.01	14.81
UK	32.35	51.23	16.52

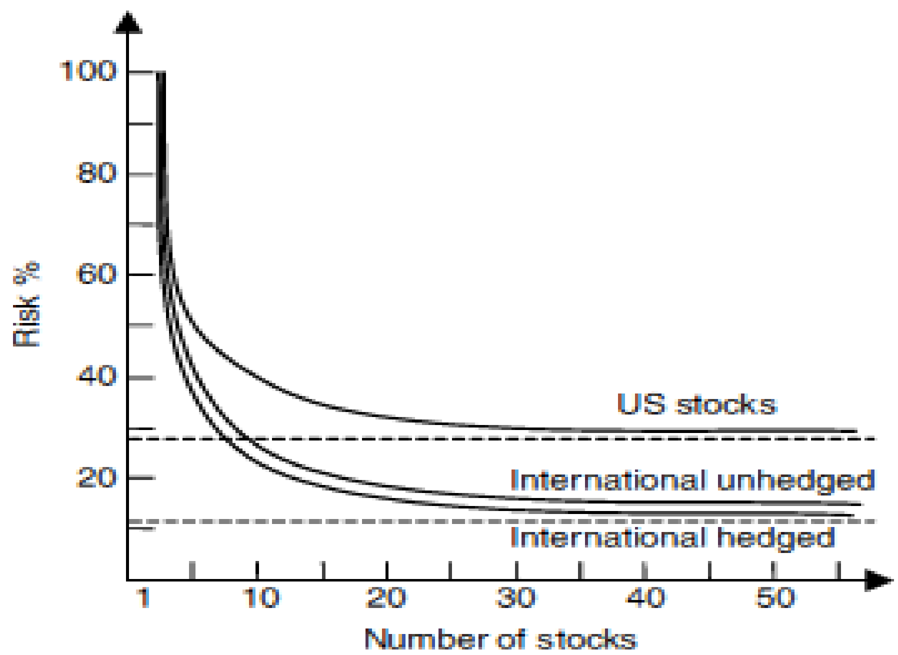
Source: Cheol S. Eun and Bruce G. Resnick, "Exchange Rate Uncertainty, Forward Contracts, and International Portfolio Selection," *Journal of Finance*, March 1988, pp. 197–215.

Given some Exchange Rate Risk…I

Does it completely nullify the benefits arising from international diversification? NO!

1. It is always possible to hedge against FX risk;
2. Even without hedging, the σ^2 of an internationally diversified portfolio < the variance of a domestically diversified portfolio

Given some Exchange Rate Risk…II



Source: B.H. Solnik, "Why not diversify internationally rather than domestically?", *Financial Analysts Journal*, 1974

International K Asset Pricing

The pricing (and, consequently, the returns) of assets depends on whether prices are determined in an **integrated** or in a **segmented** international K mkt

- *Integrated*: the connection between countries' capital markets is seamless
- *Segmented*: different countries' capital markets are not integrated because of implicit or explicit factors inhibiting the free movement of capital between the countries.

Integration vs Segmentation

- Whenever international K mkts are **integrated**, the **returns** on a given stock will depend on its **contribution to the risk** of an **internationally diversified portfolio**;
- Conversely, if assets are priced in **segmented** K mkts, their **returns** will also depend on the **systematic risk of their domestic mkt**

⇩

If we were able to circumvent the causes of mkt segmentations, we would be able to enjoy higher benefits deriving from international diversification

CAPM: Main Assumptions

1. Investors are purely price-takers;
2. Investments are limited to a universe of publicly traded financial assets;

3. No taxes and no transaction costs;
4. Investors are rational mean-variance optimizers and have the same investment horizon;
5. Homogeneous expectations (same views) and risk appetite.

CAPM: One Major Implication I

If all investors use **identical mean-variance analysis**, applied to the **same** universe of **securities**, for the **same time horizon** and use the **same information set**, they all must arrive at the **same determination of the optimal risky portfolio** on the efficient frontier…

CAPM: One Major Implication II

…however, if all the investors hold and identical risky portfolio…

…this portfolio has to be the **MARKET PORTFOLIO** (including all tradable assets).

CAPM I

The CAPM relies on the idea that the **appropriate risk premium** on an asset will be determined by its **contribution to the risk of the overall portfolio**.

Risk-Reward Ratio for a generic asset (j)

$$\frac{E(r_j) - r_f}{Cov(r_j; r_m)}$$

Risk-Reward Ratio for the mkt portfolio

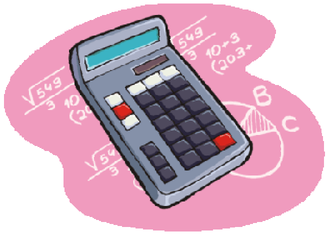
$$\frac{E(r_m) - r_f}{\sigma^2(r_m)}$$

CAPM II

The two foregoing risk-reward ratios must be strictly equal (could you explain why?), so that

$$\frac{E(r_j) - r_f}{Cov(r_j; r_m)} = \frac{E(r_m) - r_f}{\sigma^2(r_m)}$$

Rearranging the terms..



CAPM III

$$r_j = r_f + \beta(r_m - r_f)$$

$$\beta = \frac{Cov(r_j, r_m)}{\sigma^2_{r_m}}$$

- r_j: E[r] on the j^{th} security/portfolio
- r_f: risk-free rate of interest
- r_m: E[r] on the mkt portfolio
- $Cov(r_j; r_m)$: covariance between the j^{th} security/portfolio and the mkt portfolio
- σ^2_{rm}: variance of the mkt portfolio

CAPM IV

$$r_j - r_f = \beta(r_m - r_f)$$

$$\beta = \frac{\rho(r_j, r_m)}{\sigma^2_{r_m}}$$

The risk premium is linearly related to…

…the risk that the single asset/portfolio contributes to the mkt as a whole→ **SYSTEMATIC RISK**

ICAPM

$$r_j = r_f + \beta(r_w - r_f)$$

$$\beta = \frac{\rho(r_j, r_w)}{\sigma^2_{r_w}}$$

- r_j: E[r] on the j^{th} security/portfolio
- r_f: risk-free rate of interest
- r_w: E[r] on the world portfolio
- $\rho(r_j; r_w)$: cov between the j^{th} security/portfolio and the world portfolio
- σ^2_{rw}: variance of the world portfolio

Very appealing→ no possibility of further diversification (no further returns to be enjoyed), yet **difficult to implement** (what is a "world portfolio"?)

K mkts integration I

By holding the internationally diversified portfolio in a integrated K mkt, an investor could enjoy the best possibile risk-return profile

⬇

Are K mkts really integrated?

K mkts integration II

The available empirical evidence tends to support the view that international K mkts are still quite segmented

The most obvious example of segmentation is in the form of a bias towards domestic investments (so called "**Home-equity Bias**")→ the global holdings of foreign securities is largely sub-optimal

Reasons behind the HEB

- Legal barriers to foreign investments;
- Higher transaction costs on foreign equities;
- Indirect barriers to foreign investments→ e.g. the difficulty in finding (and interpreting) information about foreign securities;
- Additional risks to be hedged (FX risk, country risk…)

To put it into practice

- Suppose that the risk premium on the market portfolio is estimated at 8% with a standard deviation of 22%. What is the risk premium on a portfolio invested 25% in Apple and 75% in Google, if they have βs 1.10 and 1.25, respectively?
- Stock ABC has an expected return of 12% and risk of β = 1. Stock XYZ has expected return of 13% and β = 1.5. The market's expected return is 11% and rf = 5%. According to the CAPM, which stock is a better buy? Why?