MEASURING PORTFOLIO RISK: CO-MOVEMENT BETWEEN SECURITIES

PORTFOLIO RISK: CO-MOVEMENT BETWEEN SECURITIES

- The variance of a portfolio is not a weighted average of the individual variances.
- The variance of a portfolio's return is affected by how the securities 'co-move'.
- Therefore, we need to define **covariance** and **correlation** measures that allow us to evaluate how securities move or do not move together.

COVARIANCE

- Covariance is a measure of the pair-wise co-movement between two securities.

MEASURING COVARIANCE BETWEEN TOYOTA AND PFIZER

State of the economy	Prob.	Toyota	Pfizer
Expansion	0.10	6.0%	2.5%
Normal	0.40	7.5	-0.5
Recession	0.30	2.0	1.0
Depression	0.20	-3.0	13.0
Expected return E(R)		**3.60%**	**2.95%**
Standard deviation σ		**4.02%**	**5.11%**

CORRELATION

- One drawback of the covariance measure is that its magnitude does not tell us much about the strength of the co-movement. Correlation is a standardized measure of co-movement.

MEASURING CORRELATION BETWEEN TOYOTA AND PFIZER

PORTFOLIO RISK

RISK OF A TWO-ASSET PORTFOLIO

- How can we incorporate this measure of co-movement into the calculation of portfolio variance?

PORTFOLIO RISK: ½ TOYOTA + ½ PFIZER

State of the economy	Prob.	Toyota	Pfizer	½ Toyota + ½ Pfizer
Expected return E(R)		3.60%	2.95%	3.275%
Standard deviation σ		4.02%	5.11%	1.29%

PORTFOLIO RISK: ½ TOYOTA + ½ WALMART

State of the economy	Prob.	Toyota	Walmart	½ Toyota + ½ Walmart
Expected return E(R)		3.60%	3.65%	3.625%
Standard deviation σ		4.02%	2.41%	3.16%

RISK OF A 2-ASSET PORTFOLIO

Portfolio	Portfolio Standard Deviation	Avg. Standard Deviation of the 2 stocks	Diversification?	Why?
50% Toyota 50% Walmart	3.16	3.21	Very little	Nearly Perfect Positive Correlation
50% Toyota 50% Pfizer	1.29	4.56	Lots	Nearly Perfect Negative Correlation

EFFECT OF CORRELATION ON TWO-ASSET PORTFOLIO RISK

EFFECT OF CORRELATION ON TWO-ASSET PORTFOLIO RISK

Correlation coefficient	Effect of diversification on risk
+1.0	No risk reduction is possible
+ 0.5	Moderate risk reduction is possible
0	Considerable risk reduction is possible
- 0.5	Most risk can be eliminated
- 1.0	All risk can be eliminated

SUMMARY

- You learned how to compute the portfolio variance for a two-asset portfolio.
- Portfolio risk is not simply a weighted average of the individual assets.
- How assets co-move together is ultimately what affects portfolio risk.

DIVERSIFICATION: SYSTEMATIC VS. IDIOSYNCRATIC RISK

WHAT WILL YOU LEARN?

- Why does diversification reduce risk?
- What is systematic risk?
- What is idiosyncratic risk?

EFFECT OF CORRELATION ON TWO-ASSET PORTFOLIO RISK

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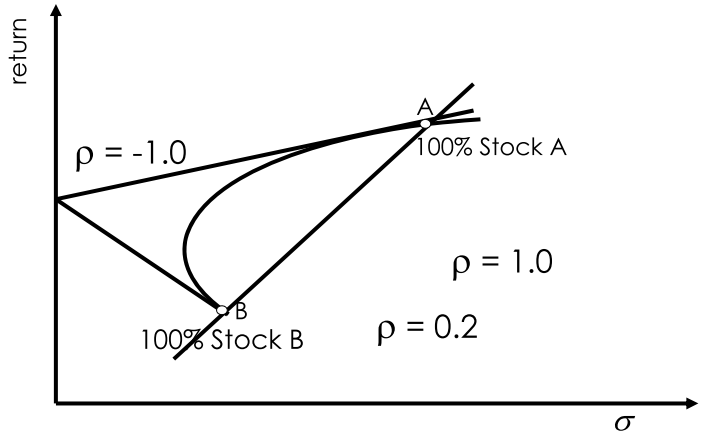
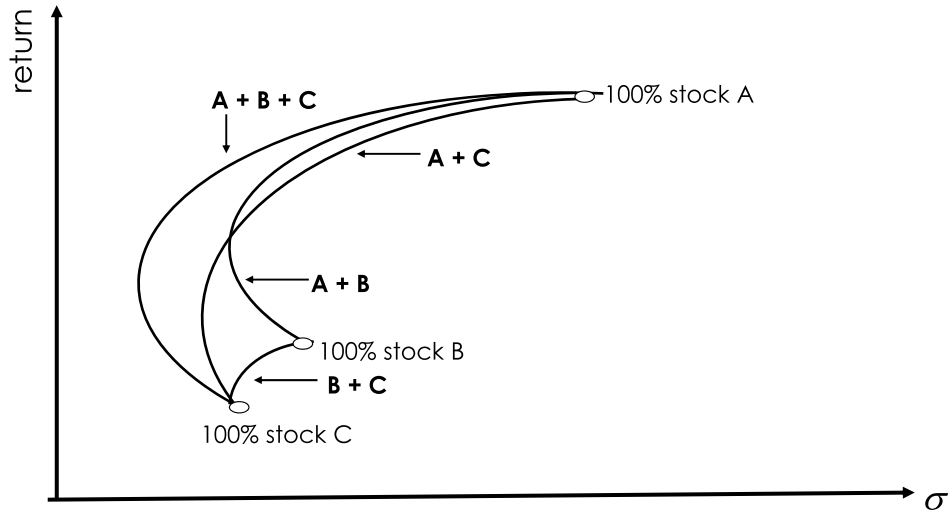
EFFECT OF CORRELATION ON A TWO-SECURITY PORTFOLIO RISK



WHAT IF YOU HAD MORE THAN TWO STOCKS?

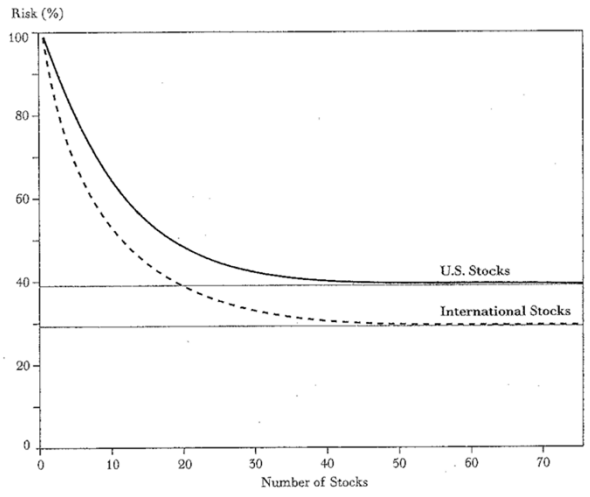


PORTFOLIO VARIANCE WITH N ASSETS

WHY DOES DIVERSIFICATION REDUCE RISK?

- There are two sources of risk:
  - Market-wide risk or systematic risk
  - Idiosyncratic (or firm-specific or unique or non-systematic) risk
- When securities are combined into a portfolio, the unique risk tends to cancel out or gets diversified away.
- In a well-diversified portfolio, what remains is the risk that can not be diversified away. This is the systematic or market risk.

LIMITS TO DIVERSIFICATION



Malkiel, B. A Random Walk Down Wall Street, (2012)

SO, WHY DO PEOPLE DIVERSIFY?

SUMMARY

- When assets are imperfectly correlated, combining them into a portfolio reduces the total variance – the risk – of the portfolio return.
- Diversification eliminates unsystematic risk.
- A well-diversified portfolio contains only systematic risk that cannot be diversified away.