RISK & REAL ESTATE INVESTMENT

- It is extremely **important to quantify and measure risk** when valuing an investment project
- **Considerable risk is associated with real estate investments**
- In addition to the riskiness of **individual properties**, risk is also viewed from a **portfolio** context
- **Do the expected returns** from investment **compensate** the investor for the **risks** taken

Sources & Measurement of RE Risk

1. **Probability distribution**
2. **Variance**
3. **Standard Deviation**
4. **Coefficient of variation**

Probability distribution

- **Investment risk can be defined as the possibility that future cash flows - and therefore "returns and values" - will be different from what was expected when the investment was undertaken**
- **Because risk refers to the probability of earning a return greater or less than the expected return, probability distributions** provide the foundation for risk measurement.

Probability distribution

- **A probability distribution** defines the likelihood of certain events occurring.
- Probability distribution may be determined
  - after long and rigorous tests
  - or they may be based on quite logical theorems; for example, the probability of a fair coin coming up heads is one-half.

Probability distribution

- **Subjective probability distributions** represent an opinion or guess as to the likelihood of particular events occurring
- For example, economists may state that there is
  - a **50 %** chance that the national economy will experience average growth over the next five years,
  - a **20 %** chance that there will be either a mild boom or a mild recession,
  - and a **5 %** chance that the economy will experience either a strong boom or a deep recession

Probability distribution

		Rate of return if state of economy occurs		
State of the Economy	**Probability**	**T-Bonds**	**Office Building**	**Shopping Center**
Deep recession	0,05	7,0%	3,0%	5,0%
Mild recession	0,20	7,0%	5,5%	8,5%
Average economy	0,50	7,0%	7,0%	11,0%
Mild boom	0,20	7,0%	8,5%	13,5%
Strong boom	0,05	7,0%	11,0%	17,0%
Expected return E(R)	**1,00**	**7,0%**	**7.0%**	**11.0%**

Probability distribution

- The **rate of return on the Treasury bond** is **known with certainty** - it will yield 7% per year **regardless of the state of the economy**. The T-bond has **no risk**.
- However, the **rates of return on the two income property investments** will **not be known until the end of holding period**. Because their **rate of return outcomes are not known with certainty**, these investment alternatives are defined as **risky**

Probability distribution

- Probability distributions may be either discrete or continuous.
- A **discrete probability distribution has a finite number of outcomes. Our example** contains a **discrete probability distribution with five possible outcomes**. Each outcome, or state of the economy, has a corresponding probability. For example, the probability of the Treasury bond providing a 7 % return is 1,00 (or 100 %), and the probability of the office investment producing an 11 % return is 0,05 (or 5 %).

Probability distribution

- By multiplying each possible outcome by its probability of occurrence, and then summing these products, we can determine a **weighted average of outcomes**
- The weights are the probabilities, and the weighted average is defined as the **expected value** (annual rates of return). The expected rate of return, E(R), is expressed in equation form as follows

Probability distribution

$$E(R) = \sum_{i=q}^{n} o_i p_i$$

- o: Outcome (return, cash flow, etc) of each state of economy
- p: Probability
- n: Number of possible outcomes

Investment in T-Bonds

State of the economy	**Probability**	**Return**	**Prob x R**
Deep recession	0.05	7%	0.35%
Mild recession	0.20	7%	1.40%
Average economy	0.50	7%	3.50%
Mild boom	0.20	7%	1.40%
Strong boom	0.05	7%	0.35%
	1.00	***∑E(R)***	**7.00%**

Investment in Office Building

State of the economy	Probability	Return	Prob x R
Deep recession	0.05	3.00%	0.15%
Mild recession	0.20	5.50%	1.10%
Average economy	0.50	7.00%	3.50%
Mild boom	0.20	8.50%	1.70%
Strong boom	0.05	11.00%	0.55%
	1.00	**∑E(R)**	**7.00%**

Investment in Shopping Center

State of the economy	Probability	Shopping center	Prob x R
Deep recession	0.05	5.00%	0.25%
Mild recession	0.20	8.50%	1.70%
Average economy	0.50	11.00%	5.50%
Mild boom	0.20	13.50%	2.70%
Strong boom	0.05	17.00%	0.85%
	1.00	***∑E(R)***	**11.00%**

Risk aversion

- For ***individual investors***, the degree of risk aversion is usually related to their **age and wealth**.

- Among ***institutional investors***, the degree of risk aversion is often related to the importance of **preserving capital** and the extent to which investment managers are personally liable for their actions.

- ***For example***, **life insurance companies** place a high premium on **preserving capital** because they ***must*** pay claims
- And managers of **pension fund investments** are legally personally liable for their actions as investment managers.

Measuring project-specific risk

- The concepts of discrete probability distributions and expected values (or rates of return) can be used to **quantify risk**
- We know that **risk is present** when the estimated distribution of **cash flows or returns has more than one possible outcome**, but **how should risk be measured and quantified?**

Variance & Standard Deviation

- Variance is a **measure of the dispersion** of a distribution around its expected value. The larger the variance, the greater the dispersion.
- The **variance** is the sum of the squared deviations from the expected value, weighted by each deviation's probability of occurrence.

Variance

$$Variance = \sigma^2 = \sum_{i=1}^{n} (o_i - E(R)^2 \, p_i$$

Standard Deviation

$$\sigma = \sqrt{\sigma^2}$$

- The ***standard deviation***, is more frequently used as a *measure of dispersion, or risk*.
- The ***standard deviation*** is simply the square root of the variance.

Coefficient of variation

$$Coefficient \cdot of \cdot \text{var}\, iation = \frac{\sigma}{E(R)}$$

- To interpret properly the **relative riskiness** of two investments, it is sometimes useful to go one step further and to calculate the ***coefficient of variation***, which is the standard deviation of the return divided by the expected return

Coefficient of variation

- The **coefficient of variation** is a **measure** of ***risk per unit of return***.
- The **coefficient of variation** provides a **relative (or scaled) measure of riskiness** that can be useful **when comparing the attractiveness of alternative investments**.
- **Investments with lower risk per unit** of return are generally **preferred to investments with higher risk per unit** of return.

Office Builing Investment

State of the economy	Probabilité	Outcome	Deviation	Variance
Deep recession	0.05	3.00%	-4.00%	0.0080%
Mild recession	0.20	5.50%	-1.50%	0.0045%
Average economy	0.50	7.00%	0.00%	0.0000%
Mild boom	0.20	8.50%	1.50%	0.0045%
Strong boom	0.05	11.00%	4.00%	0.0080%
Expected return (outcome)		**7.00%**	**0.00%**	**0.025%**
Standard deviation				**1.58%**
Coefficient of variation				**22.59%**

Office Builing Investment

- **Variance** (σ^2) = 0,025 %
- **Variance at Deep recession**: (Deviation)^2 x Probability = 0,008%
- The **standard deviation** of the office building investment is 1.58 %

$$\sigma = \sqrt[2]{0{,}025\%} = 1{,}58\%$$

- **Standard deviation** (STD) is the distance of 1.58 % in either direction from the office building's 7 % expected return

Shopping Center Investment

State of the economy	Probabilité	Outcome	Deviation	Variance
Deep recession	0.05	5.00%	-6.00%	0.0180%
Mild recession	0.20	8.50%	-2.50%	0.0125%
Average economy	0.50	11.00%	0.00%	0.0000%
Mild boom	0.20	13.50%	2.50%	0.0125%
Strong boom	0.05	17.00%	6.00%	0.0180%
Expected return (outcome)		**11.00%**	**0.00%**	**0.061%**
Standard deviation				**2.47%**
Coefficient of variation				**22.45%**

Synthesis

	T-Bonds	Office building	Shopping center
E(R) (Expected Return)	7.00%	7.00%	11.00%
σ^2 *(Variance)*	0	0,025%	0,061%
σ *(STD)*	0	1.58%	2.47%
Coefficient of variation	0	22.59%	22.45%

Real estate risk

- The challenge in analyzing real estate investment risk lies in the measurement of risks
- The ideal process would be to **collect data from recent periods on the returns** for the property under evaluation
- The analyst then would calculate the historical mean and standard deviation of returns as a first measure of the property's risk
- **This approach** is essentially the way risk **analysis is done for stock and bond investments**

Real estate risk

- **Unfortunately**, **data on past returns for subject properties** and comparables **are not usually available**.

- Unlike stocks and bonds, one cannot simply look at the ***Wall Street Journal*** to obtain past data on returns from shopping centers inTokyio or office buildings in Paris.

- **Real estate markets are not nearly as active as securities markets**, and therefore data on recent sales are not readily available

Real estate risk

- The use of **subjective probabilities used for different states of economy** is the only way in many cases to quantify the risk of real estate investment

- The **unwise alternative** is to do no risk analysis at all

Real estate risk

Real estate investors generally face two sources of risk:

- The **risk associated with uncertain outcomes** given an known probability distribution, and

- **The additional risk that results from the fact that the assumed distribution may itself be incorrect**. Even if historical data on the properties of interest are available, the **data may not accurately *reflect current* expectations about future returns and risk**. Therefore, this ***second source*** of risk is quite important.

Real estate risk

- **Most investors are risk averse** in that they prefer assets with higher potential mean returns and avoid assets with more volatile (higher standard deviations of returns) cash flows and returns

Real estate risk

Tools investors may employ to reduce the variability of their investment returns:

1. Avoiding risky projects,
2. Using insurance to transfer risk to others,
3. and Diversification

1. Avoiding risky projects

- **One way to reduce the variability of investment returns is to invest** in less risky projects or securities, for example, **T-Bonds.** Unfortunately, this low-risk strategy tends to reduce the chances of achieving larger returns
- Investors search investments with a **positive NPV**
- This suggests that the availability of **positive NPV** investments in a particular market is **negatively related** to how well functioning and competitive the market is.
- Put differently, **the persistent search by well-informed investors competing for positive NPV projects tends to reduce the likelihood that such opportunities will exist**. These same competitive market forces also provide discipline for sellers of income properties and other securities.

If IRR > [Return required by the market] ➔ NPV

2. Using insurance to transfer risk to others

- **What can affect investment returns :** Fire, flood, earthquake, and other natural hazard
- **Predictability based on statistical averages** from large numbers is the **foundation of the insurance industry**
- Real estate investors can, and should, **transfer many risks to insurance companies** in exchange for a certain insurance premium
- the insurance is a **risk-reducing** investment

3. Diversification

- Investors can further **reduce the variability of investment returns** by the use of **diversification**
- The intuition behind the concept of diversification is illustrated by the maxim "**Don't put all your eggs in one basket."**

Portfolio concept

- **The portfolio concept of risk states** that investments should be **accepted or rejected** on the basis of **their effect on the risk and return of the entire portfolio of assets**
- Most investors do not invest in only one asset, but rather in many assets
- These **portfolios can consist** of **diverse investments from different financial markets and submarkets**.
- A portfolio may include numerous different **stocks**, a combination of stocks and **bonds**, several **income property investments**, gold, or combinations of these and other investment alternatives

Diversification as a Risk-Management Tool

The literature of finance categorizes risk as either **diversifiable** or **non diversifiable**

Diversifiable risk

- **Diversifiable risk**, also called **unsystematic risk, can be eliminated** from a portfolio by holding securities and other investments with returns that are **less than perfectly correlated**

- **Perfectly correlated returns** always move exactly together when market conditions change

- **Perfectly negatively correlated returns always move exactly opposite**. If one asset in the portfolio reacts negatively to a market downturn, losses may be offset through holding another asset that reacts positively.

Diversification as a Risk-Management Tool

Risks that can affect Return and Value :

- *Poor management (higher OE, decreased occupancy, etc)*
- *property's location (RE development, road construction, etc)*
- *changes in environment (environmental problems, etc)*
- *restrictions imposed by local governments, property tax laws, zoning*
- *changes in the local, regional, or national economy*
- Etc

Diversification as a Risk-Management Tool

Non-diversifiable Risk

Extensive diversification cannot eliminate risk.

Non-diversifiable risk is frequently referred to as **systematic risk** or **market risk**.

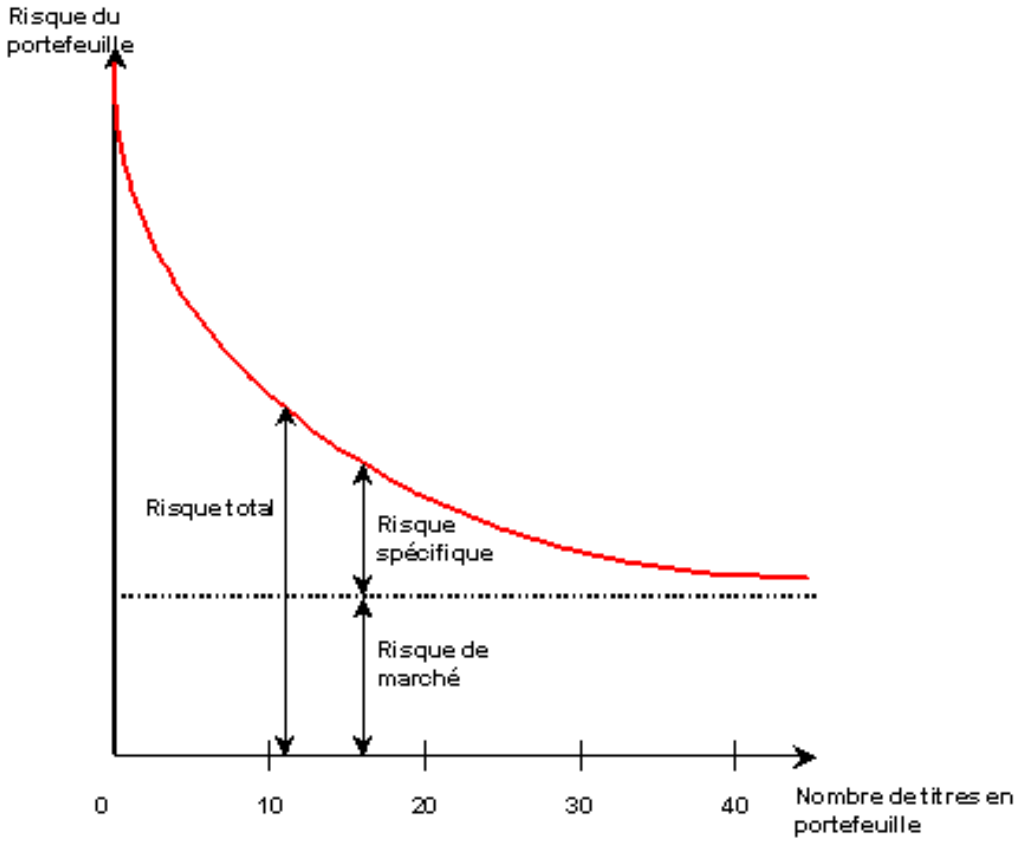
Market risk (or systematic risk, or non diversifiable risk) is due to the global evolution of an economy, of fiscal policy, of interest rates, of inflation, etc... It is inevitable. The dangers that are inherent to these factors affect the entire economy.

Diversification as a Risk-Management Tool

What happens when more stocks, bonds, and real estate are added to a portfolio?

- In general, the riskiness of a portfolio will fall as the number of assets increases
- **Portfolio risk declines depends on the degree of correlation**
- It is **difficult to find assets whose expected returns are negatively correlated *:***
  - Most assets tend to do well when the national economy is strong and less well when the national economy is weak
  - Although diversification can eliminate much of the risk from a portfolio of assets, unanticipated events or "shocks" that affect all, or most, assets will inevitably produce variations in portfolio returns over time even in large, well-diversified portfolios. Thus, even extensive diversification cannot eliminate risk.

Diversification as a Risk-Management Tool



Example : Portfolio of two Assets

	50%	**50%**	**100%**
Year	**Stock**	**Shopping center**	**Portfolio**
2004	14%	-10%	2.00%
2005	-10%	8%	-1.00%
2006	23%	12%	17.50%
2007	-5%	17%	6.00%
2008	8%	-5%	1.50%
2009	12%	15%	13.50%
Mean return	**7.00%**	**6.17%**	**6.58%**

Investing in stock

Year	E(R)	Deviation	Variance
2004	14%	7.00%	0.49%
2005	-10%	-17.00%	2.89%
2006	23%	16.00%	2.56%
2007	-5%	-12.00%	1.44%
2008	8%	1.00%	0.01%
2009	12%	5.00%	0.25%
Average return	**7.00%**	**0.00%**	
Sum of squared deviations			**7.64%**
Variance			**1.53%**
Standard deviation			**12.36%**

Investing in stock

$$Variance = \sigma^2 = \frac{Total \cdot of \cdot squared \cdot deviations}{n-1} = \frac{7{,}64\%}{5} = 1{,}53\%$$

$$S\tan dard \cdot deviation = \sqrt{\sigma^2} = \sqrt{1{,}53\%} = 12{,}36\%$$

Fonctions Excel : VAR & STD

Investing in Shopping center

	E(R)	Deviation	Variance
2004	-10%	-16.17%	2.61%
2005	8%	1.83%	0.03%
2006	12%	5.83%	0.34%
2007	17%	10.83%	1.17%
2008	-5%	-11.17%	1.25%
2009	15%	8.83%	0.78%
Mean return	**6.17%**	**0.00%**	
Total of squared deviations			**6.19%**
Variance			**1.24%**
Standard deviation			**11.13%**

Investing in Shopping center

$$Variance = \sigma^2 = \frac{Total \cdot of \cdot squared \cdot deviations}{n-1} = \frac{6{,}19\%}{5} = 1{,}24\%$$

$$S\tan dard \cdot deviation(STD) = \sqrt{\sigma^2} = \sqrt{1{,}24\%} = 11{,}13\%$$

Fonctions Excel : VAR & STD

Investing in Stock & Shopping center (diversification)

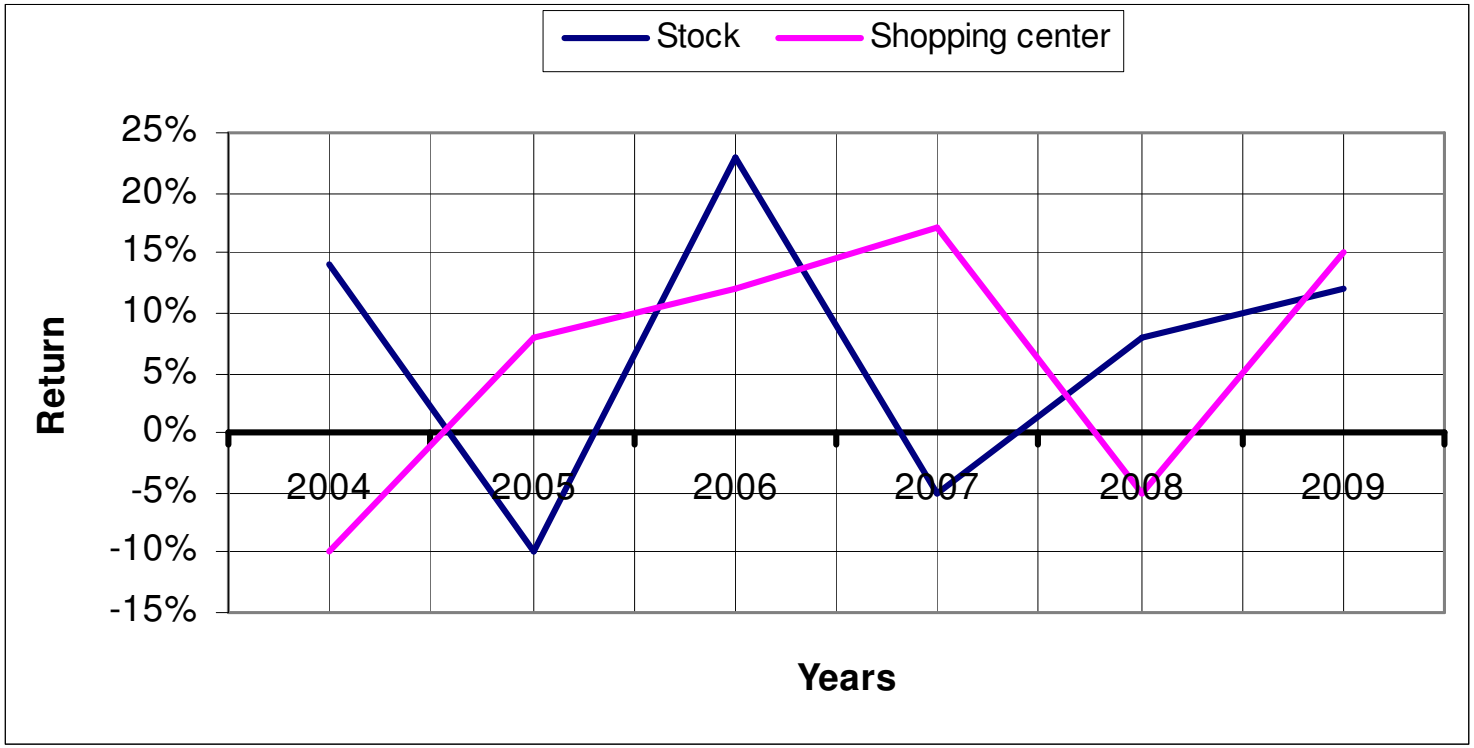
Year	E(R) Stock	Shopping center E(R)	Mean Return	Deviation	Variance
2004	14%	-10%	2.00%	-4.58%	0.21%
2005	-10%	8%	-1.00%	-7.58%	0.58%
2006	23%	12%	17.50%	10.92%	1.19%
2007	-5%	17%	6.00%	-0.58%	0.00%
2008	8%	-5%	1.50%	-5.08%	0.26%
2009	12%	15%	13.50%	6.92%	0.48%
Mean return	**7.00%**	**6.17%**	**6.58%**	**0.00%**	
Total of squared deviations					**2.72%**
Variance					**0.54%**
Standard deviation					**7.37%**

Investing in Stock & Shopping center (diversification)

Synthèse	**Stock**	**Shopping Center**	**Portfolio**
Mean return	7.00%	6.17%	6.58%
Sum of squared deviations	7,64%	6,19%	2,72%
Variance	1,53%	1,24%	0,54%
Standard deviation	12.36 %	11.13 %	7.37 %

Investing in Stock & Shopping center (diversification)

Pourquoi le risk a fortement diminué ?



Investing in Stock & Shopping center (diversification)

- **If held separately, the two assets produced fairly volatile returns.** However, when combined in a portfolio, the return volatility decreased to 7.37 %, significantly less than the volatility of either asset separately held.

- **The reason the combination of the stock and shopping center** resulted in a significant **reduction in risk** at the portfolio level is that their **returns tended to move somewhat counter cyclically** to one another over the sample period. When the stock's return falls, the return on the shopping center often increases, and vice versa. In statistical terms, the returns were ***negatively correlated*** over the sample period.

Covariance

$$COV_{AB} = \frac{\sum stock \cdot deviations \times \sum Shopping \cdot center \cdot deviations}{n-1}$$

- **Covariance** (COV) is **an absolute measure of the tendency of an asset's return to vary with that of another asset over time**.
- A negative **covariance** between an asset A and an asset B indicates that the returns on the two assets tended to **move in opposite directions**.
- Covariance statistics can take on values ranging from minus infinity to positive infinity, making it **difficult** to know when a covariance is "large" or "small."

Covariance

Portfolio	**50%**	**50%**
Year	**Stock**	**Shopping center**
2004	14%	-10%
2005	-10%	8%
2006	23%	12%
2007	-5%	17%
2008	8%	-5%
2009	12%	15%
Mean Return	7,00%	6,17%
COV	**- 0,002467**	

Fonction Excel : COVARIANCE

Correlation coefficient (CC)

$$CC_{AB} = \frac{COV_{AB}}{\sigma_A \sigma_B}$$

- The **correlation coefficient (CC)** is often **used to measure the degree of co-movement** between two variables.

Fonctions Excel : COEFFICIENT.COREELATION

Example

	Negative correlation		Positive correlation	
Portfolio	**50%**	**50%**	**50%**	**50%**
Year	**E(R)A**	**E(R)B**	**E(R)A**	**E(R)B**
2004	10%	5%	5%	5%
2005	9%	6%	6%	6%
2006	8%	7%	7%	7%
2007	7%	8%	8%	8%
2008	6%	9%	9%	9%
2009	5%	10%	10%	10%
CC		**-1.00**		**1.00**

CC Stock & Shopping center

Portfolio	50%	50%
Year	Stock E(R)	Shopping center E(R)
2004	14%	-10%
2005	-10%	8%
2006	23%	12%
2007	-5%	17%
2008	8%	-5%
2009	12%	15%
COEFFICIENT DE CORRELATION		**-0.22**

CC Stock & Shopping center

If the returns on two assets are highly negatively correlated, then the variance of a portfolio consisting of the tow assets will be less than the variance of the return on either asset held in isolation.

	Stock	Shopping center	Portfolio
Return	7,00 %	6,17 %	6,58 %
VAR	1,53%	1,24%	0,54%
STD	12,36%	11,13%	7,37%
COV			- 0,002467
CC			- 0,22

Basic Real Estate Diversification Strategies

Three basic diversification strategies for investors seeking to hold an efficient portfolio of real estate:

1. **investing in different property types** and
2. **investing in different geographical areas**
3. **combine investment in public and private real estate markets**.

Property types diversification
Derived Demand

1. A **decrease in the demand for industrial goods** causes a **decrease in the demand for industrial space**
2. Similarly, the **demand for office space is derived from the demand for the services provided by the tenants of office buildings**, such as **law and accounting firms**, **banks, insurance companies**, **real estate brokerage firms**, and **mortgage banks**
3. The **demand for retail space** in a market is ***directly related*** to **the population** in the trade area and to the ***disposable income of the population***
4. The **demand for apartment units** ***fluctuates with the number of households in a given market***
5. **General economic trends** will likely ***alter the demand for all types of space***
6. Etc

Geographic diversification

Another popular method of diversifying is geographically

Although national economic trends can have a significant effect on real estate markets, local market conditions are often more important than national economic trends. In fact, **it is often argued that real estate markets are decidedly local**. To the extent that this is true, a ***portfolio* of geographically diverse properties may provide better risk-return** characteristics than a geographically concentrated real estate portfolio.

Combining public and private market investments

1. The dramatic growth in securitized real estate markets in recent years provides investors with expanded opportunities to purchase interest in estate that can be exchanged in public markets
2. The most prominent example is the growth in the market value of **REITs (publicly traded real estate securities)** that are traded on major stock exchanges

Choosing a optimal portfolio

An investment is efficient in a portfolio context if its acquisition

- **increases the expected return** on a portfolio **without increasing portfolio risk**, or
- **decreases the riskiness** of the portfolio **without sacrificing** the portfolio's expected **rate of return**

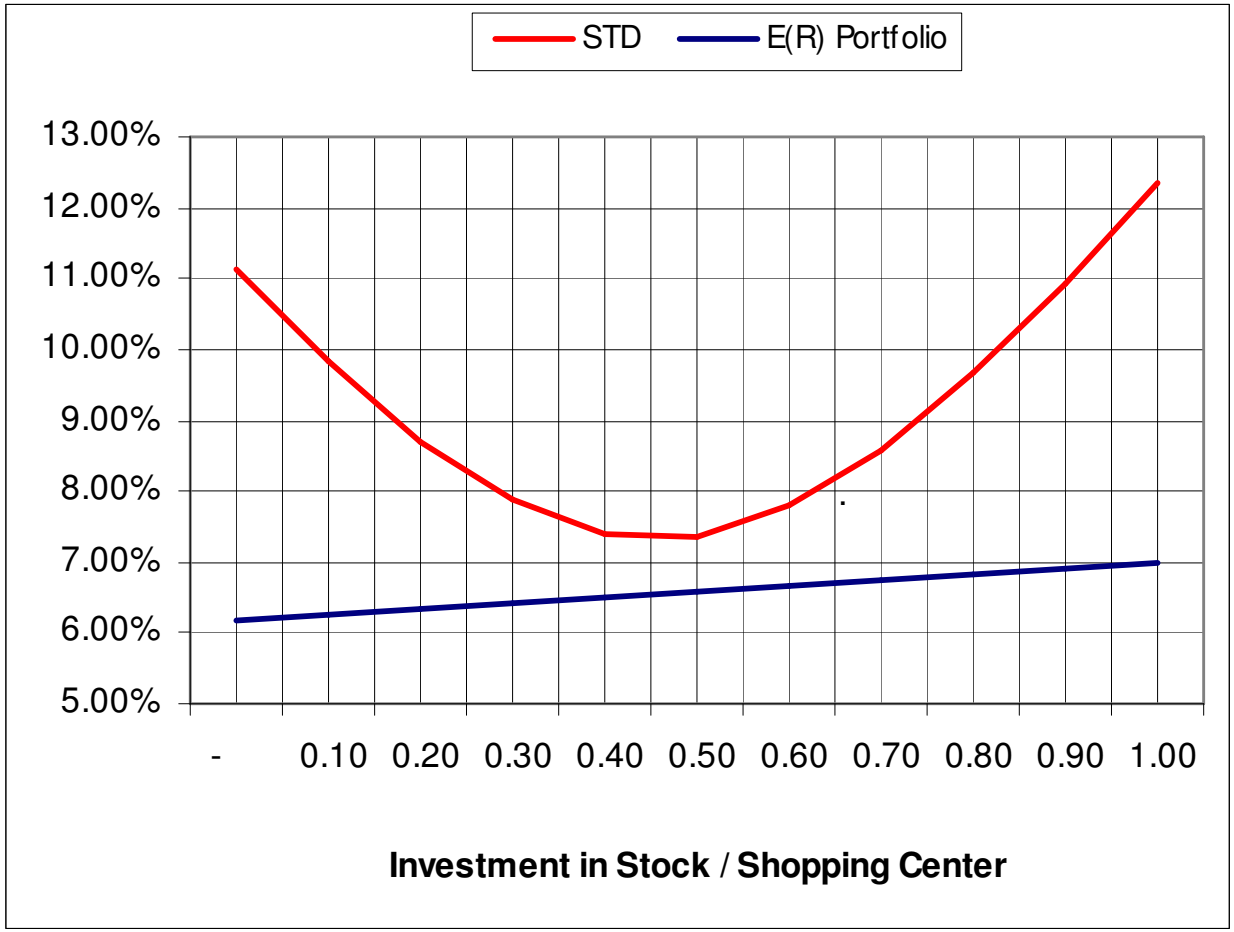
Choosing a optimal portfolio

Portfolio Structure					
Stock	**Shopping**	**E(R) Portfolio**	**Variance**	**STD**	**E(R) - STD**
-	1.00	6.17%	1.24%	11.13%	-4.96%
0.10	0.90	6.25%	0.96%	9.82%	-3.57%
0.20	0.80	6.34%	0.76%	8.71%	-2.37%
0.30	0.70	6.42%	0.62%	7.87%	-1.45%
0.40	0.60	6.50%	0.55%	7.40%	-0.90%
0.50	**0.50**	**6.58%**	**0.54%**	**7.37%**	**-0.79%**
0.60	0.40	6.67%	0.61%	7.78%	-1.12%
0.70	0.30	6.75%	0.74%	8.58%	-1.83%
0.80	0.20	6.83%	0.93%	9.66%	-2.82%
0.90	0.10	6.92%	1.20%	10.94%	-4.02%
1.00	-	7.00%	1.53%	12.36%	-5.36%

Choosing a optimal portfolio

	50%	50%			
Year	**Stock**	**Shopping center**	**Mean Return**	**Deviation**	**Variance**
2004	14%	-10%	2.00%	-4.58%	0.2101%
2005	-10%	8%	-1.00%	-7.58%	0.5751%
2006	23%	12%	17.50%	10.92%	1.1917%
2007	-5%	17%	6.00%	-0.58%	0.0034%
2008	8%	-5%	1.50%	-5.08%	0.2584%
2009	12%	15%	13.50%	6.92%	0.4784%
Mean return	**7.00%**	**6.17%**	**6.58%**		
Total of squared deviations					**2.72%**
Variance					**0.54%**
Standard deviation					**7.37%**
Coefficient Correlation					**- 0.22**

Choosing a optimal portfolio



Choosing a optimal portfolio

- **Much research has shown** that a portfolio can be fully diversified in the sense that its **unsystematic risk is eliminated** by choosing **15 or 20 assets**

- This type of diversification is often termed ***naive diversification***

- The **objective of portfolio risk management** is to develop an efficient portfolio by **eliminating diversifiable risk.**

Choosing a optimal portfolio

- An **asset that is quite risky** can be **combined** in a portfolio **with a risk-free asset** to reduce the overall risk of the portfolio.

- This so-called ***efficient or smart diversification*** makes it possible to reduce the unsystematic risk in a portfolio to zero with fewer assets under a smart diversification strategy than under a naïve strategy.

Why are so many Investors not well-diversified ?

- ***Many homeowning households*** are very **poorly diversified** with a large percentage of their wealth invested in their home (local rental houses, small appartments, etc)

- **Investors in local rental properties :**
  - They desire to actively manage their rental properties in a **local area**
  - **They have limited** financial **resources**
  - They consider themselves **experts** at acquiring, managing, and disposing of rental homes
  - Return of their RE portfolio> Return on a mixed-asset portfolio
  - No expertise in portfolio Management

Why are so many Investors not well-diversified ?

The **use of mean-variance theory and techniques continues to grow rapidly**, especially among **institutional investors**.

Apparent irrational investment behaviour, especially by local, less wealthy investors, may actually result from

- wealth constraints,
- the perceived advantages of owning and operating a particular property type,
- or an emphasis on investing in a particular geographic market

Holding an undiversified portfolio also can be rational if the investor truly believes the return prospects outweigh the increased risks of pursuing such a strategy

How risky is Real Estate

- **To evaluate the performance of an asset class**, such as **real estate**, it is important to be able to **measure** both the **potential risk** and **expected return** associated with holding the asset

- **From a technical standpoint**, portfolio models require **past data on returns** because the **measurement of portfolio risk** and **diversification** relies on the calculation of **historical means and variances** as well as **co-variances** among the returns from the different assets in the portfolio.
- **For stocks and bonds**, this measurement objective represents little problem because an abundance of historic performance data is available.

How risky is Real Estate

- **Return information for real estate is much harder to come by, and is often less accurate than the information available on traditional stock and bond alternatives**

- **If the real estate is held** by a ***publicly traded*** corporation, for example, by a **REIT** that is traded on one of the major stock exchanges, accurate historical return **data** are **generally available**

- However, past data on returns for ***privately held real estate*** assets are usually not available

- **Only large institutions** with a large number of properties already in their portfolios ***can use portfolio models for real estate investment analysis***

NCREIF – NAREIT

- The **NCREIF** and **NAREIT** indexes **provide** useful **information** on the absolute level of **risk** and **expected return** associated with **real estate**.
- What may be more **important to potential investors**, however, is the **riskiness of real estate relative to other assets**

NCREIF – NAREIT

- **The NCREIF Classic Property Index (NCPI)** is a measure of the historical performance of income properties held by pension funds (**direct property investments**)
  - **N.B.** NCREIF : National Council of Real Estate Investment Fiduciaries
- The **NAREIT Index** is a value-weighted index that tracks the total return pattern of **publicly traded** REITs
  - **N.B.** : NAREIT : National Association of Real Estate Investment Trusts

Equity REITs

- **Equity REITs** : real estate investment trusts invest in and operate income producing properties
- **The term equity REIT** refers to a corporate entity that is engaged in the acquisition, management, building, renovation, and sale of real estate
- **This type of real estate investment trust** offers the greatest potential of reward and as such tends to be favored by professional money managers
- **Equity REITs** often operate in a specific area of expertise.
- **Some examples** include:
  - Residential REITs
  - Retail REITs
  - Office and Industrial REITs
  - Health care REITs
  - Hotels and resort REITs

Historical Returns, Risk, and Correlations

Year	NAREIT	S&P500	DJ Industrials	Russell 2000	NASDAQ	US-T 10 years	Equity REITs
1	35.75%	23.70%	26.01%	16.49%	22.71%	6.43%	6.05%
2	18.86%	33.36%	22.64%	22.36%	21.61%	5.75%	5.48%
3	-18.82%	28.58%	16.10%	-2.55%	39.63%	4.65%	7.13%
4	-6.48%	21.04%	25.22%	21.26%	85.59%	6.45%	8.70%
5	25.89%	-9.11%	-6.17%	-3.02%	-39.29%	5.12%	7.52%
6	15.50%	-11.88%	-7.11%	2.49%	-21.05%	5.03%	7.14%
7	5.22%	-22.10%	-16.76%	-20.48%	-31.53%	3.82%	7.05%
8	38.47%	28.70%	25.32%	47.25%	50.01%	4.26%	5.52%
9	30.41%	10.87%	3.15%	18.33%	8.59%	4.22%	4.66%
10	8.29%	4.91%	-0.61%	4.55%	1.37%	4.42%	4.57%

AVG Return	15.31%	10.81%	8.78%	10.67%	13.76%	5.02%	6.38%
VAR	3.44%	3.83%	2.59%	3.46%	15.05%	0.01%	0.02%
STD	18.55%	19.56%	16.11%	18.61%	38.79%	0.93%	1.34%

Historical Returns, Risk, and Correlations

Year	Portfolio
1	19.59%
2	18.58%
3	10.67%
4	23.11%
5	-2.72%
6	-1.41%
7	-10.68%
8	28.50%
9	11.46%
10	3.93%

AVG Return	10.10%
STD	12.65%

Historical Returns, Risk, and Correlations

	NAREIT	S&P500	DJ Industrials	Russell 2000	NASDAQ	US-T 10 years	Equity REITs
NAREIT	**1.00**						
S&P500	0.03	**1.00**					
DJ Industrials	0.09	0.95	**1.00**				
Russell 2000	0.50	0.73	0.77	**1.00**			
NASDAQ	-0.23	0.81	0.87	0.67	**1.00**		
US-T 10 years	0.00	0.43	0.61	0.27	0.45	**1.00**	
Equity REITs	-0.51	-0.23	-0.04	-0.33	0.13	0.39	**1.00**

Risk in Valuation Decisions

- RE investment analysis using the discounted cash-flow (DCF) methodology requires specification of **three major items**:
  - The cash flows in each period
  - The reversion when the property is sold
  - The discount rate : **E(R) = Rf + RP**
- **The discount rate** is of **critical importance** because present values are extremely sensitive to changes in the required discount rate
- A **major problem** with the traditional discount-rate approach to real estate valuation is that the specification of the risk premium is, in the end, **highly subjective**, **relying heavily** upon the **analyst's judgment**.

Risk in Valuation Decisions

The discount rate : E(R) = Rf + RP

Rf : Current return available on risk-free T-securities of comparable maturities

RP : Risk premium that reflects the perceived riskiness of the property's cash flow estimates

E{R) : The expected or required rate of return on the investment

*Some analysts believe return premiums also should be added for non marketability because **real estate**, in comparison to other investments, is **less liquid**.*

*This **practice is not generally followed**. However, **some analysts believe** that **illiquidity will become an important part of standard Valuation***

Risk in Valuation Decisions

Investors struggling to **determine their required rate** of return on a potential investment frequently find themselves asking the following question :

"What rate of return are other investors requiring on similar investments?"

- **Attitudes toward risk** - and therefore required risk premiums vary across investors
- The ability to abstract this **information** from other investors is very **useful**
- **Most real estate investors rely heavily on such information** in determining their E(R)

Risk in Valuation Decisions

Spread : a risk measure of a single asset

	2005	2006	2007	2008	2009
Required RE Return	12,20 %	12,10 %	11,70 %	11,50 %	11,60 %
Return on 10-year T-Bonds	6,40 %	5,40 %	7,50 %	6,10 %	6,80 %
Spread	580	670	420	510	480

Risk in Valuation Decisions

Modern asset-pricing models (CAPM), developed initially for the valuation of stocks, are able to quantify the relationship between systematic risk and required rates of return. CAPM classifies sources of **investment risk** into **2 categories :**

- **systematic (or macroeconomic) risk** : can be represented by a single index of stock market returns, such as the S&P500. The systematic risk of an individual asset is then measured by determining the sensitivity **(β)** of the individual asset's return to changes in the macroeconomic risk (stock market index).

- **Specific (microeconomic) risks** that are diversifiable

Risk in Valuation Decisions

CAPM (Return on Equity) = Rf + β (R_m – R_f)

- **R_m** : Market return
- **R_m- R_f** : Market risk
- **R_f** : Risk-free rate
- **β(R_m- R_f)** : Individual Asset Risk

Beta (β) : a risk measure of an individual asset

$$\beta = \frac{COVARIANCE(Historical \cdot assets \cdot returns; Historical \cdot Market \cdot \mathrm{Re}turns)}{VARIANCE(Historical \cdot Market \cdot \mathrm{Re}turns)}$$

- **If the covariance** between returns on the asset and the macro economy **is zero**, the asset bears no systematic risk because changes in the macro economy do not affect returns on the individual asset.

- Because the **return on most assets positively covaries**, at least to some extent, with changes in the macro economy, systematic risk cannot be diversified away.

- In most applications of the CAPM, the historical risk of an asset is measured as indicated above..

Beta (β) : a risk measure of a single asset

Years	Stock Returns	S&P500 Returns	Years	Stock Returns	S&P500 Returns
1990	2.13%	4.51%	2000	-2.92%	-2.04%
1991	13.26%	18.86%	2001	-12.29%	-17.26%
1992	6.85%	7.34%	2002	-5.21%	-24.29%
1993	14.10%	9.76%	2003	9.18%	32.19%
1994	-2.87%	-2.32%	2004	8.26%	4.43%
1995	25.98%	35.20%	2005	12.92%	8.36%
1996	15.70%	23.61%	2006	12.18%	12.36%
1997	9.36%	24.69%	2007	-2.49%	-4.15%
1998	12.84%	30.54%	2008	-13.68%	-40.09%
1999	1.44%	8.97%	2009	22.20%	30.03%

Beta (β) : a risk measure of a single asset

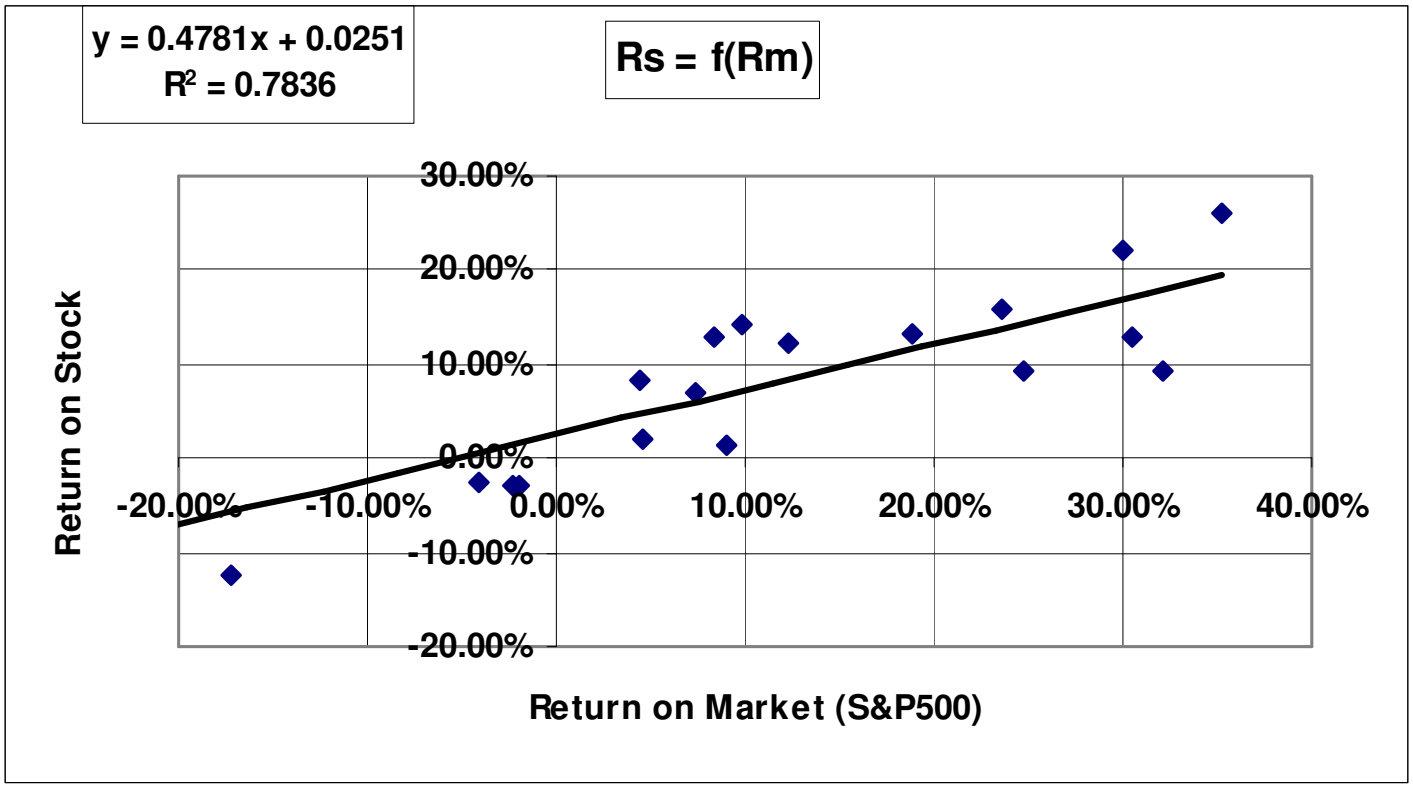
$$\beta = \frac{COVARIANCE(Historical \cdot assets \cdot returns; Historical \cdot Market \cdot \mathrm{Re}turns)}{VARIANCE(Historical \cdot Market \cdot \mathrm{Re}turns)}$$

COV	0.0175817
VAR	0.0387110
Bêta	0.4541777

CAPM = Rf + 0,4542 ($R_m - R_f$)

Beta (β) : a risk measure of a single asset

$$\textbf{CAPM} = Rf + \textbf{0,4781}\ (R_m - R_f)$$



Beta (β) : a risk measure of a single asset

CAPM = Rf + **0,4781** (Rm – Rf)

Régression linéaire	
R^2	0.7836
Constante	0.0251
Variable X 1	0.4781

Sensitivity analysis

Cas 5 – Chapitre 3 – 100% Equity

Years	0	1	2	3	4	5
Asking price	-885'000					
NOI		89'100	91'773	94'526	97'362	100'283
NSP						974'660
Total CF	**-885'000**	**89'100**	**91'773**	**94'526**	**97'362**	**1'074'943**

IRR	**12.21%**
PV of CF (OCC : 12 %)	891'823
- Asking price	-885'000
NPV	**6'823**

Sensitivity analysis

Growth rent	IRR	NPV (OCC : 12%)
3.00%	**12.20%**	**6823**
2.00%	11.88%	-4037
1.00%	11.50%	-14696

What-if questions

1. "What if gross rental income does not increase at the assumed 3 % annual rate?"
2. "What if operating expenses consume more or less than 45 % of gross income?"
3. "What if vacancy rates are higher than the assumed 10 % level?

Sensitivity analysis can provide the investor with answers to questions such as these

Sensitivity analysis

VC rate	IRR	NPV (OCC : 12%)
10.00%	**12.20%**	**6823**
15.00%	11.41%	-19361
20.00%	10.61%	-45545

Sensitivity analysis

OE (% of EGI)	IRR	NPV (OCC : 12%)
40.00%	13.14%	37621
45.00%	**12.20%**	**6823**
50.00%	11.27%	-23975

Sources

- *Real Estate Perspectives, An Introduction to Real Estate. 3thd edition, J.B. Gorgel, H.C. Smith, D.C. Ling, Mc Graw Hill, 1998*
- *RealEstate Course, Bernard Jaquier*