

Andreas Krause

Asset pricing

# Assets pricing and valuation

# Assets pricing and valuation

- ▶ Asset pricing is mainly concerned with determining appropriate **expected returns** for assets

# Assets pricing and valuation

- ▶ Asset pricing is mainly concerned with determining appropriate expected returns for assets
- ▶ How such expected returns are then translated into actual prices is subject of **valuation models**

# Assets pricing and valuation

- ▶ Asset pricing is mainly concerned with determining appropriate expected returns for assets
- ▶ How such expected returns are then translated into actual prices is subject of valuation models
- ▶ In this topic we will therefore focus on the determinants of **expected asset returns**

# Assets pricing and valuation

- ▶ Asset pricing is mainly concerned with determining appropriate expected returns for assets
- ▶ How such expected returns are then translated into actual prices is subject of valuation models
- ▶ In this topic we will therefore focus on the determinants of expected asset returns

# The importance of asset pricing

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on **theoretical considerations**



# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on **empirical evidence**

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the **stock market**

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into **portfolio selection models**

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the **investment decisions** of individuals

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the investment decisions of individuals
- ▶ Most models of asset pricing take the **risks** of assets **as given**

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the investment decisions of individuals
- ▶ Most models of asset pricing take the risks of assets as given and **based on these risks** determine the expected returns

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the investment decisions of individuals
- ▶ Most models of asset pricing take the risks of assets as given and based on these risks determine the expected returns
- ▶ Asset pricing forms the basis of the **valuation of assets**

# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the investment decisions of individuals
- ▶ Most models of asset pricing take the risks of assets as given and based on these risks determine the expected returns
- ▶ Asset pricing forms the basis of the valuation of assets, but also affects investment decisions by **companies**



# The importance of asset pricing

- ▶ A large number of asset pricing models have been developed, some based on theoretical considerations, others based on empirical evidence, especially in the stock market
- ▶ Expected returns are a key ingredient into portfolio selection models and therefore the investment decisions of individuals
- ▶ Most models of asset pricing take the risks of assets as given and based on these risks determine the expected returns
- ▶ Asset pricing forms the basis of the valuation of assets, but also affects investment decisions by companies

# Analysing further portfolio selection theory

## Analysing further portfolio selection theory

- ▶ Asset returns are determined through the **demand and supply** of assets in markets

## Analysing further portfolio selection theory


- ▶ Asset returns are determined through the demand and supply of assets in markets
- ▶ The demand is affected by **investment decisions** of individuals

## Analysing further portfolio selection theory

- ▶ Asset returns are determined through the demand and supply of assets in markets
- ▶ The demand is affected by investment decisions of individuals
- ▶ As investment decisions are the consequence of **portfolio selection**, this theory will serve as the starting point for asset pricing

## Analysing further portfolio selection theory

- ▶ Asset returns are determined through the demand and supply of assets in markets
- ▶ The demand is affected by investment decisions of individuals
- ▶ As investment decisions are the consequence of portfolio selection, this theory will serve as the starting point for asset pricing



Andreas Krause

Capital Asset Pricing Model

## Rewarding systematic risk only



## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the **systematic risk** of assets only

## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the systematic risk of assets only
- ▶ The expected returns are proportional to the **covariance** of the asset with a market portfolio

## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the systematic risk of assets only
- ▶ The expected returns are proportional to the covariance of the asset with a market portfolio
- ? If investors have **different opinions** about asset characteristics, will they have different expected returns from the CAPM?

## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the systematic risk of assets only
- ▶ The expected returns are proportional to the covariance of the asset with a market portfolio
- ? If investors have different opinions about asset characteristics, will they have different expected returns from the CAPM?

## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the systematic risk of assets only
- ▶ The expected returns are proportional to the covariance of the asset with a market portfolio
- ? If investors have different opinions about asset characteristics, will they have different expected returns from the CAPM?
- ! Different opinions will lead to **different optimal risky portfolios**, but all assets still need to be held in equilibrium, this is unlikely to be fulfilled and the CAPM becomes **unsustainable** as a theory

## Rewarding systematic risk only

- ▶ The CAPM suggests that expected returns are determined by the systematic risk of assets only
- ▶ The expected returns are proportional to the covariance of the asset with a market portfolio
- ? If investors have different opinions about asset characteristics, will they have different expected returns from the CAPM?
- ! Different opinions will lead to different optimal risky portfolios, but all assets still need to be held in equilibrium, this is unlikely to be fulfilled and the CAPM becomes unsustainable as a theory

# Diversification and systematic risk

## Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is **beneficial** to investors



# Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how **effective** diversification is in reducing risks

# Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how effective diversification is in reducing risks
- ▶ The CAPM suggests investors are only rewarded for **some elements** of the risk they are facing

## Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how effective diversification is in reducing risks
- ▶ The CAPM suggests investors are only rewarded for some elements of the risk they are facing, the **covariance** with the market

# Diversification and systematic risk


- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how effective diversification is in reducing risks
- ▶ The CAPM suggests investors are only rewarded for some elements of the risk they are facing, the covariance with the market (**systematic risk**)

# Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how effective diversification is in reducing risks
- ▶ The CAPM suggests investors are only rewarded for some elements of the risk they are facing, the covariance with the market (systematic risk)
- ▶ We will explore how this **covariance** is related to **diversification**

# Diversification and systematic risk

- ▶ Portfolio theory suggests that diversification is beneficial to investors
- ▶ We will assess how effective diversification is in reducing risks
- ▶ The CAPM suggests investors are only rewarded for some elements of the risk they are facing, the covariance with the market (systematic risk)
- ▶ We will explore how this covariance is related to diversification



Andreas Krause

Limits to diversification

# Summary of key results



## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes **less and less effective** as the number of assets increases

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the **systematic risk**

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the systematic risk, a further reduction is **not possible**

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the systematic risk, a further reduction is not possible
- ? Will investing into **more assets always** result in **lower risk** than investing in a few assets only?

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the systematic risk, a further reduction is not possible
- ? Will investing into more assets always result in lower risk than investing in a few assets only?

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the systematic risk, a further reduction is not possible
- ? Will investing into more assets always result in lower risk than investing in a few assets only?
- ! Investing into few assets with **low correlations** may be more effective as the average covariance will be lower.

## Summary of key results

- ▶ We see that increasing the number of assets to invest into becomes less and less effective as the number of assets increases
- ▶ Diversification can reduce the risk at most towards the systematic risk, a further reduction is not possible
- ? Will investing into more assets always result in lower risk than investing in a few assets only?
- ! Investing into few assets with low correlations may be more effective as the average covariance will be lower.

# Shortcomings of the CAPM



# Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection

# Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection and identifies a single risk factor, the market

## Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection and identifies a single risk factor, the market
- ▶ How the market return and risk is determined is **not explained**

## Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection and identifies a single risk factor, the market
- ▶ How the market return and risk is determined is not explained
- ▶ With all influences obtained through the market, the ultimate **driving forces** behind returns **cannot be identified**

# Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection and identifies a single risk factor, the market
- ▶ How the market return and risk is determined is not explained
- ▶ With all influences obtained through the market, the ultimate driving forces behind returns cannot be identified
- ▶ We will look at **Arbitrage Pricing Theory** to obtain a tool allowing us to determine the influence of different factors on asset returns

# Shortcomings of the CAPM

- ▶ The CAPM is obtained from on the theory of portfolio selection and identifies a single risk factor, the market
- ▶ How the market return and risk is determined is not explained
- ▶ With all influences obtained through the market, the ultimate driving forces behind returns cannot be identified
- ▶ We will look at Arbitrage Pricing Theory to obtain a tool allowing us to determine the influence of different factors on asset returns



Andreas Krause

Arbitrage Pricing Theory

# Limits in the practical use of APT



## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a **single factor**

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives **no hint** how these factors are to be found

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives no hint how these factors are to be found, nor how these factor portfolios are to be **constructed**

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives no hint how these factors are to be found, nor how these factor portfolios are to be constructed
- ? As the CAPM is a special case of APT, is using the APT **better**?

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives no hint how these factors are to be found, nor how these factor portfolios are to be constructed
- ? As the CAPM is a special case of APT, is using the APT better?

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives no hint how these factors are to be found, nor how these factor portfolios are to be constructed
- ? As the CAPM is a special case of APT, is using the APT better?
- ! The APT suffers from factors having **no sound theoretical basis** and **difficulties** in identifying and using any such factors; this makes the use of APT more challenging

## Limits in the practical use of APT

- ▶ APT suggests that asset prices are proportional to the returns of portfolios which are only affected by a single factor
- ▶ It gives no hint how these factors are to be found, nor how these factor portfolios are to be constructed
- ? As the CAPM is a special case of APT, is using the APT better?
- ! The APT suffers from factors having no sound theoretical basis and difficulties in identifying and using any such factors; this makes the use of APT more challenging

# Summary



# Summary

- ▶ Asset pricing theory suggests that investors are only **rewarded** for being exposed to **systematic risk**

# Summary

- ▶ Asset pricing theory suggests that investors are only rewarded for being exposed to systematic risk
- ▶ Risks that can be diversified, unsystematic risk, is **not rewarded**

# Summary

- ▶ Asset pricing theory suggests that investors are only rewarded for being exposed to systematic risk
- ▶ Risks that can be diversified, unsystematic risk, is not rewarded
- ▶ While diversification reduces unsystematic risk, its impact is **small** once a larger number of assets are held

# Summary

- ▶ Asset pricing theory suggests that investors are only rewarded for being exposed to systematic risk
- ▶ Risks that can be diversified, unsystematic risk, is not rewarded
- ▶ While diversification reduces unsystematic risk, its impact is small once a larger number of assets are held
- ▶ Using a small number of assets with **low correlations** can give low total risk

# Summary

- ▶ Asset pricing theory suggests that investors are only rewarded for being exposed to systematic risk
- ▶ Risks that can be diversified, unsystematic risk, is not rewarded
- ▶ While diversification reduces unsystematic risk, its impact is small once a larger number of assets are held
- ▶ Using a small number of assets with low correlations can give low total risk, even though it includes **unsystematic risk**

# Summary

- ▶ Asset pricing theory suggests that investors are only rewarded for being exposed to systematic risk
- ▶ Risks that can be diversified, unsystematic risk, is not rewarded
- ▶ While diversification reduces unsystematic risk, its impact is small once a larger number of assets are held
- ▶ Using a small number of assets with low correlations can give low total risk, even though it includes unsystematic risk



Copyright © by Andreas Krause

Picture credits:

Cover: Premier regard, Public domain, via Wikimedia Commons, [https://commons.wikimedia.org/wiki/File:DALL-E\\_-\\_Financial\\_markets\\_\(1\).jpg](https://commons.wikimedia.org/wiki/File:DALL-E_-_Financial_markets_(1).jpg)

Back: Rhododendrites, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons.

Andreas Krause

Department of Economics

University of Bath

Claverton Down

Bath BA2 7AY

United Kingdom

E-mail: [mnsak@bath.ac.uk](mailto:mnsak@bath.ac.uk)