Andreas Krause

Valuing Futures and swaps

- We will be looking at some key derivatives, how they can be used, and how their value can be determined.
- We will focus on futures and swaps, the most widely used derivatives.

Arbitrage pricing

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→ We will briefly explain the principle of arbitrage, which is used to obtain the value of derivatives.

- A derivative is a security or contract whose final payment depends on the value of another security or asset; thus its value is 'derived' from the value of this security of asset.
- The determination of the value is done by means of arbitrage.
- The idea is that if at any point in time two securities, or combination of securities, must have the same value, then their value must be the same at any time. To see this suppose they are not identical at some point, say the price A is larger than B. We can sell A and use these proceeds to purchase a slightly larger number of B (as the price is lower); thus we made no no net investment. At that time the price of the securities is equal, you repurchase A, costing you the value at that time, and you sell B, which has the same value; but you have bought more of B and hence will receive more monies from selling B. Thus you have made a profit. But this profit was made without any initial investment. There is also no risk involved as you know the two values must be the same. Such a 'free lunch' where someone makes money out of nothing cannot exist as everyone would do it.
- Arbitrage is most explicitly applied in options pricing, but it also used when pricing forwards and swaps, although this is not immediately obvious.

→ We will thus use arbitrage implicitly when determining the value of forwards and swaps.

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- As an example consider a company that will receive a payment from its customer in the future and this payment is in a foreign currency, as this is what the contract stipulates.
- The company therefore is exposed to the risk that the foreign currency will depreciate until payment is received.
- Another example is a company needs to purchase some commodities in the future, for example some oil or metals.
- The company therefore is exposed to the risk that the commodity price increases until the purchase is necessary.
- Companies can use futures and forwards to eliminate this risk.
- We will now look at who such contracts work and how they can be valued.

→ In conducting our analysis, we will focus only on the key features of forwards and futures, leaving many, although important, details aside for clarity.

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Forwards and futures

→ The first derivative we will look at are forwards and futures and we will ficus on their valuation first.

Key characteristics of futures and forwards

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→ Now that we have derived the main results of the model, as far as relevant for us, we will briefly discuss some implications as well as limitations of this model. This will allow us to interpret the model in its context of the initial problem and enables us to apply it appropriately in a realistic context.

- With a future or forward, the buyer has to buy the underlying asset as agreed and the seller has to seel it as agreed, even if this causes them a loss.
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  - The value of such contracts is determined by the profits the that can be made at maturity.
  - These profits are adjusted for funding costs.
- Futures can have a negative value, why would anyone purchase something that has a negative value?
- If the value is negative, it implies that the purchaser is receiving a payment, off setting the negative value of the futures. This is a peculiar situation in which the buyer of a securities receives payment and the seller pays to offload a security.

→ We can now look at how futures and forwards can be used to hedge the risks of companies or investors.

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  - The value of such contracts is determined by the profits the that can be made at maturity.
  - These profits are adjusted for funding costs.
- Futures can have a negative value, why would anyone purchase something that has a negative value?
- If the value is negative, it implies that the purchaser is receiving a payment, off setting the negative value of the futures. This is a peculiar situation in which the buyer of a securities receives payment and the seller pays to offload a security.

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Key characteristics of futures and forwards

- Futures and forwards are a contract in which the buyer (seller) has the obligation to buy (sell) the underlying asset at the agreed time and agreed price
- The value of a futures and forwards can be obtained from the profits expected at maturity, adjusted for the net costs of obtaining the underlying asset instantly

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Futures and forwards for hedging

Futures and forwards for hedging

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Andreas Krause
Hedging with futures

→ We will look at perfect hedges of the exposure from assets and how approximate hedges can work.

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- Futures contracts are mostly short-term in that the time to maturity is often below three months.
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- Forwards are bespoke contracts agreed with a counterparty, usually a bank, and can therefore be long-term.

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Use of swaps

Use of swaps

→ We can now consider another derivative, a swap. We start with two examples of the risks a company faces and which it seeks to hedge.

- Suppose a company has obtained a loan in their local currency, but use this money to mae an investment abroad. They have set up a subsidiary in the country they seek to invest in to this effect.
- The parent company now provides their subsidiary a loan, but this loan is denominated in the subsidiary's currency, thus a foreign currency for the parent company.
- The parent company receives interest payments from the subsidiary on the loan, but as the loan is in a foreign currency, these payments will be in a foreign currency. having to transfer the currency into their own, imposes the parent company to currency risk.
- In another example, a bank has accepted deposits and agrees to pay depositors the money market rate.
- The bank has used these deposits to provide loans, but the interest rate on these loans has been fixed at the current competitive level.
- The bank is therefore exposed to interest rate risk as the deposit rate is variable.
- We will see how we can use swaps to eliminate these risks from the company and from the bank using swaps.

→ We will look at how swaps can eliminate these risks.

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- A company has obtained a loan in their home country and invest this loan into an overseas subsidiary

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- The parent company receives interest payments from the subsidiary on the loan, but as the loan is in a foreign currency, these payments will be in a foreign currency. having to transfer the currency into their own, imposes the parent company to currency risk.
- In another example, a bank has accepted deposits and agrees to pay depositors the money market rate.
- The bank has used these deposits to provide loans, but the interest rate on these loans has been fixed at the current competitive level.
- The bank is therefore exposed to interest rate risk as the deposit rate is variable.
- We will see how we can use swaps to eliminate these risks from the company and from the bank using swaps.

→ We will look at how swaps can eliminate these risks.

Use of swaps

- A company has obtained a loan in their home country and invest this loan into an overseas subsidiary
- The investment takes the form of a loan, which is denominated in the subsidiary's currency
- Receiving payments from the subsidiary in a different currency is exposing the company to currency risk
- A bank attracts deposits on which it agrees to pay interest that tracks the current interest rate in the money market
- These deposits are used to provide loans for which fixed conditions, including the loan rate, are agreed
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→ We can now consider another derivative, a swap. We start with two examples of the risks a company faces and which it seeks to hedge.

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Andreas Krause
Swaps

→ We can now see how swaps work and how they can be priced.

Swaps allowing to hedge multiple payments

Swaps allowing to hedge multiple payments

→ Swaps allow to hedge the risks from a large number of similar payments with a single derivative.

- We can use swaps to exchange payments that are determined on different terms.
  - This might be because they are in different currencies
  - or the interest rates are determined differently, mainly where one is fixed and the other variable, but we could also exchange two variable interest rates.
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- Futures allow to hedge for a single payment in the future, but swaps hedge multiple, recurring future payments. In principle a swap is nothing but a collection of forward contracts where the risky payment (variable interest rate or foreign currency payment) is hedged at different points in time. Thus a swap is a more convenient way of achieving this hedge, and it circumvents the problems of futures not being available for long times to maturity.

→ Thus we can see swaps a collection of forward contracts.

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Summary

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→ We can now summarize the key results we have obtained about forwards, futures and swaps.

- These instruments are able to perfect (or partially) hedge risks that investors may face.
  - However, in doing so, they also eliminate any possibility for gains if the market in the investors' favour.
- Futures, forwards, and swaps are primarily designed to hedge the risks of future payments, whether they are made or received. The introduction of stock in futures and futures on individual stocks saw a deviation from this idea as they hedge against the value of these assets rather than any payments the may be necessary.
- The value of these derivatives are based on these payments, adjusted for any costs or benefits that may arise from the use of derivatives rather than purchasing the underlying asset directly.

→ Forwards and swaps are the basic derivatives used for hedging risks in financial markets. They are widely used and well understood, but in many investor's view face the downside of not only providing insurance against any losses, but also eliminating and possible gains.

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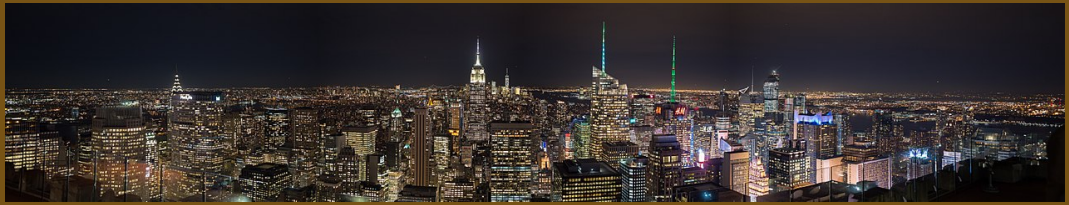

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