Andreas Krause

Fixed income securities

- Fixed income securities are all those securities that promise to pay a regular amount to investors until the security is repaid.
- This regular amount is either fixed in advance or variable but linked to a benchmark; importantly, the regular amount is not dependent on the profits the issuer makes.
- The most common fixed income security is a bond, but other securities exist that have similar properties, mainly based on credit derivatives.

Definition of bonds

Definition of bonds

→ Although most people know what a bond is, we make a more formal definition here.

- A bond pays a regular amount to investors, in regular time intervals, typically quarterly, semi-annually, or annually.
- This payment is made until the bond is repaid, which is a fixed point in time.

- The regular payments are called 'coupon' and represent the interest the bond pays.
- Coupons are either fixed for the life-time of the bond or determined in regular intervals (mostly quarterly) with reference to a benchmark.

- The repayment of the bond is most commonly at its face value. The face value is the basis on which the coupon payments are based and which is the basis for the initial offer price. Typically this is set at 100 and the coupon as well as the value expressed as a percentage of this amount.
- As all payments and their timings are pre-determined, bonds are called fixed income securities.

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- A bond is a security that promises to pay a well-defined amount per time period

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Risk-free and risky bonds

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→ We can distinguish bonds by the credit risk they are bearing.

- It is common to assume that all payments, as agreed, will be made with certainty and hence there is no risk in bonds.
- Bonds of most developed countries and international organisations backed by these countries are seen as such risk-free bonds.
- Bonds issued by companies, banks or developing countries might, however, may not be repaid as these issuers might not be able to make payments as agreed. These bonds are classed as risky in the sense that they are exposed to credit risk, or default risk.
- The credit risk is the risk arising from the ability of the issuer to make the payments as agreed.
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Explaining different yields

Explaining different yields

→ We seek to explain why yields of bonds with different maturities are different and what information these differences convey.

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- Bonds issued by most governments are available for a wide range of maturities; other issuers in most cases have a much lower range of maturities. These different maturities are not necessarily the result of countries issuing bonds at different maturities, but as time goes on, the time to maturity of bonds continuously falls. Thus, a country issuing bonds regularly, will have a range of times to maturity left. We are focussing here on the time to maturity at the current time, not at the time the bond was issued.
- Typically times to maturities that are of importance are 1 month, 3 months, 1 year, 5 years, 10 years, and then 30 or 50 years.

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- Although bonds are risk-free, the yields are different.
- Moreover, the yields of bonds for the same maturity are changing over time.

▶ We will look at how we can explain these differences and how we can explain any such changes.

→ We will therefore introduce the yield curve and a theory to explain its shape.

Explaining different yields

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Yield curves

→ We will now look at the yield curve representing the yields to maturity of bonds and how they can be explained.

Yield curves as predictors

Yield curves as predictors

→ 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.

- We have seen that bond yields give us information about what the market expects future (short-term) yields to be.
- The slope of the yield curve gives us indications how the market expected short-term yields to evolve over time and this can be used to assess future macroeconomic conditions due to the link between short-term bond yields and monetary policy.
- Assume that the issuer will not default, is there no risk in investing into bonds?
- As the bond changes its maturity, it will change the yield, on top of any change sin the yield itself. With the bond value determined as the present value of any payments to the investor, the discount rate will vary and hence the bond value. If selling a bond before maturity, its value will be uncertain. A risk-free bond is only truly risk-free if it is held to maturity.

→ We can now investigate this risk of bond values prior to maturity further.

Yield curves as predictors

- The term structure of interest rates reflects expectations about future short-term interest rates

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! The value of the bond will change over time as the interest rate changes, but this will affect investors only if they sell their bond; if they retain the bond until maturity their payments are fixed

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- As the bond changes its maturity, it will change the yield, on top of any change sin the yield itself. With the bond value determined as the present value of any payments to the investor, the discount rate will vary and hence the bond value. If selling a bond before maturity, its value will be uncertain. A risk-free bond is only truly risk-free if it is held to maturity.

→ We can now investigate this risk of bond values prior to maturity further.

Yield curves as predictors

- The term structure of interest rates reflects expectations about future short-term interest rates
- The slope of the yield curve can be used to predict the future macroeconomic performance of an economy

? Is investing in bonds really risk-free, provided the issuer will not default?

! The value of the bond will change over time as the interest rate changes, but this will affect investors only if they sell their bond; if they retain the bond until maturity their payments are fixed

Yield curves as predictors

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The risk of changing interest rates

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- While changes to the yield are predictable as the bond moves along the yield curve towards ever shorter maturities, the yield curve itself changes. These changes can be as expected from the slope of the yield curve, but it will be subject to additional changes arising from market demands, unexpected shocks to the macroeconomic conditions, and other factors.
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  - All changes in the yield will change the value of the bond and while the expected changes of the yield curve and the movement of the bond down the maturity are considered by investors, any additional changes to the yield constitute risk to the value of the bond.
  - We will therefore seek to use a measure to determine the size of the risk to bond investors.
- We will also see how such risks can be managed, by an investor into bonds and also by banks who have a significant exposure to interest rate risk.

→ We will now see how bond investors can address interest rate risk.

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Andreas Krause
Interest rate risk

→ Our focus will be on the unpredictable interest rate risk, thus we do not consider changes arising from bonds' changing time to maturity or changes to the yield curve that are expected.

Duration risk

Duration risk

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- We have seen that the risk of a bond, with respect to interest rate risk, is proportional to the duration of this bond.
- We have also seen that using a portfolio of bonds, we can eliminate such interest rate risk.
- We have seen that adding another bond to the portfolio may eliminate interest rate risk. Is such a strategy always feasible?
- We have seen that using short positions of bonds with longer duration are required. Such positions will not be feasible for meany investors and will also incur additional costs of achieving this position. It will therefore often not be possible. In addition, hedging a portfolio of bonds with long durations requires a bond with an even longer duration, which might not be available. Small differences in duration $D_1 - D_2$, will require large short positions, which even for professional investors will be difficult to achieve.

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→ We can now summarize the key results we have obtained about yield curves and interest rate risk.

- The yield curve can be used to extract information on the market perception of future interest rates,
- As short-term interest rates are closely linked to the macroeconomic performance of an economy, the expected changes to these interest rates can be used to assess how the market predicts the economy to develop.
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  - We have also seen that supposedly risk-free bonds are risky in that their value changes as the interest rates change.
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→ Bond yields of risk-free government bonds provide us information about the market assessment of the further development of the economy and yield curves can be used to predict economic growth and inflation, in combination with other pieces of information.

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