Capital Markets and Asset Pricing
Goethe Business School
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Problem Set 1

Problem 1.1 (Bond Pricing) You have a bond with notional $N = 1,000$ which matures in 240 days (30/360 usance). The coupon is 6% and the clean price is 990.

(a) Calculate the accrued interest and the dirty price. Explain the difference between clean and dirty bond prices.

(b) Assume capital market usance and redo problem (a).

Problem 1.2 (Discretely compounded vs. Continuously) Current prices of zero-coupon bonds ($N = 100$) with maturities in 6 months, and twelve months are $P_0(T = 0.5) = 99.8$, and $P_0(T = 1) = 98.4$

(a) Determine the discretely compounded spot rates $r(0.5)$, $r(1)$, and the forward rate for an investment over the second period $f(0.5, 1)$.

(b) Determine the corresponding continuously compounded interest rates.

Problem 1.3 (TSIR and Bond Pricing) Suppose the following bond data of German Bundesanleihen is given

	T	P_0	c	N
1st Bond	1	101.15	1.0%	100
2nd Bond	2	98.00	2.0%	100
3rd Bond	3	99.50	1.5%	100

(a) Back out the spot and forward rates from this bond data. What kind of term structure do you get? What do you observe?

(b) Determine the current yield, simple redemption yield, and yield-to-maturity for the second bond. Explain the differences between these yield concepts.

(c) Suppose there is another German Bundesanleihe with a coupon rate of 3% maturing in 3 years. Determine its arbitrage-free price.

(d) What would you do if this bond were trading at 102?

(e) What would be different if the bonds were US Treasuries? Write down the pricing equations using spot rates.

Problem 1.4 (Interest Rate Exposure) We consider a coupon bond with a coupon rate of 2% per annum, a notional of 100 euros, and a time to maturity of 3 years. Coupons are paid annually. Its continuously compounded yield-to-maturity is 1%.

(a) Determine the bond's price P_0, duration D, and convexity Γ.

(b) What change in the yield-to-maturity does the duration predict if the price goes down by \$1?

(c) Suppose you observe rising interest rate and the yield-to-maturity goes down by 80bps=0.8%. Predict the price change using (i) duration only, (ii) duration and convexity, and compare it to (iii) the true price change.

(d) Suppose you hold an equally weighted portfolio of the bond above and a zero-coupon bond with a maturity in 5 years and a current price of 89. Determine the portfolio duration and convexity.