ECON 337901
FINANCIAL ECONOMICS

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March 10, 2020

Midterm Exam

Tuesday, March 17: 1030 - 1145am

Short answer questions like those from the homeworks, covering the material discussed in class, up through and including bond pricing (Overview of Asset Pricing Theory).

Bring a pen or pencil. You probably won't need a calculator, but you can use one if you want to.

Midterm Exam

For Extra Practice:

Midterm from Fall 2013: Question 1
Midterm from Spring 2014: Questions 1, 2
Final (two versions) from Spring 2014: Question 4
Midterm from Spring 2015: Questions 1, 3
Midterm from Fall 2015: Questions 1, 2, 3
Midterm from Spring 2016: Questions 1, 2, 3
Midterm from Spring 2017: Questions 1, 2, 3, 4
Midterm from Fall 2017: Questions 1, 2, 3, 4, 5
Midterm from Spring 2018: Questions 1, 2, 3, 4, 5
Midterm from Spring 2019: Questions 1, 2, 3, 4, 5
Midterm from Fall 2019: Questions 1, 2, 3, 4, 5

2 Overview of Asset Pricing Theory

A Pricing Safe Cash Flows
B Pricing Risky Cash Flows
C Two Perspectives on Asset Pricing

Next: 3 Making Choices in Risky Situations

Pricing Safe Cash Flows

A *T-year discount bond* is an asset that pays off \$1, for sure, T years from now.

If this bond sells for \$ P_T today, the annualized return from buying the bond today and holding it to maturity is

$$1 + r_T = \left(\frac{1}{P_T}\right)^{1/T}.$$

Hence, the bond price and the interest rate are related via

$$P_T = \frac{1}{(1 + r_T)^T}.$$

Pricing Safe Cash Flows

Since, for a T-period discount bond,

$$P_T = \frac{1}{(1 + r_T)^T},$$

the interest rate equates today's price of the bond to the present discounted value of the future payments made by the bond.

US Treasury bills, that is, US government bonds with maturities less than one year, are structured as discount bonds.

Pricing Safe Cash Flows

A *T-year coupon bond* is an asset that makes an annual interest (coupon) payment of \$$C$ each year, every year, for the next T years, and then pays off \$$F$ (face or par value), for sure, T years from now.

US Treasury notes and bonds, with maturities of more than one year, are structured as coupon bonds.

Pricing Safe Cash Flows

Notice that a coupon bond can be viewed as a bundle, or portfolio of discount bonds, since the cash flows from a T-year coupon bond can be replicated by buying

C one-year discount bonds

C two-year discount bonds

. . .

C T-year discount bonds

F more T-year discount bonds

Pricing Safe Cash Flows

And if both discount and coupon bonds are traded, then the price of the coupon bond must equal the price of the portfolio of discount bonds.

If the coupon bond was cheaper than the portfolio of discount bonds, one could sell the discount bonds, buy the coupon bond, and thereby profit.

If the coupon bond was more expensive than the portfolio of discount bonds, one could sell the coupon bond, buy the discount bonds, and thereby profit.

Pricing Safe Cash Flows

Building on this insight, the price P_T^C of the coupon bond must satisfy

$$\begin{aligned} P_T^C &= CP_1 + CP_2 + \ldots + CP_T + FP_T \\ &= \frac{C}{1+r_1} + \frac{C}{(1+r_2)^2} + \ldots + \frac{C}{(1+r_T)^T} + \frac{F}{(1+r_T)^T} \end{aligned}$$

Today's price of the coupon bond equals the present discounted value of the future payments made by the bond.

Pricing Safe Cash Flows

$$P_T^C = \frac{C}{1+r_1} + \frac{C}{(1+r_2)^2} + \ldots + \frac{C}{(1+r_T)^T} + \frac{F}{(1+r_T)^T}$$

Note that the interest rates used to compute the present value are those on the discount bonds

The yield to maturity defined by the value r that satisfies

$$P_T^C = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \ldots + \frac{C}{(1+r)^T} + \frac{F}{(1+r)^T}$$

is a measure of the interest rate on the coupon bond.

Pricing Safe Cash Flows

In fact, the US Treasury allows financial institutions to break US Treasury coupon bonds down into portfolios of separately-traded discount bonds.

These securities are called US Treasury STRIPS (Separate Trading of Registered Interest and Principal of Securities).

Pricing Safe Cash Flows

Next, consider an asset that generates an arbitrary stream of safe (riskless) cash flows $C_1, C_2, \ldots, C_T$, over the next T years.

To simplify the task of "pricing" this asset, we might view it as a portfolio of more basic assets: one that pays C_1 for sure in one year, one that pays C_2 for sure in two years, . . ., and one that pays C_T for sure in T years.

The price of the multi-period asset must equal the sum of the prices of the more basic assets.

Pricing Safe Cash Flows

We've now reduced the problem of pricing any riskless asset to the simpler problem of pricing a more basic asset that pays C_t for sure t years from now.

But this more basic asset has the same payoff as C_t t-year discount bonds. Its price P_t^A today must equal

$$P_t^A = C_t P_t = \frac{C_t}{(1 + r_t)^t},$$

the present discounted value of its cash flow.