CHAPTER 5

Introduction to Risk, Return, and the Historical Record

McGraw-Hill/Irwin

Interest Rate Determinants

- Supply
  - Households
- Demand
  - Businesses
- Government's Net Supply and/or Demand
  - Federal Reserve Actions

Real and Nominal Rates of Interest

- Nominal interest rate: Growth rate of your money
- Real interest rate: Growth rate of your purchasing power

- Let R = nominal rate, r = real rate and i = inflation rate. Then:

$$r \approx R - i$$

$$1 + r = \frac{1 + R}{1 + i}$$

Solve:

$$r = \frac{R - i}{1 + i}$$

Equilibrium Real Rate of Interest

- Determined by:
  - Supply
  - Demand
  - Government actions
  - Expected rate of inflation

Figure 5.1 Determination of the Equilibrium Real Rate of Interest

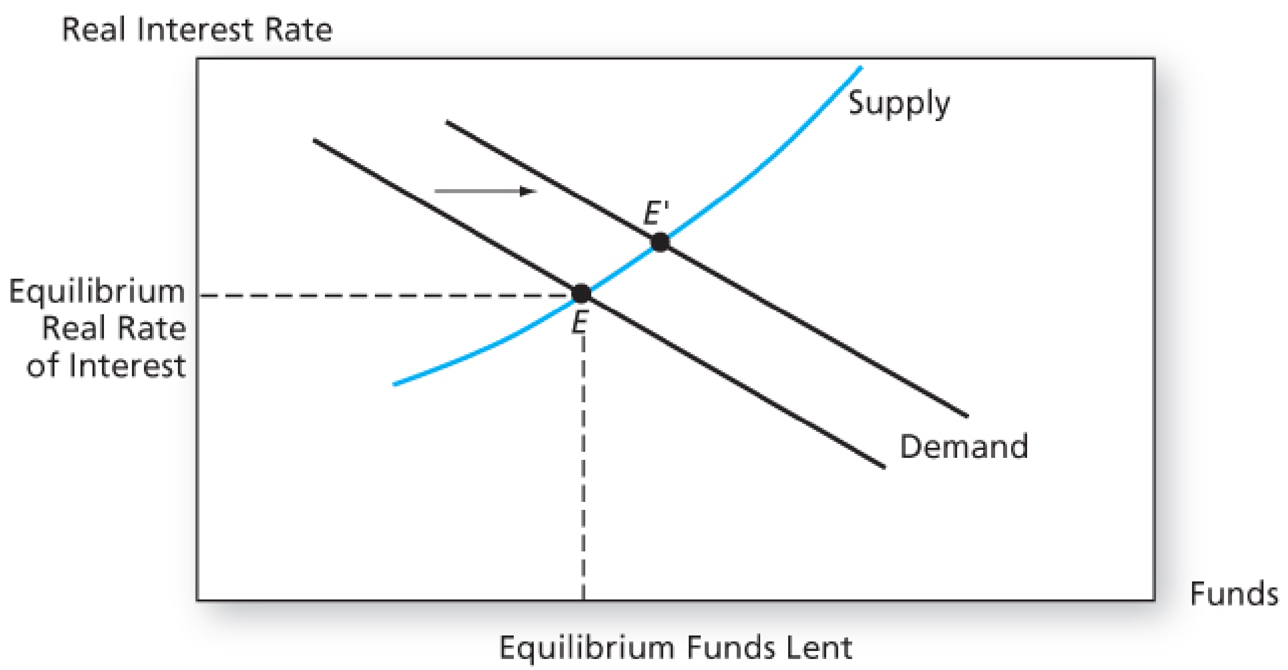

Figure 5.1 Determination of the equilibrium real rate of interest

Equilibrium Nominal Rate of Interest

- As the inflation rate increases, investors will demand higher nominal rates of return
- If *E*(*i*) denotes current expectations of inflation, then we get the Fisher Equation:
- Nominal rate = real rate + inflation forecast

$$R = r + E(i)$$

Taxes and the Real Rate of Interest

- Tax liabilities are based on *nominal* income
  - Given a tax rate (t) and nominal interest rate (R), the *real* after-tax rate rate of return is:

$$R(1-t)-i=(r+i)(1-t)-i=r(1-t)-it$$

- As intuition suggests, the after-tax real rate of return falls as the inflation rate rises.

Rates of Return for Different Holding Periods

Zero Coupon Bond

Par = $100

T = maturity

P = price

$r_f(T)$ = *total* risk free return

$$P = \frac{100}{1 + r_f(T)} \qquad r_f(T) = \frac{100}{P} - 1$$

Example 5.2 Annualized Rates of Return

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Suppose prices of zero-coupon Treasuries with $100 face value and various maturities are as follows. We find the total return of each security by using Equation 5.6:

Horizon, T	Price, $P(T)$	$[100/P(T)] - 1$	Risk-Free Return for Given Horizon
Half-year	$97.36	100/97.36 − 1 = .0271	$r_f(.5) = 2.71\%$
1 year	$95.52	100/95.52 − 1 = .0469	$r_f(1) = 4.69\%$
25 years	$23.30	100/23.30 − 1 = 3.2918	$r_f(25) = 329.18\%$

Equation 5.7 EAR

- Effective Annual Rate definition: percentage increase in funds invested over a 1-year horizon

$$1 + r_f(T) = [1 + EAR]^T$$

$$1 + EAR = [1 + r_f(T)]^{1/T}$$

Equation 5.8 APR

- APR: annualizing using simple interest

$$1 + APR \times T = (1 + EAR)^T$$

$$APR = \frac{(1 + EAR)^T - 1}{T}$$

Table 5.1 APR vs. EAR

Compounding Period	T	EAR $= [1 + r_f(T)]^{1/T} - 1 = .058$		APR $= r_f(T)*(1/T) = .058$	
		$r_f(T)$	APR = [(1 + EAR)^T − 1]/T	$r_f(T)$	EAR = (1 + APR*T)^(1/T) − 1
1 year	1.0000	.0580	.05800	.0580	.05800
6 months	0.5000	.0286	.05718	.0290	.05884
1 quarter	0.2500	.0142	.05678	.0145	.05927
1 month	0.0833	.0047	.05651	.0048	.05957
1 week	0.0192	.0011	.05641	.0011	.05968
1 day	0.0027	.0002	.05638	.0002	.05971
Continuous			$r_{cc} = \ln(1 + \text{EAR}) = .05638$		EAR $= \exp(r_{cc}) - 1 = .05971$

Table 5.1

Annual percentage rates (APR) and effective annual rates (EAR). In the first set of columns, we hold the equivalent annual rate (EAR) fixed at 5.8% and find APR for each holding period. In the second set of columns, we hold APR fixed at 5.8% and solve for EAR.

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