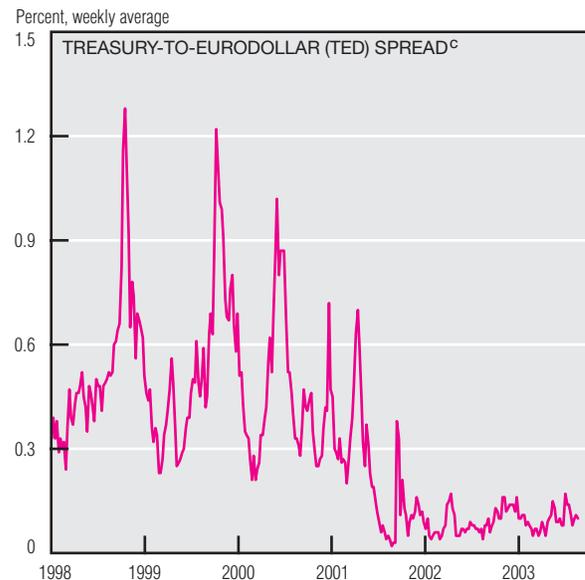
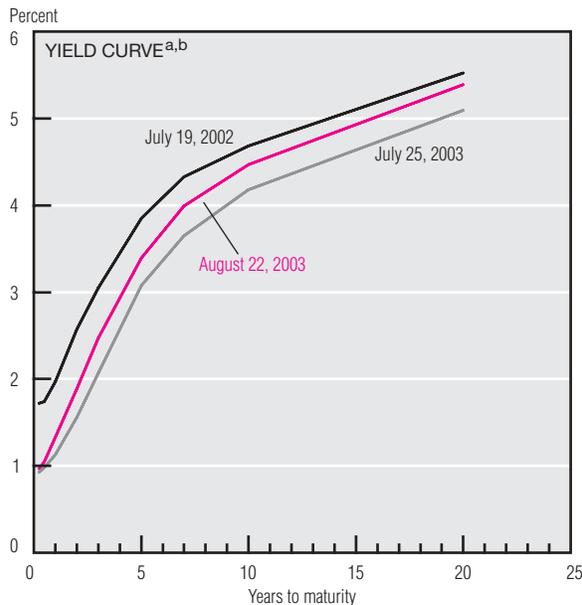
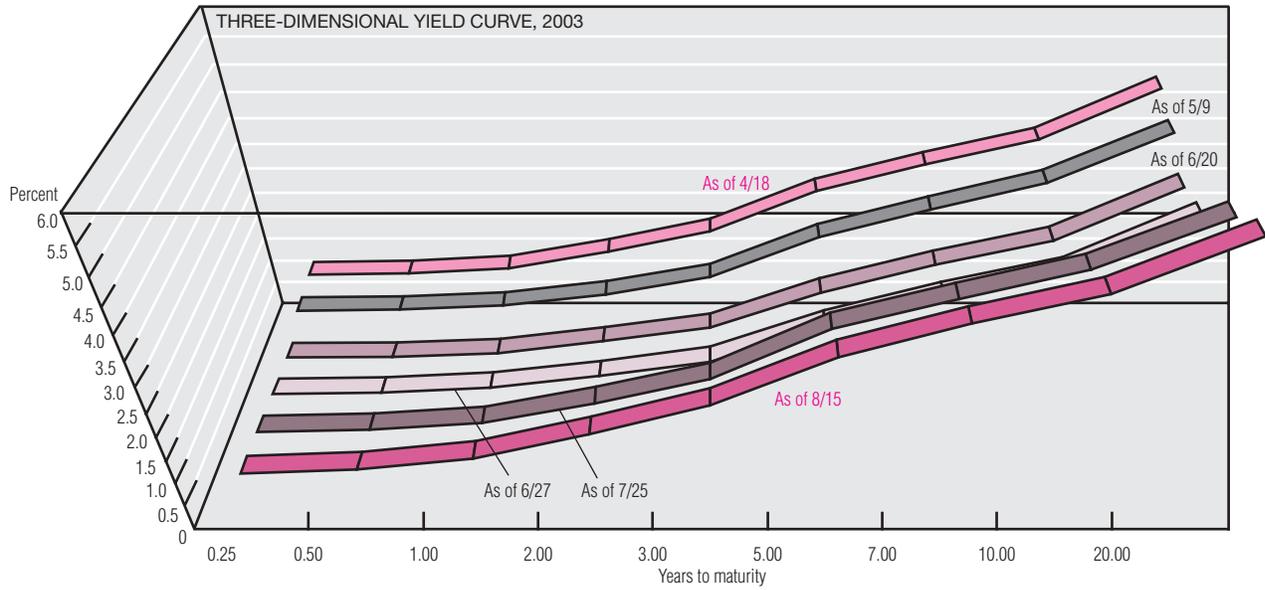


Money and Financial Markets



a. Average for the week ending on the date shown.

b. All yields are from constant-maturity series.

c. Yield spread: three-month euro minus three-month constant-maturity Treasury bill.

SOURCES: Board of Governors of the Federal Reserve System, "Selected Interest Rates," *Federal Reserve Statistical Releases*, H.15; and Bloomberg Financial Information Services.

The yield curve has steepened since last month, but this change represents more than a bounce-back from the summer's exceptionally low long-term rates; current yields show an increase over April and May as well. The 10-year, three-month spread, often cited as a predictor of future economic growth, stands at a robust 350 basis points (bp), up from 325 last month and 277 last year. Other spreads also look promising. The TED spread—the difference between

eurodollar deposits and Treasury bonds, widely thought to reflect concern over international tensions—remains quite low by recent historical standards.

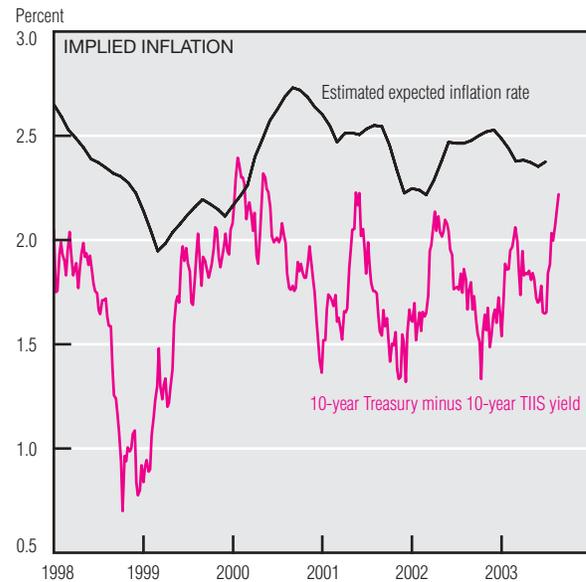
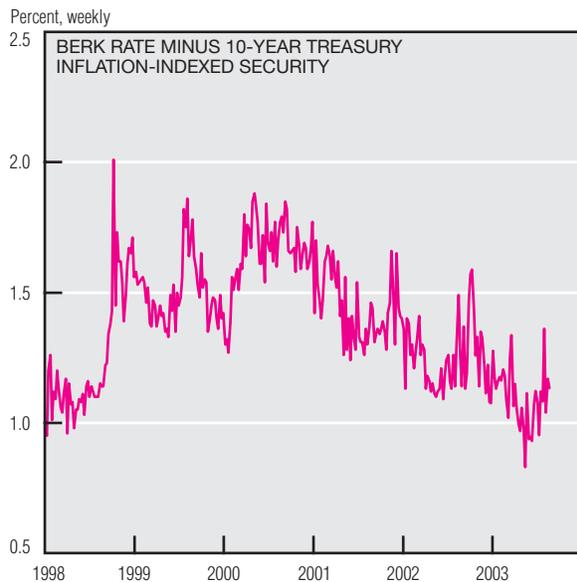
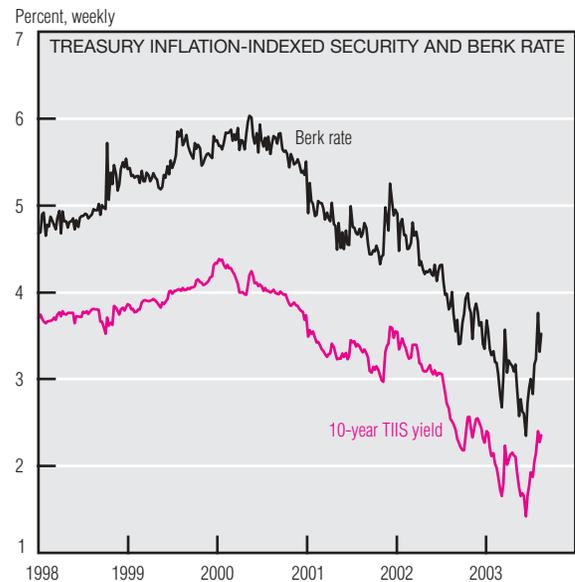
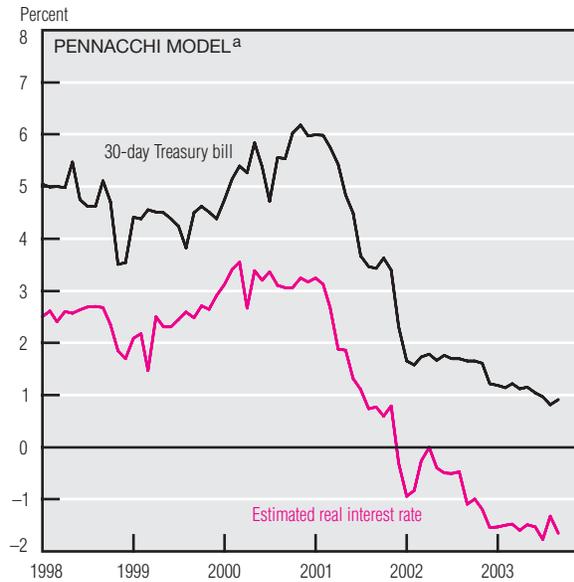
Although headlines usually focus on nominal interest rates, the economy is affected by real rates, that is, rates adjusted for inflation. Treasury inflation-indexed securities (TIIS), which adjust their principal and interest for inflation, provide a direct measure of real rates. Inflation expectations may also be used to estimate

real rates; the Pennacchi approach estimates 30-day real rates. Short rates have remained steadfastly negative throughout 2003. Although long rates have shown more variability, their current value is near its level at the beginning of the year.

Real interest rates matter because they influence investment. One must be careful to consider the appropriate real rate, however, since most projects implicitly embed a subtle option—the option to wait. If real rates rise, the

(continued on next page)

Money and Financial Markets (cont.)



a. The estimated real interest rate is calculated using the Pennacchi model of inflation estimation and the median forecast for the GDP implicit price deflator from the *Survey of Professional Forecasters*. Monthly data.

SOURCES: Board of Governors of the Federal Reserve System, "Selected Interest Rates," *Federal Reserve Statistical Releases*, H.15; Bloomberg Financial Information Services; and Jonathan B. Berk, "A Simple Approach for Deciding When to Invest," *American Economic Review*, vol. 89 (1999), pp. 1319–26.

waiting option has two contrary effects: The present value of future profits is lower with higher interest rates, but delaying investment also looks worse. Thus, the increase in real rates has an ambiguous effect on investment.

One way to adjust for this problem is to use bonds that embed the option to wait. Fortunately, such "callable" bonds, which the issuer can buy back at a pre-specified price, do exist. The chart at the lower left takes a common callable bond, the

30-year Government National Mortgage Association bond, and subtracts, as an estimate of inflation, the yield difference between a 10-year Treasury bond and a 10-year TIPS. Both the 10-year TIPS rate and the option-adjusted rate (dubbed the "Berk rate," after the economist who developed these ideas) have been increasing lately, but the Berk rate has risen nearly 80 bp since early June, compared with the TIPS's 60 bp rise.

The counterpart to real rates is expected inflation. Although the

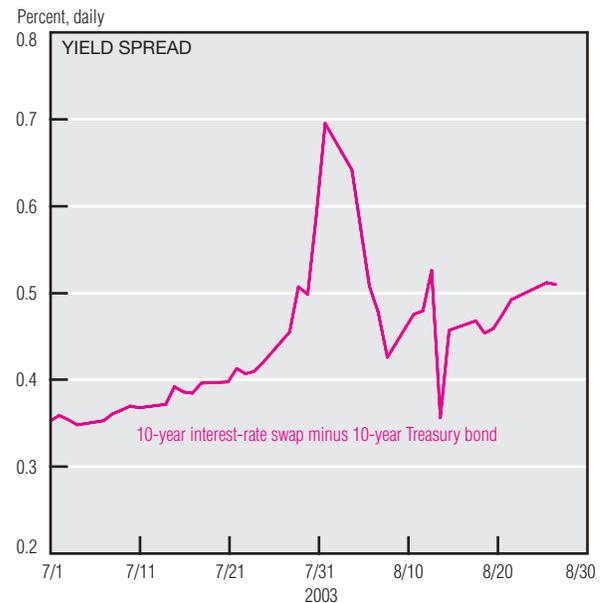
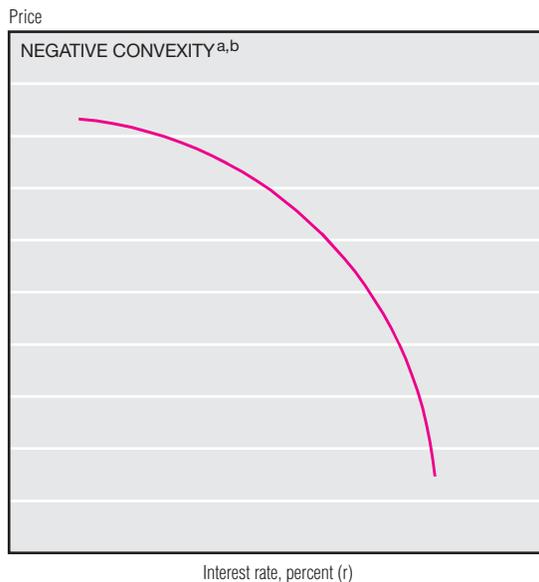
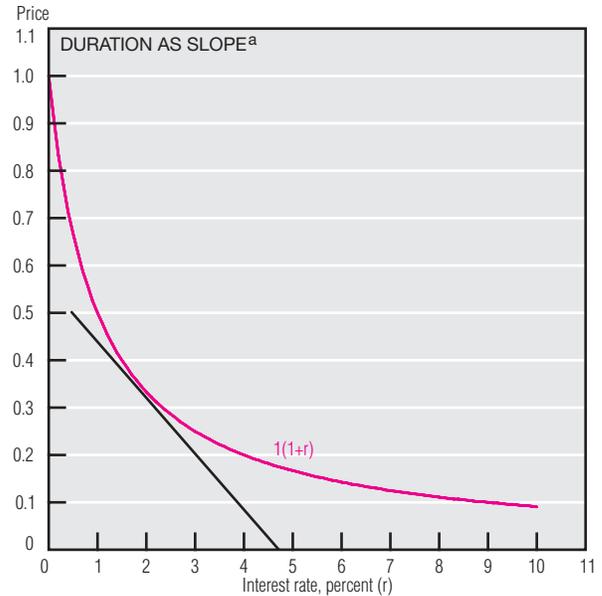
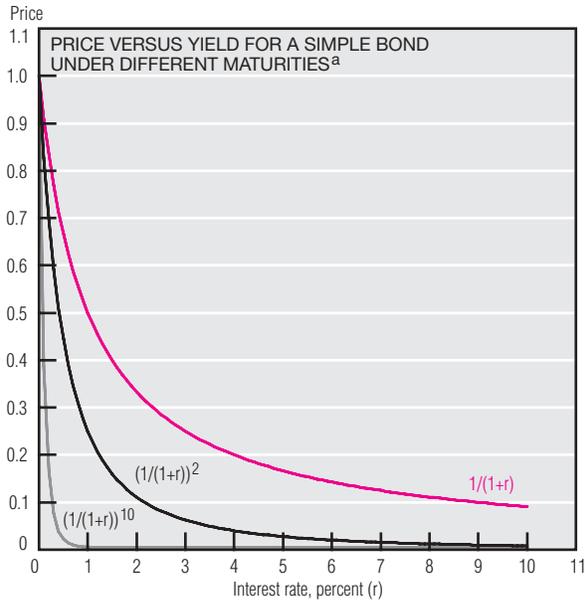
shorter-term measure from the Pennacchi model shows little movement, longer-term expectations have gone up more than 0.5% since early June.

Late July and early August saw increased volatility and a large spike in yields on interest rate swaps. The market has since settled down, but the event taught some useful lessons.

The price of a simple bond varies inversely with market interest rates. This makes sense because tomorrow's dollar is worth less today if the interest rate is higher. How much a bond's

(continued on next page)

Money and Financial Markets (cont.)



a. Author's calculations.

b. As interest rates rise, the duration of a bond increases.

SOURCE: Bloomberg Financial Information Services.

price changes when the interest rate changes depends on several things. A longer-maturity bond is more sensitive to interest rate changes because rates are compounded over time.

Most bonds are more complicated, with multiple payments and added features, but a version of the same relationship between price and interest rate still holds. Financial professionals call the relation between interest rates and a bond's price the duration. This is a weighted average of the maturity of

all payments, coupon and otherwise, that tells how much the price of a bond changes when interest rates change. It can be thought of as the slope of the price/interest rate curve, as shown in the chart at the upper right.

Duration itself depends on interest rates: The slope of the line is flat at high interest rates and steep at low interest rates. How duration changes depends on how "curvy" the line is, which is termed convexity. Most bonds have positive convexity—their price line bends inward. But some

(many mortgage-backed securities, for example) have negative convexity—their curve bows outward. When interest rates started rising in late July and people stopped refinancing their mortgages, the duration of mortgage-backed securities began to increase. Financial managers realized that this increased their portfolios' sensitivity to interest rates and attempted to reduce duration (and sensitivity). This effort led them into the swaps market, provoking the spike.