

## Inflation & Interest Rates

Fama (AER, 1975): Short-term Interest Rates as Predictors of Inflation

- CPI inflation & Tbill yields, 1953-71

## Short-term Interest Rates as Predictors of Inflation

Return on k-period discount bond (interest rate on T-bill maturing in k months) is known at time t-k when you buy the bill

$$B(k,t) = \ln[\$1000/P(t-k)]$$

where  $B(k,t)$  is the continuously compounded return (interest rate) from t-k to t

Thus, the only thing uncertain at t-k is how many groceries you can buy with \$1000 when the bill matures at time t

- i.e. the real return

Fama & Schwert (1977): Autocorrelations of Nominal (\$) Returns (Table 1)

### Impt Facts:

- quite large and persistent (decay slowly at higher lags) for assets with small standard deviations (bills, bonds, real estate)
- small for assets with large standard deviations (stocks)
- autocorrelations of inflation rate are about .35 for all 12 lags
  - suggests a lot of predictability of inflation (stays high/low for long periods)

Autocorrelations of Real Returns [Deflated by CPI Inflation] (Table 2)

### Impt Facts:

- generally small at all lags
  - about .1 at lag 1 for all assets (could be due to poor measurement of CPI changes)
- about .2 at lag 12 for smallest risk assets (bills)
  - could be due to seasonality (real or spurious) in CPI
- If you couldn't see means & standard deviations you wouldn't be able to guess which assets were which

### F&S (JFE, 1977): Implications of Autocorrelations

- It looks like the random walk model is reasonable for nominal stock and human capital returns, but not for other assets
- It looks like the random walk model is reasonable for real returns to all classes of assets
- Simple story: people worry about how many groceries they can buy when they invest, not how many pictures of Geo Washington they have

### Short-term Interest Rates as Predictors of Inflation

Given the evidence (Table 1) that inflation autocorrelations are high, but autocorrelations of real T-bill returns are low, a simple model is suggested:

$$(1) E[r(t) | \phi(t-k)] = E[r] = \text{constant over time}$$

- about 1% per year
- $[.0007 \times 12 \times 100]$ ; Table 2]

$$(2) E[p(t) | \phi(t-k)] = B(k,t) - E[r]$$

- so the expected inflation rate is just the nominal T-bill yield minus the constant expected real return

### Short-term Interest Rates as Predictors of Inflation

The simple model for inflation expectations,

$$E[p(t) | \phi(t-k)] = B(k,t) - E[r]$$

implies a regression model:

$$p(t) = \alpha + \beta B(k,t) + \varepsilon(t)$$

- where the slope  $\beta = 1$  and the intercept  $\alpha = -E[r]$

### Short-term Interest Rates as Predictors of Inflation

Estimates of the regression

$$p(t) = \alpha + \beta B(k,t) + \varepsilon(t)$$

in show:

- (1) slopes remarkably close to 1,
  - (2) intercepts imply about 1% per year expected real return,
  - (3)  $R^2$  about .3 for monthly (.48 and .82 for quarterly & semi-annual) implies that a large portion of inflation variation is predictable
- prediction model for inflation is:

$$B(k,t) - .0007k \text{ (for } k\text{-period inflation)}$$

### Short-term Interest Rates as Predictors of Inflation: Questions

(1) Do you think that short-term interest rates have done as well at predicting inflation since 1971? [i.e., have expected real interest rates remained fairly constant at about 1%?]

(2) Can you think of macroeconomic situations where the interest rate-inflation model could not have worked well? Why?

(3) If we had another bout of high (expected) inflation, do you think that stocks would do as poorly again? Why or why not?

### Short-term Interest Rates as Predictors of Inflation: 1916-91

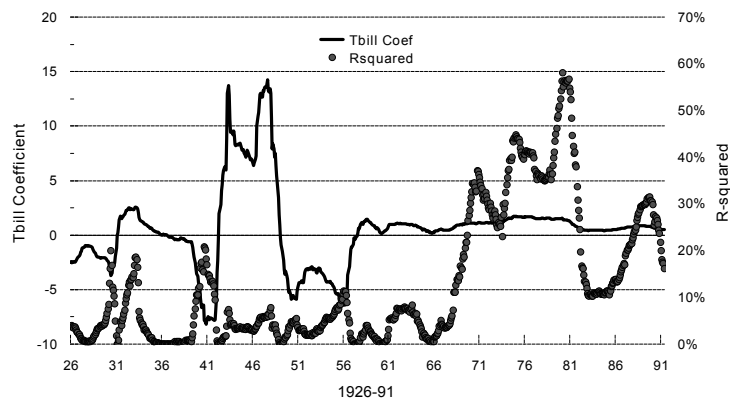
Estimate the regression:

$$\rho(t) = \alpha + \beta B(1,t) + \varepsilon(t), \quad t=1,\dots,T$$

using 10 years' worth of monthly data on inflation  $\rho(t)$  and one month Treasury bill yields  $B(1,t)$

- then plot the estimates of  $\beta$  and  $R^2$  for month  $T+1$
- ▶ e.g., use 1916-25 to estimate  $\beta$  and  $R^2$  for January 1926

### Short-term Interest Rates as Predictors of Inflation: 1916-91



### Short-term Interest Rates as Predictors of Inflation: Summary

1953-71 was a period where expected real interest rates were remarkably constant. Since

$$\begin{aligned} E[r(t)] &= B(1,t) - E[\rho(t)] \\ &= B(1,t) - [\alpha + \beta B(1,t)] \\ &= -\alpha + [1 - \beta] B(1,t) \\ &= -\alpha, \text{ when } \beta = 1. \end{aligned}$$

When  $\beta$  doesn't equal 1, or if past inflation also helps predict  $\rho(t)$ , then the expected real rate of return varies over time

### Short-term Interest Rates as Predictors of Inflation: Summary

The chart on the next slide shows the one month nominal interest rate,  $B(1,t)$ , the expected inflation rate,  $E[\rho(t)]$ , and the expected real return on Tbill,  $E[r(t)]$

where the expected inflation rate comes from a regression of current inflation on 12 lags of monthly inflation and the current Tbill yield, using the last 10 years of data

$$E[r(t)] = B(1,t) - E[\rho(t)]$$

Fama's sample period of 1953-71 was unusual in that  $E[r(t)]$  seemed relatively constant

### Nominal Interest Rates, Expected Inflation & Real Interest Rates

