FRBSF Weekly Letter

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Money and the Fisher Effect

Although nominal or market interest rates are published daily, it is the anticipated real, or inflation-adjusted rate that determines individual and firm behavior. This distinction between real and nominal interest rates dates back at least to Irving Fisher, a distinguished early 20th-century economist. Abstracting from taxes, Fisher emphasized that the nominal rate is the sum of the expected real interest rate and the expected rate of inflation.

Changing expectations of inflation, therefore, can affect nominal interest rates dramatically. The sharp rise in long-term interest rates since January this year has been attributed by many analysts to upward revisions in the market's expectations of future inflation rates prompted by increases in the actual rate of inflation. Long-term interest rates (on 30-year U.S. government bonds) rose 140 basis points from 7.4 percent in January to 8.8 percent in May, while the rate of consumer price increases on a year-over-year basis rose 160 basis points to 3.8 percent.

Numerous other episodes of increases in inflation rates have not, however, been associated with rising interest rates. Viewed from a long historical perspective (shown in Chart 1), the linkage between inflation and interest rates has often been weak and seemingly unstable. In this *Letter*, we offer new insights, based on the changing relationship between money supply growth and inflation, into why the Fisher effect has appeared to be so unstable.

The Fisher effect

According to Fisher, in a world in which the real rate were constant, variations in nominal interest rates would be due solely to variations in anticipated inflation. That is, a one-percentage point increase in the expected rate of inflation, holding constant the real rate, would result in a one-percentage point increase in the nominal rate — a phenomenon known as the Fisher effect.

The theory underlying the Fisher effect relies on the notion that individuals do not suffer from money illusion, that is, that they are concerned about the real goods and services that money can buy, and not about money itself. People are concerned with the real, not nominal, rate of interest because the real rate represents the expected future purchasing power of the returns from an initial outlay of funds. For example, the expected real return on a default-free bond paying 10 percent interest would be two percent if prices were expected to rise at an 8 percent rate.

The expected real interest rate, not the nominal rate, therefore is a key determinant of economic behavior because individual investors and savers are concerned with the real returns (future purchasing power) yielded by their investments, borrowers are concerned with the real cost of future payments, and firms are concerned with the real cost of funds in evaluating their investments.

Although the nominal rate is known with certainty, the future rate of inflation and, hence, the expected real rate are not. Investment, saving, and borrowing decisions must, consequently, be made with a degree of uncertainty because of the uncertainty regarding the real rate. When nominal rates change, it is this very uncertainty about future inflation that makes it difficult to determine whether the real interest rate has changed. However, if future inflation were easily predictable and the Fisher effect held strongly, there would be less uncertainty regarding real returns on investments.

Lack of evidence

Surprisingly, there is only weak statistical evidence of the Fisher effect's existence. For example, for the period from 1860 through 1939, there is no statistical evidence of a Fisher effect. Similarly, even during the early post-war period (up until 1960), many researchers have been unable to find strong statistical evidence of a Fisher effect in the U.S. This seeming lack of a relationship for the 1870-1960 period is illustrated in Chart 1.

The lack of evidence may be due to two major difficulties in testing for the Fisher effect. First, real rates need not be constant. Changes in technology, demographics, preferences, and real

commodity prices can, for example, alter real interest rates. Second, Fisher hypothesized a relationship between *expected,* not realized, inflation and interest rates. Since market expectations about inflation cannot be observed directly, it is difficult to determine whether market participants are behaving as Fisher hypothesized.

To illustrate the difficulties in testing for the Fisher effect, consider the most extreme case in which all market participants do behave as Fisher hypothesized but changes in the inflation rate are purely random and therefore not predictable. In this case, expected inflation would be constant even though actual inflation might be quite variable. Observed variations in the actual inflation rate (consisting solely of random forecast errors) therefore would be unrelated to the expected inflation rate (which would be constant). As a result, there would be no observable relationship between (the unpredictable) variations in the inflation rate and variations in interest rates. Moreover, there would be no statistical way of testing whether interest rates varied with expected inflation when expected inflation itself was constant. (However, this is not to say that the degree of volatility of inflation itself might not be positively associated with the level of nominal interest rates.)

This extreme case suggests that we could expect a tighter relationship between actual and anticipated inflation during periods when movements in inflation are highly regular and easily predictable. Realized or actual inflation under those circumstances would serve as a reliable proxy for expected inflation, and thus a closer relationship between actual inflation and interest rates would be observed.

Empirical evidence seems to support this conclusion. Statistical work by economist Robert Barsky suggests that inflation during the 1860-1930 period in the U.S. was largely unpredictable. That is, changes in inflation tended to be random. As a consequence, Barsky found little evidence of a Fisher effect during this period. Benjamin Klein, in earlier work, made essentially the same point. He found that during the gold standard period in the U.S. (1880-1915), the price level fluctuated randomly from year to year around a constant level. Since these changes in inflation were unpredictable (and expected inflation was constant), there was no relationship between actual inflation and nominal interest rates.

Money and inflation

Our study of the Fisher effect is based on the belief of most economists that there is a strong link between money supply growth and inflation. In particular, given money demand, expected inflation to a large extent depends on expected money supply growth in the future.

This linkage is based on theoretical underpinnings connecting money supply and demand growth with price level determination, as well as on a large body of statistical evidence covering the U.S. and international experiences. Although numerous other factors — such as oil-price shocks, exchange rate shifts or crop failures — may have significant short-term effects on inflation, money growth is the most widely recognized factor behind long-term inflation trends.

The process governing money creation can thus have an important impact on the predictability of inflation and hence, on whether a Fisher effect can be observed. In particular, during a period when money supply growth is highly predictable, inflation also will tend to follow a predictable pattern. And, because expected inflation depends on expected future money growth, we should be able to obtain a reasonably accurate forecast of inflation during periods when money can easily be forecast.

This means that we should be able to observe a Fisher effect during periods when money growth is predictable. The upshot is that estimates of the Fisher effect that include periods during which money and inflation cannot be forecast may show a very small Fisher effect even though the effect might actually hold very strongly.

As an example, consider whether a Fisher effect likely could be observed in a gold-based monetary system. Since the quantity of gold supplied depends on demand and supply conditions for gold production, the price level should be predictable over the long run because growth in the supply of gold is predictable over the long run. (In fact, there is evidence that the price level over the long run is relatively stable under a gold standard.) Yet unexpected gold discoveries or temporary increases in gold demand can cause short-run random fluctuations in the price level. Since such fluctuations by definition are unexpected, they may lead to unpredictable effects on inflation as well. (Predictable fluctuations would be incorporated into the current price of gold and thus would not affect the price level in the future.) This unpredictability of short-run inflation may explain why researchers have been unable to observe a Fisher effect under a gold-based monetary system.

Chart 1
Inflation and Interest Rates
1870 - 1986

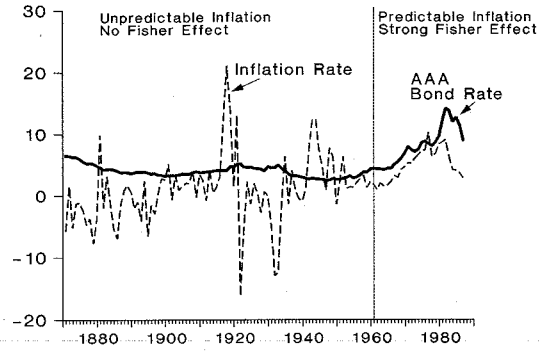
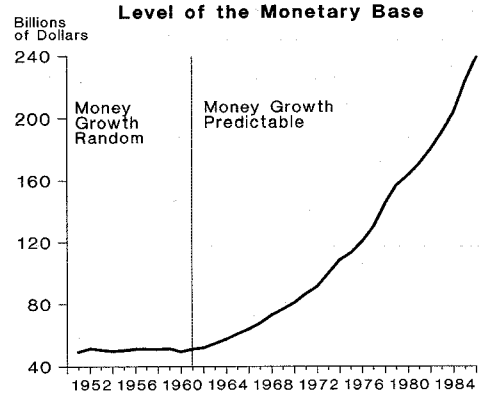


Chart 2
Level of the Monetary Base



Shift in the money supply process

We recently conducted a test for the Fisher effect using data from the post-1951 period, when the U.S. Treasury and the Federal Reserve agreed ("The Treasury Accord") to release the Fed from its obligation to try to fix interest rates on new U.S. Treasury issues. Since 1951, in other words, the Federal Reserve has in principle been allowed to determine the growth of the monetary base (currency plus bank reserves) independent of Treasury debt financing needs and fiscal policy.

As part of the test, we tried to distinguish possible shifts in the money supply process that may have precluded observation of the Fisher effect. We found that the statistical relationship between current and past money supply growth was very different between the periods 1951-1960 and 1961-1986. Money growth, to a large extent, was unpredictable (on the basis of past money growth) during the earlier period, and highly predictable during the later period.

The shift in 1960 is evident in Chart 2. The monetary base fluctuated randomly around a fairly stable level from 1951 to 1960, at which point the base began to grow exponentially.

This pattern suggests that we would likely observe a weak link between past money growth and inflation during the early, pre-1960 period, and a much stronger link between the two during the later post-1960 period when money growth was predictable. In fact, our statistical tests did not show any evidence of a significant cumulative impact of money on inflation during the early period but did show a strong effect during the later period. During the post-1960 period, we found that a one percentage point rise in money growth is matched by a one percentage point rise in inflation within a three-year period.

These findings could help explain why there is so little evidence of a Fisher effect prior to 1960. They also could explain why researchers using data from the entire post-war period have found weak Fisher effects. In contrast to the argument that financial markets only gradually learned their "Fisher" or that they were irrational, we attribute earlier doubt about the Fisher hypothesis to randomness and shifts in the money supply growth process.

Evidence of the Fisher effect

Consistent with the greater predictability of money and the stronger relationship between money and inflation during the post-1960 period, we found much stronger evidence of a Fisher effect then. In fact, during the post-1960 period, we found that a 1 percentage point increase in expected inflation resulted in a 0.9 percentage point increase in the nominal interest rate. These estimates of the Fisher effect using post-1960 data are larger than those of most other studies.

But more importantly, the evidence suggests that instability in the observed Fisher effect can be associated with shifts in the money supply growth process. In particular, the extent to which money can be forecasted, and hence inflation can be forecasted, will partly determine the extent to which the Fisher effect is statistically observable.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 7/15/87	Change from 7/8/87	Change from 7/16/86 Dollar	Percent[7]
Loans, Leases and Investments[1] [2]	205,352	− 884	6,360	3.1
Loans and Leases[1] [6]	182,441	− 461	905	0.5
Commercial and Industrial	51,928	− 547	325	0.6
Real estate	69,582	− 153	2,454	3.5
Loans to Individuals	36,865	148	− 4,166	− 10.1
Leases	5,431	0	− 67	− 1.2
U.S. Treasury and Agency Securities[2]	15,965	− 441	5,419	51.3
Other Securities[2]	6,945	17	− 427	− 5.7
Total Deposits	209,014	47	325	0.1
Demand Deposits	54,165	119	135	0.2
Demand Deposits Adjusted[3]	36,805	− 1,918	− 12,639	− 25.5
Other Transaction Balances[4]	19,737	− 236	3,256	19.7
Total Non-Transaction Balances[6]	135,112	165	− 3,067	− 2.2
Money Market Deposit Accounts—Total	44,770	76	− 2,390	− 5.0
Time Deposits in Amounts of $100,000 or more	31,810	− 7	− 4,046	− 11.2
Other Liabilities for Borrowed Money[5]	23,407	437	− 3,000	− 11.3

Two Week Averages of Daily Figures	Period ended 7/13/87	Period ended 6/29/87
Reserve Position, All Reporting Banks		
Excess Reserves (+)/Deficiency (−)	− 24	217
Borrowings	18	18
Net free reserves (+)/Net borrowed(−)	− 42	199

1 Includes loss reserves, unearned income, excludes interbank loans
2 Excludes trading account securities
3 Excludes U.S. government and depository institution deposits and cash items
4 ATS, NOW, Super NOW and savings accounts with telephone transfers
5 Includes borrowing via FRB, TT&L notes, Fed Funds, RPs and other sources
6 Includes items not shown separately
7 Annualized percent change