

Federal Reserve
Bank of
San Francisco

September 30, 1983

Are Markets Really Efficient?

J.M. Keynes, in Chapter 12 of his book *The General Theory*, used a metaphor to describe the importance of psychology in determining stock prices. Keynes likened the process by which the investors value shares to popular newspaper contests of the 1930s in England. The prize was awarded to the competitor whose choice of the prettiest beauty contestant most nearly corresponded to the average preferences of all the competitors taken together. The contest then became "not a case of choosing those which, to the best of one's judgement are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects average opinion to be."

His critique of financial markets was an important justification for proposing government intervention in depressed times. The gambling nature of investors, made up of unstable psychological factors, was seen by Keynes as creating problems for an economy. He believed that these speculative influences on stock and bond prices often discouraged productive investment. For this reason, he forecast that the government would have to take a more active role in encouraging investment, perhaps by undertaking more of investment directly, rather than leaving it to the vagaries of the speculative psychology of the private market.

Whether Keynes' representation of the stock market is accurate is still an unresolved issue in economics. Most financial economists disagree with the idea that financial markets can be irrationally influenced by psychological factors. Instead, they claim that asset price movements are the results of changing market expectations of relevant economic factors. According to this *efficient markets* hypothesis, investors use all available infor-

mation about the fundamentals determining stock and bond prices in buying these assets. Moreover, the power of profit-seeking arbitrage prevents any market participants from continually earning excessive profits by ensuring that incorrectly valued assets are systematically discovered and bought or sold until their prices are brought into line with their correct underlying value.

This *Letter* examines some current arguments in support of Keynes. These arguments and their supporting evidence contend that prices in the stock, bond, and financial futures markets vary too much in the short term to be justified by changes in people's expectations of the fundamental, underlying determinants of the values of these financial instruments.

Market efficiency

The theory of efficient markets does not require everyone to process new information quickly and accurately. Indeed, the theory suggests that for most investors no excess profits will be made from spending resources in such analysis. Since asset prices rapidly reflect all relevant information, one cannot systematically better the overall rate of return without also having systematic access to superior information. The best strategy for most participants is to buy and hold a well-diversified portfolio of securities. The theory, however, *does* require that, at the margin, where prices are determined, rational agents exist to determine asset values correctly, and that these agents are sufficiently rewarded for their efforts.

Frequently used tests of whether financial markets correctly process information involve searching for methods of earning "excess" profits, either through discovering a successful trading rule or by finding some significant correlation between excess returns and past observable information. However, some have questioned the ability

Research Department
Federal Reserve
Bank of
San Francisco

Opinions expressed in this newsletter do not necessarily reflect the views of the management of the Federal Reserve Bank of San Francisco, or of the Board of Governors of the Federal Reserve System.

of these tests to prove or disprove the theory. When applied to artificially generated data of asset returns that incorporate some form of market inefficiency, e.g., persistent excess returns, these tests sometimes wrongly accept the hypothesis that the "market" is efficient in the pricing of these assets.

Recently, an alternative form of test of market efficiency has been developed that looks at the movements of asset prices relative to the movements of their fundamental determinants. These volatility tests, as they are called, seek to judge whether the observed variability of prices can be justified in terms of the volatility of the underlying determinants. Unlike those discussed above, these tests do not directly address the same issue of whether excess profit opportunities exist. Instead, they question rationality by testing whether asset prices over-react to the arrival of new information.

Stock and bond markets

Theory says that the value of a firm's stock, and hence the price investors should be willing to pay for it, should be equal to the discounted value of its current and expected future earnings. Today's stock price for a firm therefore should be a weighted average of present and future earnings, where the weights depend on how far in the future the earnings occur. (Earnings far in the future, for example, will get a relatively low weight because they will be heavily discounted compared to earnings generated sooner.) The intuition behind volatility tests is that a stock price, because it is an average, should move less than the individual earnings components that comprise it. Limits can then be derived from theory for how variable stock prices should be in relation to the variability of the underlying earnings.

For the stock market, Robert Shiller of Yale University used a real dividend series of stocks as a proxy for earnings, and calculated from the variability of those dividends around their long-run growth path a limit on the corresponding variability in the value of

the stock. Comparing his result with stock prices, he found that the latter move too much for their movements to be attributed to new information about future real dividends.

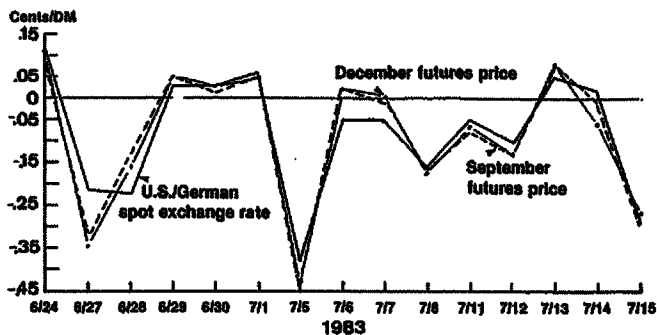
Shiller used the average real return on stocks over two sample periods (1871-1979 and 1928-1979) as the discount rate for calculating the present value of the stocks. Changes in the discount rate used by investors could add to the volatility of stock prices, but Shiller argued that the variability in real returns that would be necessary to justify the observed variability of stock prices was unreasonably large. It was much larger, for example, than the observed variability of short-term nominal interest rates. Shiller claims that nominal rates should be expected to be more volatile than real rates, thus making it difficult to accept changes in discount factors as an explanation for the high variability in stock prices.

Shiller performed similar tests for the bond market. According to the expectations theory of the term structure of interest rates, long-term rates can be approximated by an average of short-term rates expected over the maturity of the bond. To clarify his point, Shiller first calculated a "pseudo" long-term rate using *actual* subsequent short rates. The resulting series of "rationally" derived long rates was strikingly more stable than that observed. His tests conclude that the volatility of observed yields (and hence prices) on bonds also appears to be excessive relative to what a rational model of bond pricing would suggest.

Information in market forecasts

Some analysts believe that the volatility of futures prices suggests market inefficiencies as well. One implication of efficient markets is that a futures contract on a financial instrument is an unbiased predictor of that asset's expected price, properly discounted and adjusted for uncertainty and transaction costs. Market participants are supposed to use all available information, and create the best forecast when agreeing to deliver the

CHANGE IN SPOT EXCHANGE RATE VS. CHANGE IN FUTURES CONTRACTS



underlying asset at some future date. Efficiency requires any divergence of the eventual price from this predicted price to be uncorrelated with past information. If this were not the case, there would be an opportunity to use this information to make extra profits.

Various studies indicate, however, that futures prices, while unbiased estimates of subsequent spot prices, frequently are no more accurate than a simple extrapolation of the current spot price. In other words, today's spot rate seems as good a guess of the future as the futures prices, suggesting perhaps that—unlike what an efficient markets view would argue—participants in futures markets make little effort to forecast prices.

The similarity of futures price and spot price behavior can be seen in the chart. From an efficient markets hypothesis, futures prices should move less than their corresponding spot prices. The change in price of the underlying asset over the length of a futures contract is the result of a number of daily changes, each in response to new information. A futures price should then not move nearly as much as the spot price because the value of each day's news is small in comparison to all that will be learned before the futures contract runs out. The chart plots daily changes from June 27 to July 15, 1983 in the U.S./German spot exchange rate and the value of its corresponding futures contracts due approximately two months and five months hence. The fact that differences in daily changes in the futures prices, in response to new information, compared to the corresponding changes in spot prices is insignificant relative to the daily volatility suggests that little in the way of forecasting is involved in the determination of futures prices.

The same phenomenon can be observed in the strong co-movements of long- and short-term interest rates. For long rates to go up as much as short rates implies that the market

expects the average of all future short-term rates to rise by a roughly comparable amount. Just like the futures market in foreign currency, the bond market seems to behave as if it believed today's short-term rate was the best guess for all future short-term rates. This implies that any movement in short rates is expected to persist, causing long rates to adjust accordingly.

Conclusion

How could financial markets fail to be rational? Experiments in the field of cognitive psychology have documented the tendency of individuals to over-react to new information when making decisions that involve calculating probabilities. Also, the difficulty economists have in testing rationality implies that the market itself may have trouble deciding which movements of prices are in line with changing economic fundamentals. And even those who succeed in correctly processing information will not necessarily be rewarded for their efforts if the dominant majority is "irrational." When the market's psychology is strongly bent in one direction, contrary effort may not be profitable enough, when discounted, to be worthwhile. It may in fact be quite unprofitable.

The evidence presented agrees with Keynes' notion that inherently unstable psychological factors dominate financial markets at least some of the time. This evidence, though, has not been nearly enough to convince most financial economists to reject the theory of efficient markets. For instance, recent studies question the robustness of Shiller's results to modifications in his methodology and data. Also, the observed volatility can be rationalized as reflecting the inability of markets to forecast. Still, it appears the efficient markets hypothesis no longer occupies the practically unassailable position it once enjoyed.

Tom Klitgaard

Research Department
Federal Reserve
Bank of
San Francisco
 Alaska • Arizona • California • Hawaii
 Idaho • Nevada • Oregon • Utah • Washington

BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT
 (Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 9/14/83	Change from 9/7/83	Change from year ago	
			Dollar	Percent
Loans (gross, adjusted) and investments*	161,505	- 292	- 1,125	- 0.7
Loans (gross, adjusted) — total#	141,458	- 11	- 687	- 0.5
Commercial and industrial	43,058	- 7	- 2,620	- 5.7
Real estate	56,979	120	- 498	- 0.9
Loans to individuals	24,493	69	962	4.1
Securities loans	2,333	- 464	- 207	- 8.1
U.S. Treasury securities*	7,379	- 162	816	12.4
Other securities*	12,667	- 119	- 1,254	- 9.0
Demand deposits — total#	43,842	943	1,672	4.0
Demand deposits — adjusted	30,285	736	2,319	8.3
Savings deposits — total†	66,012	- 438	34,490	109.4
Time deposits — total#	67,321	120	- 32,102	- 32.3
Individuals, part. & corp.	61,520	101	- 28,042	- 31.3
(Large negotiable CD's)	17,544	- 112	- 19,466	- 52.6
Weekly Averages of Daily Figures	Week ended 9/14/83	Week ended 9/7/83	Comparable year-ago period	
Member Bank Reserve Position				
Excess Reserves (+)/Deficiency (-)	NA	138	88	
Borrowings	NA	64	142	
Net free reserves (+)/Net borrowed(-)	NA	74	- 55	

* Excludes trading account securities.

Includes items not shown separately.

† Includes Money Market Deposit Accounts, Super-NOW accounts, and NOW accounts.

Editorial comments may be addressed to the editor (Gregory Tong) or to the author . . . Free copies of this and other Federal Reserve publications can be obtained by calling or writing the Public Information Section, Federal Reserve Bank of San Francisco, P.O. Box 7702, San Francisco 94120. Phone (415) 974-2246.