

# Review of *Market Volatility* by Robert J. Shiller

*Much ado about . . . very little.*

*G. William Schwert*

**M**arket Volatility includes fifteen of Robert Shiller's previously published papers that deal with fluctuation in asset prices. There are three chapters that survey the literature on stock and bond price volatility, and a summary of Shiller's surveys of investors following the October 1987 stock market crash. An appendix lists some annual stock market data used in many of Shiller's papers.

My review has three distinct parts. First, I summarize the basic methods and results that are common to Shiller's work, including a discussion of the important criticisms that exist in the literature. Second, I identify the implications (or the lack thereof) of Shiller's work for financial practitioners. Finally, I speculate about why Shiller has become a guru in some segments of the financial community (as well as for frustrated macroeconomic policymakers).

## SHILLER'S METHODS

A common feature of Shiller's work on stock volatility is a comparison of the variability of stock prices with the variability of the cash flows received in the future by the stockholder. Shiller then asks whether the subsequently observed behavior of dividend payments on a broad portfolio of New York Stock Exchange-listed stocks can explain the changes in prices for that portfolio that are observed today. Even a casual reader of his work quickly understands that Shiller thinks stock prices vary too much, and he often asserts that this is evidence of market inefficiency.

Of course, since the early days of the efficient markets hypothesis, such as Fama's [1970] survey paper in the *Journal of Finance*, it has been recognized that tests of market efficiency are always conditioned on the model of equilibrium expected returns. In other words, you have to make some assumptions about how prices *should* behave if markets were efficient to identify behavior that is abnormal. If you make poor assumptions about "normal" behavior, you may conclude incorrectly that prices behave abnormally.

Much debate about the validity of Shiller's conclusions has focused on the adequacy of his assumptions about "normal" price behavior. To understand that debate, it is useful to look at Shiller's work in more detail. The engine that drives most of Shiller's analysis is the familiar present value model:

$$P_t = E_t \sum_{k=0}^{\infty} D_{t+k} \prod_{j=0}^k [1 / (1 + r_{t+j})]$$

where  $P_t$  is the price of the asset at time  $t$ ,

$E_t$  is the conditional expectation based on information available at time  $t$ ,

$D_{t+k}$  is the cash flow received by investors in period  $t+k$ , and

the real discount factor  $1 / (1 + r_{t+j})$  uses the one-period discount rate at time  $t+j$ ,  $r_{t+j}$ .

There is little debate about the validity of the present value model at this level of generality. It is the

simplifying assumptions that Shiller makes in his empirical work, and some issues concerning his use of statistical methods, that have sparked controversy in the academic literature. For this review, I illustrate Shiller's methods with simple examples.

Suppose that real discount factors are constant over time ( $r_{t+j} = r$ ), and that cash flows are drawn randomly from the same probability distribution every period. *In this example there is no randomness in asset prices*, because investors know that realizations of current cash flows have no implications for future cash flows (the assumption of randomness). Price is always equal to expected cash flows  $E(D)$  divided by the discount rate  $r$ , the familiar perpetuity model.

When discount rates are random, the expected value in Equation (1) is not a simple function of expected cash flows and discount rates because it involves products and ratios of random variables. Nevertheless, if cash flows and discount rates are drawn from the same joint conditional distribution each period, there should be no variation in prices over time because there is no information about future cash flows or discount rates contained in past realizations.

Thus, in present value models such as Equation (1), the randomness in prices over time must be attributable to changes in cash flows, discount rates, or other information that have implications for future values of cash flows or discount rates. In fact, the motivation for the early efficient markets models of security prices is the insight that price *changes* would be random if discount rates are constant and the *level* of future cash flows changes randomly through time.

In this example, changes in cash flows are random, but the level wanders around through time. A specific case is when cash flows follow the random walk model:

$$D_t = D_{t-1} + u_t \quad (2)$$

where dividend changes  $u_t$  are drawn randomly from a constant probability distribution.

If discount rates are constant, asset prices also will follow a random walk with  $P_t = D_t/r$  (because  $E_t D_{t+k} = D_t$  for all  $k > 0$ ). Non-stationary processes like the random walk in Equation (2) imply that dividends and prices do not have long-run levels to which they return. Every random shock  $u_t$  becomes a permanent part of the level of the series. It is not meaningful to talk about the mean or variance of the level of dividends or prices. Nevertheless, the standard deviation of price *changes* will be proportional to the standard deviation of *changes* in cash flows,  $\sigma(\Delta P_t) = \sigma(\Delta D_t)/r$ .

As Shiller points out in his Chapter 6, Equation (I-3), a more general bound for the variance of changes in prices is

$$\sigma(\Delta P_t) \leq \sigma(\Delta D_t) / [2r^3(1+2r)] \quad (3)$$

and this bound is not violated in Shiller's data.

The table shows the sample standard deviations for dividend and price changes from 1871-1983. It also shows the standard deviation of price changes implied by the random walk model for dividends in Equation (2) and the bound in Equation (3) for different levels of the annual real discount rate  $r$ .

TABLE 1  
Standard Deviations of Stock Price Changes and Dividend Changes

Bounds Implied by Different Discount Rates		
Std Dev of Price Changes $\sigma(\Delta P)$	Annual Discount Rate $r$	Shiller's Upper Bound on $\sigma(\Delta P)$ , Eq. (3)
1.40	0.10	2.86
1.56	0.09	3.38
1.75	0.08	4.06
2.00	0.07	5.01
2.33	0.06	6.36
2.80	0.05	8.44
3.50	0.04	11.91
4.67	0.03	18.50
7.00	0.02	34.32
14.00	0.01	98.02

Historical Std Dev of Dividend Changes  $\sigma(\Delta D)$ : 0.14  
Historical Std Dev of Price Changes  $\sigma(\Delta P)$ : 7.53

This evidence shows that the historical standard deviation of dividend changes is consistent with a real discount rate of about 2% per year if discount rates are constant and dividends follow a random walk. It shows that Shiller's bound in Equation (3) is not violated for annual discount rates below about 5.5% per year. If discount rates vary over time, there will be additional reason for prices to vary, so the measured standard deviation of price changes would be consistent with even larger real discount rates.

Of course, even if some of Shiller's bounds are violated by point estimates, this is not evidence of *excess* volatility of stock prices. These estimates contain substantial sampling error, and several authors have noted that some versions of Shiller's tests are subject to substantial bias as well as sampling error. So, Shiller's inferences about *excess* volatility are often fragile.

Several classes of problems with Shiller's empirical work have been identified. First, the issue of whether dividends (and prices) have a stationary distribution is very important. Most of Shiller's early work explicitly assumes that stock prices vary randomly around an exponential time trend. Several authors, notably Kleidon [1986], have shown that the random walk model for dividends (and prices) has a large effect on the behavior of the tests.

Even Shiller in his later work (Chapter 8) drops the assumption that dividends and prices are stationary, and substitutes the assumption that dividend yields (D/P) are stationary. The assumption that nominal interest rates have a stationary distribution has similarly important effects on Shiller's tests of excess bond yield volatility (i.e., long-term interest rates fluctuate more than they should if short-term interest rates are stationary).

A second issue that has received considerable attention is Shiller's use of aggregate dividends to proxy for cash flows in Equation (1). As Marsh and Merton [1986] note, there is a large corporate finance literature that argues that firm dividend policy is a matter of managerial choice (indeed Franco Modigliani and Merton Miller have won Nobel Prizes in Economics for this work). Because dividends are discretionary, there is reason to believe that they are smoother than the underlying cash flows that would be paid to stockholders if payout ratios were always equal to 1. Given this fact, and because aggregate earnings data have larger fluctuations than aggregate dividends, most financial economists do not find it surprising that Shiller's tests sometimes find *inadequate* volatility in dividends (which he calls excess volatility in stock prices). Moreover, the recent wave of share repurchases, leveraged buyouts, mergers and acquisitions has created large cash flows to stockholders that Shiller's dividend series does not capture.

A third issue is the question of time-varying discount rates. Shiller's early work assumes that discount rates are constant over time ( $r_{t+j} = r$ ). This is roughly consistent with the early random walk tests for stock price behavior (which test whether returns to stocks vary randomly around a constant average value). In some later work, though, Shiller tries to generalize his tests to allow for some amount of time variation in expected returns to assets. Time-varying discount rates, of course, will increase the volatility of stock returns.

In Chapter 4, Shiller concludes that evidence in recent work by Fama and French [1988a,b] and Poterba and Summers [1988] is consistent with excess volatility of stock prices. My interpretation is that these papers show further evidence that discount rates are not constant over time.

This is not a new theme. I have written at least three papers showing evidence of time-varying expected returns (Nelson and Schwert [1977], Fama and Schwert [1977], and French, Schwert, and Stambaugh [1987]), and there are many other related papers in the finance literature. The common theme in these papers is that there are small predictable movements in stock returns (so the random walk model is not literally true).

To interpret this evidence, however, we must postulate what kinds of predictable movements in stock returns are attributable to factors that affect equilibrium expected returns to assets, such as risk, inflation, and investment opportunities in real asset markets. It is clear from his book that Shiller interprets this evidence as showing excess volatility of stock prices. Another clear interpretation is that time-varying discount rates are one possible explanation for predictable movements in stock returns.

Most of the papers in Shiller's book use some version of variance bounds tests. The other chapters discuss survey evidence concerning investors' perceptions of values and volatility in stock and real estate markets, or they discuss "psychological models" for asset price behavior.

I have little to say about the surveys. There is a long tradition in economics emphasizing the importance of studying how people behave, rather than asking them how they think they behave. For example, the question "Do you maximize profits?" will typically receive a different answer from the equivalent question "Could you make more money by raising or lowering the price of your products?"

Shiller's attempt to generalize economic models of securities markets based on rational self-interested agents is interesting, and there have been several subsequent attempts to develop behavioral models of security markets. I am not yet aware of testable implications that come from these models. Likewise, it is not clear to me how one would use these models to improve one's performance as a money manager.

#### IMPLICATIONS FOR PRACTITIONERS

Although Shiller spends much time implying that *excess* volatility of stock, bond, or real estate prices implies market inefficiency, he never makes the leap to suggest how a smart money manager might profit from his evidence. Indeed, his empirical work implies that the kind of trading rules Shiller would advocate involve market timing or "strategic asset allocation." For example, if aggregate dividend yields seem too low, perhaps because stock prices are too high, the implied strategy is to move out of stocks into bonds. As Samuelson [1990] notes, the costs of such strategies can be substantial. Moreover, if the

trading rules simply identify periods when *equilibrium expected returns or risk premiums* are low, there is no benefit to investors from switching out of stocks (i.e., investors are compensated appropriately for the risk they will bear in the next period, given alternative consumption and investment opportunities).

Another interpretation of Shiller's work is that simple dividend discount models do not work well to explain the behavior of aggregate stock prices. Likewise, simple term structure models do not work well to explain bond price behavior. Anyone who has tried to use such models to forecast stock or bond price movements should not be surprised by these conclusions. Yet I see no constructive prescriptions for how money managers should behave. I also see little reason to equate these conclusions with a failure of the efficient markets hypothesis.

#### WHY IS SHILLER A GURU?

I have read several reviews that attribute fundamental insights to the articles in this book. On the back cover of the book jacket, Paul Samuelson is quoted as saying ". . . the level of the whole market displays no demonstrable macroefficiency. Bob Shiller is (the) key economist in this great debate. . . . Learn what the October 1987 crash was all about." Bruce Wasserstein says, "Professor Shiller's book offers the fresh insight of a new realism on how markets are not completely rational and efficient; an invaluable perspective to professionals in the field."

Peter Spiro [1990], in the *Financial Analysts Journal*, says "Robert Shiller's research in the past dozen years has made him one of the most widely respected academic authorities on financial markets. . . . Shiller gained fame as the leading counterrevolutionary against the rational expectations/market efficiency paradigm. . . . Many financial analysts never fully accepted this paradigm and one could say that Shiller has proved what most people working in the financial markets have known all along." Spiro follows these comments by concluding, as I have, that Shiller has little positive guidance to offer financial professionals.

Why do so many people embrace Shiller's papers with such enthusiasm, despite the criticism his work has received in the financial economics literature? I will now enter onto Shiller's playing field by trying to be an amateur social psychologist. I think that a large part of the demand for Shiller's work derives from the strong desire among members of the financial community to believe that security markets are inefficient (as reflected in the quotation from Spiro). If market efficiency means that financial analysis is of limited value, it is not surprising that mem-

bers of that industry would react positively to someone with academic credentials like Shiller's who loudly claims that markets are inefficient. This is a natural outcome of self-interest.

Yet the evidence produced by Shiller has little or nothing to do with the kind of work done by most analysts. He does not address or refute the evidence that stock and bond prices react quickly to reflect new information in an unbiased way. He does not give any reason to believe that active money managers, as a group, can outperform passive indexed investment strategies. In fact, none of his work involves individual securities or even subsets of securities. Rather, Shiller repeatedly asserts that the volatility of aggregate stock and bond returns is "too large."

As I indicate above, this can only have implications for money managers who are market timers. This makes Paul Samuelson's generous praise on the jacket of Shiller's book seem most puzzling, given the context of his recent *Journal of Portfolio Management* article warning against the folly of market timing.

In short, I think that the wide acceptance of Shiller's work and his elevation to guru status has little to do with the scientific merits of his work. Rather, there is a large audience that likes the conclusions he draws from his work ("the market is inefficient"), although these conclusions are essentially unrelated to the usual meaning of market efficiency in the finance literature. I choose the word "guru" because I sense that Shiller followers have almost a religious attachment to his conclusions, even though the logical structure of his analysis has little to do with the day-to-day problems these people face in their jobs.

In my introduction I mention that macroeconomic policymakers have also welcomed Shiller's work with open arms. Indeed, his work has been widely cited in the macroeconomics literature as proving that stock and bond markets are irrational. The usual next statement, which is a non sequitur, is that this provides a rationale for active management of monetary or fiscal policy. In other words, investors in stocks and bonds can be fooled by government policy actions.

As I note for financial analysts, I believe that these post-Keynesian macroeconomists are expressing pent-up frustration from their years of battle with rational expectations economists. Shiller's evidence has nothing to do with the reaction of stock or bond prices to macroeconomic policy decisions, just as it has nothing to do with the speed of adjustment to firm-specific information.

Thus, I conclude that Shiller's status as a hero to financial analysts and post-Keynesian macroeconomists derives paradoxically from the vast impact

that the efficient markets/rational expectations research has had on a variety of real world issues. The constituents who are threatened by the voluminous evidence that asset prices reflect new information in a speedy, unbiased way have adopted Shiller as their savior. If this review does nothing else, I hope it causes a few of these adherents to think again about the logical relation (and the lack thereof) between their beliefs in market inefficiency and the evidence that Shiller provides.

Indeed, I know few financial economists who would identify Shiller's use of the present value model as a test of the "efficient markets model." Perhaps his greatest success has been in associating his variance bounds tests with the much broader and more important idea of market efficiency.

#### REFERENCES

Fama, Eugene F. "Efficient Capital Markets: A Review of Theory

and Empirical Work." *Journal of Finance*, 25 (May 1970), pp. 383-417.

Fama, Eugene F., and Kenneth R. French. "Dividend Yields and Expected Stock Returns." *Journal of Financial Economics*, 22 (October 1988a), pp. 3-25.

—. "Permanent and Transitory Components of Stock Prices." *Journal of Political Economy*, 96 (April 1988b), pp. 246-273.

Fama, Eugene F., and G. William Schwert. "Asset Returns and Inflation." *Journal of Financial Economics*, 5 (November 1977), pp. 115-146.

French, Kenneth R., G. William Schwert, and Robert F. Stambaugh. "Expected Stock Returns and Volatility." *Journal of Financial Economics*, 19 (September 1987), pp. 3-29.

Kleidon, Allan W. "Variance Bounds Tests and Stock Price Valuation Models." *Journal of Political Economy*, 94 (1986), pp. 953-1001.

Marsh, Terry A., and Robert C. Merton. "Dividend Variability and Variance Bounds Tests for the Rationality of Stock Market Prices." *American Economic Review*, 76 (1986), pp. 483-498.

Nelson, Charles R., and G. William Schwert. "On Testing the Hypothesis that the Real Rate of Interest is Constant." *American Economic Review*, 67 (1977), pp. 478-486.

Poterba, James M., and Lawrence H. Summers. "Mean Reversion in Stock Prices." *Journal of Financial Economics*, 22 (October 1988), pp. 27-59.

Samuelson, Paul A. "Asset Allocation Could Be Dangerous to Your Health." *Journal of Portfolio Management* (Spring 1990), pp. 5-8.

Spiro, Peter S. "Book Review: Market Volatility." *Financial Analysts Journal*, 46 (September-October 1990), p. 80.