



American Finance Association

Are Markets Efficient? Tests of Alternative Hypotheses: Discussion

Author(s): John Lintner

Source: *The Journal of Finance*, Vol. 36, No. 2, Papers and Proceedings of the Thirty Ninth Annual Meeting American Finance Association, Denver, September 5-7, 1980 (May, 1981), pp. 307-311

Published by: Blackwell Publishing for the American Finance Association

Stable URL: <http://www.jstor.org/stable/2327012>

Accessed: 27/11/2009 08:24

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=black>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Blackwell Publishing and American Finance Association are collaborating with JSTOR to digitize, preserve and extend access to *The Journal of Finance*.

<http://www.jstor.org>

simply confirm the opinion that the special assumptions he makes are too special for some purposes.

Are there any empirical implications deducible from the efficient markets hypothesis *without* the support of additional arbitrary assumptions? Without committing myself too much on what is “arbitrary”, I would say that there certainly are implications of this sort. As far as I can see, however, they *all* involve *comparison* of the price-dividend behavior of a given security or portfolio with *other* observations—usually the contemporaneous price-dividend behavior of other securities. How else is one to judge, for example, whether arbitrage profit opportunities exist and are systematically identifiable using contemporaneously available information? This kind of basic “efficiency” question simply can’t be answered by reference to the observed behavior of a single security or portfolio in isolation.

The price of a given security can, of course, be compared with a present value of its own predicted or actual future dividends. This comparison has no efficiency implications, however, unless the present value is computed in such a way that it is the contemporaneous market price of a related portfolio of other investments. This related portfolio is one whose future dividends are estimated, using available information, to be essentially identical to the future dividends of the security in question. In other words, the portfolio is estimated to be a one-for-one substitute for the security. Deviation of a given security’s price from the present value of its dividends computed in this way would be clear evidence of market inefficiency but such deviations obviously can’t be measured by looking only at the security in question.

Although I have questioned the relevance of the variance inequalities examined in this paper, I would like to emphasize the value of the hypothesis testing framework that Bob employs. Specifically, examination of the restrictions an hypothesis imposes on the sample likelihood function and derivation of the likelihood ratio test can clearly reveal the most restrictive empirical implications of the hypothesis. These implications are often not very obvious a priori. Bob’s pricing model provides a good example of this. Evidently, the variance inequalities implied by the model were not obvious to those of us who implicitly and explicitly asserted the model’s empirical validity long before Bob examined it. Had we viewed the model as a constraint on the likelihood function of a price-dividend sample, however, the variance inequality would have been forced to our attention. This is the essential virtue of a formal application of the likelihood principle. Even though the exact likelihood ratio test may be rather intractable, the qualitative information it conveys about the appropriate rejection region in the sample space is a valuable guide in selecting simpler tests.

DISCUSSION

JOHN LINTNER*: Shiller’s paper for this session summarizes and extends his recent work which has developed and exploited bounds on the volatility of speculative asset prices relative to the variance of critical elements of the information set, or to the rational expectations based on that information set, as tests of market efficiency. This work is making a highly constructive contribution

* Harvard University

to ongoing scientific research. Researchers must always be as concerned with the risks of failing to reject false hypotheses as with those involved in rejecting true ones. If some popular models which have not been rejected on the more usual tests now have to be abandoned because the data fail to satisfy Shiller's variance inequalities, the outcome should be viewed constructively as further stimulus to the development of more satisfactory models and hypotheses.

Until quite recently, most statistical tests of market efficiency have relied on regression techniques. A structural model of the determination of the economic data of interest (such as asset prices or interest rates or holding period yields) will be specified. A joint hypothesis that the specified model is correct *and* that markets are efficient implies that residuals must be orthogonal and that certain critical parameters must have particular values (e.g., zero or unity). Most researchers have been willing to accept the joint hypothesis specified so long as these necessary implications are not rejected by the data at hand at some rather arbitrarily chosen significance level. In effect, Shiller's work reminds us that the very randomness of most economic series reduces the power of the usual regression tests. The lower the signal-to-noise ratio in the available data, the lower the likelihood of rejecting a statement that the observed (estimated) values of the parameters in some models do not differ significantly from their theoretical values. But with such data the risks of type II errors can be very high. In principle, failure of the data to reject the orthogonality of residuals and the satisfaction of certain predicted values (e.g., zero or unity) for crucial parameters must be regarded as necessary, but in general not as sufficient, conditions for the acceptance of the model (including the efficiency specification).

Shiller's work exploits the potentially powerful insight that the randomness in data which reduces the likelihood of rejection on standard tests and thereby increases the risks of failing to reject joint hypotheses when they are false directly leads to other and often more powerful tests. He convincingly argues that the model *cum* efficiency specification imposes a set of upper bounds on the variance of observed prices or price changes, and that failure to satisfy these restrictions is in itself sufficient grounds for the rejection of any (joint) hypothesis being tested. While Shiller understandably devotes most of his papers to these new test statistics he is advancing, the underlying thrust of his work seems to be that any joint hypothesis must be rejected if it fails to satisfy *either* the standard regression tests *or* his new volatility tests.

Shiller is to be commended for the insights and contributions of his work to date, and he should be encouraged along with others to fill out and extend this work along several lines of development. I have three different but related suggestions and comments. First, I observe that since several variances are directly used in the usual tests of regression parameters and orthogonality, the relations between Shiller's new volatility bounds and the standard test statistics commonly used—and in particular, the relative power functions of each set of statistics—need to be much more fully explored. Shiller's paper does include some perceptive and useful analyses of the general likelihood functions involved in the alternative tests. He shows for instance that his tests will have greater power in some regions of the parameter space than the usual regression tests, and that in certain circumstances they will be more robust to data errors or misalign-

ments, but these investigations are still incomplete and should be carried much further.

Secondly, throughout this and his earlier papers, Shiller refers to his volatility bounds as tests of market efficiency. It is well known, however, that the standard "regression" tests are necessarily tests of the *joint* hypothesis of the validity of an assumed model *and* of market efficiency.¹ This is no less true of Shiller's alternative (or additional) tests. Whenever the maintained assumptions of the structural model used in a given study are contradicted by other evidence, violations of Shiller's variance constraints should be attributed to the inappropriateness or inadequacy of the model tested rather than to market inefficiency *per se*.

I believe this is the proper conclusion to be drawn from the models introduced in Shiller's paper today. As an illustration, the model in equation (1) assumes a strictly stationary process with constant expected real returns, real discount rates, ex ante growth rates and ex ante variances. Leaving aside whether real discount rates or ex ante growth rates are (or rationally should be expected to be) constant over time, let me just cite the evidence provided by Black (1976) and Merton (1980) and others using data on premiums in the option market that the ex ante variances of security returns in fact vary widely over time. Using the rational options pricing model, Merton also demonstrates that expected holding period yields must consequently also vary widely. Using this other confirmed evidence in our Bayesian prior, our posterior judgment must be that even Shiller's volatility tests of this model provide little evidence regarding market efficiency *per se*.

Finally, I would observe that Shiller just speaks of market efficiency without distinguishing among the several different meanings which have been attached to that important concept. Again referring to his tests of equation (1), in addition to the assumptions already noted, all market participants are assumed to have presciently known at *all* points of time *within* the sample period 1871–1976 what the "true" (ex post) values of all the (constant) relevant parameter values would turn out to be. This represents an extreme version of a rational expectations specification of market efficiency (Cf. Friedman (1979)). Fama (1970) and (1976) and others have advanced less demanding specifications of market efficiency which essentially require the exhaustion of all economic rents, *given* the information sets available at each point in time. If we believe information sets do change and that market participants do exhibit learning behavior, it is quite possible for the data to be consistent with such weaker specifications of market efficiency even though they would reject the stronger and more rigid forms often tested. The issue of which specification of efficiency best characterizes the data available from different markets is at least as important as the narrower issue of whether particular markets are efficient on some one specification.

The Cohn-Lessard paper is also basically concerned with the question of market efficiency, but the thrust of their work is rather different. While Shiller develops new tests and generally seeks to enrich our methodology in testing for market efficiency, Cohn and Lessard (CL) apply the standard regression tests to

¹ This must be true except where the tests of market efficiency or rationality are based directly on objective measures of expectations, as in Friedman (1978). See Abel and Miskin (1980).

the specific issue of whether stock market valuations have responded rationally and efficiently to the changes in corporate earnings and interest rates induced by inflation. The authors first establish that the negative impact of inflation on stock prices, well established by earlier work on U.S. data, also characterizes the equity markets of most other major industrialized countries. The well-known earlier paper by Modigliani and Cohn (MC) [1979] had concluded that increasing inflation has depressed American equity prices by roughly half of their theoretically justified values primarily because (a) investors (irrationally) fail to credit earnings with that part of nominal interest expense which is a return of capital and (b) they (irrationally) capitalize long-run profits, a real variable, at the nominal rather than the real cost of capital. Using substantially the same theoretical models and methodology, the present paper by Cohn and Lessard undertakes to determine whether the negative impact of inflation on equity values in other countries can be attributed to the same valuation errors.

This is a very useful and ambitious study of an important set of issues. The authors are to be commended for the care and sophistication with which they dealt with the serious problems created by different accounting and reporting standards and tax structures in different countries, and for the cautious but constructive statement of their conclusions in the final paragraph. Indeed, in my view such caution in drawing conclusions would have still been appropriate even if the results of the earlier MC study of U.S. data had been replicated in each other country by the present authors. As illustrations, both studies have based their estimates of the relevant leverage variable on balance sheet data, ignoring the fixed financial charges involved in leases and the off-balance sheet liabilities on private pension contracts. Both studies use the deviations of unemployment from its long-term mean as a proxy for the changing risk premiums required by investors on equity investments. Both studies include additional terms to smooth out cyclical fluctuations in "adjusted profits." The fact that this cyclical adjustment term differs in the two studies (and that CL add a growth term omitted in MC) is less important than the general observation that any failure to properly identify or measure any variable in such equations changes the size (and "significance") of the coefficients of particular interest (such as the a_1 and a_2 in CL's equation (8)).

Taking the MC and CL papers together, the evidence seems to justify a conclusion that the equity markets are not fully efficient and that both the valuation errors identified in MC are probably contributing to this inefficiency. Other independent evidence also supports these positions.² But the evidence is by no means clear that the degree of inefficiency is as great as these regression results suggest.³ Moreover, the efficiency shown by these tests may reflect inefficiency in the decision process within business firms rather than inefficiency within the stock market in valuing the cash flows generated within business units. While rational decision making within business firms should maintain real returns to equity while inflation increases, there is other evidence that the pricing policies of business firms actually fail to maintain these real returns,⁴ as assumed in the

² See, for instance, the discussion at pages 35–6 in Modigliani-Cohn, *op. cit.*

³ See, for instance, Richard Kopcke (1979).

⁴ See Lintner (1975).

models under discussion. This suggests that at least some part of the observed negative impact of inflation on equity prices must be attributed to such reductions in the real returns being capitalized, rather than to inefficiencies in the markets' valuations of any given set of these returns.

BIBLIOGRAPHY

- Andrew B. Able and Frederick S. Mishkin, "A Unified Framework for Testing Rationality, Market Efficiency and the Short-run Neutrality of Monetary Policy," University of Chicago, (mimeo., 1980).
- Fischer Black, "Studies of Stock Prices Volatility Changes," Proceedings of the 1976 meeting of American Statistical Association, Business and Economic Statistics Section, pp. 177-181.
- Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, May 1970, pp. 383-417.
- , *Foundations of Finance*, (Basic Books, 1976).
- Benjamin M. Friedman, "Survey Evidence on the 'Rationality' of Interest Rate Expectations," NBER Working Paper #261 (July, 1978), forthcoming in the *Journal of Monetary Economics*.
- , "Optimal Expectations and the Extreme Information Assumptions of 'Rational Expectations' Macromodels," *Journal of Monetary Economics*, January, 1979, pp. 23-41.
- Richard Kopcke, "Are Stocks a Bargain?," *New England Economic Review*, May/June 1979, pp. 5-23.
- John Lintner, "Inflation and Security Returns," *Journal of Finance*, May 1975, pp. 259-280.
- Robert Merton, "On Estimating the Expected Return on the Market: An Exploratory Investigation," NBER Working Paper #444, February 1980.
- Franco Modigliani and Richard A. Cohn, "Inflation, Rational Valuation and the Market," *Financial Analysts Journal*, March/April 1979, pp. 24-44.