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ASSET PRICING AND INTRINSIC VALUES: A REVIEW ESSAY

Bruce N. Lehmann

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ABSTRACT

The efficient markets hypothesis has dominated modern research on asset prices. Asset prices and their intrinsic values differ in inefficient financial markets but difficulties in the measurement of intrinsic value greatly complicate market efficiency tests. Reflections on the measurement of intrinsic value provide insight into the interpretation of existing evidence and suggestions for generating new evidence on market efficiency. This review essay on the state of knowledge about market efficiency focuses on *A Reappraisal of the Efficiency of Financial Markets*, analyzing the research areas from this perspective: (1) short-run stock return predictability; (2) asset pricing anomalies; and (3) excess volatility and present value relations.

Bruce N. Lehmann
Graduate School
of Business
Columbia University
New York, NY 10027
and NBER

It is open season on the efficient markets hypothesis. The accumulation of asset pricing anomalies, the debate over excess volatility and market overreaction, and the stock market crash of 1987 have all contributed to an intellectual environment which encourages the questioning of the efficient markets hypothesis. Recently, the North Atlantic Treaty Organization convened an Advanced Research Workshop on "A Reappraisal of the Efficiency of Financial Markets." From this five day conference held in Sesimbra, Portugal, a volume of the same name comprising some 800 pages has issued forth containing the 31 conference papers along with an overview paper by the conference organizers. The publication of this volume provides an opportunity to discuss the present state of knowledge about the efficiency of financial markets.

The efficient markets hypothesis has proven to be a powerful engine for intellectual growth in financial economics and we are accustomed to thinking of it as thoroughly modern, an intellectual viewpoint totally different from any that came before it. It is therefore interesting to note that the central issue in the market efficiency debate was well-expressed by Graham and Dodd (1934) more than a half century ago:

> In other words, the market is not a *weighing machine*, on which the value of each issue is recorded by an exact and impersonal mechanism, in accordance with its specific qualities. Rather should we say that the market is a *voting machine*, whereon countless individuals register choices which are the product partly of reason and partly of emotion. (p. 27).

A half century later, the question of whether the market is a "weighing machine" (i.e., efficient) or a "voting machine" (i.e., subject to fads and fashions) remains a matter of much contention.

There are four basic ingredients of efficient markets models, theories in which asset markets are "weighing machines." The first component is the perfect markets assumption, the absence of frictions like taxes, transactions costs, and constraints on short sales. The second element is the assumption of 'no free lunch,' that is, the absence of arbitrage opportunities. Third, investors are presumed to have rational expectations. Finally, discount factors embody investment opportunities and investor attitudes toward risk. Models which do not specify discount factors are generally not positive asset pricing theories.

Both advocates and opponents of the efficient markets hypothesis typically postulate that investors perceive no arbitrage opportunities in market prices. Given *a priori* restrictions on investor beliefs like rational expectations, no-arbitrage, no frictions models provide a framework for measuring the properties of postulated unobservable entities like intrinsic values, discount factors, or expected returns. Given *a priori* restrictions on discount factors, no-arbitrage, no frictions models provide a framework for measuring the properties of postulated unobservable entities like investor beliefs. Maintained hypotheses about discount factors are

required to settle the question of whether the market is a "weighing machine" or a "voting machine."

This essay makes two modest suggestions regarding the resolution of the market efficiency debate. First, plausible partial restrictions on discount factors or expected returns can help shed light on the efficient markets hypothesis in the absence of a complete theory of expected returns. Second, much has been and can be learned about market efficiency by studying large cross-sections of asset returns.

This essay is not comprehensive or exhaustive as a survey would be. Nor is it a review of the book—I can not hope to compete with its four surveys in the space allotted. Rather it provides an interpretation of selected, but representative, evidence on market efficiency along with some modest suggestions for future research. Accordingly, the paper is laid out as follows. The next section contrasts modern approaches to security valuation with older analyses of price and intrinsic value measurement. The subsequent three sections discuss three topics from this perspective: (1) short-run stock return behavior; (2) asset pricing anomalies; and (3) excess volatility and present value relations.[1] The final

[1]Uncovered topics include long-run mean reversion in stock prices, seasonal or calendar anomalies, and corporate finance issues like the underpricing of initial public offerings. The latter two topics received much attention in the NATO volume.

section contains concluding remarks.

1. Asset Prices and Intrinsic Values

The intellectual centerpiece of modern financial theory is the no-arbitrage approach to the valuation of uncertain income streams which assumes the absence of frictions like taxes, transactions costs, and constraints on short sales. The result is the general present value relation:[2]

$$P_{it} = \sum_{j=1}^{\infty} E^*[d_{it+j} Y_{t,j} / I_t]; \qquad Y_{t,j} > 0 \; \forall \; t,j > 0 \qquad (1)$$

where P_{it} is the price of a claim to the income stream d_{it+j}, d_{it+j} is income received from security i at time t+j, $Y_{t,j}$ is the pricing kernel (giving state prices per unit probability),[3] and the expectation operator $E^*[\cdot/I_t]$ reflects probability beliefs held conditional on information available at time t. There is no requirement of rational expectations—probability beliefs need only satisfy the general mathematical properties of an expectation.

This general present value relation embodies value additivity and covariance risk adjustments, two of the central elements of modern

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[2]See, for example, Rubinstein (1976) and Ross (1978). The definition of common information is implicit in (1)—I_t is the intersection (technically the 'meet') of investor information sets under asymmetric information. Note that this is a nominal, not a real, present value relation—nominal arbitrage opportunities are precluded by the no-arbitrage assumption.

[3]$Y_{t,j}$ is given by investors' intertemporal marginal utility functionals adjusted for inflation in asset pricing relations but is generally not unique in incomplete markets: constraints are placed on Arrow-Debreu prices but the assumption of no-arbitrage alone is generally insufficient to uniquely identify them in incomplete markets.

financial theory. The linearity of expectations implies value additivity and the celebrated Modigliani-Miller theorems on capital structure and dividend policy irrelevance that follow from the observation that the value of the income stream d_{it+j} is the sum of the values of claims to any arbitrary decomposition of this stream. In addition, the certainty equivalents of the cash flows d_{it+j} are based on the covariance risk adjustments underlying modern portfolio theory.

It is instructive to compare older analytical frameworks with the technically sophisticated no-arbitrage model. Two seminal books provide an excellent historical record: *Security Analysis* by Benjamin Graham and David Dodd (1934) and *The Theory of Investment Value* by John Burr Williams (1938). In fact, most of the conceptual foundations of modern theory were present in the older literature. Williams (1938) invoked present value relations like (1) with deterministic discount factors.[4] Similarly, both Graham and Dodd (1934) and Williams (1938) clearly understood Modigliani-Miller notions of capital structure irrelevance,

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[4]As is common, Williams increased discount factors to adjust for risk. I am not suggesting he understood (1)—in fact, he suggested that the riskless rate was the appropriate discount factor given plausible forecasts of future dividends. It is clear from Chapters 5 and 18 that Williams would have preferred pricing kernels based on production (i.e., marginal rates of transformation) to investor-based (i.e., marginal utility-based) ones. Graham and Dodd valued stocks based on price-earnings ratios and capitalization 'multipliers' but viewed these as reasonable approximations to the more complicated present value calculations.

which led Williams (1938) "to speak of the Law of the Conservation of Investment Value, just as physicists speak of the Law of the Conservation of Matter, or the Law of the Conservation of Energy" (p. 73).[5]

Accordingly, the no-arbitrage model (1) does not separate market efficiency from its precursors. The dividing line is the rational expectations assumption that the probability beliefs embedded in $E^*[\cdot/I_t]$ represent objective conditional expectations $E[\cdot/I_t]$. Hence, market efficiency implies the equality of price and objective fundamental or intrinsic value or, equivalently, that the market is a "weighing machine." By contrast, both Graham and Dodd (1934) and Williams (1938) thought it self-evident that market prices typically differ from objective or rational intrinsic values because the market is a "voting machine," a view typically held by modern opponents of the efficient markets hypothesis. The efficient markets hypothesis differs from the older tradition in the assumed link between intrinsic values and market prices, not on the sources of intrinsic value.[6]

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[5]By contrast, both thought dividend policy was important, primarily for moral hazard and signalling reasons.

[6]Graham and Dodd (1934) argued that prices fluctuate around intrinsic value. Williams (1938) thought stocks were typically overvalued by the winner's curse argument that stockholders tend to be the most optimistic investors (given binding short sales constraints). Not surprisingly, both books were largely devoted to extracting intrinsic value measures from imperfect accounting numbers for comparison with market prices.

The rational expectations—no frictions—no arbitrage version of the efficient markets hypothesis is a collection of joint hypotheses about the market environment and investor behavior. The environmental assumptions involve common information and the absence of frictions.[7] The behavioral assumptions are those of investor rationality, both with regard to their assessments of uncertain future prospects (i.e., $E[\cdot/I_t]=E^*[\cdot/I_t]$) and their exploitation of any perceived arbitrage opportunities (i.e., the positive state prices implicit in $Y_{t,j}$). As Fama (1970) forcefully argued, any test of this model is a test of these joint hypotheses.

This model is not a positive theory of asset pricing without an *a priori* theory of discount factors. In the absence of strong priors about expected returns, it is merely a framework for measuring properties of these discount factors. Put differently, the efficient markets hypothesis is indistinguishable from fads models where predictable fluctuations in asset prices are largely determined by waves of optimism and pessimism without strong prior restrictions on the behavior of $Y_{t,j}$. Nevertheless, the

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[7]The no frictions assumption plays a peculiar role in the efficient markets hypothesis since we would surely not view the presence of taxes or transactions costs as evidence of investor irrationality. Nevertheless, financial economists consider the no frictions assumption to be a reasonable approximation to real world financial markets in many applications. It is also technically convenient—frictions generally make discount factors investor and asset specific, although proportional taxes or transactions costs can usually be accommodated.

theory does make some predictions given the availability of plausible *a priori* restrictions on some aspects of expected return behavior. This approach has been taken in some of the research on market efficiency and other applications are suggested below.[8]

What follows is a brief review of the evidence on market efficiency from three areas: short-run equity return behavior, asset pricing anomalies, and the relation between *ex post* present values, prices, and excess volatility. In each area, additional assumptions are made about discount factors that further narrow the definition of market efficiency. My goal is to evaluate which assumptions are the most probable culprits in any rejections of these joint hypotheses or what additional ancillary hypotheses may be helpful. This is useful in assessing both the present state of the market efficiency debate and the prospects for future research.

2. Constant Expected Returns Models over Short Horizons

One of the most astonishing applications of the efficient markets hypothesis was Samuelson's (1965) "Proof That Properly Anticipated Prices Fluctuate Randomly," a prediction that arises when expected returns are constant. For many, the proposition that returns are unpredictable is synonymous with market efficiency. Of course, theorists have since

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[8]My focus is on potential inefficiencies related to beliefs (i.e., fads) and not on other possibilities like bubbles and finite horizons (i.e., irrational future investors might affect terminal prices and, hence, current prices).

explored the more general present value relation (1) which permits time-varying expected returns. Similarly, empirical researchers have studied return predictability at different horizons.

The constant expected returns model remains approximately synonymous with market efficiency in the important special case of short-run returns. As Merton (1982) and Sims (1984) have emphasized, expected return variation should be negligible in the limit of continuous trading.[9] Accordingly, the constant expected returns model should provide a good approximation for short time intervals like a day or a week in an efficient market. Many researchers continue to equate the unpredictability of returns with market efficiency over short intervals. Several papers in the NATO volume perform such tests in a variety of markets and the survey by Werner DeBondt is devoted in large part to existing evidence on the predictability of short-run returns.

Tests of constant expected returns models examine the moment condition:[10]

$$E[R_{it+1}-r_i/I_t] = 0 \qquad (2)$$

which, of course, means:

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[9]This occurs because the ability to bet frequently on large expected return movements over short horizons generates arbitrage profits in the limit of continuous trading.

[10]The translation of the present analysis to the case of constant expected excess returns is straightforward.

$$E[(R_{it+1}-r_i)z_{it}] = 0 \; \forall \; z_{it} \in I_t \tag{3}$$

where R_{it+1} denotes the gross return between t and t+1 and r_i is the expected gross return. The no arbitrage model (1) with constant expected returns implies that:[11]

$$E^*[(R_{it+1}-r_i)z_{it}] = 0 \; \forall \; z_{it} \in I_t \tag{4}$$

so that tests of (2) and (3) are tests of the joint hypotheses of constant expected returns, rational expectations (i.e., $E[\cdot/I_t]=E^*[\cdot/I_t]$), no frictions, and no arbitrage.

Any rejection of (2) and (3) can, of course, be attributed to any combination of their underlying assumptions. However, in the case of short-run return behavior, we can reasonably assume that expected returns are constant and that investors perceive no arbitrage opportunities.[12] Conditioning on these maintained hypotheses leaves two potential sources of rejection: violations of the assumptions of rational expectations and the lack of frictions like taxes, transactions costs, and short sales constraints.

The predictability of daily and weekly stock returns provides a good illustration of the importance of large cross-sections in learning about asset pricing regularities. Individual stock return autocorrelations are

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[11]The present value relation implies the single period expected return model $E^*[R_{it+1}Y_{t,1}/I_t] = 1$ and (4) follows if expected return variation is negligible over short periods like a day or a week.

[12]More precisely, changes in expected returns must contribute little to short-run return variation.

economically small but are often statistically significant and negative.[13] However, conditional autocorrelations are considerably larger—positive returns typically follow large negative returns and somewhat smaller negative returns often follow large positive returns, a frequently overlooked asymmetry. These observations hold for daily, weekly, and monthly intervals.

It is useful to interpret these kinds of price movements in terms of the industrial organization of stock markets. Mechanically, a large price change on the exchanges typically occurs in the following manner. If there is a large order imbalance (i.e., an excess of buy (sell) over sell (buy) orders), the specialist satisfies the initial imbalance out of existing limit orders and his own inventory. However, there is a limit (based on inventory costs, risk aversion, and fear of the information content of the order imbalance) to which the specialist will use his inventory to accommodate this demand for liquidity. Hence, a substantial demand for liquidity must ultimately be met by other investors, who must be concerned about the motives for trade of investors who have, on net,

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[13]The evidence for broad market indices is less clearcut. The substantial positive short-run autocorrelation in the average return of stocks remains the subject of debate. The largest daily declines in stock prices are often followed by substantial price increases. This effect is asymmetric—several of the largest price declines were followed by some of the largest price increases but the converse seldom occurs.

placed orders so large as to outstrip the specialist's risk bearing capacity.[14]

Large price movements might reflect the enthusiasm of uninformed, overly optimistic or pessimistic traders or the private information of informed traders about where asset prices are headed. Any potential trader can reasonably fear that the other party to the trade has special information about near-term asset prices and can reasonably hope that their motives for trade are unrelated to asset values such as their own unanticipated liquidity needs. The risk of loss to informed traders is reasonably viewed as a cost of trading.[15] Accordingly, the inability of the constant expected returns model to account for short-run return reversals can be attributed to a failure of the no-frictions assumption in a world where trade might be generated in part by speculative fads.

The analysis of short-run returns can potentially inform us about information arrival, the supply of liquidity, and other features of market microstructure but can probably teach us little about the overall relations

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[14]Market makers like specialists are best viewed as intermediaries between buyers and sellers who provide liquidity over very short intervals as part of the provision of intermediation services. Liquidity, however, is ultimately provided by the willingness of other investors to trade.

[15]My own (1990) evidence on arbitrage profits based on weekly return reversal portfolio strategies hinges on assumptions about transactions costs and the prospects of trading at measured prices (i.e., assuming measured returns would have been unaffected by this trading strategy). If the profits I calculated did represent an *ex ante* arbitrage opportunity, my results are compatible with the no frictions—no arbitrage assumptions and mistaken probability beliefs $E^*[\cdot/I_t]$ (i.e., all investors *perceived* no arbitrage opportunities in frictionless markets).

between price and value. In terms of the present value relation, these liquidity effects occasionally affect the short-run discount factors of a subset of stocks. Put differently, measured liquidity effects die out in days, weeks, or months, suggesting that they have little long-run influence on the social allocation of capital.[16]

More importantly, the Samuelson model, which has dominated research on the efficient markets hypothesis, makes sharp predictions about the stochastic properties of asset prices in the special case of constant expected returns, eliminating the need to construct estimates of objective intrinsic value for comparison with observed market prices. Yet the unpredictability of returns is necessary for market efficiency but is not a sufficient condition for price to equal objective intrinsic value.[17] Hence, liquidity effects cannot shed light on the fundamental question of whether price equals objective intrinsic value since they are measured with respect to the eventual level of prices and not of underlying intrinsic values.[18]

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[16]This may understate the social costs of illiquidity—stocks are listed on organized exchanges in part because they are relatively liquid and, hence, the impact of liquidity on the cost of capital in general may be hard to measure from listed stocks. In addition, substantial resources might be devoted to exploiting any market imperfections, which would also represent a social cost.

[17]In this context, it is interesting to note that asset prices typically converge rapidly to martingale behavior in experimental asset markets but often fail to converge to objective intrinsic value.

[18]Information in market microstructure models is always about near-term security prices, not about whether near-term prices will equal objective intrinsic values (although this is usually assumed).

3. Asset Pricing Anomalies

The first empirical cracks in the efficient markets edifice appearing in the academic literature involved asset pricing anomalies. In the last fifteen years, researchers have found numerous security characteristics that help explain expected stock returns usually after controlling for risk using linear models like the Capital Asset Pricing Model (CAPM) or the Arbitrage Pricing Theory (APT). A partial list of such characteristics includes firm size, dividend yield, price-earnings ratio, market-to-book value, and residual risk.

The price-earnings or earnings yield and size effects—the subject of an excellent paper by Don Keim in the NATO volume—provide a good example of the problems of interpretation that arise in the anomalies literature. Stocks with low price-earnings ratios (or high earnings yields) appear to outperform those with high price-earnings ratios even after CAPM or APT-style risk adjustments. Similarly, small firm returns typically exceed those of large firms, particularly in the month of January (and especially in its first four trading days). There are several several empirical features of these anomalies that muddy the waters.[19]

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[19]The effects are present in some time periods and not in others. The anomalies are hard to distinguish—firms with low price-earnings ratios are, on average, small firms that pay no dividends and have high residual or total return volatility. Numerous investigators have attempted to sort out these effects with inconclusive results.

From the perspective of this essay, the major uncertainty is the extent to which anomalies represent market inefficiencies. Anomalies simply define what was expected before they were uncovered. In the asset pricing literature, what was expected was the mean return given by linear models like the CAPM or the APT and what was unexpected were the higher than expected average returns of small, high earnings yield, high volatility firms. Assuming market efficiency, these firm characteristics reflect aspects of risk/return relations missed by these models. "Anomalies" reflect exposure to unspecified risk factors under this interpretation.

Consider, for example, the role of market-to-book value in asset pricing relations. The book value of owners' equity is the accountants' measure of capital—capital contributions at stock issuance plus retained earnings valued at historical cost. Ignoring capital measurement issues (i.e., historical cost need not equal current market value), the ratio of market-to-book value measures the perceived present value of the firm's growth opportunities (i.e., intangible assets or good will) which can be an important factor in determining the discount factors or expected returns appropriate for the firm. Accordingly, it is internally consistent to view measurement of market-to-book value effects as reflecting properties of expected returns in an efficient market.

A typical application, like Keim's in the NATO volume, involves the following kind of exercise. For each security i, the investigator posits an expected return model r^*_{it+1} and a vector of characteristics for each security $\underline{z}_{it}$ which represents some of the information available to investors at time t. The investigator measures the incremental effects of the characteristics by examining the sample moment condition:

$$\hat{\underline{\theta}} = \frac{1}{T}\sum_{t=1}^{T}\sum_{i=1}^{N}[R_{it+1} - r^*_{it+1}][\underline{z}_{it} - \underline{z}_t] \tag{5}$$

where $\underline{z}_t$ denotes the cross-sectional average value of $\underline{z}_{it}$ at time t.[20] In Keim's application, the expected return model is simple—all securities have the same expected return (i.e., risk neutral pricing). Keim found that there was a significant risk premium associated with earnings yield in all months of the year while the size effect remained largely concentrated in January as was found in previous research.[21]

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[20]Expected returns typically include a pricing intercept so that relations like (5) involve deviations from means. The estimates are weighted by the sums of squares and cross products of $\underline{z}_{it} - \underline{z}_t$ in cross-sectional regressions and the summands are multiplied by time and security specific weights for weighted and generalized least squares estimates. In addition, expected return models are typically estimated, a complication that does not affect the basic points made in the text. Note that the estimation of expected return models is complicated under heterogeneous beliefs. They might be measured from nonprice sources such as balance sheet data or from selected moment conditions about which investors are assumed to be rational. For example, a researcher could assume that investors perceived constant expected returns and were right on average, making unconditional mean returns unbiased estimators of discount factors.

[21]Keim's estimates are insensitive to the use of CAPM and APT models

Studies of this sort are unlikely to resolve outstanding differences in the market efficiency debate. If markets are efficient, parameter estimates like $\hat{\underline{\theta}}$ provide information about the errors in the expected return models r^*_{it+1}. Alternatively, these estimates reflect the difference between rational beliefs $E[\cdot/I_t]$ and average investor beliefs $E^*[\cdot/I_t]$ conditional on the expected return models and the no frictions and no arbitrage assumptions.[22] The earnings yield effect provides a clear example—earnings yield is a plausible indicator of intrinsic value and expected returns but its measured effects on returns might reflect discount rate changes or the overreaction of prices to earnings. One simply cannot tell whether markets react rationally or irrationally to indicators of intrinsic value without a more precise valuation model.[23]

This is an old observation—one cannot test market efficiency without plausible *ex ante* risk premium models. In principle, one can remain agnostic about rejections of these joint hypotheses but in practice

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for r^*_{it+1}. See also the papers by Cadsby on Canada, Hawawini, Michel, and Corhay on Belgium, and Levis on the UK in the NATO volume for international evidence on anomalies.

[22]Researchers usually study monthly or quarterly returns for which frictions are probably not too important.

[23]Similarly, observed links between expected returns across assets and measures of business activity are often regarded as suggestive of market rationality (see Fama (1990) and Cochrane (1991)). The question is not whether investors react to the 'right' news (like business conditions) but rather whether they overreact to it.

financial economists usually interpret them as reflecting problems with the model, not with market rationality. Research can reasonably proceed as if improved models for risk premiums are the appropriate response to any such rejections but this approach will not shed light on the plausibility of the efficient markets hypothesis.

However, the cross-sectional aspect of these parameter estimates can, in principle, provide additional clues in the market efficiency debate. It also illustrates the differences between time series and time series/cross-sectional evidence. Trivial algebraic manipulation of (5) reveals that:

$$\hat{\theta} = \sum_{i=1}^{N} (\bar{R}_i - \bar{r}_i^*)(z_i - \bar{z}) + \frac{1}{T} \sum_{i=1}^{N} \sum_{t=1}^{T} \left[(R_{it+1} - r_{it+1}^*)(z_{it} - z_i) - (R_{it+1} - r_{it+1}^*)(z_t - \bar{z}) \right] \quad (6)$$

where $\bar{r}_i^*$ is the sample time series mean of r_{it+1}^*, z_i is the sample time series mean of z_{it}, and $\bar{z}$ is the sample time series mean of z_t. The first term is the cross-sectional relation between mean excess returns and average characteristics as deviations from their cross-sectional means. This is usually reported in the literature as the risk premium for the anomalies. The second term shows that estimation purges the cross-sectional covariance estimates of the effects of the aggregate factor $z_t - \bar{z}$. Hence, cross-sectional analyses implicitly search for the incremental information in the cross-sectional variation in the characteristics about

individual excess returns.

While the efficient and inefficient markets views are difficult to distinguish, one's priors can be altered by examining estimates like (6). Recall that $\hat{\underline{\theta}}$ is the vector of average excess profits of the zero net investment portfolio strategies with weights $\underline{z}_{it}-\underline{z}_t$, strategies that could have been followed by investors possessing the information $\underline{z}_{it}$. It is a simple matter to estimate the standard deviations of excess profits. Accordingly, one's views might change if mean profits proved so much larger than their standard deviations that the strategies were implausibly profitable.[24] This possibility is one reason for exploiting the richness of cross-sectional variation in returns. There is little evidence in this form in the literature—financial economists typically use this framework to measure properties of discount factors rather than to learn about market efficiency and appear reluctant to take an *a priori* stand on plausible relations between expected profits and their variance.

Finally, note that the anomalies literature represents a partial shift away from the stochastic process orientation of the analysis of short-run return behavior. To be sure, parameter estimates obtained from (5) do not involve the calculation of estimates of intrinsic value. Nevertheless, the characteristics embodied in $\underline{z}_{it}$ are often variables that would probably be

[24]This kind of exercise is advocated in Hansen and Jagannathan (1990).

included in any intrinsic value calculations. Accordingly, this approach reflects a partial reintroduction of intrinsic value measurement into the market efficiency debate.

4. The Volatility of Stock Prices and the Present Value Relation

Popular belief about market efficiency holds that stock market volatility provides obvious evidence of market inefficiency. Part of this conventional wisdom comes from stock market crashes—it is hard to identify the 'news' that caused the stock market to decline by more than 20% on October 19, 1987 and then rebound by more than 10% the next morning. In the academic world, a decade of excess volatility studies comparing the volatility of stock prices with the *ex post* present values of actual realized dividends have convinced many of the inefficiency of equity markets. However, many financial economists continue to interpret the evidence on excess volatility as descriptions of the behavior of discount factors in an efficient market.[25]

There are three kinds of tests of this comparison in the literature: volatility, orthogonality, and present value model tests. Volatility tests measure whether the sample variances of (often detrended) stock prices exceed those of the (often detrended) *ex post* present values of their

[25]See, for example, Cochrane (1991).

dividends.[26] Orthogonality tests examine whether the covariances of prices with variables known at time t equal their covariances with *ex post* present values. Finally, the last kind of test compares market prices with estimated models of the *ex ante* present value of future dividends. All of these tests require *a priori* assumptions about discount factors.

The papers by Shea and Shiller in the NATO volume illustrate the main preoccupations of this literature.[27] Shea's paper concentrates on statistical properties of alternative volatility tests and uses bootstrapping methods to assess their finite sample properties. Shiller's paper summarizes his work with Campbell on linearizing present value relations to accommodate nonstationary dividend policies and some forms of time variation in expected stock returns. Both papers follow the standard practice of confining their attention to the Standard and Poor's Index since 1871.

The latter point represents a missed opportunity in the excess

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[26]Defining $r_{it,j}$ as the time t discount factor for security i for time t+j cash flows, the *ex post* present value is:

$$PV_{it} = \sum_{j=1}^{T} \frac{d_{it+j}}{(1+r_{it,j})^{j}} + \frac{P_{it+T}}{(1+r_{it,T})^{T}}$$

[27]Other related papers in the NATO volume include those by Bulkley and Tonks, who study trading rules related to Shiller's variance bounds in UK data, Uselton and Fraser, who examine cross-sectional variation in the ratio of *ex post* present values to prices in US data, and Verga, who studies Italian stock price volatility.

volatility literature. Except for the Fraser and Uselton paper in the NATO volume, I know of no published paper which studies cross-sections of stocks rather than aggregate indices. The use of indices is the norm despite the fact that the small incremental information content of the underlying observations is one of the major conceptual and statistical problems afflicting excess volatility tests—PV_{it} and PV_{it+1} differ only by the time t present value of d_{it+1} and by the changes in discount factors between times t and t+1. To be sure, PV_{it}-P_{it} and PV_{jt}-P_{jt} are not independent due to correlations in dividend payouts and discount factors across firms, reflecting the common effects of changes in business conditions. Nevertheless, the cross-sectional correlations between PV_{it}-P_{it} and PV_{jt}-P_{jt} are probably much smaller than the time series correlations between PV_{it}-P_{it} and PV_{it+1}-P_{it+1}. Accordingly, cross-sectional evidence may provide additional useful information in the excess volatility debate.

The accommodation of time-varying discount factors is another preoccupation of the excess volatility literature. The choice of appropriate discount factors is a difficult one, especially given the poor performance of existing expected return models and the low precision with which relevant moments like mean returns are measured. The problem is pernicious—*ex post* present values and *ex ante* intrinsic value estimates tend to be high for

low discount rates and low for high discount rates, suggesting corresponding valuation errors.

The same problem afflicts value-based investors seeking undervalued stocks. For many years, value-oriented analysts (cf., Graham and Dodd (1934)) have advocated a simple principle—buy stocks selling at large discounts relative to their apparent intrinsic values where a "'margin of safety' resides in the discount at which the stock is selling below its minimum intrinsic value, as measured by the analyst." (page 309). The "margin of safety" is an intended hedge against bad fortune and the miscalculation of intrinsic values.

The researcher can exploit a similar intuition in a large cross-section of stocks by studying the relations between *ex post* present values and prices using plausible upper and lower bounds on discount factors. Any ability to predict differences between prices and plausible upper and lower bounds on *ex post* present values can potentially change one's priors on market efficiency even in the absence of a complete theory of discount factors. The calculation of a range of *ex post* present value (or, for that matter, of *ex ante* intrinsic value) estimates imparts robustness to any evidence of market inefficiency obtained in this fashion.

In a peculiar sense, the excess volatility literature has consistently been dominated by questions about dividend policy. The early volatility

tests were criticized for relying on the assumption that dividends followed stationary stochastic processes and much recent research, such as Shiller's in the NATO volume, has dealt with this criticism by making more empirically palatable assumptions like the covariance stationarity of dividend growth rates or price-dividend ratios. This is a peculiar strategy under the null hypothesis of market efficiency with its concomitant implication of dividend policy irrelevance.

In the Modigliani-Miller world of the present value relation, there is simply nothing fundamental about dividends.[28] Seemingly innocuous assumptions about the stochastic processes for dividends may be violated due to the vagaries of managerial dividend setting practice. Well-specified policies are hard to imagine given the prevalence of zero dividend firms and of apparent abrupt and permanent changes in the dividend policies of individual firms.[29] However, the ability to pay dividends follows from the earning power of the firm as emphasized by Graham and Dodd (1934)—one must distinguish the (fundamental) sources of funds from their (irrelevant) uses. Economic profits are fundamental (i.e., invariant

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[28]This question does not arise when analyzing returns whose numerator, the *cum* dividend price $d_{it+1}+P_{it+1}$, is independent of time t+1 dividend policy (what Ohlson (1991) calls dividend payment irrelevance).

[29]This is less of a problem for orthogonality tests than for the other tests. The standard errors in orthogonality tests may be sensitive to stable dividend policy assumptions.

with respect to arbitrary changes in dividend policy) but difficult to measure. A more fundamental variable would be something easy to measure like earnings or cash flows purged in some manner of the effects of dividend policy.

Fortunately, the present value relation can be rewritten in terms of the kinds of stocks and flows that arise in accounting income and capital measures. Since earnings e_{it} and the book value of owners' equity BV_{it} satisfy the stock/flow relation:[30]

$$e_{it} - d_{it} = BV_{it} - BV_{it-1} \tag{7}$$

the present value relation can be rewritten as:

$$P_{it} = BV_{it} + \sum_{j=1}^{\infty} \frac{E^*\left[e_{it+j} - \lambda_{it,j} BV_{it+j-1} / I_t\right]}{(1+r_{it,j})^j};$$

$$1+\lambda_{t,j} = \frac{(1+r_{it,j})^j}{(1+r_{it,j-1})^{j-1}} \tag{8}$$

This purely mathematical consequence of the arithmetic of stocks and flows provides no solution to the dividend policy problem without further analysis of earnings measures. Earnings and cash flows differ from economic profits in the treatment of depreciation—economic profits

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[30]See, for example, Ohlson (1991) and Lehmann (1991). They assume no new equity issues or asset write-downs which can be added to earnings in (7). The present value relation (8) holds for arbitrary stocks and flows that satisfy (7) and, hence, can be used with cash flows instead of earnings.

include all capital gains and losses on the firm's assets while earnings incorporate accounting depreciation and cash flows make no depreciation allowance. As Lehmann (1991) shows, (8) is an operational vehicle for valuation given the discount factors $r_{it,j}$ and the assumption that any income generated by dividend policy does not contain unrealized capital gains and losses. In this setting, the income variable $e_{it+j}-\lambda_{it,j}BV_{it+j-1}$ (termed residual income in the accounting literature when $\lambda_{it,j}$ is the cost of capital) is more fundamental than dividends.

Note the shift in focus in the passage from short-run return analyses to the anomalies and excess volatility literatures. Analyses of short-run return behavior involve the examination of the stochastic processes of returns without attempts to measure any possible deviations of price from intrinsic value. The anomalies literature involves studying the relations between returns and plausible indicators of intrinsic value without a clear metric for compatibility with market efficiency. The analysis of present value relations forces researchers to confront the problem of intrinsic value measurement in the market efficiency debate.

5. Conclusion

As I look over these pages, I am amazed at how much we know about some aspects of the efficient markets hypothesis and how little we know about others. We know that security prices seem to move quickly to

levels that can be defined as where investors think they should be but know virtually nothing about whether these price levels are warranted by rational economic fundamentals. We know that plausible indicators of intrinsic value help explain expected returns but know little about the rationality of their associated risk premiums. We know that risk premiums vary but do not know about the nature and magnitude of rational variation in discount factors. In fact, Fama (1970) has forcefully argued and Fama (1990) has reaffirmed that our ignorance reflects the absence of maintained *a priori* models of intrinsic values or expected returns.

Perhaps the plausibility of the efficient markets hypothesis as a good approximation to real world financial markets is destined to remain a largely theological question. If this is right, the efficient markets hypothesis is best viewed as a useful and internally consistent framework for the generation and interpretation of facts about asset prices and discount factors.[31] Believers in market efficiency will continue to learn about discount factors while skeptical or agnostic researchers can learn instead about the discount factors of hypothetical rational investors. Perhaps opponents of the efficient markets hypothesis can also make models based on investor irrationality an equally useful framework for interpreting the same facts and generating new ones. It is certainly easy to

[31]This is Fama's (1990) view.

sustain either view when one can appeal to plausible unobservable (or hard to measure) factors like information, signals, discount factors, and beliefs. It is equally easy to remain agnostic.

In order to take the market efficiency debate beyond the theological level, we need to develop a calculus of the plausible for assessing the efficiency of financial markets. I made two modest suggestions above—the *a priori* specification of plausible reward to risk ratios for evaluating whether portfolio strategies are too profitable to be compatible with market efficiency and of plausible bounds on discount factors to examine whether a range of *ex post* present values or *ex ante* intrinsic value estimates deviates far from observed market prices. There are doubtless other ways of generating plausible partial restrictions on expected returns and intrinsic values that shed light on the efficient markets hypothesis.

Either kind of outcome is a happy one for the efficient markets hypothesis. In the former case, we can learn about stock prices even if it is not possible to learn about market efficiency. In the latter case, we can learn about both. Nevertheless, I remain hopeful that the market efficiency debate proves to be settled in an empirical court, because I both prefer questions that have answers and recognize the social importance of the question of the efficiency of financial markets.

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