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INFLATION AND SECURITY RETURNS*

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WE ARE MEETING at a time when few matters are of more serious concern to students of finance and to members of the financial community than the impacts of inflation on our financial institutions and markets and its implications for investment policy. The evidence now available clearly indicates that substantial modifications and major new developments in our generally accepted models of security returns and capital market equilibria are going to be required to deal effectively with the impacts of inflation on our markets. The bulk of this address will be devoted to reviewing some of this evidence and suggesting some of the indicated modifications in our by-now conventional models and analytical frameworks. I will also advance some new theory which explains observed relations between inflation and equity market prices and returns, identify further effects of inflation on security markets and financial behavior, and suggest directions for further research on these issues.

It will be useful, however, to view these further advances in our work in the perspective of a brief review of a few of the major landmarks in the development of our discipline. Although most of these basic earlier advances have not dealt specifically with inflation, they have provided a set of analytical frameworks and insights which form an essential base from which to develop a more probative understanding and analysis of the effects of inflation. Additional perspective comes from observing that—even though many of our central models and propositions *as they stand* are indeed seriously incomplete and biased, if not positively misleading, with respect to the impact of *inflation* on security returns—this earlier work has otherwise made very substantial and important advances in our understanding of financial markets and had a constructive impact on financial management and decision-making which should not be overlooked as we emphasize the need for further developments.

I

In historical perspective, progress in academic disciplines has typically been marked by a series of seminal conceptual breakthroughs, followed by often long periods of consolidation, refinement, testing and implementation. The grand insights which have fundamentally restructured our understanding of major areas of concern have very often been a response to pressing new conditions or needs which overwhelmingly demonstrated the inadequacy of earlier analytical models. A notable case in point some forty years ago led to Keynes' development of a more general theory of

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the determinants of the levels of employment and capacity utilization of the economy which included the classical full employment models only as a special case. Other grand insights have found essential simplicity in previously perceived complexity, as in the displacement of Ptolemaic epicycles in the Copernican revolution in Astronomy, or alternatively have found essential order and structure in previously unorganized masses of detail. The general equilibrium system of Walras in Economics and the analogous work of Gibbs in Thermodynamics and the later work of L. J. Henderson on the homeostasis of blood are illustrations of the latter type. But most generally significant advances have come when the old structures and analysis prove to be grossly inadequate to handle old problems satisfactorily under new conditions, or when the accretion of tests and organized observation has established that the older models and theories are inadequate to handle (or give false predictions with respect to) more refined questions about the phenomena under study.

Happily, our field of Finance has had its share of such seminal breakthroughs. The theory of present value calculations based on interest rates as measures of the time-value of money had of course gradually evolved in the work of many economists by the turn of the century, but it was Irving Fisher's distinctive concern with Finance which led to his critical insistence that the value of *financial* assets at any point in time depended solely on the discounted sum of their future *cash* flows to the holder (cash dividends and later sales price in the case of common stocks, and dated sequences of interest payments and principal retirements in the case of debt instruments). At about the same time, he also clearly identified the *nominal* rate of interest as the sum of a real purchasing-power adjusted rate augmented by the *expected* rate of inflation.[1] But if Irving Fisher is to be acclaimed as at once the Adam Smith and the Leon Walras of Finance, it must be for his classic model[2] of the equilibrium of financial markets in which the optimal scale of real investment of each type at each point in time, and the optimal amount of borrowing or lending of each person in the market would be simultaneously determined under admittedly idealized conditions (no uncertainty, transactions costs or imperfections) by a set of interest rates (one for each time interval) which would reflect (and *ceteris paribus* vary with) the initial endowments, earned income streams, real investment opportunities and preference functions of each of the entire set of market participants.

The following years were marked by Macauley's classic studies of Bond Yields, Interest Rates and Stock Prices,[3] which among other major insights first formulated the important concept of the "duration" or weighted average futurity of the stream of cash flows generated by investment instruments[4] which is central to an understanding of many

1. *Appreciation and Interest,* Publications of the American Economics Association, Third Series, August, 1896, and *The Rate of Interest* (1907).

2. *The Rate of Interest* (1907) and *The Theory of Interest* (1930).

3. Frederick R. Macauley, *The Movements of Interest Rates, Bond Yields and Stock Prices in the United States Since 1856,* N.B.E.R., 1938.

4. The same concept was independently developed and applied in another relevant context by Hicks in his *Value and Capital* (1939) as the "average period of production."

phenomena involving the market values of securities, as well as the basic asset preferences and investment strategies of institutional investors, including life insurance companies, universities and pension funds. At about the same time, Hicks and Lutz[5] developed related but distinct theories of the term structure of interest rates based upon the set of expectations held by the market participants regarding the probable patterns of future short term rates extending out to the maturity of the bond.

From the 1930's, mention should surely also be made of John Burr William's classic *Theory of Investment Value*[6] which developed the value implications of algebraic budgeting, perceptively sorted out some of the effects of unanticipated as distinct from expected inflation on the aggregate market value of a company's securities, and clearly formulated the Law (or Principle) of the Conservation of Investment Value on the remarkably modern ground that the option of shareholders to hold equal fractions of a company's stocks and bonds would effectively make the combined market value of its stocks and bonds invariant to the mixture of equity and debt it chose to have in its capitalization. Although this seminal insight was not rigorously developed, it was nonetheless a remarkable foreshadowing of the justly famous work of Modigliani and Miller two decades later (1958)[7] which rigorously established that this invariance holds at least under restrictive conditions (equality of borrowing rates for corporations and investors, etc.),[8] and that consequently the required rate of expected return on new investments would also, apart from tax effects, not depend upon whether debt or equity was used to finance the new investment. Like the earlier theories of Hicks and Lutz on the term structure of interest rates, this classic paper on the cost of capital has inspired a massive amount of subsequent work undertaking to test, implement, refine, generalize and/or appropriately modify the basic propositions set forth.

Most of the other important conceptual breakthroughs in Finance which are relevant to the announced subject matter of this address stem from the efforts of many scholars to introduce the unavoidable fact of uncertainty into our models of capital market values, rational investment behavior and standards of judging investment performance. Fisher's great work earlier in the century was a major landmark in our discipline precisely because for the first time he worked out the fundamental relations between prices, returns, borrowing and lending, and "real" investment decisions when many participants simultaneously pursued their own self interest in purely competitive markets which cleared. Without the simplifying assumption that all present and future data were *known* to all participants, essential features of the market interactions among the conditional decisions and actions of its members would have been obscured, if not missed entirely. Although Fisher clearly recognized the

5. Hicks, *op. cit.*, and Frederick Lutz, "The Structure of Interest Rates," Quarterly Journal of Economics (1940).

6. Harvard University Press, 1938.

7. "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review,* June 1958 and "Correction," same Journal, June 1963.

8. See pages 32-34.

critical importance of risks and uncertainties[9] for individual decisions and market outcomes, the tools and concepts needed to introduce them into a rigorous analysis had not yet been developed. In contrast to the rigor of his basic model assuming known (future) data, Fisher could only introduce these further essential matters of risk and uncertainty into his analysis in an essentially *qualitative* manner. And it is worth noting that J. R. Hicks in his *Value and Capital* a decade later (1939) left these matters in essentially the same suggestively qualitative but unresolved state.[10]

The stage for the next major advance in Finance was set in related disciplines by conceptual development of cardinal utility functions in risk situations and of operational procedures for their measurement,[11] together with rigorous proofs of the optimality of choices maximizing the expectation of such functions using subjectively assessed probability distribution as weights. As early as 1952, in the *Journal of Finance*,[12] Markowitz rigorously showed the power of diversification to reduce risks in portfolios of securities without sacrificing expected returns, and this insight was effectively merged with the evolving general theory of decision-making under uncertainty in his classic *Portfolio Selection* by 1959. At about the same time, Professor Tobin[13] adapted and developed these insights to explain the Keynesian liquidity preference function and the level of interest rates in the market in terms of rational behavior of investors optimizing the proportions of a short-term riskless asset and risky long-term bonds in their portfolios. The same seminal paper established the now famous Separation Theorem, showing that under rather reasonable conditions including the availability of a riskless asset, optimal proportions *within* the portfolio of risky assets would be independent of the risk-averter's particular preference function, and that the latter would simply determine the *scale* of risk-investment in relation to investible funds (or wealth).

Within a few years, Sharpe,[14] Mossin,[15] and I[16] built on these founda-

9. "Our present behavior can only be affected by the expected future—not the future as it will turn out but the future as it appears to us beforehand through the veil of the unknown. . .risk means that later there may be a wide discrepancy between the actual realization and the original expectation," Fisher, *op. cit.*, pp. 222-226.

10. See for instance, Hicks' statement (p. 134): "When risk is present, people will generally act, not upon the price they expect as most probably, but as if the price had been shifted a little in a direction unfavorable to them."

11. John von Neumann and Oscar Morgenstern, *Theory of Games and Economic Behavior*, Princeton, 1944; Leonard J. Savage, *The Foundations of Statistics*, Wiley, 1954; Frederick Mosteller and Philip Nogee, "An Experimental Measurement of Utility," *Journal of Political Economy*, 1951. See also the development and critical review of utility theory in R. Duncan Luce and Howard Raiffa, *Games and Decisions*, Wiley, 1957.

12. The title was "Portfolio Selection," March 1952.

13. "Liquidity Preference as Behavior Towards Risk," *Review of Economic Studies*, February 1958.

14. William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance*, September 1964.

15. Jan Mossin, "Equilibrium in a Capital Asset Market," *Econometrica*, October 1966.

16. John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, February 1965; and "Security Prices, Risk and Maximal Gains from Diversification," *Journal of Finance*, December 1965.

tions in our own distinctive ways and published models of the equilibrium of capital markets in which risk and uncertainty were essential elements. Sharpe's work dealt directly with necessary relations between the expected rates of return on individual securities when markets are in equilibrium. Mossin and I worked directly from individual investor's assessments of the joint distributions of risks (variances and covariances) and of expected returns over the set of available securities, and combined the conditionally optimal portfolios with market clearing conditions to determine the set of equilibrium *prices* of the risk assets in the market.

In these models, the desirability of a little larger or smaller investment in any given risky asset depends essentially on its *marginal* contributions to the return and risk associated with his *overall portfolio* (or ending wealth position). The expected returns on any given security or investment are adjusted in proportion to an investor's measurable degree of risk aversion[17] on the basis of his assessments of its covariances with all the other securities in his portfolio as well as its own independently assessed riskiness. As the number of securities in the portfolio increases, the relative importance of common factors influencing the stochastic returns on the securities held increases, and the significance of the "own risk" on each separate security diminishes asymptotically. Clear distinctions between diversifiable and undiversifiable risks are developed. A uniquely preferable portfolio of risky securities is determined for each individual investor. When a riskless investment is available, the scale of each investor's investment in his preferred risk asset portfolio depends on his wealth or investible funds and risk preferences along with the level of the return on the riskless investment in relation to the expected return and risk assessed on his composite portfolio of risk assets. Although the original derivations of this model relied upon restrictive assumptions such as Gaussian probability distributions or quadratic utility functions, single period horizons, and the availability of borrowing at a fixed rate, subsequent work has shown that the essential structure of the model is remarkably robust to generalizations in each of these dimensions, as well as to the denomination of investor's objective functions in terms of preferences over streams of consumption rather than wealth or investment returns as such (so long as commodity prices are stable).[18]

If perfect markets and homogeneous (common) assessments by different investors are assumed, along with the availability of a riskless investment, a remarkably simple characterization can be made of the equilibrium structure of risk asset prices. There is a well-defined "market price of risk" in the form of a harmonic average of the risk-aversion of each investor in the market.[19] In the presence of any given (and common)

17. John W. Pratt, "Risk Aversion in the Small and in the Large," Econometrica, Jan.-April, 1964, and Kenneth J. Arrow, *Aspects of the Theory of Risk Bearing,* Helsinki, 1965.

18. See, for instance, the papers of Samuelson, Merton, Fama, Black and others cited in M. C. Jensen, "Capital Markets: Theory and Evidence," *Bell Journal of Economics and Management Science,* 1972, pp. 357-98; also Mark Rubenstein, "A Discrete-Time Synthesis of Financial Theory," Parts I, II, III, May-September, 1974, Mss. (Berkeley) and references given there.

19. As shown in John Lintner, "The Aggregation of Investor's Diverse Judgments and Preferences in Purely Competitive Securities Markets" (*Journal of Financial and Quantitative Analysis,*

set of probability assessments over the joint distributions of uncertain returns on risky assets, purchases and sales of individual securities will be made until the set of current prices on all risk assets is such that the *expected* rate of return on each reduced by the available riskless return is homogeneously and linearly related to the corresponding expected risk premium on the composite market portfolio, in proportion to each investment's undiversifiable risk (its "beta" coefficient). Since its initial development, this version of the "capital asset pricing model," based on a risk-free asset and homogeneous assessments, has of course generated a tremendous amount of empirical research, and it seems fair to say that this model formulated a *basic structure* of the relationships between expected returns and risks on the large number of publicly traded securities which has been borne out by the data to a perhaps surpising degree.[20]

Theories and models are useful precisely to the extent to which they exclude (or approximate simply) all the multitudinous peripheral and *less* essential elements bearing on the matter of interest in order that the *more* essential aspects of the real situation can be analyzed in sharper focus. Orderly progress in any discipline requires that simpler, more basic and fundamental elements and interrelationships be rigorously developed to provide a firm base for further refinement and development. Building on Fisher's firm base of capital market interactions and pricing under uncertainty, the work briefly reviewed here has provided a rigorous model incorporating the more essential first-order effects of risk as well as expected future values on the structure of the current prices of risky capital assets. Some further refinements and elaborations have introduced significant but second-order modifications which have brought the models into closer conformance with observed market data and extended the range of phenomena encompassed in the analysis.[21] Most of this subsequent work to date, however, has been concerned with nominal returns and prices. Later in this address, I will advance the position that the introduction of purchasing power considerations requires some more basic adjustments in the model.

The remaining landmark in Finance we need to consider in this address focusses on the concept and implications of "efficient" capital markets.

Dec., 1969), this statement of the market price of risk is valid even when investors do not agree on their probability assessments, and even when there is no riskless asset available. It should be observed, however, that while *this* "market price of risk" is invariant to differences in probability assessments among investors, the "beta measures" of the relative amount of risk on each security (since they are normalized functions of the inverses of covariance matrices) do not share this invariance property in the absence of common assessments.

20. In particular, this work formulated a *quantifiable* measure of risk with economic content, and many tests have shown that the mean *excess* of holding period returns over the return on the riskless asset are very well approximated by the *linear* relation on this risk measure implied by the model. The strict positive proportionality implied by the simplest versions of CAPM has not however been uniformly confirmed, and regression slopes have not been stable over time in all tests. An excellent review of all this work, and of further developments of the model is given in M. C. Jensen, *op. cit.* See also, Marshall Blume and Irwin Friend, "A New Look at the Capital Asset Pricing Model," *Journal of Finance,* March 1973, and Eugene Fama and J. D. MacBeth, "Tests of the Multiperiod Two-Parameter Model," *Journal of Financial Economics,* May 1974.

21. See Jensen and Rubenstein, cited above.

At any given point in time, security prices will be produced by the purchase and sale transactions of large numbers of investors each acting on the basis of his/her judgments and assessments of the uncertain future based on the information available to him/her. Given normally distributed returns and purely competitive market conditions, the resulting set of market clearing prices will be Pareto-optimal[22] *vis-à-vis* the subjective assessments of the investors in the market and have various other desirable properties, but they may nonetheless fail to be fully efficient in the sense used in the efficient market hypothesis.

Individual portfolios are efficient if they are optimal, given the assessments of the investor based on the information at his disposal. Similarly, markets by definition are efficient only to the extent that they "fully reflect" all the available information in the market at any given point in time. In addition to competitive markets for the trading of securities, *sufficient* conditions for complete capital market efficiency are (a) the absence of transaction costs, (b) the prompt and costless dissemination of all relevant information to all investors, and (c) complete agreement by all participants on the implications of current information for both the current price and the distributions of future prices for each security. Under these idealized conditions, the work of Working, Cootner, Fama and especially Samuelson and Mandelbrot has shown[23] that security prices—and more particularly the distribution of the deviations of the series of *realized less expected returns* on any security—will fluctuate randomly over time. If the information-implication conditions (b) and (c) are satisfied, Fama has observed that even large transactions costs inhibiting the flow of transactions will not imply that information will not be fully reflected in prices when transactions do take place.

But we also know that within the complex weighted averages of assessments which determine the price of a stock at any time, any one investor's judgments and assessments have more weight the greater his wealth, the lower his risk aversion, the greater his confidence in his judgment of how that stock will perform,[24] and the greater his optimism regarding its expected return if held long (or his pessimism, if held short). New information is not in fact instantaneously, uniformly and costlessly available to all participants in the market. Nor are all equally perceptive in assessing the implications of the new information they do have. If it should be generally true at most times that better and newer information is only in the hands (or minds!) of restricted groups controlling only a modest fraction of the wealth in the market, or confined to those less

22. If the subjective distributions of returns are not Gaussian, competitive equilibria will still be Pareto-optimal if investors have utility functions whose risk-tolerance is linear in wealth (which include negative exponential, quadratic, logarithmic or general power functions). See Robert Wilson, "The Theory of Syndicates," *Econometria,* Jan. 1968. These conditions also insure the "separability theorem," as shown in D. Cass and J. E. Stightz, "The Structure of Investor Preferences and Asset Returns, and Separability in Portfolio Allocation. . . ," *Journal of Economic Theory,* June 1970.

23. See references in Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirieal Work," *Journal of Finance,* May 1970, and Paul Samuelson, "Proof That Properly Discounted Present Values Vibrate Randomly," *Bell Journal of Economics and Management Science,* Autumn 1973.

24. See Lintner, "The Aggregation of Investor's Diverse Judgments. . . ," *op. cit.*

incisive and less perceptive in assessing its true implications, and so on then security markets could be quite inefficient in the use of information even though at the same time fully Pareto-optimal *vis-à-vis* the set of investor preferences and subjective assessments in the market.

But the sufficient conditions are not *necessary* for efficiency.[25] The issues posed by the efficient market hypothesis thus reduce to the essentially empirical question of the degree to which the idealized predictions of theory approximate the results observed in the market place. And the theory has been borne out in tests on listed equities to a quite impressive degree. A large number of extensive and sophisticated tests has failed to detect any patterns of past histories of stock prices (or patterns of past price changes) which could be exploited for profit over any substantial period after paying commissions. The stock market's adjustment to new but obviously public information (such as earnings announcements, stock splits, dividends, mergers, etc.) has also been found to be quite prompt and efficient. On the evidence to date, it appears that one can secure above normal profits from such developments only by (correctly) anticipating them before "the market" learns of them.[26] With respect to the strongest form of the theory—that *all* available information, including information available to only limited groups such as "insiders" or preferred customers, is properly reflected in prices—the evidence is much more limited and more mixed, but to date at least seems less damaging to the predictive power of the theory than was perhaps expected.[27] It should be observed, however, that virtually all tests of efficient markets hypotheses have been confined to *listed stocks,* and there are substantial reasons for doubting its comparable efficacy in the markets for bonds and other assets.

As we thus briefly review some of the more important new insights and conceptual frameworks which have helped shape our discipline as we know it today—and I should emphasize this this listing is not intended to be either definitive or exhaustive[28]—we can collectively feel a certain degree of satisfaction in the improved understanding of financial markets and of their interdependencies, and of some of the fundamental requirements of rational financial decision-making, which has been realized. The

25. If "sufficient numbers" of investors controlling sufficient wealth have ready access to available information, markets will more or less closely approximate full efficiency. And as Fama observes, disagreements among investors over the implications of available information create market inefficiencies only if some group of investors can consistently make superior assessments of the implications of available information than those concurrently subsumed in market prices. Such superior abilities should be reflected in consistently superior returns after appropriate adjustments for the risks and costs incurred.

26. In the case of earnings announcements, for instance, one must correctly anticipate how the reported earnings will differ from the market's prior concensus expectation of the report.

27. Empirical tests of the efficient markets hypothesis are reviewed in Fama, *op. cit.,* and still more recent work is cited in Fama and MacBeth, *op. cit.*

28. For instance, our list could appropriately be extended to include the "state-preference" models as developed most notably by Jack Hirschleifer and Rubenstein on the basis of earlier work by Arrow. I also expect that the work of Samuelson and Merton on the rational pricing of warrants and its extension into a general theory of the pricing of corporate liabilities by Fischer Black and Myron Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy,* May/June, 1973, will later come to be regarded as landmark contributions.

field of finance is not one in which theory for theory's sake or as an end in itself has any place. In all our scientific work, statistical and theoretical, we should always seek to be in a position where we need apologize to no one for the logical rigor and care of our analysis, but at the same time seek to do work which others must defer to for its relevance. Even where the inherent relevance of the analysis and concept for improved decision-making is inherently great, the time lag between conception and implementation has of course often been very long—but happily it appears to be shortening rapidly. For instance, within but a few years the central implications of the modern portfolio and capital market theories have been having a major impact upon investment practice and generally accepted standards of judging investment performance. While many investment managers still just try to select the stocks with the "best prospects" measured by expected returns on each stock less some downward adjustment to allow its *own* risks—as in the Fisher-Hicks treatment of risks decades earlier[29]—a rapidly growing number are increasingly concerned with the marginal contributions of individual securities to the overall risks of entire portfolios of assets. They very generally monitor their composite portfolio risks relative to the market and increasingly select individual securities subject to maintenance of desired ranges of portfolio risks as well as diversification over industries and types of companies.

Similarly, until quite recently, investment performance was judged simply by whether the *ex post* returns over some period were greater or less than those shown by some general market index (or other mutual fund, pension manager or portfolio). Superior returns were taken to demonstrate superior competence regardless of the degree of risk which had been taken. The more relevant question whether the return was commensurate with the level of risk assumed was not raised, because no operational basis for an answer was available. Again, modern portfolio and capital market theory, implemented in the pioneering work of Treynor and Jensen,[30] has provided such a base. Evaluations of *ex post* performance increasingly compare realized returns with the returns on portfolios of comparable risk *available* in the market. This capital market theory, together with accumulating evidence of the power of efficient market concepts, has also produced major reformulations of the function of security analysts in many investment organizations, and the implications of efficient competitive markets regarding the value of so-called "technical analysis" are becoming much widely appreciated.

The very substantial advances which our theoretical and statistical work has indeed made in our understanding of financial markets and the constructive impact of this work on financial management and decision-making must not, however, be taken to minimize the tremendous gaps

29. See quotation, page 262 above.

30. Jack L. Treynor, "How to Rate Management of Investment Funds," *Harvard Business Review*, Jan.-Feb. 1965; and Michael Jensen, "Risk, Pricing of Capital Assets, and the Evaluation of Investment Performance," *Journal of Business*, April, 1969, and "The Performance of Mutual Funds in the Period 1945-64," *Journal of Finance*, May, 1968.

still remaining between our substantive knowledge and that required to handle a great many of the more important issues and problems in our area in a really solid and reliable manner. My two immediate predecessors chose in their presidential address to emphasize these very real and genuinely distressing gaps in our present knowledge. The more affirmative emphasis of the historical perspective in my remarks today will hopefully serve to fill out a more balanced assessment[31]—as well as set the stage for my consideration of the specific subject matter announced for this paper. And while it has been appropriate to emphasize here the evolution of our analytical frameworks and concepts, it is surely true that the development of more relevant and accurate data and institutional information on the one hand, and more sophisticated and reliable statistical econometric procedures for analyzing the available data on the other, have also made—and will continue to make—essential contributions to the advance of our knowledge and the solutions of the issues and problems facing our professions. It is eminently constructive to think of the "production function" of our area as having at least three necessary inputs[32] of which theoretical models are only one. These inputs are of course complementary rather than competitive in their interactions, and the relative marginal productivities of each type of research will vary from time to time and from problem to problem.

II

As noted above, major new analytical breakthroughs have often occurred when an accumulated body of tests and organized observation have established that the existing models and theories give seriously false and misleading predictions regarding phenomena of serious concern. The evidence clearly shows that the classic Fisher-Williams model of the effects of inflation on unlevered equity returns—though it still is incorporated in essentially unqualified form in the broader macro-monetary theoretical models and econometric work of many of our most sophisticated economists—is biased and misleading in an essential and serious way. This classical theory held (and these modern economic models still assume) that the *real* value of unlevered equity will be invariant to inflationary or deflationary changes in the general price level so that in principle its current *money* value will rise in proportion to rates of inflation.[33] Recent statistical analyses of data covering the entire twentieth century as well as more intensive work on the last twenty or twenty-five years, however, *uniformly* show that *both* the *nominal* and

31. After this address was prepared, I learned that Walter Heller had adopted a somewhat similar strategy in his Presidential Address for the American Economics Association. See Walter Heller, "What's Right With Economics," *American Economic Review,* March, 1975.

32. The analogy is of course not exact because of the interactions over time between the factors, as new data or statistical tests lead to the development of new theory, or as new theoretical insights lead to new empirical investigations, but the basic thrust of the analogy is essentially correct and useful.

33. The classical model adjusted for the company's net creditor-debtor position of course implies significant additional gains from unanticipated inflation from a net debtor position such as U.S. nonfinancial corporation have had over the last twenty-five years. See below.

the *real* rates of holding period returns on corporate equities have been *negatively* and very significantly related to inflation rates. After reviewing this material, the rest of this section develops some new financial theory which does predict these observed effects of inflation on stock prices and equity returns. Since the analysis is somewhat complex, the next few paragraphs provide a summary in advance of more detailed development. (Further effects of inflation are considered more briefly in the concluding section.)

My analysis will first show that the adjustments to the classical "neutrality" theory which have been generally emphasized by finance specialists—involving such matters as inability to maintain profit margins in the face of rising labor and material costs, the use of fifo instead of lifo accounting methods and the insistence on the use of historical rather than replacement costs for fixed assets both in accounting dogma and tax law—are seriously incomplete (however important they may be in practice). Even if all these impairments of real returns in times of inflation were completely eliminated[34] by the use of replacement cost depreciation and lifo accounting for inventories, and even if real profit margins and rates of growth in unit sales are always maintained, a company's relative dependence upon outside financing will *necessarily be higher* the higher the rate of inflation, whether expected or unanticipated.[35] Moreover, this greater relative dependence on outside financing required by an *increase* in realized inflation during any period will necessarily *reduce* the value of outstanding equity, and consequently also reduce the real rate of return realized on equities during the period. These results hold whether new equity *or* added debt is issued to meet the added financing required to maintain real rates of growth in the face of *either* an unexpected spurt of inflation *or* or higher rate of fully anticipated inflation. These adverse effects of an increase in *expected* rates of future inflation on equity values and on real holding-period returns during the *transition period* from one rate of inflation to a higher rate, however, will be *greater* than those of an equally large increase in unanticipated "transient" inflation.

I will then go on to show that *after* the period during which inflation rates have increased, even a continuance of higher (instead of lower) constant steady-state (and fully anticipated!) rates of inflation will leave the mean *expected real* rates of return on holding equities just as high as it was before the increase in inflation rates and expected nominal returns will be proportionately higher.[36] With the same *real* interest rate on other investments, equities will be just as attractive as before the increase in inflation (even though substantial losses will have been taken during the

34. We also abstract from the effects of current (or prospective) deflationary changes in fiscal or monetary policy. See pages 272 and 273 below for the specific assumptions used in our analysis.

35. Since the fraction of total financing which has to be obtained from external sources, other things equal, will rise or fall with the rate of change in rates of inflation, periods of increasing rates of inflation represent the worst of all worlds—witness the mountainous demands on capital markets in recent years.

36. More explicitly, in the face of continuing anticipated inflation, the expected real rate of return on a firm's outstanding equity will be maintained at the level it would otherwise have had conditional on the degree of leverage, given the firm's business risks and a constant *real* rate of interest.

transition to higher inflation rates). The same analysis, of course, *also* establishes that subsequent *reductions* in (*either* unanticipated *or* in expected future) rates of inflation will result in unusually large capital gains on equities during the transitional period of adjustment to the lowered rates of inflation. This theory consequently explains the *negative* relation of both real and nominal returns on equities with levels of inflation, whether anticipated or unanticipated, which has been observed in empirical work.

The Classical Theory. The classic Fisher-Williams model started from the proposition that the *real* returns to the ownership of capital goods will be invariant to the general price level, since these returns depend fundamentally upon production functions or input-output relations and factor proportions which are invariant to the general level of prices, and they held that the real rate of interest would also be invariant to the price level *per se*.[37] Since both the flows of real returns and the real capitalization rate are invariant to inflation, the real present value of these flows is also unaffected either by current inflation or by the expectation of future inflation. This invariance of real values means that current money values will vary in direct proportion to the general price level, making nominal capital gains (in before-tax percentage terms) on unlevered equity equal to the rate of inflation. In the classical framework, the owners of levered equity benefit from an additional capital gain (even in *real* terms) whenever there is an unanticipated increase in the rate of inflation expected to prevail in the future.[38] These conclusions regarding the effects of inflation on equity prices and returns of course reflected the classical economists' concentration on long-run comparative static equilibria denominated in real terms of exchange, independent of current levels of money prices which depended on actions of monetary authorities by way of the classical Quantity Theory of Money.

Over several intervening decades of work, more modern Keynesian, post-Keynesian and neo-Monetarist economists and builders of econometric models have moved far beyond the classical preoccupation with an essentially long-run static equilibrium to deal with shorter term equilibria and the dynamic adjustment process of the economy. They have also of course abandoned the simple classical presumption that the structure of prices and returns in financial markets do not affect the equilibrium of the real sectors of the economy, and have developed increasingly complex and flexible theoretical and econometric models of the *interactions* between levels and structures of prices, physical volumes and returns in the "real" sectors of the economy with the prices

37. Their argument was that in equilibrium this rate must be simultaneously equal (a) to the marginal real product of capital goods, and (b) to the marginal rate of substitution of real goods between adjacent time periods (which Fisher called the marginal rate of "time preference"), neither of which depend on the price level. The classical position is developed in more detail in John Lintner, "Inflation and Common Stock Prices in a Cyclical Context," published in the 1973 *Annual Report* of the National Bureau of Economic Research, esp. pp. 23-26.

38. The invariance of the real value of the *total* of ownership claims on the entire real returns provided by capital goods implied that the losses incurred by owners of debt instruments when there was an unanticipated increase in expected inflation will accrue to the owners of equity.

and returns on a rich menu of financial assets. Especially in view of the greatly increased sophistication of all this work in *other* respects, it is indeed striking to observe the truly remarkable extent to which these models have continued to rely upon and explicitly retain the classical proposition that the real returns to the ownership of capital goods will be invariant to the price level—and that stock prices will consequently rise more or less in proportion to the commodity price level determined elsewhere in the system. For instance, while Professor Tobin's recent models emphasize the primary importance of any divergence between the rates of return provided in the stock market to the ownership of existing capital assets and the marginal productivity of these capital assets as a primary driving force in the whole economic system, he holds that the commodity price level *per se* "does not affect the real rate of return on capital, calculated either on reproduction cost or on current market value."[39]

Contrary Evidence. Recent statistical analyses, however, have shown stock prices and returns are negatively rather than positively related to inflation as standard economic models presume. When percentage changes in equity prices were regressed, an annual data from 1900 to 1970, entering deflation and inflation as separate variables along with changes in earnings and long term rates, the t-ratio on the inflation was a solidly negative 2.85 and the t-value against the classical null hypothesis of a coefficient of +1.0 was over 7![40]

Annual data on equity holding period returns including dividends since 1934 and since 1948 both similarly reject the classical model with t values of 2.73 or more and the risk-premiums $(r_s - r_f)$ are similarly *negatively* correlated with inflation,[41] while both r_s and $(r_s - r_f)$ on twenty years of monthly postwar data show a negative impact of inflation which rejects the classical model with a t-value of about 5.[42] Finally, we note Mr. Zvi Body's recent work with data for 1953-72 inclusive which finds that the *real* returns on common stocks over holding periods of 1, 3 and 12 months are also quite uniformly and significantly depressed by inflation.[43]

39. James Tobin, "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit, and Banking,* February 1969, reprinted as Chapter 18 in *Essays in Economics.* (The quotation is from p. 328 in the latter.) Sections 4 and 9 of this reference are also especially relevant.

40. See Lintner, *op. cit.,* p. 32. All variables had the expected sign with t-values over 2. The coefficient on the separate inflation variable was $-.67$ with a standard error of .235 and a t of -2.85, and $1.67/.235 > 7$. Stock price change was used as the dependent variable because of the unreliability of dividend yields on the SP (Cowles) index in earlier years.

41. From 1934-73, r_s is related to p by a regression coefficient of -1.66 with an s.d. of .97; $(1 - (-1.66))/.97 = 2.73$. For 1948-73, the coefficient is -2.71 with an s.d. of 1.35; $3.71/1.35 = 2.75$. When $(r_s - r_f)$ is the dependent variable, the corresponding coefficients and s.d.'s in the two periods are -1.72 (1.00) and $-3.06(1.41)$ respectively, rejecting the classical $+1.0$ with t ratios of 2.72 and $4.06/1.41 = 2.88$. Holding period data were taken from Roger G. Ibbotson and Rex. A. Sinquefeld "Stocks, Bonds, Bills and Inflation," CRSP Seminar, May, 1974. Peter Jones ran the regressions.

42. Using the CRSP tape for 240 monthly holding periods January 1953-December 1972, Mr. Zvi Body found $r_s = 5.84 - 4.82\%\ \dot{p}$ and $(r_s - r_f) = 5.15 - 5.13\%\ \dot{p}$. t-value were respectively 4.04 and 4.3 against a null hypothesis of zero; against a null value of $+1.0$, the t-values were 4.88 and 5.14.

43. Zvi Body, "Common Stocks As a Hedge Against Inflation," Boston University School of Management Working Paper, January 1975, Table 4. The values of the t-statistics (against the classical null value of zero in real terms) for purchasing change were 2.38 (annual), 3.41 (3-month)

Indeed, this last study also finds that over one and three months holding periods, *real* returns on equities were significantly and negatively related to both expected rates of inflation and to *unanticipated inflation* entered as separated variables in the regression.[44] The evidence further indicates that the negative effect of expected inflation is larger and more significant than that of unanticipated inflation, even though the latter is sizeable and statistically significant. Such evidence clearly requires major modification in the Fisher-Williams theory of the effects of inflation on equity returns and values.

Specialists in Finance and many economists have of course long recognized the adverse effects to equity ownership involved in accounting traditions and tax codes which insist on the use of historical rather than current replacement costs as the basis for measuring depreciation on fixed assets, and they have also emphasized the "phantom" nature of the added accounting profits created by valuing inventories at average costs or by fifo instead of lifo methods which more closely approximate their replacement values. At the same time, largely offsetting emphasis is often given to the sizeable unreported and untaxed capital gains involved in writing up fixed assets (and based lifo inventory stocks) to current replacement values, and to the unreported gains accruing to non-financial corporations during periods of rapid inflation by virtue of their "net-debtor" status.[45] More generally in recent years, "cost-push" inflation involving a widespread inability to maintain profit margins in the face of rising labor and material costs has been emphasized. High or increasing rates of inflation can also reduce equity values because of the anticipation of subsequent deflationary actions of the monetary or fiscal authorities.

In my view, each of these modifications of the classical "neutrality" position is important, even though some at least partially serve to offset others. Rather than discuss these matters which have already been considered in the literature any further today,[46] however, I propose to outline a model focussing on an *additional* set of dynamic and financial factors which will *necessarily* make equity returns vary inversely with changes in anticipated as well as unanticipated inflation. For this purpose, I will abstract from all the adverse effects previously cited.

A New Theory. Consider the effects of uniform proportionate changes

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and 4.89 (monthly). [In galley: I have just learned of similar result obtained by Charles R. Nelson in "Inflation and Rates of Return on Common Stocks" (Univ. of Chicago, Feb. 1965, mss.)].

44. Body, *op. cit.* Three regressions for each holding period were run with expected inflation estimated with smoothly coefficients $\theta = .2$, $.6$ and 1.0. The three regressions for one month periods showed t-values for *each* variable over 3.5, the coefficients were each above 4.99 and larger in each case for expected than for unanticipated inflation. The results were similar with $\theta = .6$ and 1.0 for 3-months holding periods, and even with $\theta = .2$ the t-value on expected inflation was 1.69 (with 3.20 on unanticipated inflation).

45. In the latter connection, Federal Reserve *Flow of Funds* data show that the "net-debtor" status (the excess of financial liabilities over financial assets) of U.S. nonfinancial corporations increased continuously from $13.3 billion in 1946 to $263.6 billion in 1973. Their bonds and mortgages alone increased from $34.4 billion to $327.7 billion over the same period.

46. My forthcoming monograph on *Inflation and Common Stock Prices and Equity Returns,* partially financed by a grant from the American Life Insurance Association to the National Bureau of Economic Research, reviews these other considerations and develops the new theory outlined below in more detail.

in *all* prices (including wage rates, materials and all other inputs as well as output prices) upon a firm which maintains a fully synchronized steady-state rate of growth in *real* terms. Assume that capital stock and current rates of real investment are proportional to physical output at all times. Depreciation is also proportional to capital stock and is taken at *replacement* cost for tax purposes. Corporate profits are taxed at a fixed percentage rate, and dividends are a fixed fraction of profits after tax. Prices at all times provide a fixed percentage margin of gross operating profit over inventories valued at replacement costs, and the dollar amount of overheads, selling and all other costs are proportional to dollar sales. With these assumptions, it is easy to show that the *excess* of current dollar outlays for fixed investment over gross funds retained from operations (retained earnings plus depreciation) is a *fixed* fraction of *current dollar sales,* say bS_t, where b is invariant to rates of inflation.

From the basic accounting identity of the "Source and Application of Funds" statement, *additional* external funds[47] will be required to cover increases in cash balances and accounts receivable inventories. We assume that cash balances bear a fixed ratio to current dollar sales, that a fixed fraction of sales are made on credit and that there is a fixed collection period on receivables. In keeping with observed practice, we also assume there is no interest income on cash, and that terms on receivables are not adjusted for changes in the rate of inflation. These assumptions are sufficient to make these "additional" demands for external funds some *fixed* fraction of the increases in current dollar sales, say $a\Delta S_t$, where a is necessarily positive and also *invariant* to the rate of inflation over the interval covered.[48] Consequently, the *total* demands for external funds required to maintain real growth rates under these conditions is given by $\Delta F_t = a\Delta S_t + bS_t$.

Since under our assumptions, both retained earnings and gross retained funds are respectively proportional to S_t, the *ratio* of external to internal financing will increase with inflation rates if $\Delta F_t/S_t$ does so; but the latter is a linear *increasing* function of $\Delta S_t/S_t$ which in turn is an increasing function of inflation rates.[49] Consequently, *the relative dependence on external financing necessarily varies directly with realized inflation rates.*[50] In particular, higher inflation rates would increase a firm's relative dependence on external funds *even if* there were no phantom inventory profits and depreciation could be charged on replacement costs and there were no added needs due to backups of unsold inventories, increased sales on credit, or delays in collections or credit losses, and so

47. For simplicity, we ignore changes in financial assets other than "cash" and accounts receivable. External funds include accounts payable and other trade credit, tax liabilities, increases in all other forms of short as well as long term debts, and new issues of equity capital.

48. Let c = "cash" C_t as a fraction of current dollar sales S_t, and h = the fraction of sales sold on credit. With c and h constant, we have $\Delta C_t = c\Delta S_t$ and $\Delta AR_t = h\Delta S_t$. In the text, $a = c + h$, a constant.

49. Let G_p and G_r be one plus the rate of price inflation and the rate of real growth, respectively. Then $\Delta S_t/S_t = 1 - 1/G_rG_p$ which increases with G_p. For instance, with real growth rates of 4%, an increase in inflation rates form 4% to 12% increases $\Delta S_t/S_t$ from 7.5% to 14.2%.

50. In the monograph cited above, the same conclusions are shown to hold in a continuous time model and with distributed lags for both production and collections.

on. Any adverse change in any of these conditions of course merely compounds the adverse effects of increased inflation rates found within the model being developed here.

Even if *the company's* unit sales growth and real rates of return on operations and assets and its collection experience are fully maintained[50a] at a constant level, this greater relative dependence on outside financing required by an *increase* in realized inflation during any period will necessarily *reduce* the value of its outstanding *equity,* and consequently also reduce the *real* rate return realized on its equities during the period, because it involves a *deadweight dilution* of the real returns on owning equities over the period. If the added financing required to maintain real rates of growth is obtained by added debt, the after-tax cost of the debt *not otherwise required* will directly reduce real returns to equity owners even though the company's real profits are maintained. Alternatively, if the added financing is obtained with new equity issues, even if the new issue price is *initially* the same,[51] the owners of the previously outstanding shares wind up owning a smaller fraction of the company's total equity, and *their* real return will have been impaired even though the company's real returns have been fully maintained. Moreover, it should be emphasized that these reductions in real returns on equity ownership occur *even though real interest rates and returns on alternative investments are unchanged.*[52] In particular, the adverse effects of inflation on equity prices and real returns because of the deadweight real financing costs involved are *in addition* to any negative impacts of an increase in interest rates.[53]

To this point we have just dealt with the adverse effects of an *unanticipated* and transient increase in inflation rates. These effects are seriously compounded during a transition period if there is also an increase in *expected* future rates of inflation. Indeed, an increase in *anticipated*

50a. Under the assumptions made to this point, real rates of return will be fully maintained *if* the firm is in a nuetral debtor-creditor position and actually *raised* by unanticipated inflation if the firm is a net debtor. Our results depend in part on the fact that inflation is reducing the real value of cash and accounts receivable, but also on the fact that any offsetting capital gains on outstanding debt from unanticipated inflation do *not* reduce the number of new dollars required from outside sources. Indeed, the same amount of increased external financing is required if the firm has no debt outstanding or if it is a large net debtor. The author has had fruitful discussions with Philip Cagan and Jay Light on these and related issues.

51. Any anticipation of the effects described in the rest of this sentence would of course lower the initial price, increase the number of new shares required, and compound the effects noted.

52. For convenience, completeness, and brevity, the analysis in the next few pages will be developed in terms of changes in the real returns on equities. The analysis is simpler in this form, since to a good working approximation, the real interest rate can be regarded as constant.

53. If *real* interest rates are also increased, the effects emphasized in the text are clearly compounded. An alternative analysis often emphasizes that the "inflation premiums" in nominal interest rates raise nominal yields on debt instruments and argues that these higher nominal returns on alternative investments raise the opportunity costs of placing (or holding) funds in equities. Both statements are correct, but in this context, any conclusions that inflation adversely affects equity values depends on a *further* demonstration that expected nominal equity yields will not have correspondingly increased, and this step is usually omitted (or just assumed). This latter condition, however, is equivalent to requiring that *real* returns to equity holders *decline relative* to real interest rates—and this "missing step" is established in the text above.

future inflation involves a *much larger* (and additional) reduction in the current period's real returns on equity ownership (and in the end-of-period market value of equity) to reflect the *discounted value of the whole stream of future deadweight costs* which will be required if higher rates of inflation continue.[54] Since the use of *either* new debt or new equity issued to meet the added external financing required by greater inflation will involve these reductions in the real returns and values of equity over a transition period, it follows that any mixture of added debt and outside equity will do so.

We also know from capital market theory, however, that if the real rate of interest is constant and the risks of equity ownership in *real* terms are unaffected, *expected real* rates of return on equities *net of dilution* must be maintained. Consequently, with either debt or equity financing of the added requirements for external funds, the *company's* real costs of capital (*its* expected real rate of return before dilution) must rise. The increase in its real costs of capital in turn reduces its optimal rates of real growth, other things equal, even if real profit margins are maintained and *product* demands continue to expand at the same rate—and reduced rates of real growth of course further impair the values of outstanding corporate equity during the period of transitional adjustment to higher rates of inflation.[55] Nevertheless, *after* the period of adjustment to higher rates of inflation, equity investments will be just as attractive as before (even though substantial losses will have been taken during the transition).[56] Even if this higher rate continues and is fully anticipated by everyone in the market, the *expected real* rates of return on owning outstanding equity shares must be at least as high as they would otherwise have been in the absence of the increase in inflation rates.[57] If business risks in real terms and leverage ratios are greater, the expected real return on equities will be higher after the transition period, and of course expected nominal returns to equities will be still larger in any case.

54. If added equity is used to obtain the additional outside financing required with higher rates of inflation *just to maintain the company's real rates of growth and returns*, a continuing higher rate of inflation will require a continuing stream of new equity issues; the *prospect* of further subsequent dilutions of any outstanding equity will lower the price at which new equity can be issued at any given time so that still larger fractions of the company's total equity must be given up in order to finance the increased reliance on outside funds required *ceteris paribus* by the higher rate of inflation. Alternatively, if the added financing required by higher inflation is obtained by additional debt, current real returns on equity are penalized by the *discounted value of the continuing stream of the after-tax costs* of the growing volume of debt *which would not otherwise have been required* to maintain the company's real returns and rates of growth.

55. It should be emphasized that for analytical purposes our model assumes that real growth rates and real profit margins are maintained in spite of inflation. The adverse effects of increased rates of inflation on equity values and returns which have beeen summarized to this point are consequently all in addition to the genuinely important adverse effects created by firms' inability to maintain expansion in physical volume and/or to pass along increased material and labor costs, and by tax liabilities on phantom inventory profits and the restriction of depreciation to historical costs—and they are also independent of the reductions in current values induced by the anticipation of subsequent deflationary changes in fiscal and monetary policies by public authorities.

56. I have had helpful discussions with my colleague Irwin Tepper on this part of the analysis.

57. This statement of course assumes that the riskless rate in *real* terms—or more precisely, the weighted average shadow price of wealth in the market, as explained below—is no lower, but this seems like a safe assumption.

Suppose now that all firms and securities markets have fully adjusted to a high but steady rate of inflation. By reversing the arguments given above for increases in inflation rates, we see that an unexpected *reduction* in inflation rates, other things equal, will reduce firms' relative dependence on outside financing incident to inflation and thereby reduce the deadweight dilution it entails; holding period returns on equities will consequently be *larger* than expected. Correspondingly, since a reduction in *expected* rates of inflation reduces a whole stream of expected future deadweight costs, it will consequently result in *still larger* extraordinary capital gains for equity holders over a transition period until the market has fully adjusted to the new and lower expected rates of inflation.

This model consequently explains the *negative* relation of both real and nominal returns on equities with levels of inflation, whether anticipated or unanticipated, which has been observed in the empirical work cited earlier. We have focussed on important dynamic and essentially financial repercussions of changes in inflation rates on equity returns which seem to have been overlooked previously. In order to bring out these important effects in the clearest way, we have simplified the analysis by assuming that companies could maintain their real growth and real profit margins. In doing so, we have deliberately abstracted from several other important effects of inflation, previously discussed in the literature, which also bear on equity returns.[58] While the model being advanced here is thus *sufficient* to explain the observed negative relation between changes in inflation rates and equity returns, a complete analysis would also incorporate these other effects of inflation which, generally speaking, reinforce the conclusions we have reached.[59]

III

To this point our discussion has focussed on the fundamental modifications required in earlier theories of the relation of changes in the rate of inflation to equity returns and values over time. But expectations and risks of inflation also require significant modifications in many of our basic "cross-sectional" theories concerning the *structure* of asset prices and returns at any given point in time. Although these must be considered more briefly, they require some summary mention since they may prove to be equally significant for the further development of our area.

Our modern theoretical textbooks[60] still rely on the now-classic Williams-Modigliani-Miller theory of the invariance of a firm's cost of capital in the absence of taxes to its debt-equity ratio as their standard case. These results, of course, follow rigorously with respect to a world of homogeneous assessments and unsegmented perfect markets in which

58. See references in Lintner, "Inflation . . . ," *op. cit.* in the previous footnote.

59. See the second preceding footnote and my forthgoing monograph cited earlier.

60. For instance, Eugene F. Fama and Merton H. Miller, *The Theory of Finance* (1972) and Jan Mossin, *Theory of Financial Markets* (1973). Our text concentrates on the "no-tax" case because allowance for tax effects is the same in any model.

each investor would hold the same fraction of any company's outstanding stocks and bonds,[61] and each firm's prospective stream of pre-interest earnings is unaffected by its current debt-equity position.[62] Otherwise it is well known that bankruptcy risks destroy the invariance property in the absence of still stronger simplifying assumptions.[63] But in point of fact, bond markets are quite segmented and otherwise imperfect;[64] the household sector which directly owns four-fifths of corporate equity only holds about one-fifth of all corporate debt; and most debt held by intermediaries is not the portfolio-equivalent of directly held debt.[65]

Once corporate taxes are introduced into the standard idealized model, costs of capital decline linearly with debt-equity ratios so that firms optimize their financial position by selling all the debt for which they can find buyers—or more formally, by maximizing their leverage at any given point in time subject to "institutional" constraints. In more realistically specified models, however,[66] significant nonlinearities produce well defined *interior* optimums which uniformly involve *lower* debt-equity ratios than implied by their idealized counterparts, even in the absence of purchasing-power losses and risks. When such purchasing power considerations are *also* introduced into the analysis, these nonlinearities are significantly compounded. We showed earlier that even the companies which are able to maintain their *real* profit margins and growth will have to depend more heavily on outside financing when inflation rates increase. Still more outside financing will be required to the extent that historical rather than current replacement costs are used for inventories and fixed capital, and as collection periods lengthen or unsold inventories back up. Even if any given initial level of a company's debt-equity ratio

61. If allhinvestors make the *same* assessments in such perfect markets, any K'th investor would hold the same fraction Z_{ik} of the i^{th} company's stock and its bonds regardless of the degree of its leverage, and the probability distribution of his returns on the i^{th} company's bonds and stocks *together* will consequently be identical (for all levels of its debt/equity ratio) to that he would have had on its unlevered stock if it had no debt. This will be true under *these* assumptions, even when risks of default are recognized. See Mossin, *op. cit.*, pp. 76-91, and Stiglitz cited below.

62. The critical importance of this latter assumption was emphasized in Lintner, "Dividends, Earnings, Leverage, Stock Prices and the Supply of Capital to Corporations," *Review of Economics and Statistics,* August 1962, esp. pp. 265-6; see also, Alexander Robichek and Steward C. Myers, *Optimal Financing Decisions* (1965) and Joseph E. Stiglitz, "On the Irrelevance of Corporate Financial Policy," *American Economic Review,* December 1974.

63. See Stiglitz, op. cit. and "A Reexamination of the Modigliani-Miller Theorem," *American Economic Review,* Dec. 1969. Robert Merton also validates MM results in a continuous time arbitraging model ("On the Pricing of Corporate Debt . . . ," *Journal of Finance,* May 1974), assuming no taxes, identical borrowing and lending rates, invariant EBIT streams, and full use of proceeds of short sales.

64. Note, for instance, the restrictive legal lists of bonds eligible for investment by life insurance companies and mutual savings banks, and the markedly different quotations given on the same bonds to different investors at the same time. Note also the evidence of widespread credit rationing of bank loans and of lower quality long term debts.

65. This is true for many reasons, including, for instance, the fact that the investment experience and risks of uninsured pension funds generally have much more effect on the costs of the plans to the company than to the size and risks of the future pension; similar observations apply to most other pension plans and to holders of life insurance policies.

66. See, for instance, John Lintner, "Bankruptcy Risk, Market Segmentation and Optimal Capital Structure," in Irwin Friend and James Bicksler (eds), *Risks and Returns,* (Ballinger, in press).

is not allowed to increase, its bankruptcy risks will increase with higher inflation rates.[67] With any given set of initial conditions, a company's optimal capital structure will consequently depend directly on expected rates of inflation and the uncertainties of *these* assessments, as well as the more common assessments of prospective earnings streams and "business" (as apposed to financial) risks.

We also observe that the now standard Capital Asset Pricing Model also requires substantial respecification whenever expectations of (and uncertainties and covariances involving) future rates of inflation are significant elements in the assessments of individual investors reflected in market prices. The original theoretical work leading to this model had implicitly ignored purchasing power effects, and even the most sophisticated modern tests of the model[68] have all been on *nominal* returns on all assets,[69] with a riskless money-return asset[70] as the alternative to the "market portfolio." But investors who are also consumers will surely be acting in terms of preferences over outcomes denominated in purchasing power units rather than "mere money." With respect to such investors, the evidence cited earlier (pp. 22-3) showing significantly negative correlations of both real and nominal stock market returns with changes in inflation rates shows that there have been significant specification biases in all earlier tests of the market model based simply on nominal returns. Although the argument has recently been advanced[71] that the market model in nominal terms is not misspecified by ignoring inflation because purchasing power variances have been relatively small, they are nevertheless *systematically* and very *significantly* related to equity returns. The market model in nominal terms ignoring inflation is consequently misspecified *unless* the risk premium ($r_s - r_f$) on *all* individual stocks (and on the "market portfolio") is *invariant* to inflation, but Body's results on twenty years of monthly CRSP data show a t-value of 4.3 *against* this hypothesis for the overall market and consequently on the average for all individual stocks. In addition there are sure to be great cross-sectional differences in the response of the risk-premiums on individual stocks to changes in purchasing power.

At the minimum, a new battery of tests and parameter estimates is required with all returns, variances, covariances and betas measured in

67. Bankruptcy risks will increase with increases in the ratio of nominal carrying charges to expected nominal earnings flows (assuming dispersion constant for simplicity). A constant ratio of new debt to retained funds and new equity would not increase bankruptcy risk *if* nominal interest rate were constant, but bankruptcy risk will in fact rise even with this policy because nominal interest rates rise with expected inflation.

68. The only exception I know of is the work of Gonzales Gaviria discussed below.

69. These tests are reviewed in the citations on page 264.

70. Either nominal yields on Treasury Bills, or a "minimum-variance zero-beta" factor constructed from nominal risky returns, have been used.

71. Fama and MacBeth (*op. cit.*, esp. pp. 62-66) argue that the behavior of real and nominal returns on equity portfolios is "very similar" since the variance of purchasing power changes is very small relative to that of nominal returns on both equity portfolios and their zero-beta factor measuring returns on the riskless asset. The implication is that the market model in nominal terms is not misspecified by ignoring inflation, and this position is explicitly taken in Blume and Friend (*op. cit.*, p. 20), although neither paper presents direct tests of the proposition.

purchasing power units. A quite promising initial effort along these lines has recently been made by Gonzales Gaviria[72] under the restrictive assumption, however, that the distribution of real rates of return for all investment assets is independent of purchasing power changes. Since our analysis in Section II above and the evidence cited shows that purchasing power covariances are very significant, they must be explicitly introduced in further work. Indeed, purchasing power variances and uncertainties *per se* will *also* affect market equilibria in real terms whenever the aggregation of all investors in the market is in *either* a net debtor or net creditor position[73]—and the more than $80 billions of direct federal debt held by private investors (other than intermediaries) in itself insures a strong net creditor position. We also need to reorganize that, while consumer-investors doubtless optimize their preferences functions in real terms, some of their fund allocations involve purchase of life insurance and other longer term contractual obligations of intermediaries with *dollar* liabilities. The portfolios of the latter will be selected to optimize the distribution of *nominal* returns,[74] and these will necessarily differ in composition from the portfolios which optimize the distribution of *real* returns even on the basis of the same underlying assessments. The conditionally optimal security portfolios of consumer-investors oriented to real returns are thus interacting in the market with nominal-return-optimizing portfolios of various intermediaries when inflation is taken into account, and this also requires further modifications of the Capital Asset Pricing Model as we adapt it to deal more effectively with the effects of inflation and inflationary expectations.

A further casualty of modern portfolio and capital market theory denominated in *real* returns is the classic rule dating back to Fisher that nominal or money interest rates are equal to the equilibrium real rates increased by *expected* rates of inflation. This standard benchmark for students of finance and economists alike is subject to a potentially serious bias when inflation is uncertain. The Fisher rule implicitly assumes the absence of risk-aversion on the part of all investors acting on preferences over real outcomes.[75] For all such investors, the certainty-equivalent real return on any asset with a fixed *money* return will *differ* from the excess

72. Nestor Gonzales Gaviria, *Inflation and Capital Asset Market Prices: Theory and Tests* (unpublished Ph.D. thesis, Stanford University).

73. Mossin, *op. cit.* pp. 94-96 develops a model in "real" terms in which purchasing power covariances are recognized but purchasing power *variances* drop out only because of his market-clearing condition that the algebraic sum of the net debtor-creditor positions of all investors in the market must be zero. Gonzales-Gaviria gets some of his neat results by using the same clearing assumption which eliminates private debt from the "market" portfolio in spite of purchasing power risks.

74. Insurance companies and other intermediaries will also be concerned with the *duration* of their investment portfolios relative to their liabilities. See section IV in "Forward Commitment Decisions of Life Insurance Companies for Investments in Bonds and Mortgages" (Mss. 1974), part of a larger study of Investment Policies of Major Financial Institutions Under Inflationary Conditions, financed by a grant from the American Life Insurance Association to the National Bureau of Economic Research.

75. Alternatively, the Fisher rule may be derived by assuming the aggregated net creditor-debtor position of all investors in the market is zero.

of its nominal return over the expected rate of purchasing power loss (the Fisher rule) by amounts which increase with risk aversion and also with the assets' marginal portfolio risks in real terms (the entire "row-sum" of its variance and its covariances of purchasing power risks with all other assets in the portfolio).[76] Market aggregation can eliminate the resulting biases only in very special cases, violated in practice.[77] The character of the bias generally to be expected is clearly brought out by supposing that an invariant real return on some *other* asset (such as an index bond) were guaranteed by some unquestionable financially omnipotent power and that all investor's portfolios were fully diversified. The current market price of any asset with a fixed monetary payoff will then be lower (and its market clearing nominal rate of interest *higher*) than predicted by Fisher's formula.[78]

Some very promising and sophisticated theoretical work dealing with some of the issues raised in the last few paragraphs has been done quite recently,[79] but important additional elements remain to be investigated. In particular, a substantial amount of further work involving empirical investigation, testing and implementation is still required before we will have developed a clear and firm knowledge of the effects of inflation and inflationary expectations on the portfolio decisions of differently situated investor groups and how these interact to affect the prices and returns on different types of securities. The intellectual challenge posed is quite evident, and the importance of the issues fully justifies the effort.

76. See Lintner, "Aggregation of Investor's Diverse Judgments . . ." *op. cit.*, section II; and also Lintner, "The Effects of Short Selling . . . ," *Journal of Financial and Quantitative Analysis*, Dec. 1971, equation (14).

77. The condition for no bias (given in the second preceding note) is ruled out in practive by the large amounts of public debt held in private portfolios, as observed above. We may also observe that, quite apart from this consideration, the existence of an exogenous Federal Reserve System with required reserves on commercial banks virtually insures such a non-neutral borrower-lender position for "the market."

78. This conclusion follows immediately from the net creditor position of private investors noted earlier and the fact that the real return on the index bond determines the shadow value of every investors wealth constraint (see refs. in footnote 76). See also Stanley Fischer, "The Demand For Index Bonds," unpub. mss. M.I.T., Oct. 1974.

79. See especially Richard Roll, "Assets, Money and Commodity Price Inflation Under Uncertainty," *Journal of Money, Credit and Banking* (1973) and J. B. Long, Jr., "Stock Prices, Inflation and the Term Structure of Interest Rates," *Journal of Financial Economics*, June 1974, as well as Robert C. Merton, "An Intertemporal Capital Asset Pricing Model, *Econometrica*, Sept. 1973.