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An Alternative Test of The Proxy Hypothesis

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INFLATION, INFLATION ACCOUNTING, AND REAL STOCK RETURNS: AN ALTERNATIVE TEST OF THE PROXY HYPOTHESIS

By

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ABSTRACT

INFLATION, INFLATION ACCOUNTING, AND REAL STOCK RETURNS: AN ALTERNATIVE TEST OF THE PROXY HYPOTHESIS

By

Jon Allan Hooks

This paper investigates possible explanations of the inverse inflation-real stock return relationship observed in the 1954-87 period. The major question addressed is whether inflation has a genuine role in stock return models, or whether it simply proxies for true fundamental determinants of stock values. To resolve this, we examine the relationship between inflation and the components of a simple rational valuation model of equities.

We adjust conventional, U.S. nonfinancial corporate income statement and balance sheet data to remove the distorting effects of inflation from conventional profit data. We document explanatory power for inflation adjusted real profitability in a stock return model, and show that inflation adjusted real profitability dominates real dividends in explanatory power in our stock return model.

We then use the inflation adjusted profit measures to determine whether inflation proxies for these measures of real profitability in real stock returns. We find a significant inverse relationship between inflation and adjusted measures of real profitability. However, while eliminating the role of anticipated inflation, including these profit

measures in our stock return model does not eliminate the explanatory power of unanticipated inflation.

We employ our simple valuation model to derive an implied measure of the rate at which each measure of earnings is discounted. We utilize these imputed earnings capitalization rates to examine the possibility that unanticipated inflation's role in our stock return model results from it proxying for the rate at which investors discount earnings.

We find that both the risky and riskless components of the real rate at which investors discount earnings has been significantly positively related to the unanticipated rate of inflation. However, as in the case of real profitability, inclusion of the implied capitalization rate in our stock return model does not eliminate the explanatory power of unanticipated inflation.

Thus, while we eliminate the role of anticipated inflation in real stock return determination, the role of unanticipated inflation in stock return models appears genuine, and is, at least in part, driven by its impact on the riskless real rate of interest (a macroeconomic phenomenon), and on inflation adjusted real profits and the risky component of the required yield on equities (stock market phenomena).

To my Parents

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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CHAPTER I

INFLATION AND STOCK RETURNS

1.1 INTRODUCTION

There exists a documented, but not fully explained, inverse relationship between inflation and real equity returns in the post-1954 period (see Bodie [1976], and Nelson [1975]). This paper investigates this apparent violation of the classical proposition that equities provide an inflation hedge. We examine the impact of anticipated and unanticipated inflation on the two components of a simple rational valuation model-- earnings, and an imputed measure of the rate at which these earnings are discounted-- which we hypothesize are the fundamental determinants of stock values. We use our findings to examine various explanations of the observed inflation-stock return relationship.

Fama [1981] argues that the inflation-stock return relationship is spurious and stems from inflation proxying for more fundamental determinants of equity values. A second argument is that the riskiness of equities has increased, which when combined with flat (or declining) earnings, has resulted in declining equity prices (see French, Schwert, and Stambaugh [1987], and Pindyck [1984, 1988]). Alternatively, Modigliani and Cohn [1979] suggest that the decline in equity values is a result of inflation-induced valuation errors by investors.

This paper focuses on these three hypotheses (especially Fama [1981]). Our examination of the role of earnings in stock return

determination utilizes data adjusted for inflation-induced distortions to provide a more consistent, accrual based definition of income, as suggested by Modigliani and Cohn. Our examination of the role of the discount rate utilizes a simple valuation model to obtain measures of the rate implied by observable data. Furthermore, we address the proposition of French, Schwert, and Stambaugh, by examining both the risky and risk-free components of the discount rate. Finally, we examine the underlying framework of Fama's [1981] proxy hopothesis and use the results of our examination of earnings and the discount rate to reexamine an augmented version of his theory.

We utilize our adjusted data to show that average real corporate profitability under any definition, as well as proxies for real profitability (e.g., real output), behave consistently with average real stock returns over long sample periods. In contrast, upon sample partitioning, we find that neither profits, dividends, nor real activity have adequately accounted for the cyclical behavior of real equity returns during the 1954-87 period. To the extent that average real profitability and average real stock returns are consistent, we show that inflation adjusted measures of profit are most consistent.

Our sample partitioning indicates that it is the 1965-74 period in which stock returns are least consistent with the behavior of real profitability or economic growth alone. Furthermore, this period is characterized by an unstable relationship between real activity and real earnings, which is inconsistent with Fama's version of the proxy hypothesis.

Using a simple rational valuation model, the logical path of investigation into the 1965-74 (and thus 1954-87) stock returns is to examine the behavior of the earnings capitalization rate (or its co

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components-- the real riskless interest rate, and the risky required yield on equities), in addition to inflation adjusted earnings. We do this by hypothesizing a vector of macroeconomic variables which drive the capitalization rate, and by examining the relationship between this vector and real stock returns.

This paper is organized as follows. This chapter outlines some existing literature on the inflation-stock return (or stock price) relationship. Chapter II discusses the various processes used to adjust a firm's book data to yield more consistent profit data during inflationary periods. Chapter III details the specific data adjustment process used in this paper. Chapter IV develops a simple rational valuation model, and uses the data of Chapter III to examine the behavior of the components of this model and stock returns. Chapter V examines the stock return-cash flow relationship. Chapter VI examines the role of the earnings capitalization rate in stock return determination, and attempts to determine a vector of observable macroeconomic variables which explain our imputed capitalization rate measure. Chapter VII reexamines Fama's proxy hypothesis using the results of Chapters IV and V. Finally, Chapter VIII summarizes our findings.

1.2 LITERATURE REVIEW

The predicted response of stock prices to inflation is not straightforward. If markets are assumed perfect,[1] then changes in anticipated inflation can be expected to increase corporate cash flows and the rate at which those cash flows are discounted in such a way as to minimize the effects of the inflation on real equity returns. This minimal effect hypothesis breaks down under a host of market imperfections. Below we examine the classical inflation-stock price model

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and the popular hypotheses on how some existing imperfections are utilized to explain the observed, negative, inflation-stock return relationship.

A. Classical Hypothesis

The classical proposition (see Fisher [1907, 1930]) implies that stock prices rise in proportion to increases in the general price level. Thus, equity holdings are viewed as a hedge against loss of purchasing power, and firms neither enjoy capital gains nor suffer losses, in real terms, as a result of price level changes. However, Bodie [1976], and Lintner [1975], find that in the post-Accord period, increases in inflation have led to simultaneous declines in common stock returns.

B. Investor Irrationality

An attempt to reconcile the classical proposition and the findings of Bodie and Lintner, is made by Modigliani and Cohn [1979]. Modigliani and Cohn (hereafter MC) argue that there exist two equivalent, rational ways to express the nominal value of a firm at a point in time. First, an investor can capitalize current profits at a point in time at the real capitalization rate (as we do). Alternatively, an investor can discount the stream of expected nominal profits from time t on, at the appropriate nominal discount rate. They show that neither model, when rationally constructed, predicts the inverse inflation-stock return relation documented by Bodie and Lintner.

Thus, MC conclude that the inverse inflation-stock return relation is adequately explained by recognizing that investors commit two inflation-induced errors in the valuation process. First, investors fail to discount the "correct" measure of earnings during periods of inflation. Secondly, investors fail to distinguish between real and nominal discount rates. It is these valuation errors, MC argue, that account for the inverse inflation-stock return relationship, and not something inherent in inflation which causes true profits to deteriorate, or which raises the appropriate capitalization rate. However, Ely and Robinson [1989] agrue that "this framework ... is outside the generally accepted paradigm of market efficiency and thus has not generated much interest"(p. 19). Nevertheless, we examine the propositions of MC below.

C. Proxy hypothesis

A theory which has generated a great deal of interest in the 1980s is the "proxy" hypothesis of Fama [1981]. Fama (referring to [1981] unless stated otherwise) documents the negative inflation-stock return relation of the post-Accord period (1954-1977). However, he argues that there is no causality running from inflation to stock returns. Instead, he suggests that the observed inverse relationship is spurious, and results from inflation acting as a proxy for real variables which are more fundamental determinants of equity returns. That is, he argues that there exists an inverse relationship between inflation and anticipated real activity, and a direct relationship between anticipated real activity and stock returns. Thus, inflation proxies for anticipated real activity in the traditional inflation-stock return equations, and the resulting observed inverse relationship is not genuine.

Fama attempts to document his proxy hypothesis by including anticipated real activity in the inflation-stock return equation. If inflation is a proxy for anticipated real activity, we expect to see its explanatory power in a stock return model approach zero when anticipated real activity is simultaneously included as an explanatory variable. Fama's model includes both anticipated and unanticipated inflation, in addition to anticipated real activity, as explanatory variables in a stock return equation.

While Fama finds that the "more anomalous" (i.e., those involving expected inflation) of the stock return-inflation relations disappear when both real variables and inflation are included in the model, he is not able to fully support his proxy hypothesis with his results.[2] In his monthly and quarterly estimations, he is unable to eliminate the significant inverse relationship between unanticipated inflation and real stock returns. Furthermore, only by including the growth rate of the monetary base is he able to eliminate the inverse anticipated inflation-stock return relationship.

Fama's hypothesis of no explanatory power for inflation in real equity returns is rejected by Wahlroos and Berglund [1986] for Finnish data over the 1969-82 period. They test the proxy hypothesis using various measures of expected inflation and expected real activity, and are unable to reject the existence of some explanatory power for both expected and unexpected inflation, with and without the inclusion of anticipated real activity. Fama's weak support of his hypothesis, along with the findings of Wahlroos and Berglund, suggest that there may be a role for inflation in explaining equity returns, or that other relevant determinants of stock returns have been ommitted, and thus the proxy hypothesis test equation was misspecified.

D. Volatility

Pindyck [1984] investigates two channels through which increasing inflation, and the increasing variability of inflation which has accompanied it throughout the 1970s, may affect shareholder net returns. First, inflation impacts returns by affecting the real net returns

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directly through the tax system, and second by the effect of unanticipated inflation on stock returns.

He examines these two channels by focusing on the role of the firm's gross marginal return on capital. He concludes that an increase in the level of inflation alone should cause stock prices to rise slightly, while an increase in the variability of inflation should have a negligible direct effect on share values. Instead, he attributes the decline in share values to a large increase in the volitility of the gross marginal return on capital, and a slight decline in its level.

To the extent that there does exist some nonspurious relationship between inflation and equity returns, we are interested in the causal components of this relationship. A number of studies have suggested various theoretical explanations for the observed inverse relationship.

E. Tax Distortions

Feldstein and Summers [1979] argue that "... with current tax laws, inflation substantially increases the effective tax rate on capital income in the corporate sector" (p. 1). Detailed discussion of these inflation induced tax distortions is reserved for Section II below. This inflation-tax burden relationship is also documented by Davidson and Weil (1977), Lovell (1978), and Tideman and Tucker (1977). Feldstein [1980] also documents a decline in the share value per dollar of pretax earnings during the latter 1960s through the late 1970s. He argues that this relationship was not spurious, rather that it was the result of U.S. tax code features elaborated on below.

F. Inflation Accounting

Shoven and Bulow [1982] argue that, in addition to the tax

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distortions outlined by Feldstein and Summers, inflation distorts corporate income by altering the market value of tangible assets and outstanding debt, and by affecting the real burden represented by net financial liabilities. In Chapter II we discuss inflation accounting in more detail.

G. Other Theories

In addition to the inflation induced tax distortions outlined above, there are a number of less tangible effects that, although not included in our adjustment process, merit some discussion.

One such contributor to the observed negative relationship is the adverse effect of widespread market anticipation of subsequent deflationary actions to be taken by the Federal Reserve as a result of the observed higher inflation. Pearce and Roley [1984] document the adverse effect of unexpected Federal Reserve tightening of the money supply on stock prices. If increased inflation led to anticipations of Fed tightening, and if depressed stock prices are associated with this tightening, then we expect to see a downward adjustment in stock prices. The efficient market hypothesis suggests that this downward adjustment will occur at the time the increased inflation occurs rather than after the actual Fed tightening begins. Thus, this theory is consistent with the observed negative simple correlations between inflation and real stock returns.

Lintner [1975] develops what he refers to as a "new theory" of the inflation-stock price relationship. Lintner's argument begins with the proposition that a uniform proportionate increase in all prices will result in a firm increasing its reliance on external funds. Furthermore "...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 of return realized on its equities during this period ..."[3] He argues that these losses result whether the outside financing used is debt or equity, and are in addition to any negative impacts of an increase in interest rates.

1.3 CONCLUSIONS

While this chapter has alluded to the abundance of theories attempting to explain the inflation-stock return anomaly, we will direct our attention to the proxy hypothesis of Fama, and the inflation accounting literature of Shoven and Bulow. Considering the latter of these hypotheses first, if the inflation-induced tax distortions and asset and liability valuation distortions discussed above are responsible for (or contribute to) the observed negative relationship between inflation and stock returns, then using data adjusted for such distortions should better explain the relationship. The following chapter will examine the data adjustment literature.

CHAPTER II

INFLATION ACCOUNTING

2.1 INTRODUCTION

While some researchers were exploring the macroeconomic time-series relationship between inflation and stock returns, another group of writers, in a similar line of research, were analyzing the effects of inflation on the aggregate balance sheet and income statement of U.S. firms.

Given the current inability to fully rule out the existence of a genuine role for inflation in explaining equity returns, the need for developing adjustments to corporate profit figures to better approximate returns during inflationary periods is justified. We are interested in our ability to explain the inverse inflation-stock return relationship using these adjusted data compared to using the traditional unadjusted equity data.

Inflation alters the nominal value of a firm's assets and liabilities and produces potential real gains or losses, most of which are unaccounted for by conventional accounting practices. A number of adjustment processes have been outlined in an effort to develop an accounting system which adequately and consistently measures economic earnings in both inflationary and noninflationary times (see Cagan and Lipsey [1978], Modigliani and Cohn [1979], and Shoven and Bulow [1975, 1976 and 1982]).

We systematize this work utilizing new current cost accounting data and an extended sample period which includes the declining inflation period of the 1980s.

The undertaking of such an effort is supported by the late 1970s and early 1980s trend of regulating agencies requiring some firms to report data relevant to the computation of many of the adjustments discussed in this section (see Bulow and Shoven [1982], p. 241). This trend is illustrated in the September 1979 Financial Accounting Standards Board's Statement No. 33, "Financial Reporting and Changing Prices". In this statement, the Board requires that information about the effects of inflation on corporate operations be included in annual reports of some firms (see Lucas [1981] for a discussion of this rule).

Although this required supplemental reporting has expired in the early 1980s, given the low inflation rate of the mid-1980s, historical cost accounting is consistent with the results we would obtain under current cost accounting, and thus the supplemental reporting is somewhat redundant. Furthermore, in an efficient market, reporting of inflation adjusted data is not necessary so long as it is publicly available.

Bulow and Shoven [1982] outline three general arguments supporting the adjustment of corporate profits for inflation. First, useful new information may be made available as a result of the supplemental disclosures made by firms under inflation accounting. Second, the data already available will be made more useful and meaningful in adjusted form. Finally, the information provided by inflation accounting may be useful in developing policy guidelines (e.g., tax policy). These benefits, of course, must be weighed against the cost borne by the firms required to produce this information.

This paper will address four adjustments that must be made to account for the effects of inflation on firm value. Shoven and Bulow [1976] argue that these adjustments are necessary in order "To be fully consistent with a Haig-Simons accrual definition of income..."(p. 16). Although Shoven and Bulow did not use this adjusted data to explain the inflation-stock return relationship, we argue that these data provide a more consistent measure of firm performance across periods of varying inflation rates. That is, income should be measured by the change in accrued net worth (both realized and unrealized) less current consumption, and stock returns should be related to this income. We follow Shoven and Bulow [1975] in defining income in terms of gains in real economic power of holders of equity resulting from their investments. This chapter contains a general discussion of the necessary adjustments and their justification.

2.2 CURRENT COST ACCOUNTING

Inflation increases the replacement cost of capital assets and inventories. However, many corporations utilize the aquisition cost which during inflationary times is lower than replacement cost. This practice results in firms receiving a lower depreciation tax shield, hence reporting larger profits for tax purposes than would be reported under current cost reporting. The higher illusory profits result in a higher tax bill and a lower after-tax real rate of return (ceteris paribus). This phenomenon occurs for both inventory accounting and in accounting for depreciable assets.

A. Inventory Valuation Adjustment

In inventory accounting, illusory profits arise as a result of firms' continued practice of first-in, first-out (FIFO) methods of accounting.

This procedure uses the lower acquisition cost of inventory in the cost of goods sold figures rather than the more relevant current cost, as would be used in last-in, first-out (LIFO) accounting, thus overstating profits for tax purposes. On the other hand, FIFO inventory accounting does have the advantage of carrying inventories at current cost on the balance sheet, whereas LIFO accounting understates the value of inventories carried over.

The SEC and the IRS require firms to use the same accounting procedure (i.e., LIFO or FIFO) for tax reporting purposes and annual reports to shareholders. This may help explain why firms continue to choose to report higher incomes for tax purposes under the FIFO system. By doing so, during periods of rising prices, firms are able to report higher profits and higher asset to liability ratios to shareholders than would be the case under LIFO accounting.

The effect on the valuation of inventories of a universal adoption of LIFO accounting methods is reported in the national income and product accounts (NIPA) in their assessment of the inventory valuation adjustment (IVA). The IVA estimates the amount of nominal inventory profits added to taxable income by inflation. With rising prices, the use of FIFO implies a lower cost of goods sold figure which results in higher taxable earnings. However, the lower cost is based on historical rather than replacement cost of the inventories used. Thus the higher reported profits, and hence higher tax liability, result from the failure of firms to recognize the opportunity cost of the inventories used.

An alternative method of inventory accounting would be a constant dollar FIFO. This method prices inventories similarly to the LIFO method for income statement purposes (although the timing differs), but retains the balance sheet advantages (mentioned above) of the FIFO method. On a firm by firm analysis this is highly desirable. However, the adjustments necessary for adoption of this in the aggregate would be very difficult. Since the IRS and the National Income and Product Accounts recognize the IVA adjustment, we will adopt it in our adjustments in Section III.

B. Capital Consumption Adjustment

In addition to inventories, depreciable assets are affected by the use of historical acquisition costs rather than current or replacement costs.[4] Firms use the appropriate depreciation schedules to deduct the historical acquisition cost of a depreciable asset over its specified life. Rising prices mean that a firm could sell an asset at a price above its historical cost, purchase a similar asset at the higher, current price, and hence report higher depreciation. Thus, the historical cost depreciation method ignores the opportunity cost of holding an asset during inflation (the purchasing power gained from the appreciation of depreciable assets is a separate question, and is addressed below in Section 2.5 of this chapter). The IRS has recognized that, in times of inflation, depreciation of assets by historical costs underestimate the true cost to the firm in terms of replacement, and has thus accelerated the permissible depreciation schedules.

Despite this acceleration, the real tax shield from depreciation is reduced, resulting in higher tax bills than under current or replacement cost depreciation accounting. This can be illustrated by a simple example using straight-line depreciation (see Shoven and Bulow [1975]). Consider a firm using straight-line, historical cost depreciation for an asset that cost \$C, and has a depreciable life of n years. Thus, equal annual amounts C/n are charged off each year. Discounting at a constant nominal interest rate (r) yields the following present value of the tax shield:

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$$(2.1) \qquad PV = (C/n) \int_0^{n} e^{-r_t} dt.$$

Let the nominal interest rate r equal the sum of a real rate i and the rate of inflation π. Then we can rewrite (2.1) as,

$$(2.2) \qquad PV = (C/n) \int_0^{n} e^{-(\pi+i)_t} dt.$$

For a constant real interest rate, the present value of the tax shield varies inversely with the rate of inflation. Only if the real interest rate varies inversely with the inflation rate, and completely offsets changes in inflation (i.e., r is unaffected by inflation), is the conclusion of this analysis incorrect. Thus, the depreciation tax shield falls with rising inflation under historical cost accounting. Shoven and Bulow [1975] show that this does not occur under a current cost accounting system (p. 27). The NIPA recognize this phenomenon and report a capital consumption adjustment (CCAdj) showing the effect of undertaking a current cost system, and accelerating the depreciation schedules.

Feldstein [1980] argues that the observed, negative inflation-stock price relationship is in part a result of adverse effects to equity ownership involved in accounting traditions and tax codes. The use of historical rather than current replacement cost in depreciation computations, and the use of FIFO rather than LIFO procedures in inventory valuations are two of the contributing factors. These adjustments are widely accepted, and thus, a number of studies employ the National Income and Product Accounts (NIPA) data with the IVA and CCAdj.

2.3 LONG-TERM DEBT

Inflation can impact interest rates so as to cause changes in the market value of a firm's outstanding bonds (primarily long term), and mortgages. The key to this effect is the impact of inflation on nominal interest rates. Many researchers have argued that the real rate of interest is roughly constant. This assumption implies a rise in inflation resulting in the nominal interest rate rising in proportion (as an inflation premium is added to the real interest rate). In turn, this rise in the nominal interest rate lowers the market value (i.e., retirement cost) of the firm's outstanding bonds and mortgages.

Under the Haig-Simons accrual definition of real income, changes in the market value of such liabilities should be immediately incorporated into income rather than, as currently practiced, being considered income only upon realization of the gain (or loss).

2.4 NET FINANCIAL LIABILITIES

A third major area of adjustment involves changes in the real obligation represented by the net financial liabilities of nonfinancial corporations, which are in aggregate net debtors. Cagan and Lipsey [1978] argue that we must adjust profits for the traditional inflationary gain of holders of nominally denominated liabilities (net of financial assets) when inflation reduces the real obligation they represent. This adjustment is the basis for one of the two valuation errors Modigliani and Cohn [1979] argue is made by investors (discussed in Section I above, and Section IV below).

The simple idea that net-debtors gain while net-creditors lose when inflation occurs is well established (see Alchian and Kessel [1959]). This wealth redistribution can occur if the inflation is unanticipated or if anticipations change during a period when an individual's or a firm's net financial asset position cannot be altered.

The net-debtor position (excess of financial liabilities over financial assets) of U.S. nonfinancial corporations has fluctuated over the last 40 years. Thus, we expect to see the adverse effects of inflation vary proportionately if wealth redistribution is an important factor in the observed negative relationship between inflation and stock prices. Thus, in Section III we adjust the profit data to account for these inflation induced changes in the real obligation of net financial liabilities.

2.5 CAPITAL ASSETS

Finally, the firm can incur capital gains on tangible assets if the specific price index for capital goods rises or falls by more than the general price level. This adjustment must be incorporated in addition to the capital consumption adjustments outlined in subsection one above. These gains can occur when inflation raises the value of a firm's land, buildings, equipment, or inventories. Such a gain is currently only recognized upon realization. However, as with financial assets and liabilities, under a comprehensive definition of income, the gain should be recorded when it occurs. This final adjustment presents a problem not found in the other adjustments. That is, recognition of this income might mean ending the existence of the business as a going concern (i.e., selling off of assets to recognize the capital gain). To the extent that this liquidation is necessary, this source of potential income is distinct from the other sources which allow normal firm activities to continue.

2.6 CONCLUSIONS

Two potentially offsetting forces emerge in the preceding four sections (2.2-2.5). First, inflation, coupled with historical cost accounting practices, results in illusory profits, a higher corporate income tax bill, and thus a lower after-tax return. That is, if one subtracts the tax liability from the profits adjusted for CCAdj and IVA, the resulting series is lower than if the tax bill were computed based on the adjusted profits. Conventional after tax profits are actually higher than adjusted profits during inflationary periods. Thus, the depreciation and inventory adjustments result in lower reported profits during inflation. However, the profits eliminated were illusory; thus the quality of the adjusted earnings is higher. On the other hand, the latter three forces work to offset the adverse impact of the inflation induced tax distortions by accounting for the appreciation in the values of physical and financial assets.

Modigliani and Cohn [1979] argue that "The tax system in effect taxes what should not be taxed and does not tax what should be taxed. By and large, the results tend to cancel out for the U.S. corporate sector as a whole" (p. 27). While the offsetting nature of the above forces is clear, the net effect does not appear to be zero. Davidson and Weil [1975] find that for only seven of the 30 Dow Industrials does the adjusted net income meet or exceed the reported net income (i.e., is the offset complete or overcompensating).[5] Hasbrouck [1983] finds that the degree to which the offset is complete is a function of the inflation rate.

MC, Davidson and Weil [1975], and Hasbrouck [1983] include only the IVA, CCAdj and net financial liability adjustments for which the offset is more nearly complete than under full adjustment. In aggregate, Cagan and Lipsey find, and the results in Chapter III confirm, that the three latter forces (in Sections 2.3-2.5 above) dominate the depressing effect of current cost accounting (Section 2.2) resulting in fully adjusted profits generally exceeding conventionally reported income. The full adjustment process used in this paper is outlined in Chapter III below.

CHAPTER III

INFLATION ADJUSTED PROFITS

In this section we will outline the specific procedures used to adjust the conventional data to correct for the four inflation induced distortions reviewed in Chapter II. The discussion below follows very closely the work of Shoven and Bulow [1975, 1976] and Cagan and Lipsey [1978]. The differences lie primarily in the sample period and the specific data used (although some methodological differences are noted). The data used in each calculation are discussed in the text, and summarized below each table.

Table 3.1 sets out the necessary adjustment to conventional profit data to reflect depreciable assets and inventories at their current market values. To the conventional, after-tax profits we add the inventory valuation adjustment (IVA), and the capital consumption adjustment (CCAadj) to arrive at after-tax profit on a national account basis (NAB). The profit, IVA, and CCAdj data are taken from the Nonfinancial Corporate Business (Excluding Farms) table of the September, 1987, Federal Reserve, Flow of Funds Accounts, release Z.1.

As explained in Section 2.2 of Chapter II above, the resulting profit series in column 6 Table 3.1 is the profit firms would report if depreciation were calculated on a replacement cost basis with accelerated depreciation, and under the universal adoption of LIFO accounting. The

TABLE 3.1

NONFARM NONFINANCIAL CORPORATIONS PROFITS
ADJUSTMENTS FOR IVA AND CCA
($millions)

DATE	CONV PRE-TAX PROFITS (1)	INCOME TAX (2)	CONV AFT-TAX PROFIT (3)	IVA (4)	CCA (5)	NAB PROFITS (6)
1954	32032	15603	16429	-300	-1627	14502
1955	42012	20175	21837	-1750	-260	19827
1956	41781	20006	21775	-2675	-1053	18047
1957	39753	19054	20699	-1525	-1204	17970
1958	33654	16128	17526	-250	-1205	16071
1959	43120	20701	22419	-277	-750	21392
1960	39610	19123	20487	-173	-237	20077
1961	39430	19369	20061	271	284	20616
1962	44066	20618	23448	88	3090	26626
1963	48912	22716	26196	54	3827	30077
1964	55275	23915	31360	-494	4376	35242
1965	65039	27096	37943	-1245	5129	41827
1966	70183	29409	40774	-2107	5422	44089
1967	66421	27794	38627	-1554	5479	42552
1968	72982	33499	39483	-3651	5327	41159
1969	69442	33251	36191	-5870	5846	36167
1970	56943	27112	29831	-6552	4953	28232
1971	65471	29849	35622	-4584	4123	35161
1972	76488	33646	42842	-6610	5444	41676
1973	96099	39896	56203	-20022	5369	41550
1974	106930	42018	64912	-39457	1387	26842
1975	108523	41230	67293	-10952	-6908	49433
1976	137852	52748	85104	-14911	-10500	59693
1977	160107	59683	100424	-16637	-9361	74426
1978	181208	66804	114404	-25293	-11333	77778
1979	194866	69278	125588	-43175	-14043	68370
1980	181359	66662	114697	-43129	-16099	55469
1981	181417	63633	117784	-24189	-13848	79747
1982	129799	46195	83604	-10350	-8387	64867
1983	159520	59308	100212	-10900	16024	105336
1984	196049	73267	122782	-5800	30860	147842
1985	175977	69665	106312	-750	51049	156611
1986	174623	77982	96641	6550	43345	146536
1987	202402	102230	100172	-15650	46328	130850

Source: Federal Reserve, Flow of Funds Accounts, Release Z.1, September, 1987.

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impact of each of these adjustments is approximated by the capital consumption adjustment and the inventory valuation adjustment in columns 5 and 4 respectively.

Tables 3.2 and 3.3 report the valuation adjustment of long-term bonds and mortgages respectively, resulting from the changes in nominal interest rates. If the real rate of interest is roughly constant and the nominal rate is the real rate plus some inflation premium, then we can attribute this valuation change to inflation. If, on the other hand, the real rate of interest varies, then this revaluation must result from other factors affecting the real rate of interest as well. This is discussed in Chapters VI and VII below.

This adjustment is not invalidated by the possibility that the real rate of interest varies. If the real rate is constant, then we are able to attribute changes in the nominal rate, and hence revaluation of debt, to changes in the expected rate of inflation. If, on the other hand, the real rate of interest varies systematically with some macroeconomic variables, of which inflation may be one, then we cannot as easily infer changes in the inflation premium from changes in the nominal interest rate. However, we would still use changes in the nominal rate to compute the current burden represented by long-term bonds and mortgages. We could no longer, however, attribute this revaluation to changes in inflation, unless it was inflation alone which systematically affected real interest rates. For the present discussion we will proceed as if inflation alone systematically affects the real rate of interest, and hence the inflation premium over this real rate.

Thus, if there is an increase (fall) in expected inflation, an inflation premium is added to (subtracted from) the current nominal interest rate, and the market value of outstanding long-term debt is

TABLE 3.2

GAIN OR LOSS ON LONG-TERM BONDS
($millions)

DATE	PAR VAL OF L.T. BONDS (1)	MKT VAL AS A % OF PAR (2)	MKT VAL OF L.T. BONDS (3)	CUMULATIVE UNREALIZED GAIN (4)	YEAR'S ACCRUED GAIN (5)
1955	54564	0.9976	54433.0	131.0	-126.8
1956	58040	0.8740	50727.0	7313.0	7182.1
1957	64072	0.8809	56441.0	7631.0	317.9
1958	69715	0.8906	62088.2	7626.8	-4.2
1959	72794	0.8377	60979.5	11814.5	4187.6
1960	76216	0.8641	65858.2	10357.8	-1456.7
1961	80611	0.8813	71042.5	9568.5	-789.2
1962	84643	0.9022	76364.9	8278.1	-1290.4
1963	88414	0.9045	79970.5	8443.5	165.5
1964	92408	0.9231	85301.8	7106.2	-1337.4
1965	97260	0.9132	88817.8	8442.2	1336.0
1966	107474	0.8440	90708.1	16765.9	8323.8
1967	122132	0.8207	100233.7	21898.3	5132.3
1968	135025	0.8225	111058.1	23966.9	2068.7
1969	147000	0.7212	106016.4	40983.6	17016.7
1970	166756	0.8078	134705.5	32050.5	-8933.1
1971	185563	0.8993	166876.8	18686.2	-13364.3
1972	197750	0.9148	180901.7	16848.3	-1837.9
1973	206909	0.8571	177341.7	29567.3	12719.0
1974	226579	0.7635	172993.1	53585.9	24018.6
1975	253983	0.8413	213675.9	40307.1	-13278.8
1976	276614	0.9703	268398.6	8215.4	-32091.7
1977	299491	0.9313	278916.0	20575.0	12359.6
1978	320607	0.8631	276715.9	43891.1	23316.1
1979	337915	0.7976	269521.0	68394.0	24502.9
1980	365570	0.7404	270668.0	94902.0	26508.0
1981	388331	0.7010	272220.0	116111.0	21209.0
1982	406997	0.8346	339679.7	67317.3	-48793.7
1983	423023	0.8327	352251.3	70771.7	3454.4
1984	469152	0.8277	388317.1	80834.9	10063.1
1985	542905	0.9050	491329.0	51576.0	-29258.9
1986	664181	0.9040	600419.6	63761.4	12185.4
1987	703831	0.9000	633447.9	70383.1	6621.7

Source: Federal Reserve, Flow of Funds Accounts, Release Z1, December, 1987

TABLE 3.3

GAIN OR LOSS ON MORTGAGES
($millions)

DATE	PAR VAL OF MORTGAGES (1)	MKT VAL OF MORTG (2)	CUMULATIVE UNREALIZED GAIN (3)	YEAR'S ACCRUED GAIN (4)
1955	21598	21546.2	51.8	-46.8
1956	23225	20298.7	2926.3	2874.5
1957	24857	21896.5	2960.5	34.1
1958	27714	24682.1	3031.9	71.4
1959	30800	25801.2	4998.8	1966.9
1960	33448	28902.4	4545.6	-453.3
1961	37442	32997.6	4444.4	-101.2
1962	42084	37968.2	4115.8	-328.6
1963	46780	42312.5	4467.5	351.7
1964	49475	45670.4	3804.6	-662.9
1965	51685	47198.7	4486.3	681.6
1966	54525	46019.1	8505.9	4019.6
1967	56626	46473.0	10153.0	1647.1
1968	58847	48401.7	10445.3	292.3
1969	58038	41857.0	16181.0	5735.7
1970	58918	47594.0	11324.0	-4857.0
1971	61422	55236.8	6185.2	-5138.8
1972	64183	58714.6	5468.4	-716.8
1973	66040	56602.9	9437.1	3968.7
1974	67016	51166.7	15849.3	6412.2
1975	66033	55553.6	10479.4	-5369.8
1976	68568	66531.5	2036.5	-8443.0
1977	72252	67288.3	4963.7	2927.2
1978	76887	66361.2	10525.8	5562.1
1979	78432	62557.4	15874.6	5348.8
1980	80602	59677.7	20924.3	5049.6
1981	78652	55135.1	23516.9	2592.7
1982	77432	64624.7	12807.3	-10709.7
1983	80937	67396.2	13540.8	733.5
1984	81270	67267.2	14002.8	462.1
1985	81703	73941.2	7761.8	-6241
1986	84416	76312.1	8103.9	342.2
1987	81412	73270.8	8141.2	37.3

Source: Federal Reserve, Flow of Funds Accounts Release Z1, December, 1987 reduced (increased). Since the impact on short-term obligations should be minimal, we adjust only long-term obligations. The magnitude of the change in market value is primarily a function of the maturity of the securities. We include all long-term debt and mortgages in our calculations. The par values of outstanding long-term bonds and mortgages are taken from the Nonfinancial Corporate Business, Asset and Liabilities Tables of the December, 1987, Flow of Funds, release Z.1.

The market value of these obligations is estimated using the ratio of market value to par value of listed bonds for all U.S. companies (column 2, Table 3.2) taken from the table of Listed Bonds by Major Group in various issues of the New York Stock Exchange Fact Book.[6] The end-of-year market values of long-term bonds and mortgages are listed in column 3, Table 3.2, and column 2, Table 3.3 respectively.

Column 4 in Table 3.2, and column 3 in Table 3.3 show the cumulative unrealized gain for that year and are computed as the difference between par and market value for that year. The year's accrued gain in column 5, Table 3.2, and column 4, Table 3.3 is the annual change in the cumulative unrealized gain. These series represent the year's total unreported profits (losses) of the nonfinancial corporate sector resulting from the decrease (increase) in the market value of their long-term obligations induced by the higher (lower) inflation premium in the nominal interest rate used in pricing the security. The ratio of market value to par value series is available only on an annual basis. Thus the inflation-induced revaluation on a quarterly basis must be interpolated. The process for computing quarterly changes is outlined in Appendix B.

Table 3.4 shows the adjustment of net financial liabilities (at market value) for the inflation-induced decline in the real obligation these liabilities represent to the firm. The market value of liabilities is estimated as the par value plus the cumulative unrealized gain on long-term bonds and mortgages in column 4 of Table 3.2, and column 3 of Table 3.3 respectively. Net financial liabilities is the difference between total liabilities in column 1, and total financial assets in column 2. The financial asset and liability data are from the December, 1987, Flow of Funds, release Z.1.

Column 4 shows the potential nominal gain or loss resulting from a change in the real obligation represented by the firm's net financial liabilities. The price index used to measure the change in the real obligation is the 1967 CPI-U listed in Table 3.5. Geometric averages of monthly figures are used for both quarterly and annual computations. The series in column 4 of Table 3.4 is obtained by multiplying the net financial liabilities at the end of the year previous (t-1) by the change in the monthly CPI from the end of year (t-1) to the end of the current year (t) to arrive at the current value of changes in real net financial liabilities induced by inflation (the same process is used for quarterly computations, substituting end-of-quarter values for end-of-year values). This adjustment is designed to capture the transfer of wealth from net debtors to net creditors resulting from price level changes. For a given level of net financial liabilities outstanding at the end of a quarter, a rise in the price index over the following quarter leads to the constant nominal liabilities being repaid in dollars with less purchasing power (i.e., the real obligation represented by these net liabilities falls). In Table 3.4 we list only annual data representing end-of-year outstanding (fourth quarter) figures.

Table 3.6 sets out the inflation-induced capital gains or losses on tangible assets. Columns 1 and 2 report the current and historical cost aggregate values (respectively) of structures, equipment, and inventory

TABLE 3.4

CHANGE IN MARKET VALUE OF NET FINANCIAL LIABILITIES
($millions)

DATE	M.V. TOTAL LIAB (1)	TOTAL FIN ASSETS (2)	M.V. NET FIN LIAB (3)	CHANGE M.V. NFL (4)
1954	155389.4	124627	30762.4	-123.0
1955	177079.8	142089	34990.8	92.3
1956	200218.4	147210	53008.4	804.8
1957	209756.4	151876	57880.4	1325.2
1958	219779.7	163502	56277.7	868.2
1959	244595.3	178716	65879.3	731.6
1960	254274.3	181736	72538.3	856.4
1961	269044.9	194579	74465.9	435.2
1962	283661.9	206757	76904.9	819.1
1963	306436.0	222448	83988.0	1153.6
1964	324941.8	237308	87633.8	923.9
1965	360232.4	259125	101107.4	1577.4
1966	406240.8	272722	133518.8	3235.4
1967	441378.3	289197	152181.3	4005.6
1968	492123.3	320072	172051.3	7304.7
1969	563847.6	351827	212020.6	11183.3
1970	583805.5	370274	213531.5	13145.3
1971	605033.4	406708	198325.4	8541.3
1972	658535.7	456211	202324.7	8329.7
1973	771790.4	526810	244980.4	22660.4
1974	812812.2	517494	295318.2	41401.7
1975	1087160.0	558515	528645.0	32189.7
1976	1174632.0	612893	561739.0	42291.6
1977	1296362.0	672704	623658.0	66285.2
1978	1468333.0	765661	702672.0	104774.5
1979	1649400.0	897665	751735.0	190424.1
1980	1822842.0	1012922	809920.0	215747.9
1981	1999327.0	1098579	900748.0	181422.1
1982	2093260.0	1124234	969026.0	98181.5
1983	2234977.0	1242313	992664.0	92057.5
1984	2540079.0	1352020	1188059.0	106215
1985	2837617.0	1458906	1378711.0	133062.6
1986	2503540.3	1569494	934046.3	31710.4
1987	3253180.0	1574701	1678479.0	44834.2

Source: Federal Reserve, Flow of Funds Release Z1, December, 1987.

TABLE 3.5

CONSUMER PRICE INDEX (1967=100)

DATE	CPI(67)	DATE	CPI(67)	DATE	CPI(67)
1954.1	80.60	1965.2	94.30	1976.3	171.87
1954.2	80.53	1965.3	94.73	1976.4	173.80
1954.3	80.57	1965.4	95.13	1977.1	176.86
1954.4	80.20	1966.1	95.90	1977.2	180.66
1955.1	80.10	1966.2	96.87	1977.3	183.30
1955.2	80.10	1966.3	97.80	1977.4	185.33
1955.3	80.37	1966.4	98.53	1978.1	188.40
1955.4	80.50	1967.1	98.73	1978.2	193.33
1956.1	80.33	1967.2	99.40	1978.3	197.83
1956.2	80.93	1967.3	100.47	1978.4	201.80
1956.3	81.97	1967.4	101.30	1979.1	207.02
1956.4	82.57	1968.1	102.37	1979.2	214.32
1957.1	83.07	1968.2	103.50	1979.3	221.53
1957.2	83.90	1968.3	104.80	1979.4	227.73
1957.3	84.80	1968.4	106.07	1980.1	236.55
1957.4	85.10	1969.1	107.27	1980.2	245.16
1958.1	85.97	1969.2	109.13	1980.3	249.83
1958.2	86.63	1969.3	110.70	1980.4	256.39
1958.3	86.73	1969.4	112.23	1981.1	263.13
1958.4	86.73	1970.1	113.90	1981.2	269.09
1959.1	86.73	1970.2	115.73	1981.3	276.73
1959.2	87.00	1970.3	117.03	1981.4	280.40
1959.3	87.53	1970.4	118.57	1982.1	282.50
1959.4	88.00	1971.1	119.47	1982.2	286.75
1960.1	87.97	1971.2	120.83	1982.3	292.33
1960.2	88.57	1971.3	122.03	1982.4	292.93
1960.3	88.73	1971.4	122.70	1983.1	292.47
1960.4	89.27	1972.1	123.67	1983.2	296.13
1961.1	89.30	1972.2	124.67	1983.3	299.50
1961.2	89.33	1972.3	125.80	1983.4	301.40
1961.3	89.80	1972.4	126.93	1984.1	303.10
1961.4	89.90	1973.1	128.70	1984.2	305.23
1962.1	90.10	1973.2	131.53	1984.3	309.96
1962.2	90.50	1973.3	134.43	1984.4	312.10
1962.3	90.87	1973.4	137.56	1985.1	313.93
1962.4	91.07	1974.1	141.43	1985.2	317.73
1963.1	91.20	1974.2	145.43	1985.3	319.73
1963.2	91.43	1974.3	149.86	1985.4	322.43
1963.3	92.10	1974.4	154.23	1986.1	322.96
1963.4	92.33	1975.1	157.03	1986.2	321.60
1964.1	92.57	1975.2	159.50	1986.3	323.73
1964.2	92.77	1975.3	162.90	1986.4	325.37
1964.3	93.10	1975.4	165.50	1987.1	329.06
1964.4	93.47	1976.1	167.10	1987.2	333.53
1965.1	93.63	1976.2	169.16		

Source: Survey of Current Business.

TABLE 3.6

GAIN OR LOSS ON TANGIBLE ASSETS
($millions)

DATE	REPRODUCIBLE ASSETS CURRENT (1)	REPRODUCIBLE ASSETS HIST. (2)	LAND CURRENT (3)	LAND HIST. (4)	TOTAL TANGIBLE ASSETS CURRENT (5)	TOTAL TANG ASSETS HIST (6)	CUMM +or- TANG ASSETS (7)	ACCRUED + OR - TANG ASSETS (8)
1955	314382	245383	52935	10919	367317	256302	111015	11731
1956	349921	269788	60317	12131	410238	281919	128319	17304
1957	371645	290021	67876	12876	439521	302897	136624	8305
1958	378522	299508	74620	14390	453142	313898	139244	2620
1959	396473	319055	80407	15997	476880	335052	141828	2584
1960	407705	337109	85505	17516	493210	354625	138585	-3243
1961	417655	353214	91126	19570	508781	372784	135997	-2588
1962	434026	373409	93042	21428	527068	394837	132231	-3766
1963	452326	394887	95015	23286	547341	418173	129168	-3063
1964	477878	420328	98106	25274	575984	445602	130382	1214
1965	515965	455091	101357	27850	617322	482941	134381	3999
1966	572599	501694	105011	30199	677610	531893	145717	11336
1967	621393	542245	105245	32374	726638	574619	152019	6302
1968	684696	586239	105271	34664	789967	620903	169064	17045
1969	756887	639283	108925	38922	865812	678205	187607	18543
1970	823377	684117	111576	40574	934953	724691	210262	22655
1971	893870	727322	114555	42509	1008425	769831	238594	28332
1972	966298	782786	122954	45380	1089252	828166	261086	22492
1973	1096153	869215	135361	49898	1231514	919113	312401	51315
1974	1362786	992286	158252	53787	1521038	1046073	474965	162564
1975	1487304	1056647	164377	54965	1651681	1111612	540069	65104
1976	1627296	1154649	178309	56479	1805605	1211128	594477	54408
1977	1803382	1274988	200962	59415	2004344	1334403	669941	75464
1978	2076158	1434108	234891	63637	2311049	1497745	813304	143363
1979	2351545	1623381	266922	67252	2618467	1690633	927834	114530
1980	2670714	1805510	317632	73822	2988346	1879332	1109014	181180
1981	2992933	2005222	369567	81676	3362500	2086898	1275602	166588
1982	3106655	2119370	398520	87118	3505175	2206488	1298687	23085
1983	3184066	2244498	425022	94788	3609088	2339286	1269802	-28885
1984	3382270	2453900	464016	102371	3846286	2556271	1290015	20213
1985	3498352	2621950	494698	110561	3993050	2732511	1260539	-29476
1986	3612119	2792309	528332	116089	4140451	2908398	1232053	-28486
1987	3809655	2962095	551531	119621	4361186	3081716	1279470	47417

Source: Federal Reserve, Balance Sheets for the U.S. Economy, 1947-87, Release C.9, October, 1987.

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(collectively refered to as reproducible tangible assets). Columns 3 and 4 do the same for land holdings. Columns 5 and 6 aggregate tangible assets on a current and historical cost basis respectively. The difference in the historical cost and market values is reported in column 7 as the cumulative nominal gain or loss. Finally, the year's accrued nominal gain or loss on tangible assets is listed in column 8. To obtain the real gain or loss on tangible assets (i.e., the rise in their value that exceeds the general inflation rate), we would deflate the current value series, and subtract the historical cost series from this deflated tangible asset series. The tangible asset data were taken from the October, 1987, Federal Reserve, Balance Sheets for the U.S. Economy 1947-87, release C.9, pages 21 through 25.

The series in column 8 represents the capital gain or loss attributible to the market value of a firm's tangible assets rising (falling), resulting in a potential nominal gain (loss) to the firm. If the rate at which these assets appreciate exceeds the general inflation rate, then there would be a real gain on these assets. These gains (or losses) are generally not reported by firms in conventional profit data. Furthermore, they are not taxed, nor can they be applied against a tax liability in the case of a loss, unless they are realized.

Table 3.7 summarizes the adjustment process, in nominal terms, from national accounts basis (NAB) after-tax profits in column 1, to the fully adjusted profit series in column 8. P1 is the conventionally reported measure of profits (e.g., those in annual reports) found in column 1 of Table 3.1. P2 is the NAB measure of profits in column 1 of Table 3.7. P3 add the inflation-induced gain or loss in net financial liabilities (column 2, Table 3.7) to P2. P4 add the gain or loss on bonds and mortgages (columns 4 and 5, Table 3.7) to P3. P5 is the fully adjusted

TABLE 3.7

NONFARM NONFINANCIAL CORPORATIONS ADJUSTMENTS TO PROFITS
($millions)

DATE	NAB PROFITS (1)	GAIN ON M.V. NFL (2)	GAIN OR LOSS ON TANGIBLE ASSETS (3)	YEAR'S ACCRUED GAIN LT BONDS (4)	YEAR'S ACCRUED GAIN MORTG (5)	FULLY ADJUSTED NAB PROFITS (6)
1955	19827	92.3	11731	-126.8	-46.8	31477
1956	18047	804.8	17304	7182.1	2874.5	46212
1957	17970	1325.2	8305	317.9	34.1	27952
1958	16071	868.2	2620	-4.2	71.4	19626
1959	21392	731.6	2584	4187.6	1966.9	30862
1960	20077	856.4	-3243	-1456.7	-453.3	15780
1961	20616	435.2	-2588	-789.2	-101.2	17573
1962	26626	819.1	-3766	-1290.4	-328.6	22060
1963	30077	1153.6	-3063	165.5	351.7	28685
1964	35242	923.9	1214	-1337.4	-662.9	35380
1965	41827	1577.4	3999	1336.0	681.6	49421
1966	44089	3235.4	11336	8323.8	4019.6	71004
1967	42552	4005.6	6302	5132.3	1647.1	59639
1968	41159	7304.7	17045	2068.7	292.3	67870
1969	36167	11183.3	18543	17016.7	5735.7	88646
1970	28232	13145.3	22655	-8933.1	-4857.0	50242
1971	35161	8541.3	28332	-13364.3	-5138.8	53531
1972	41676	8329.7	22492	-1837.9	-716.8	69943
1973	41550	22660.4	51315	12719.0	3968.7	132213
1974	26842	41401.7	162564	24018.6	6412.2	261239
1975	49433	32189.7	65104	-13278.8	-5369.8	128078
1976	59693	42291.6	54408	-32091.7	-8443.0	115858
1977	74426	66285.2	75464	12359.6	2927.2	231462
1978	77778	104774.5	143363	23316.1	5562.1	354794
1979	68370	190424.1	114530	24502.9	5348.8	403176
1980	55469	215747.9	181180	26508.0	5049.6	483955
1981	79747	181422.1	166588	21209.0	2592.7	451559
1982	64867	98181.5	23085	-48793.7	-10709.7	126630
1983	105336	92057.5	-28885	3454.4	733.5	172696
1984	147842	106215.0	20213	10063.1	462.1	284795
1985	156611	133062.6	-29476	-29258.9	-6241.0	224698
1986	146536	31710.4	-28486	12185.4	342.2	162288
1987	130850	44834.2	47417	6621.7	37.3	229760

Source: Column (1) Table III.1. (2) Table III.4. (3) Table III.7. (4) Table III.2. (5) Table III.3. (6)=sum (1)-(5).

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profits, and is obtained by adding the gain or loss on tangible assets (column 3, Table 3.7) to P4. We could express each adjustment in real terms. However, we will instead utilize the nominal values to derive real return on capital series for each earnings measure in Chapter IV.

We are now in a position to examine the time-series properties of five different measures of nominal corporate earnings, representing various degrees of inflation adjustment. The following chapter develops a simple rational valuation model which suggests that real profitability and the rate at which these earnings are discounted are fundamental determinants of stock returns. We will utilize our adjusted profit measures (P1-P5) to derive some conclusions concerning the behavior of earnings, the discount rate, their interaction in the determination of stock returns, and the inflation-stock return relationship.

CHAPTER IV

FUNDAMENTAL DETERMINANTS OF STOCK RETURNS

4.1 INTRODUCTION

Two fundamental problems we face when trying to explain stock returns (or stock values) are delineating a set of relevant variables which drive returns, and measuring these variables. In this chapter, we discuss a simple rational valuation model which suggests potential determinants of stock returns. We then derive observable measures of these determinants, and examine the behavior of these variables and stock returns over the post-1954 period.

Since our goal is to explain the anomalous inverse inflation-real stock return relationship observed over this period, the second half of this chapter reviews the classical hypothesis and Fama's proxy hypothesis explanation of the violation of the classical theory. We then develop an alternative to Fama's model based on our findings.

4.2 SIMPLE RATIONAL VALUATION MODEL

We discuss a simple two-component model of stock values. We then employ this model to define a set of variables which drive stock values. These results are used to outline potential problems with existing model specifications, and consider solutions to these problems. We hypothesize that current stock values depend on investors' perceptions of future cash flows as follows (see Ely and Robinson [1989]):

$$(4.1) \qquad SP_t = \sum_{i=1}^{\infty} \frac{E_t(C_{t+i})}{(1+R)^i},$$

where SP_t is the stock value (or index value) at the end of time t, C_{t+i} is some measure of the cash flow in time t+i, R is the nominal interest rate at which investors discount cash flows, and $E_t(\ )$ denotes the expectations operator at time t.

If we assume the cash flow is expected to grow at a constant rate g, where g is less than R, then (4.1) can be rewritten as:

$$(4.1') \qquad SP_t = \sum_{i=1}^{\infty} \frac{C_t(1+g)^i}{(1+R)^i}.$$

Simplifying using the rule for the sum of a geometric progression, we get:

$$SP_t = E_t(C_{t+1})/(R-g),$$

or,

$$(4.2) \qquad SP_t = E_t(C_{t+1})/\rho,$$

where ρ=R-g, and represents the rate at which the cash flow (C) is discounted (also referred to as the capitalization rate). This specification is identical to the model of MC [1979], p. 27, and is consistent with that of Keim and Stambaugh [1983], and Chen, Roll and Ross [1986].

The time subscripts of (4.2), which difine ρ, are subject to debate. Thus, we will develop and discuss alternative measures of the capitalization rate. Nevertheless, Kiem and Stambaugh [1983] argue that whether ρ is useful in a stock return model is an empirical question.[7]

Thus, we will procede as if equation (4.2) is correctly specified, and examine the empirical relationship between real stock returns and the components of (4.2).

We express (4.2) as an identity and in real terms (consistent with MC [1979] and Fama [1981]) by dividing both sides by a current cost measure of the net capital stock:[8]

$$(4.3) \qquad (SP/\kappa)_t = \frac{E_t([C/\kappa]_{t+1})}{\rho},$$

where κ is the net capital stock (see note 8). Supressing subscripts and the expectations operator, and expressing (4.3) in log first-difference form ($\Delta\ln$) yields:[9]

$$(4.4) \qquad \Delta\ln[SP/\kappa] = \Delta\ln[C/\kappa] - \Delta\ln[\rho].$$

Equation (4.4) suggests that real stock returns ($\Delta\ln[SP/\kappa]$) are determined by factors affecting the anticipated growth rate in the real cash flow, and by factors affecting the growth rate of the capitalization rate.[10] We must thus establish measurable definitions of SP, C, and ρ (measurement of κ is not subject to debate).

4.3 COMPONENT DEFINITIONS

A. Equity Values

The series representing the nominal market value of all nonfinancial corporations (SP) is shown in Figure 4.1 for end-of-quarter values. The end-of-year market values are taken from the Federal Reserve Balance Sheets for the U.S. Economy 1947-87, release C.9, pages 21-25. The end-of-quarter series is an interpolation of the annual series. The interpolation method used is outlined in Appendix A below. The nominal i

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market value of equities rose moderately from 1954 through the late 1960s. The series then appears trendless, though volatile, through about 1980. After 1980, there has been strong growth in the nominal market value of nonfinancial, corporate equities.

The late-1960s decline in aggregate real equity values (SP/κ) is illustrated in Figure 4.2 using quarterly observations. The variable plotted is the left hand side of equation (4.3) above, and represents the aggregate real market value of all U.S. nonfinancial corporations as defined by MC [1979] (p. 27).

The cash flow investors choose to discount when valuing equities (C) is unobservable. Thus the question of which cash flow measure to employ in econometric studies is one of extensive theoretical debate. We do not attempt to prove which cash flow investors actually discount. Instead we examine three measures that arise in existing literature: dividends (D), profits (P), and real activity economic (A).

B. Dividends

As expected, given the implicit and explicit costs of adjusting dividends, the growth pattern of nominal dividends is much less volatile than that of earnings. Like earnings, real stock returns exhibit volatile behavior. Nevertheless, Fama and French [1987] use dividend yields (D/SP) in an attempt to explain (ex post) future stock returns. For some time periods and levels of aggregation they find marginal explanatory power for this variable.

The appeal of defining the cash flow (C) as dividends stems from the popular notion that investors place current value on an asset based on the expected future cash flows to be received from that asset. The clear drawback to dividends is that we must explain positive market values for

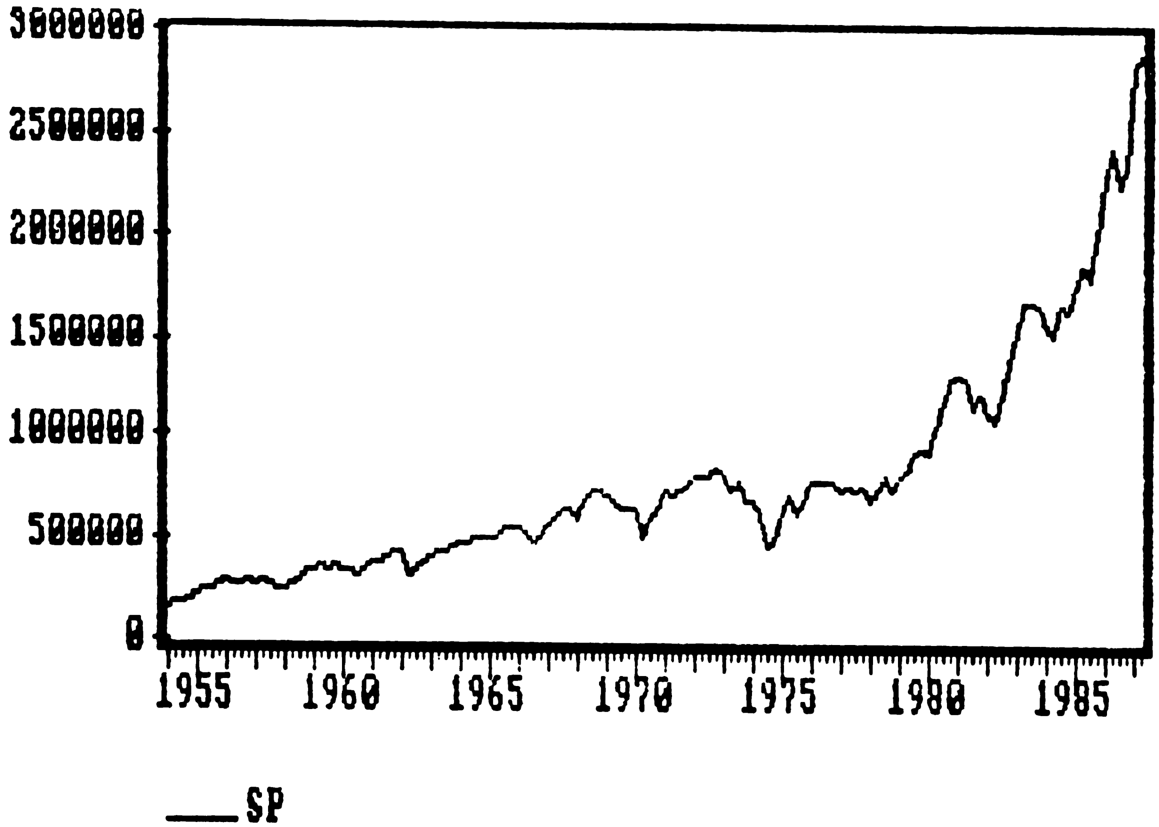

FIGURE 4.1

MARKET VALUE OF EQUITY: NONFINANCIAL CORPORATIONS

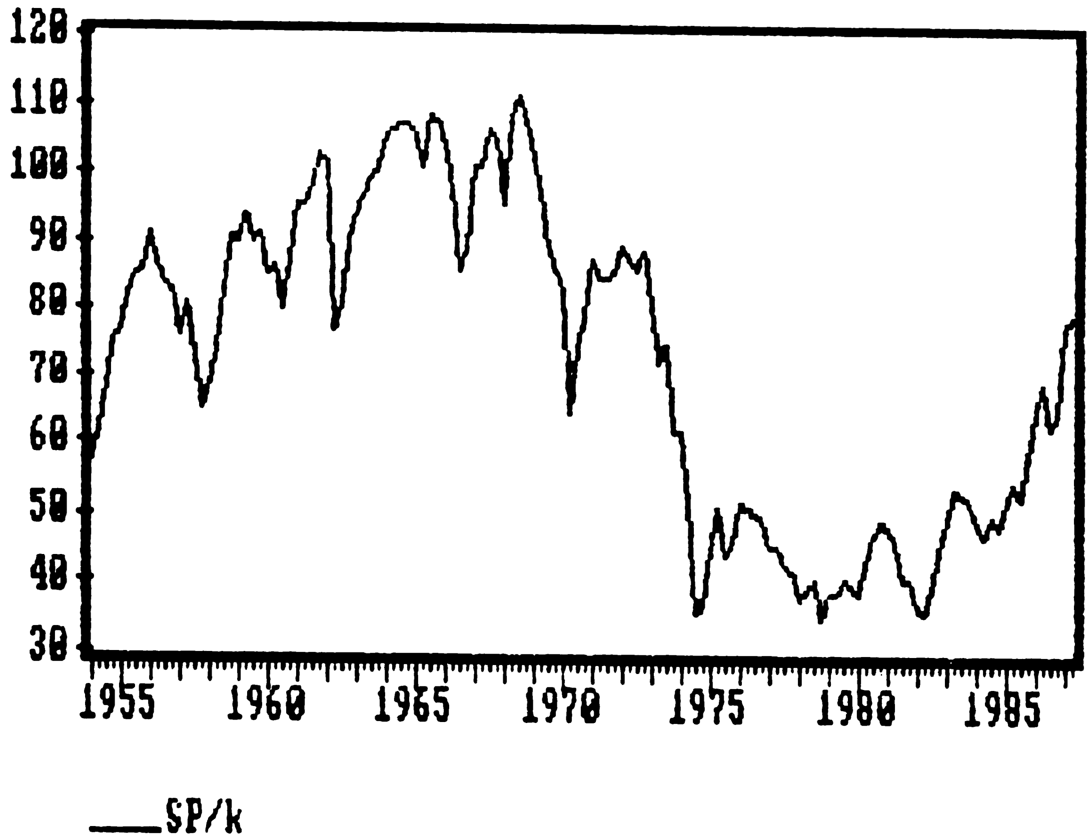

FIGURE 4.2

RATIO OF MARKET VALUE OF EQUITY TO NET CAPITAL STOCK nondividend paying firms in an infinite holding period model such as (4.2). Using aggregate data, however, the empirical problems this poses are reduced.

C. Earnings

Modigliani and Cohn [1979] employ operating income as a determinant in a model of stock returns. In addition, Fama [1981] argues that real profitability (or return on capital) is a fundamental determinant of stock returns. The use of earnings is based on the notion that earnings drive dividends (i.e., firms make their dividend decision based on earnings prospects). In addition, retained earnings capture potential capital gains, thus overcoming the zero-dividend problem discussed in Part B above.

The popularity of stock repurchase plans in lieu of dividends adds to the zero (or low) dividend problem. That is, given the double taxation of dividends and the (past) preferential treatment of long-term capital gains, some firms engaged in (informal) stock repurchase programs rather than dividend payments. Again, to the extent that earnings are related to both dividends, and stock repurchase plans, they are a relevant component of stock returns.

D. Real Activity

The use of real activity as a proxy for dividends or earnings stems from the proposition that the behavior of real economic activity (e.g., GNP, or Industrial Production) is a primary determinant of earnings (and hence dividends). Fama [1981], argues that real activity captures the explanatory power of fundamental determinants of stock returns. His ability to support this argument is discussed in detail below.

E. Capitalization Rate

Unlike the cash flow measures and stock values, the capitalization rate is not observable. The ideal measure of the capitalization rate would be applied to the true expectation of cash flow. However, we can not observe this expectation. Thus, we must develop observable proxies for the time t anticipation of the time t+1 cash flow (however we define the cash flow).

Modigliani and Cohn develop their model under assumptions of zero real growth. Thus, the best anticipation of next period's real cash flow is this period's observed cash flow (i.e., equation (4.2) above). Employment of this contemporaneous cash flow measure in (4.2) results in:

(4.2′) $$SP_t = C_t/\rho',$$

where ρ' is the appropriate capitalization rate for the contemporaneous cash flow (C_t), which proxies for the unobservable true expected cash flow (and thus ρ' proxies for the unobservable true capitalization rate ρ).

On the other hand, Fama employs what he refers to as a "rational expectations" augmented model of stock returns. That is, he assumes that $E(C_{t+1}|\Omega_t)=C_{t+1}$, where Ω_t represents all information available at time t. That is, the unobservable time t expectation of the time t+1 cash flow in equation (4.2) is replaced by the actual time t+1 cash flow observed next period. We utilize Fama's "rational expectations" approach to measuring $E(C_{t+1}|\Omega_t)$ in much of the work below. Use of this "rational expectations" augmented expected cash flow in (4.2) results in:

(4.2′′) $$SP_t = C_{t+1}/\rho'',$$

where, C_{t+1} proxies for the unobservable true expected cash flow discussed above, and ρ'' proxies for ρ. The econometric problems with allowing actual future values to proxy for current expectations are discussed in Appendix D.

Fama and French [1987] discuss the advantages and disadvantages of using ρ' and ρ'' as measures of the capitalization rate (for C-dividends). Rather than choosing between the two, we will examine whether the two measures have any relevant independent explanatory power in our stock return model. The basic notion that investors are concerned with current and future cash flow is widely accepted. To the extent that both current and observed future cash flows should contribute to an investors formulation of anticipated cash flow, and hence stock valuation, we argue that they each provide valuable, independent, information, and thus both ρ' and ρ'' can play a role in stock return determination.

4.4 CASH FLOWS AND STOCK RETURNS

A. Conventional Profits

The discounted dividend model is the foundation of most textbook analysis of stock valuation. The flow of dividends over a particular period can be observed and the relationship between this flow and stock values evaluated. On the other hand, unlike dividends which are observable and not subject to measurement debate, a more clouded question (see Chapter II) is that of determining the appropriate measure of earnings to be discounted. Thus, we consider alternative measures of earnings and their relationship with real activity and stock returns.

It has been well documented that reported real aggregate corporate profits declined appreciably over the late 1960s through the 1970s (see

Lovell [1978]). A widely debated question is whether the simultaneous decline in real equity values is attributable to this declining profitability. To answer this question, we must determine the relevant measure of profits. We can examine this question by using our five measures of profit (P1-P5) from Chapter III, to look at U.S. nonfinancial corporations' real profit vis-a-vis the real market value of equities.

Series ROC1 in Figure 4.3 plots, for U.S. nonfinancial corporations from 1954 to 1987, the ratio of conventional profits [P1] to a current cost measure of the net capital stock (i.e., ROC1 = P1/κ from (4.3) above).[11] This ratio represents a real rate of profitability of the type employed by Fama [1981], and Modigliani and Cohn [1979]. Series ROC2 in Figure 4.3 plots the ratio of NAB profits [P2] to the replacement cost of capital. MC argue that there is "...a clearly negative trend that begins accelerating in 1965, and hits its lowest point by 1975" in both of these series (p. 25). Equation (4.3) indicates that unless this is offset by opposite changes in the rate at which these earnings (per unit of capital) are capitalized (ρ), this implies falling real equity values during the late 1960s and early 1970s, and thus accounts for the theory that falling real profitability caused the lower equity values which accompanied inflation.

A problem with the above analysis of real profitability is outlined by MC [1979]. The profit series P1 and P2 underestimate true corporate profits. Furthermore, the degree of this underestimation is positively related to the rate of increase in the inflation rate. The reason is that higher inflation is reflected in the nominal interest rate as an inflation premium. This leads to a higher interest expense (ceteris paribus). However, as discussed in Sections II and III, the rising price level also leads to a lower real obligation of net financial liabilities. In other

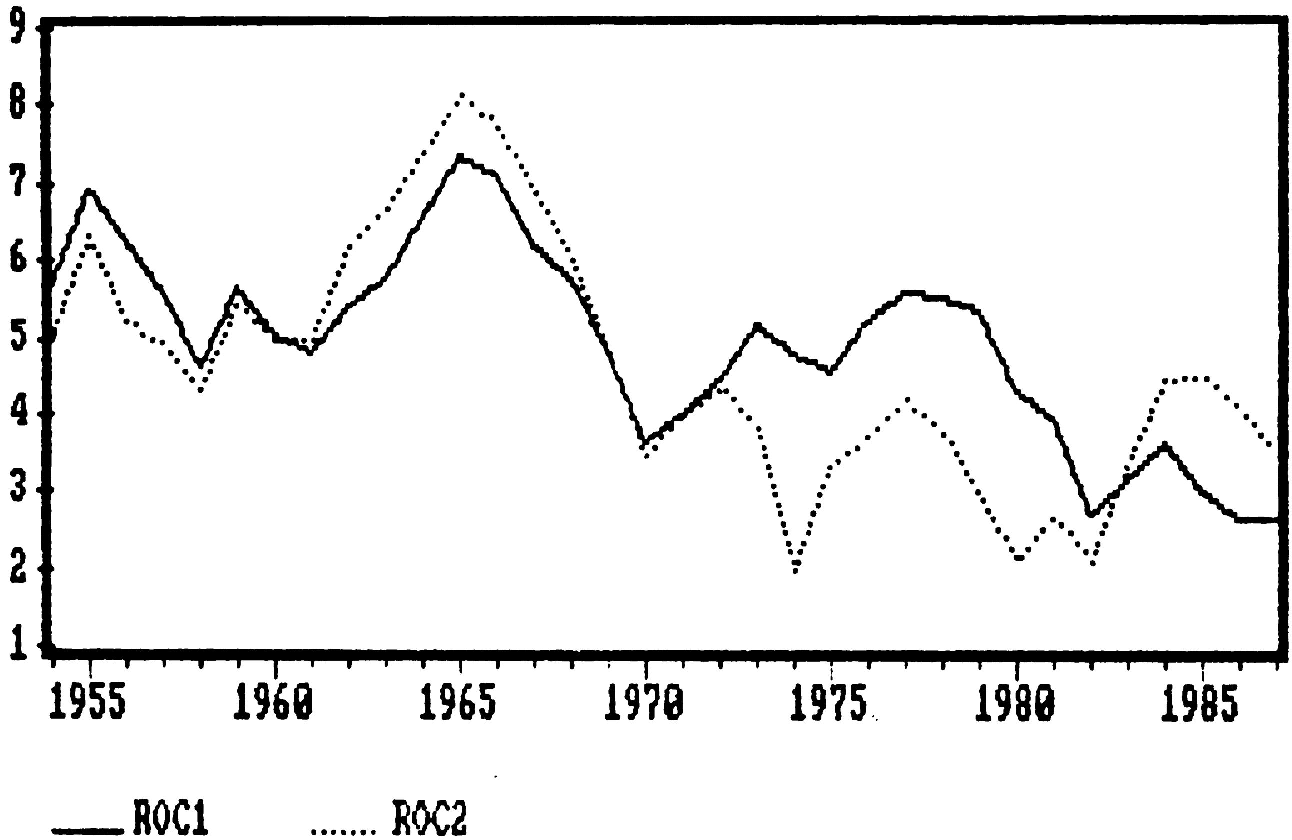

FIGURE 4.3

RATIO OF CONVENTIONAL PROFITS TO NET CAPITAL STOCK words, "That part of the interest bill corresponding to the inflation premium is actually repayment of real principal..."[12] Thus, to subtract the interest payment from profits while not simultaneously reducing the obligation represented by net financial liabilities by the corresponding amount is inappropriate.

B. Adjusted Operating Income

In recognition of this, MC add back the inflation-induced component of interest expense to the NAB profits to obtain what they call adjusted operating income (OI). This is the theoretical counterpart to P3 derived in Section III above. P3, however, instead of adding the interest expense to NAB profits, directly accounts for the repayment of real principal by adding back to NAB profits [P2] the nominal reduction in the real obligation represented by net financial liabilities. Series ROC3 in Figure 4.4 plots the ratio of P3 to the replacement cost of capital. MC argue that the strong downward trend of the series in Figure 4.3 is no longer evident, and that the resulting series can be characterized as trendless despite obviously responding to cyclical forces. Thus, they conclude that real stock values fell, at least in part, as a result of investors using P2 (or P1) as the relevant cash flow rather than the appropriate P3.[13]

We argue that Modigliani and Cohn's work has two shortcomings. First, although there is no way to observe the cash flow investors discount in valuing equities, we argue that it should be most highly correlated with an economic (Haig-Simons) definition of corporate profits which requires additional inflation adjustments beyond those of MC [1979]. Secondly, by examining the average behavior of profits and stock values over nearly 30 years, MC face the possibility of failing to recognize the

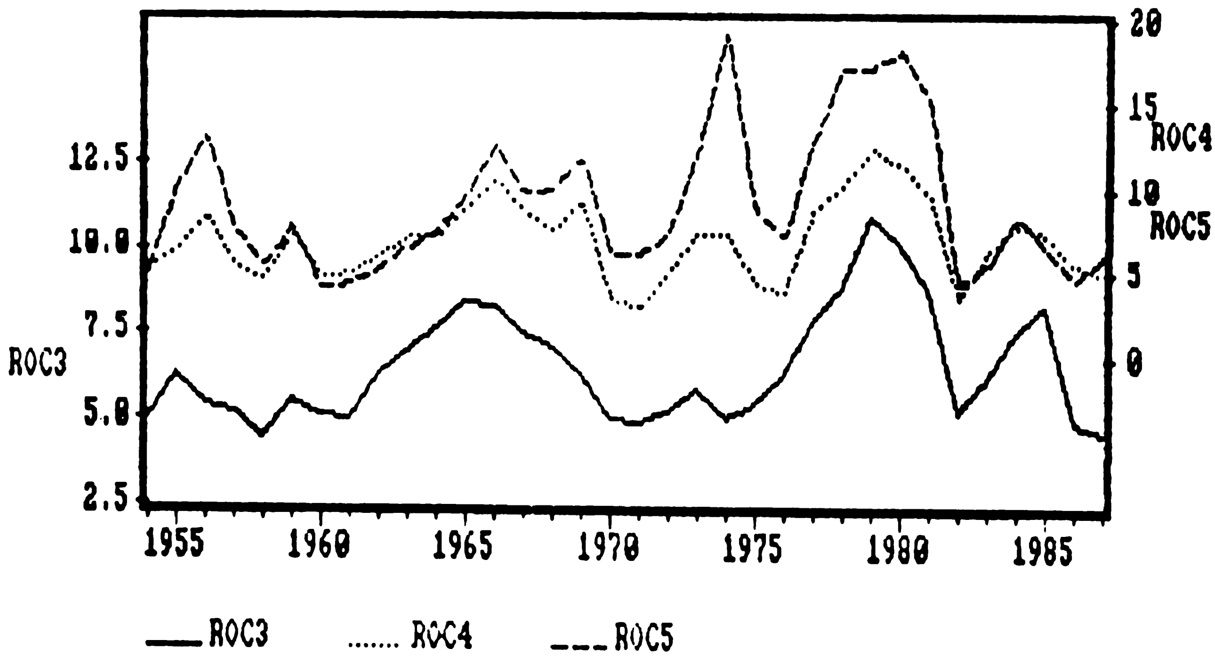

FIGURE 4.4

RATIO OF ADJUSTED PROFITS TO NET CAPITAL STOCK separate role, and possible changing importance, of profits and the rate at which these profits are discounted in determining stock values.

MC address this latter criticism by arguing that investors used both the wrong profit measure and the wrong discount rate. Furthermore, they dismiss the role of a changing risk premium component of the discount rate, and instead argue that investors persistently use a nominal, rather than the appropriate real, discount rate.

They support this investor irrationality by arguing that investors continue to use P1 and P2 rather than the correct P3 at least in part because of the availability of P1 and P2 which are published in the National Income Accounts. However, Gordon [1983] has shown that had investors actually been guilty of the fallacy that MC accuse them of (i.e., used a nominal rate of discount), then the fall in stock values would have been greater than actually occurred. Thus the two valuation errors hypothesized by MC do not adequately account for real stock values over the 1960s and 1970s.

C. Fully Adjusted Profits

We thus expand on MC's adjustment of conventional profits data to account for the effects of two additional inflation distortions. The two additional adjustments to ROC3 are outlined in Chapter III. These adjustments, which result in profit measures P4 and P5, account for the annual change in the difference between current and historical cost measures of long-term debt and capital assets respectively. The real forms of these two measures are plotted in Figure 4.4. As was the case for ROC3, series ROC4 and ROC5 exhibit no apparent strong downward trend during the late 1960s and early 1970s as seen in the series in Figure 4.3. Because we have seen a rise in corporate takeovers and mergers recently,

and since these transactions seek to exploit differences in book values vis-a-vis market value of firms, these two profit measures (P4-P5) seem especially relevant.

Figure 4.4 casts serious doubt on the hypothesis that the failure of nominal equity values to adequately reflect inflation is fully explained by a declining after-tax return to capital. In fact, all three profit series, unlike the real equity values, end the relevant period (1987) near the same rate they began the period (1954)-- at a 5 percent level-- and the 1970s are not characterized by a significant negative trend.

Table 4.1 presents data summarizing the behavior of stock returns, dividends, profitability, and economic activity (all in real form) over the Fama sample period (1954-77), our extended sample period (1954-87), and the intervening period (1977-87).[14] The figures are average annualized quarterly real growth rates (see note 9). The first row of the table presents the growth rates over the 1954-77 period. This approximates the sample period of Fama [1981] and MC [1979]. The first five column numbers reflect the measure of profit used (i.e., column 1 uses P1, column 2 uses P2,...). Column (6) reflects annualized average quarterly real dividend growth ($\Delta \ln[D/\kappa]$), and column (7) shows real GNP growth rates ($\Delta \ln[RGNP]$). The last column represents the average annual real stock return (see notes 10 and 14).

Table 4.1 ignores the role of changes in the rate at which these various cash flow measures are capitalized. The results in row (1) support MC's finding that, in the framework of equation (4.4), the negative average annual real stock return is not accounted for by the behavior of real profitability defined as ROC3 (the measure used by MC). That is, these results suggest that had investors been capitalizing the profit measure P3, then, under the constant capitalization rate assumption

TABLE 4.1

BEHAVIOR OF CASH FLOW MEASURES AND REAL STOCK RETURNS##

Time Period	Profit Measure P1 (1)	P2 (2)	P3 (3)	P4# (4)	P5 (5)	DIV (6)	GNP (7)	SP (8)
1954-1977	0.16	-1.11	0.23	-3.00	2.73	-1.75	3.15	-1.05
1954-1987	-1.99	-0 91	0.45	-0.77	2.08	-0.68	3.01	0.94
1977-1987	-5.91	-0.10	2.79	6.34	3.63	1.72	2.77	4.60

#Excludes 1971.1 and 1971.2 when P4<0.
##Average annualized quarterly growth rates:
$Growth(X)=400*[\log(X)_t-\log(X)_{t-1}]$.

TABLE 4.2

THE BEHAVIOR OF CASH FLOW MEASURES AND STOCK RETURNS: PARTITIONED SAMPLE

Time Period	Profit Measure P1 (1)	P2 (2)	P3 (3)	P4# (4)	P5 (5)	DIV (6)	GNP (7)	SP (8)
1954-1964	1.82	4.08	4.17	4.21	5.85	0.61	3.27	5.75
1965-1972	-3.69	-5.80	-5.33	-15.02	-2.63	-3.38	5.42	-2.32
1973-1987	-3.88	-1.90	0.89	3.41	1.35	-0.15	2.47	-0.83

#Excludes 1971.1 and 1971.2 when P4<0.
##All in real terms expressed as average quarterly growth rates (Annualized): $Growth(X) = 400*[\log(X)_t-\log(X)_{t-1}]$.

of MC, real stock returns would have been slightly positive. The average annual growth rate of ROC3 over the 1954-77 period (representing MC's sample period) was 0.23 percent, compared with -1.05 percent for real stock returns. The 1.11% average annual **decline** in real NAB profits (P2) may explain why some writers in the late 1970s attributed the real stock value decline to falling real profits.

The second row reports average growth rates for the 1954-87 period. The addition of the last eight years results in no measure of profit or dividends alone fully accounting for stock returns (although P3 now appears to be most consistent with real stock returns given a constant discount rate).

Column (7) in Table 4.1 shows the average annual growth in real economic activity (real GNP). This measure clearly does not have a stable relationship with real stock returns across the two periods. This variable is included since it was Fama's explanatory variable in a stock return model (see Fama [1981]). This point is discussed further below.

Rows (1) and (2) indicate that a different measure of profitability is (alone) most consistent with stock returns during the 1954-77 and 1954-87 periods respectively. Thus, we examine the intervening 1977-87 period in the third row of Table 4.1. Row (3) indicates that the consistency of P2 and P3 with stock returns reverses during the 1977-87 period from the 1954-77 period. The fact that, ignoring discount rate changes, we see stock return behavior being most consistent with the hypothesis that investors capitalized P2 before MC's paper (row 1), and most consistent with inflation adjusted measures (especially P3 and P5) after their work (row 3), may mean that investors began paying more attention to inflation adjusted data after the work of MC.

On the other hand, these results, as well as the real activity results, suggest the possibility of a structural shift in the model determining stock returns, or changes in factors in that model which are not captured in Table 4.1. To examine this possibility, we argue that the economy faced (at least) three distinct macroeconomic subperiods during the 1954-87 period,[15] and reexamine the findings of Table 4.1 for the partitioned sample in Table 4.2 (above). The 1954-64 period was a pre-Vietnam, low inflation period. The 1965-72 period was characterized by the emergence of higher and more variable inflation, and the post-1972 period marked the emergence of numerous supply shocks and rapid financial innovation and deregulation (as well as continued bouts with inflation).

Because of the somewhat arbitrary nature of the sample partitioning of Table 4.2 (see note 15), we do not attempt to draw strong quantitative conclusions from the results. Instead, we are interested in determining whether the interpretation of Table 4.1 could benefit from examining the possibility of a change in the underlying stock return model at the onset of a more volatile economy.

Table 4.2 examines the behavior of the cash flow measures and stock returns during the three subperiods discussed above (1954-64, 1965-72, and 1973-87). Each row reflects a separate subsample. Each column (1-5) reflects the respective profit measure employed (i.e, P1-P5). As in Table 4.1, column (6) is real dividend growth, column (7) is the growth in real GNP, and the final column represents the average annual real stock return.

The results suggest that no measure of profitability or dividends alone consistently fully accounted for the behavior of real stock returns across the three subperiods. However, the average behavior of the fully adjusted real profit measure (P5) appears most consistent with average real stock returns (especially in the pre-1977 sample period corresponding to the work of MC [1979] and Fama[1981]).

In addition, the average growth rate of real economic activity (real GNP) diverges sharply from the behavior of real stock returns across these subperiods. An interesting observation which we will address below is the fact that the real activity-real earnings relationship appears unstable across the subperiods under any definition of earnings. This finding does not support the use of real activity as a proxy for profitability.

As we would expect given the low inflation of 1954-64, this period is characterized by uniformity among the profit measures. Furthermore, the behavior of all measures is consistent with the high real stock returns over the period. On the other hand, the post-1965 behavior of stock returns was not fully explained by any cash flow measure.

One of the most interesting results of this sample partitioning concerns the work of MC. They argued that the falling real equity values of the 1954-77 period result from investors capitalizing P1 or P2 rather than the correct P3. Table 4.2 illustrates two points which do not support this hypothesis. First, since equities had a positive 5.8% average annual return during the 1954-65 period, the 1% average annual decline in real stock returns during the 1954-1977 sample period (used by MC) is a result of the sharp declines in the post-1965 period. However, as the second row of Table 4.2 shows, the 1965-72 period was characterized by MC's measure of profit (P3) actually declining at a **greater** rate than did real stock returns. Moreover, P1 declined at a **lower** average annual rate than did P3. Thus, contrary to the conclusions of MC, the use of P3 rather than P1 by investors would have presumably resulted in even **greater** declines in stock values during this period (ceteris paribus).

We can draw some general qualitative conclusions from Tables 4.1 and 4.2. The behavior of economic growth, profitability, and dividends is consistent with the behavior of stock returns during the 1954-64 period, but not during the post-1965 period. None of our cash flow measures alone consistently account for the behavior of stock returns across subsamples (although P5 comes close). Thus, the use of these cash flow measures implies a role for other factors influencing stock returns. However, whether these other factors can be identified and measured is not known. If equation (4.2) adequately characterized the process by which stock values are determined, then one of these "other factors" may be the rate at which earnings are capitalized. We will consider this possibility below.

4.5 ALTERNATIVE MODEL SPECIFICATION

The results of Section 4.4 suggest that no single cash flow measure alone fully accounts for stock returns. In the context of equation (4.4), there is an apparent role for the discount rate in determining stock returns. We thus want to specify and estimate a stock return model consistent with equation (4.4). To do this, we rewrite equation (4.4) as the following two equation system in which we no longer have to treat the capitalization rate as a random error:

$$(4.5) \qquad \Delta\ln(SP/\kappa) = \Delta\ln E([C/\kappa]_{t+1}|\Omega_t) - \Delta\ln(\rho),$$
$$\Delta\ln(\rho) = f(\Phi) + \epsilon,$$

where as in (4.4), $\Delta\ln(SP/\kappa)$ is the real stock return, C/κ is the appropriate cash flow measure, Φ is some vector of macroeconomic variables determining the rate at which investors capitalize profits, and ϵ is a random error term. System (4.5) is consistent with the identity (4.4) discussed above. However, in (4.5) we add meaning to (4.4) by suggesting that the implied capitalization rate from (4.2) can be expressed as a function of observable macroeconomic variables, rather than as a random error measure. Before examining (4.5) in more detail, we outline the purpose of doing so.

4.6 IMPLICATIONS FOR EXISTING WORK

One focus of the remainder of this paper is on whether we can explain the anomalous inflation stock return relationship using system (4.5). That is, we want to examine the consistency of existing work on inflation and stock returns (especially Fama [1981]) with our system (4.5). To do so, we examine in more detail (than Chapter I) the Classical hypothesis, and the work of Fama [1981].

A. Classical Hypothesis

The basis for much of the research on inflation and stock returns stems from the work of Fisher [1930]. The generalized Fisher hypothesis for asset markets implies that the stock market is efficient, and that expected real stock returns are independent of the inflation rate. We can examine this hypothesis using a simple model of the form:

$$(4.6) \qquad r_t = \alpha + \beta E_t(\pi_{t+1}) + \epsilon_t,$$

where r_t is the real NYSE stock return taken from the CRSP tapes,[16] π_t is the inflation rate, and ϵ_t is a random disturbance term, and $E_t(\ )$ the true expectations operator conditional on the time t information set (this meaning is retained below unless otherwise stated).

The anticipated inflation rate in (4.6) is unobservable. We can approximate this series using (1) contemporary inflation (see Gultekin [1983]), or (2) estimates from ARMA models (see Bodie [1976]). First, we utilize the observed inflation rate to estimate (4.6). The results of this estimation using quarterly data are summarized in Table 4.3 for the 1954-77 and 1954-87 periods.

The Fisher hypothesis calls for $\beta=0$. Table 4.3 indicates that, instead, there is a significant inverse inflation-stock return relationship over both sample periods (i.e., $\beta<0$). These results are consistent with those of Gultekin [1983] for U.S. data, and Wahlroos and Berglund [1986] for Finnish data.

Table 4.4 summarizes the results of estimating equation (4.6) using anticipated and unanticipated inflation measures from an ARMA model (discussed in Appendix C) rather than contemporaneous inflation. Substituting the ARMA measures of expected and unexpected inflation into (4.6) yields:[17]

$$(4.7) \qquad r_t = \alpha + \beta_1\pi_t^{e} + \beta_2\pi_t^{u} + \epsilon_t,$$

where the time t ARMA expectation of inflation will henceforth be denoted π^e, and actual inflation π, less the anticipated rate π^e measures the time t unanticipated inflation rate which we will denote π^u. The results in column (1) of Table 4.4 indicates that β_1 and β_2 are significantly different from zero during the 1954-77 time period. Column (2) shows that, in our extended sample period, while anticipated inflation is no longer significant, unanticipated inflation maintains a significant inverse relationship with real stock returns. This suggests that the violation of the classical theory (i.e., $\beta_1<0$) stems from the 1954-77 period and is masked when the sample period is extended to include the 1977-87 period.

The more interesting results are found when we estimate (4.7) for the

TABLE 4.3

OLS REGRESSION: FISHER TEST
$r_t = \alpha + \beta\pi_t + \epsilon_t$

Independent Variable	Sample 1954-77	Sample 1954-87
Constant	24.72	20.95
π	-5.10**	-2.94**
	(1.06)	(0.73)
R^2	.20	.11
D-W	1.89	1.80

Quarterly estimations.
**Significant at 5% level.
(standard errors)

TABLE 4.4

OLS REGRESSION: FISHER TEST
$r_t = \alpha + \beta_1\pi^e + \beta_2\pi^u + \epsilon_t$

Independent Variable	Sample 1954-77	Sample 1954-87
Constant	15.78	13.56
π^e	-3.03**	-1.43
	(1.37)	(0.96)
π^u	-8.03**	-4.92**
	(1.79)	(1.27)
R^2	.22	.12

Quarterly observations.
**Significant at 5% level.
(standard errors)

partitioned sample discussed above. Column (1) of Table 4.5 indicates that there is no violation of the classical hypothesis for the 1954-65 period. That is, the coefficients on both anticipated and unanticipated inflation are insignificantly different from zero. On the other hand, column (2) shows that both coefficients are significantly less than zero in the 1965-73 period. Column (3) shows that in the final subperiod (1973-87) only unanticipated inflation has significant explanatory power ($\beta_2<0$).

Most of the work done in the 1970s used a sample period running from the early 1950s through the late 1970s. Thus, these studies combined two distinctly different periods into one. That is, the 1954-65 period, a period of low inflation and no major economic shocks, appears to support the classical hypothesis. On the other hand, the emerging inflation period of 1965-73 (which also is characterized by the beginning of some economic shocks) violates the classical hypothesis. Finally, the 1974-87 period is characterized by a significant inverse relationship between real stock returns and unanticipated inflation.

These results are important in that they suggest that attempts to explain the inverse inflation-stock return relationship (and especially the violation of the classical proposition) must explain the 1965-73 period.

B. Fama's Proxy Hypothesis

As discussed in Chapter I above, Fama [1981] argues that the inverse inflation (both expected and unexpected)-stock return relationship documented in Tables 4.4 and 4.5 is spurious and results from "...the mechanics of money demand, real activity, and inflation imbedded in the quantity theory"[18] To test this proposition we (following Fama) include

TABLE 4.5

OLS REGRESSION: FISHER TEST

$$r_t = \alpha + \beta_1 \pi_t^{\bullet} + \beta_2 \pi_t^{u} + \epsilon_t$$

Independent Variable	Sample 1954-64	1965-1972	1973-87
Constant	19.84	33.23	22.17
$\pi^{\bullet}$	-4.99	-7.44**	-2.01
	(4.40)	(3.29)	(1.46)
π^{u}	-2.69	-11.14**	-5.04**
	(3.31)	(2.78)	(1.76)
R^2	.04	.35	.16
	----	2.00	1.82

Quarterly estimations.
**Significant at 5% level.
(standard errors)

anticipated real economic growth in (4.7) to yield:

$$(4.8) \qquad r_t = \alpha + \beta_1 \pi_t^{e} + \beta_2 \pi_t^{u} + \delta \Delta \ln E(A_{t+1} | \Omega_t) + \epsilon_t,$$

where, as in Fama [1981], and as discussed in Appendix D, the true anticipation of real activity, $E(A_{t+1}|\Omega_t)$, is proxied for by observed real GNP next period (denoted $RGNP_{t+1}$ henceforth).[19] To fully support Fama's proxy hypothesis, we must find $\beta_1=\beta_2=0$, and $\delta>0$. Columns (1) and (2) of Table 4.6 indicate that for the 1954-77 and 1954-87 periods, the proxy hypothesis is not fully supported. That is, in both periods, unanticipated inflation is significantly negatively correlated with real stock returns, although anticipated inflation now has a coefficient insignificantly different from zero.

It would be even more troubling to find $\beta_1<0$ in equation (4.8). In some cases Fama does find this-- see Fama [1981], p. 563. Nevertheless, finding $\beta_2<0$ does violate Fama's proxy hypothesis which says that there is no genuine relationship between real stock returns and either measure of inflation. Table 4.7 estimates (4.8) for the three subsample periods. Column (1) indicates that, as we would expect from Table 4.5, there is no significant explanatory power for either measure of inflation during the 1954-65 period when real activity is included simultaneously. For the 1965-73 period, the inclusion of real activity attenuates the significance of anticipated inflation from that of Table 4.5, but not that of unanticipated inflation. The results for the 1973-87 period are unchanged from those of Table 4.5 when real activity is included.

These results suggest that the findings of Fama for the 1954-77 period are largely driven by the 1965-73 period (or possibly the 1965-77

TABLE 4.6

OLS REGRESSION: FAMA'S PROXY TEST EQUATION

$$r_t = \alpha + \beta_1 \pi_t^e + \beta_2 \pi_t^u + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

Independent Variable	Sample 1954-77	1954-87
Constant	-0.98	-1.16
π^e	-1.29 (1.43)	-0.22 (1.00)
π^u	-7.96** (1.70)	-4.84** (1.23)
RGNP#	2.58** (0.86)	2.29** (0.71)
R^2	.30	.19

Quarterly estimations
#Log first difference form, and advanced one period.
**Significant at 5% level.
(standard errors)

TABLE 4.7

OLS REGRESSION: FAMA'S PROXY EQUATION PARTITIONED SAMPLE

$$r_t = \alpha + \beta_1 \dot{\pi}_t + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

Independent Variable	Sample 1954-64	1965-72	1973-87
Constant	-2 13	32.28	5.91
$\dot{\pi}$	-1.18	-7.30*	-0.52
	(4.24)	(4.35)	(1.57)
π^u	-0.95	-11.17**	-5.16**
	(3.08)	(2.85)	(1.70)
RGNP#	3.04**	0.09	2.39**
	(1.08)	(1.64)	(1.18)
R^2	.23	.28	.23
D-W	----	2.00	1.86

Quarterly estimations
#Log first difference form, and advance one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

period). That is, Fama's inability to support his proxy hypothesis results from a strong violation of the classical hypothesis during the 1965-73 period. Furthermore, this violation does not appear to result from the inflation-real activity channel hypothesized by Fama.

Table 4.1 indicates that over long sample periods real activity and real profitability exhibit similar behavior, and are consistent with stock returns. On the other hand, Table 4.2 shows that during subsample periods (especially 1965-73) the average growth rates of the two variables can diverge sharply, and that neither is fully consistent with real stock returns. Although we will examine this relationship in detail below, it appears possible that equation (4.6) is oversimplified and thus does not adequately characterize the hypothesized true system (4.5). Whether unanticipated inflation is genuinely related to real stock returns is addressed below.

The finding of β_1 or $\beta_2 \neq 0$ in (4.6) does not confirm a genuine inflation-stock return relationship. Instead, it could mean a relevant determinant (or determinants) of stock returns has been omitted from the test equation. If the omitted variable is inversely related to $RGNP_{t+1}$, then parameter estimates of equation (4.6) will be biased (i.e., a negative bias in the estimate of β). Furthermore, if the omitted variable is correlated with inflation, then its exclusion could account for the unexpected finding of significant coefficients on the inflation measures.

The focus of the following chapters is on whether our cash flow measures or capitalization rate measures qualify as these "missing variables" in Fama's model, and whether they can account for the inverse unanticipated inflation-stock return relationship of the post-1965 period. We address both of these possibilities below.

4.7 Conclusions

We have shown that while no cash flow measure alone appears to consistently fully account for the cyclical behavior of stock returns over the 1954-87 period, the fully adjusted profit measure is most consistent with average stock returns. However, even defining the cash flow as P5 suggest a role for the capitalization rate in the determination of cyclical stock returns. Furthermore, we found inconsistency between earnings growth and average real stock returns. Thus, the relative roles of the cash flow, and the rate at which these cash flows are capitalized may have changed over the sample period.

This finding led to the specification of stock returns in system (4.5). If system (4.5) above is correctly specified, then Fama's specification of the proxy hypothesis test equation (4.8) is appropriate only if both of the following hold:

1. Anticipated real economic growth captures the explanatory power of the anticipated real cash flow $E([C/\kappa]_{t+1}|\Omega_t)$, correctly measured.
2. Anticipated real economic growth adequately proxies for the macroeconomic variables in the vector Φ.

We have confirmed Fama's finding of a significant inverse inflation-stock return relationship over both the 1954-77 and 1954-87 periods. We found support for Fama's proxy hypothesis explanation of this relationship only in the case of anticipated inflation (and even this is marginally violated for the 1965-73 period). On the other hand, the proxy hypothesis only explains the role of unanticipated inflation in the pre-1965 period. Unanticipated inflation retains significant explanatory power in the post-1965 period. Thus, we direct our attention to examining the components of system (4.5) over the post-1965 period.

Chapters V and VI below will discuss measures of cash flow and the capitalization rate respectively, and examine the relationship between Fama's measure of anticipated real activity and these variables. Chapter VII will then draw on the findings of Chapters V and VI to examine the role of C/κ, ρ' and ρ'' in system (4.5), and hence the appropriateness of using equation (4.8) as the "true" system determining stock returns.

CHAPTER V

CASH FLOW MEASURES

5.1 INTRODUCTION

Fama argues that growth in real GNP (RGNP) "...captures most of the information in the other real variables..."(p. 555), which he argues are fundamental determinants of stock returns. Furthermore, he suggests that this finding is "fortuitous since it allows a simple strategy for presentation of the tests that follow..." (p. 555). That is, his proxy hypothesis test equation (4.8) is simplified by allowing $RGNP_{t+1}$ to proxy for the other real variables (e.g., cash flow and discount rate) determining stock returns.

The system determining real stock returns, implied by Fama's theory, can be expressed as:[20]

$$(4.5') \qquad r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \epsilon_t,$$

where, as in the previous chapter, $RGNP_{t+1}$ proxies for the true time t anticipation of real activity. The estimations of equation (4.5') for each sample period are found in column (1) of Tables 5.1-5.5. The growth rates in real GNP are significant and correctly signed in each period.

Our focus in this chapter is on whether real activity does adequately capture the explanatory power of "fundamental determinants" of stock returns. To answer this question, we first examine whether real activity captures the explanatory power of each definition of real profitability. We employ our five profit measures (P1-P5), to examine their explanatory power in equation (4.5'). To the extent that real activity does not capture all the explanatory power of these cash flow variables, we examine which alternative cash flow measure or measures are relevant to our stock return model. That is, we examine the roles of earnings and dividends in stock return determination.

We concluded in Chapter IV that we will use actual current and future cash flows (C_t and C_{t+1}) as proxies for the true expected cash flow. The goal of this chapter is to determine the relevant measure of C_t and C_{t+1} in (4.2) in order to derive measures of ρ' and ρ'' from (4.2') and (4.2'').

5.2 REAL PROFITABILITY AND REAL ACTIVITY

Our test equation for the hypothesis that real economic growth captures the explanatory power found in real profitability takes the following form:

$$(5.1) \qquad r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln[Pi/\kappa]_{t+1} + \epsilon_t,$$

where all variables are defined as in Chapter IV. However, as discussed above, the true expectations are unobservable. Thus, we use the actual future observation of $RGNP_{t+1}$ as a proxy for the time t anticipation of real GNP, and the time t+1 observation of profits (where the subscript i denotes the measure of profit employed) as a proxy for the time t anticipation of profits. The use of actual real profit observed next period is consistent with Fama's forward looking assumptions (see Appendix D). An alternative would be to use the contemporaneous measures of real profit. However, these measures of real activity and real earnings are dropped since they are both insignificant.

Fama argues that real activity captures the explanatory power of real earnings. This implies $\delta>0$ and ψ insignificantly different from zero for all i. Thus equation (4.5′) is just a restricted version of equation (5.1). Table 5.1 estimates these equations for the 1954-77 period, and casts some doubt on Fama's argument. That is, under any definition, real profitability retains significant explanatory power when real economic activity is included simultaneously. Moreover, defining profits as P1 or P3 results in no marginal explanatory power for growth in real activity when included simultaneously with the profitability measures. Using measures P2, P4, or P5 results in real profitability, as well as real activity, exhibiting marginal explanatory power in equation (5.1).

Table 5.2 indicates that real profitability defined as P1, P2, P4 or P5 retain their marginal explanatory power over the extended 1954-1987 sample period. However, unlike the 1954-77 period of Table 5.1, measure P3 exhibits no marginal explanatory power. These results are consistent with the qualitative conclusions of Chapter IV (especially Table 4.2), and suggest that real economic growth does not fully account for the explanatory power of growth in real profitability.

Recall that the results of Table 4.2 suggested that, whereas real economic growth appeared consistent with real stock returns during 1954-64 and 1974-87, there was a dramatic breakdown during the 1965-73 period. Furthermore, we found that the real activity-real earnings relationship appeared unstable across the subperiods, suggesting that the ability of real activity to capture the explanatory power of real earnings, and to explain stock returns, is suspect. To examine this finding in more detail, we utilize the sample partitioning of Table 4.2 to reestimate equation (5.1) independently for each subsample and each measure of real

TABLE 5.1

OLS REGRESSIONS: AUGMENTED PROXY TEST EQUATION

$r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t$

1954-1977

Independent Variable#	Model					
(1)	(2)	(3)	(4)	(5)	(6)	
Constant	-2.37	4.12	0.62	2.75	-0.85	-1.84
RGNP	2.92** (0.84)	0.88 (1.32)	2.02** (0.94)	1.27 (0.93)	2.50** (0.83)	2.74** (0.83)
P1/κ	----	0.34** (0.17)	----	----	----	----
P2/κ	----	----	0.18** (0.09)	----	----	----
P3/κ	----	----	----	0.36** (0.10)	----	----
P4/κ	----	----	----	----	0.05** (0.02)	----
P5/κ	----	----	----	----	----	0.05** (0.02)
R^2	.12	.16	.16	.22	.19	.17
D-W	1.94	1.93	2.07	2.06	2.07	1.99

Quarterly estimations.

#All independent variables are in log first difference form and advanced one period.

*Significant at 10% level.

**Significant at 5% level.

(standard errors)

TABLE 5.2

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION
$r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t$
1954-1987

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)	(6)
Constant	0.62	4.52	3.06	1.71	1.99	1.58
RGNP	2.53** (0.68)	1.39 (0.96)	1.79** (0.75)	2.17** (0.74)	2.10** (0.68)	2.20** (0.67)
P1/κ	----	0.20* (0.12)	----	----	----	----
P2/κ	----	----	0.15** (0.07)	----	----	----
P3/κ	----	----	----	0.06 (0.05)	----	----
P4/κ	----	----	----	----	0.04** (0.01)	----
P5/κ	----	----	----	----	----	0.05** (0.02)
R^2	.10	.12	.13	.11	.15	.15
D-W	1.85	1.87	1.95	1.90	1.95	1.91

Quarterly estimations.
#All independent variables are in log first difference form and advanced one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

profitability.

Tables 5.3-5.5 estimate equations (4.5') and (5.1) for the three subsamples. Table 5.3 indicates that real economic growth alone (i.e., equation (4.5') above) is significant and correctly signed for the 1954-64 period. Furthermore, it remains significant in two of the five estimations of equation (5.1) when real profitability is included. In no case does real profitability enter significantly over this period. Thus, Fama's methodology for testing his proxy hypothesis is supported for the 1954-64 period.

Table 5.4 examines the 1965-72 period. The information in Table 4.2 suggests that neither real economic growth nor real profitability alone adequately accounted for the negative stock returns over this period. This conclusion is supported in Table 5.4. In no case does real economic growth or real profitability (under any definition) enter significantly. Fama's hypothesized true specification (4.5') is weak during this period, and the explicit inclusion of real profitability results in no improvement.

The 1973-87 period is examined in Table 5.5. Tests of equation (4.7) show that real economic growth alone is significant and correctly signed. The inclusion of P1-P3 results in the measures exhibiting no marginal explanatory power. However, the inclusion of real profitability defined as P4 or P5 results in their entering significantly. This indicates that, for the inflation adjusted profit measures P4-P5, system (4.5) may be superior to Fama's equation (4.5') for this time period. The results of the 1965-73 and 1974-87 estimations suggest that Fama's proxy hypothesis test equation (4.8) may be misspecified, and his inability to fully support his proxy hypothesis may be a result of this misspecification.

TABLE 5.3

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION

$r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t$

1954-1964

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)	(6)
Constant	2.02	4.20	6.45	5.49	2.51	2.65
RGNP	3.30**	2.60	1.67	2.00	3.14**	3.09**
	(0.92)	(2.07)	(1.51)	(1.47)	(0.96)	(0.97)
P1/κ	----	-0.10	----	----	----	----
		(0.26)				
P2/κ	----	----	0.26	----	----	----
			(0.19)			
P3/κ	----	----	----	0.22	----	----
				(0.19)		
P4/κ	----	----	----	----	0.02	----
					(0.03)	
P5/κ	----	----	----	----	----	0.02
						(0.03)
R^2	.24	.24	.27	.26	.24	.25
D-W	1.96	1.97	1.93	1.96	1.94	1.93

Quarterly estimations.

#All independent variables are in log first difference form and advanced one period.

*Significant at 10% level.

**Significant at 5% level.

(standard errors)

TABLE 5.4

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION
$r_t = \alpha + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t$
1965-1972

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)	(6)
Constant	2.58	10.38	5.65	10.48	5.62	2.31
RGNP	0.65 (1.51)	-1.12 (2.11)	0.06 (1.87)	-0.88 (1.79)	0.05 (1.57)	0.73 (1.51)
$P1/\kappa$	----	0.37 (0.31)	----	----	----	----
$P2/\kappa$	----	----	0.12 (0.22)	----	----	----
$P3/\kappa$	----	----	----	0.37 (0.24)	----	----
$P4/\kappa$	----	----	----	----	0.06 (0.05)	----
$P5/\kappa$	----	----	----	----	----	0.04 (0.03)
R^2	.01	.05	.02	.08	.06	.05
D-W	2.05	2.24	2.12	2.18	2.03	2.09

Quarterly estimations.
#All independent variables are in log first difference form and advanced one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 5.5

OLS REGRESSIONS: AUGMENTED PROXY TEST EQUATION

$r_t = \alpha + \delta\Delta \ln RGNP_{t+1} + \psi\Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t$

1973-1987

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.22	2.31	1.37	0.31	1.04	1.08
RGNP	2.76** (1.14)	2.01 (1.44)	2.20* (1.20)	2.53** (1.23)	2.20* (1.13)	2.23** (1.13)
$P1/\kappa$	----	0.15 (0.17)	----	----	----	----
$P2/\kappa$	----	----	0.13 (0.09)	----	----	----
$P3/\kappa$	----	----	----	0.03 (0.06)	----	----
$P4/\kappa$	----	----	----	----	0.04** (0.02)	----
$P5/\kappa$	----	----	----	----	----	0.06** (0.03)
R^2	.10	.11	.13	.10	.17	.17
D-W	1.68	1.66	1.79	1.71	1.89	1.85

Quarterly estimations.
#All independent variables are in log first difference form and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

5.3 REAL PROFITABILITY AND DIVIDENDS

Gordon [1959] argues that "...stockholders are interested in both dividend and income per share..." (p. 100), and that from this obrservation we can derive the model:

$$(5.2) \qquad SP_t = \alpha_o + \alpha_1 E_t(D_{t+1}) + \alpha_2 E_t(P_{t+1}) + \epsilon_t,$$

where all variables are defined as above. Following our previous use of $X^e = X_{t+1}$ (as in equation (5.1) above), we can rewrite (5.2) in log first difference form as:

$$(5.3) \qquad \Delta \ln(SP/\kappa)_t = \alpha_o + \alpha_1 \Delta \ln(D/\kappa)_{t+1} + \alpha_2 \Delta \ln(P_i/\kappa)_{t+1} + \epsilon_t,$$

where i denotes the measure of profit employed. This simply states that real stock returns are a function of anticipated real dividends and anticipated real profitability. To the extent that one proxies for the other when included alone, (5.3) should reveal this.[21]

Tables 5.6 and 5.7 indicate that for the 1954-77 and 1954-87 periods respectively, in no case do dividends enter significantly. On the other hand, real profitability is significant and correctly signed in every case. Thus, it appears that anticipated real earnings dominate anticipated dividends in determining stock returns.

5.4 INFLATION AND REAL PROFITABILIY

In order for the exclusion of real profitability from Fama's proxy hypothesis test equation to explain the significance of inflation (i.e., to create positive bias in the inflation coefficient) in stock return

TABLE 5.6

OLS REGRESSIONS: DIVIDENDS VS PROFITS

$r_t = \alpha_o + \alpha_1 \Delta\ln(DIV/\kappa)_{t+1} + \alpha_2 \Delta\ln(P_i/\kappa)_{t+1} + \epsilon_t$

1954-1977

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)
Constant	7.77	7.87	7.42	7.95	7.68
DIV/κ	0.39 (0.29)	0.31 (0.31)	0.28 (0.29)	0.32 (0.30)	0.30 (0.31)
P1/κ	0.43** (0.11)	----	----	----	----
P2/κ	----	0.26** (0.08)	----	----	----
P3/κ	----	----	0.42** (0.09)	----	----
P4/κ	----	----	----	0.05** (0.02)	----
P5/κ	----	----	----	----	0.05** (0.02)
R^2	.17	.12	.21	.12	.07
D-W	1.92	1.95	2.00	1.89	1.79

Quarterly estimations.

#All independent variables are in log first difference form and advanced one period.

*Significant at the 10% level.

**Significant at the 5% level.

(standard errors)

TABLE 5.7

OLS REGRESSIONS: DIVIDENDS VS PROFITS

$r_t = \alpha_o a + \alpha_1 \Delta\ln(DIV/\kappa)_{t+1} + \alpha_2 \Delta\ln(P_i/\kappa)_{t+1} + \epsilon_t$

1954-1987

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)
Constant	9.35	8.84	8.55	8.64	8.50
DIV/κ	0.33 (0.27)	0.32 (0.27)	0.29 (0.28)	0.28 (0.27)	0.25 (0.27)
P1/κ	0.33** (0.09)	----	----	----	----
P2/κ	----	0.22** (0.06)	----	----	----
P3/κ	----	----	0.11** (0.05)	----	----
P4/κ	----	----	----	0.05** (0.01)	----
P5/κ	----	----	----	----	0.05** (0.02)
R^2	.12	.10	.06	.10	.09
D-W	1.86	1.89	1.81	1.83	1.78

Quarterly estimations.

#All independent variables are in log first difference form and advanced one period.

*Significant at the 10% level.

**Significant at the 5% level.

(standard errors)

determination in the post-1965 period, we must observe a significant inverse inflation-real profitability relationship over this period. In Chapters I and II we outlined various arguments suggesting such a relationship is possible.

Table 5.8 shows that, for the 1965-77 period, anticipated inflation has no significant explanatory power in anticipated real profitability growth of any definition. Furthermore, for the unadjusted profit measures (P1-P2), unanticipated inflation is also insignificant. On the other hand, for the inflation adjusted profit measures (P3-P5), unanticipated inflation is significantly inversely related to anticipated profitability.

Table 5.9 shows that for the 1965-87 period, anticipated inflation is not significant for the profit measures P1 and P3. This, of course, is a violation of the classical theory. On the other hand, the results for the inflation adjusted profit measures (P4-P5) are consistent with the 1965-77 results.

Furthermore, Tables 5.10 and 5.11 show that, for the 1965-77 and 1965-87 periods respectively, this inverse relationship between π^u and inflation adjusted profits is independent of real activity. In fact, for the inflation adjusted measures P4 and P5, unanticipated inflation remains significant while real activity shows no significant explanatory power.

5.5 Conclusions

We have shown that inflation adjusted measures of real profitability retain significant explanatory power in a stock return equation when real activity is simultaneously included. This violates Fama's underlying hypothesis that real activity captures any explanatory power in real profits, and suggests the need for respecification of equation (4.8) to include real profitability.

TABLE 5.8

OLS REGRESSION: INFLATION AND REAL EARNINGS

$$\Delta \ln(ROCi)_{t+1} = \alpha + \beta_1 \pi_t^e + \beta_2 \pi_t^u + \epsilon_t$$

1965-77

Independent Variable	i: 1	2	3	4	5
Constant	11.68	-2.13	5.18	62.74	57.86
π^e	-2.55	-0.59	-1.49	-13.22	-10.49
	(1.72)	(2.93)	(2.17)	(10.80)	(8.71)
π^u	-2.24	-4.47	-7.28**	-46.08**	-41.68**
	(2.28)	(3.89)	(2.88)	(14.31)	(11.55)
R^2	.05	.03	.12	.19	.22
D-W	1.58	1.69	1.69	2.70	2.98

Quarterly observations.
**Significant at the 5% level.

TABLE 5.9

OLS REGRESSION: INFLATION AND REAL EARNINGS

$$\Delta \ln(ROCi)_{t+1} = \alpha + \beta_1 \dot{\pi}_t + \beta_2 \pi^u_t + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	11.19	5.76	25.51	44.56	40.55
$\dot{\pi}$	-2.57**	-1.63	-4.54*	-7.62	-6.41
	(1.42)	(1.73)	(2.40)	(7.49)	(6.10)
π^u	-0.41	-0.87	-10.41**	-30.30**	-26.11**
	(1.42)	(2.17)	(3.00)	(9.35)	(7.62)
R^2	.06	.01	.15	.11	.13
D-W	1.69	1.51	2.04	2.86	3.03

Quarterly observations.
**Significant at the 5% level.

TABLE 5.10

OLS REGRESSION: INFLATION AND REAL EARNINGS

$$\Delta \ln(ROCi)_{t+1} = \alpha + \beta_1 \dot{\pi}_t + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

1965-77

Independent Variable	i: 1	2	3	4	5
Constant	-38.85	-47.07	-31.51	22.33	107.11
$\dot{\pi}$	3.68**	4.94	3.03	-8.24	-16.55
	(1.54)	(3.45)	(2.52)	(13.62)	(10.94)
π^u	-1.13	-3.49	-6.48**	-45.20**	-42.76**
	(1.64)	(2.99)	(2.67)	(14.48)	(11.62)
RGNP#	6.39**	5.68**	4.63**	5.11	6.22
	(0.95)	(2.13)	(1.56)	(8.42)	(6.76)
R^2	.53	.16	.27	.19	.24
D-W	1.88	1.65	1.82	2.74	2.90

Quarterly observations.

#Log first difference form, and advanced one period.

*Significant at the 10% level.

**Significant at the 5% level.

TABLE 5.11

OLS REGRESSION: INFLATION AND REAL EARNINGS

$$\Delta \ln(ROCi)_{t+1} = \alpha + \beta_1 \pi_t^e + \beta_2 \pi_t^u + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	-21.48	-24.79	-12.29	-30.04	8.62
π^e	0.53	1.43	-0.75	-0.12	-3.20
	(1.03)	(1.83)	(2.57)	(8.29)	(6.87)
π^u	-0.08	-0.56	-10.03**	-29.55**	-25.79**
	(1.14)	(2.03)	(2.85)	(9.20)	(7.62)
RGNP#	5.13**	4.79**	5.93**	11.71**	5.02
	(0.74)	(1.31)	(1.85)	(5.95)	(4.93)
R^2	.40	.14	.24	.15	.14
D-W	2.01	1.60	2.19	2.92	3.08

Quarterly observations.
#Log first difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

In addition, we show that simultaneous inclusion of anticipated profitability and dividends results in significance only in the coefficients on profitability. Finally, we found that there exists a consistent inverse relationship between unanticipated inflation and inflation adjusted measures of real profitability. Moreover, we show that this inverse relationship is not explained by simultaneous inclusion of real activity.

Thus, it appears that the explanatory power of inflation adjusted measures of profit in a simple (Fama type) stock return equation are not fully explained by real activity. Furthermore, these profit measures are inversely related to unanticipted inflation, and real activity does not explain this inverse relationship. These three observations are all inconsistent with the underlying framework of Fama's specification of the proxy hypothesis, although not the proxy hypothesis in general.

CHAPTER VI

EARNINGS CAPITALIZATION

6.1 INTRODUCTION

We concluded in Chapter V that earnings dominate dividends in explaining stock returns, and that this explanatory power is not captured by real activity. Thus, we now utilize earnings in equations (4.2') and (4.2'') to examine the relationship between stock returns and the rate at which investors capitalize earnings. Since the true capitalization rate (ρ) is unobservable, we first examine our two implied rate measures ρ' and ρ'' (defined in Chapter IV). We examine the role of each capitalization rate measure in a stock return model. We then analyze the relevant components of Φ which determine this capitalization rate. Finally, we examine whether the explanatory power of π^u in stock returns, documented in Chapter IV, results from π^u proxying for the capitalization rate.

6.2 DEFINING THE EARNINGS CAPITALIZATION RATE

Recall that equations (4.2') and (4.2'') implied two distinct definitions of the earnings capitalization rate: $\rho'=P_t/SP_t$, and $\rho''=P_{t+1}/SP_t$, respectively (where P_t and P_{t+1} are alternative proxies for the true earnings expectation). Since we obtained the greatest explanatory power in P_{t+1} in Chapter V, ρ'' seems to be the natural choice.

The capitalization rate, ρ'', is a required return measure. That is, investors anticipate a certain flow of earnings over their holding period, and are willing to pay a certain price for this flow. The capitalization rate ρ'' measures the return implied by paying SP now for the anticipated future cash flow (measured by P_{t+1}).

The question we face is whether ρ' has a theoretical basis for being included in our stock return model as well. That is, we must determine whether ρ'', ρ', or both are relevant components of our stock return model. According to (4.2'), ρ' is simply the inverse of a trailing measure of the price-earnings ratio (PE). Thus, the question of whether ρ' has explanatory power in a stock return model reduces to asking whether current PE ratios explain contemporaneous stock returns.

Whether this PE effect is captured by ρ'' (eliminating the need to include ρ' independently) is an empirical question. Tables 6.1 and 6.2 conduct an analysis similar to that of Tables 5.6 and 5.7 by giving estimates of parameters of the equation:

$$(6.1) \qquad r_t = \gamma_o + \gamma_1 \Delta \ln(\rho'_i)_t + \gamma_2 \Delta \ln(\rho''_i)_t + \epsilon_t.$$

The results indicate that both ρ' and ρ'' are significant and correctly signed for definitions i=1-3 (i.e., for the unadjusted to partially adjusted definitions of profit) for both sample periods. This suggests that for these definitions of profit, both the value investors place on trailing earnings, as well as forecasted earnings, explain realized contemporaneous stock returns.[22] On the other hand, for the inflation adjusted profit measures, P4 and P5, the resulting ρ' dominates ρ'' in explanatory power for the full sample period, and for the the 1954-77 period in the case of P5. Thus, to the extent that inflation adjusted profits are the relevant cash flow, the value investors place on trailing earnings dominates the value they place on forecasted earnings in

TABLE 6.1

OLS REGRESSIONS: ALTERNATIVE CAPITALIZATION RATES

$r_t = \gamma_o + \gamma_1 \Delta \ln(\rho'_i)_t + \gamma_2 \Delta \ln(\rho''_i)_t + \epsilon_t$

1954-1977

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)
Constant	7.94	7.25	7.98	7.06	7.28
ρ'	-0.42**	-0.22**	-0.38**	-0.02	-0.05*
	(0.06)	(0.08)	(0.08)	(0.02)	(0.03)
ρ''	-0.24**	-0.27**	-0.24**	0.02	-0.01
	(0.08)	(0.07)	(0.08)	(0.02)	(0.03)
R^2	.60	.27	.42	.03	.03
D-W	1.01	0.98	0.93	1.66	1.54

Quarterly estimations.

#All independent variables are in log first difference form.

*Significant at the 10% level.

**Significant at the 5% level.

(standard errors)

TABLE 6.2

OLS REGRESSIONS: ALTERNATIVE CAPITALIZATION RATES
$r_t = \gamma_o + \gamma_1 \Delta \ln(\rho'_i)_t + \gamma_2 \Delta \ln(\rho''_i)_t + \epsilon_t$
1954-1987

Independent Variable[#]	Model (1)	(2)	(3)	(4)	(5)
Constant	6.56	7.51	8.18	8.32	8.41
ρ'	-0.41** (0.05)	-0.22** (0.06)	-0.21** (0.04)	0.03** (0.02)	-0.05** (0.02)
ρ''	-0.20** (0.06)	-0.23** (0.06)	-0.13** (0.04)	0.01 (0.02)	-0.01 (0.02)
R^2	.57	.27	.28	.05	.06
D-W	1.00	1.04	1.31	1.64	1.54

Quarterly estimations.
[#]All independent variables are in log first difference form.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

explaining contemporaneous stock returns. Since we found in Chapter V that profit measures P4 and P5 exhibit explanatory power independent of real acitivity, we consider them the relevant measures of cash flow, and thus we will examine the role of ρ' in the analysis which follows.

6.3 REAL ACTIVITY AND THE EARNINGS CAPITALIZATION RATE

Before examining the determinants of ρ', we reestimate equation (5.1) of Chapter V above, respecified to examine the significance of the capitalization rate in a stock return equation in which real activity is simultaneously included (i.e., to test the proposition that real activity captures the explanatory power of the capitalization rate):

$$(6.2) \qquad r_t = \alpha + \delta\Delta \ln RGNP_{t+1} + \gamma\Delta\ln(\rho'_i)_t + \epsilon_t,$$

for i=1-5. Tables 6.3-6.4 estimate (6.2) for the Fama sample period (1954-77), and our extended sample period (1954-87).[23]

The results indicate that the implied capitalization rate measure, under any definition, is significant and correctly signed when included simultaneously with real activity. These results strongly suggest a role for the implied capitalization rate in a stock return equation, and that real activity does not adequately account for the explanatory power of this variable.

6.4 INFLATION AND THE EARNINGS CAPITALIZATION RATE

If $\Delta\ln\rho'$ and inflation are significantly positively related, and this relationship is not accounted for by real activity, then Fama's proxy hypothesis test equation (4.8) will not explain the inverse inflation-stock return relationship. We found in Chapter IV that it is the post-

TABLE 6.3

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION
$r_t = \alpha + \delta\Delta\ln RGNP_{t+1} + \gamma\Delta\ln(\rho'_i)_t + \epsilon_t$
1954-1977

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)
Constant	-0.01	-2.38	-2.00	-4.28	-3.88
RGNP	2.39** (0.55)	2.92** (0.77)	3.01** (0.65)	3.49** (0.84)	3.46** (0.84)
ρ'1	-0.53** (0.04)	----	----	----	----
ρ'2	----	-0.32** (0.07)	----	----	----
ρ'3	----	----	-0.50** (0.06)	----	----
ρ'4	----	----	----	-0.05** (0.02)	----
ρ'5	----	----	----	----	-0.06** (0.02)
R^2	.63	.27	.49	.18	.19
D-W	2.02	1.78	1.72	1.93	1.91

Quarterly estimations.
#All independent variables are in log first difference form. RGNP is advanced one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 6.4

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION
$r_t = \alpha + \delta\Delta \ln RGNP_{t+1} + \gamma\Delta \ln(\rho'_i)_t + \epsilon_t$
1954-1987

Independent Variable[#]	Model (1)	(2)	(3)	(4)	(5)
Constant	-0.75	-0.43	-0.00	-0.65	-0.62
RGNP	2.48** (0.44)	2.70** (0.60)	2.68** (0.59)	2.90** (0.66)	2.92** (0.65)
ρ'1	-0.51** (0.04)	----	----	----	----
ρ'2	----	-0.32** (0.05)	----	----	----
ρ'3	----	----	-0.24** (0.04)	----	----
ρ'4	----	----	----	0.04** (0.01)	----
ρ'5	----	----	----	----	-0.06** (0.02)
R^2	.62	.29	.32	.17	.18
D-W	2.08	1.77	1.91	1.87	1.84

Quarterly estimations.
[#]All independent variables are in log first difference form. RGNP is advanced one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

1965 period which is characterized by an inverse inflation-stock return relationship. To pursue this, we reexamine the inflation-capitalization rate relationship for the post-1965 period. Table 6.5 examines the relationship between observed inflation and the capitalization rate (ρ'_i) for the 1965-77 and 1965-87 periods. The results indicate that only one significant relationship exists for the 1965-77 period (for ρ'_i for i=1), and only one case in the 1965-87 period (ρ'_i for i=3).

Since we found that the explanatory power of π^e in stock returns is largely accounted for by real activity, we turn our attention to the documented (see Chapter IV) strong inverse relationship between π^u and stock returns. To examine the interaction of π^u and ρ'_i, we repeat the analysis of Table 6.5, dividing inflation into its two components-- π^e and π^u. Tables 6.6 and 6.7 indicate that there is never (under any definition of ρ'_i, or any time period) any significant explanatory power in π^e for either sample period. On the other hand, π^u is significantly inversely related to ρ'_i in four of five cases in the post-1965 sample periods (for all definitions except ρ_2).

This unanticipated inflation-capitalization rate relationship can result from inflation proxying for variables which are genuine determinants of the capitalization rate (i.e., the relationship is spurious), or from π^u being a genuine determinant of ρ'. Pertaining to the present work, to the extent that real activity is a determinant of the capitalization, unanticipated inflation could proxy for real activity which would be consistent with Fama's proxy hypothesis.

However, Tables 6.8 and 6.9 show that for no measure of the capitalization rate does the inclusion of real activity eliminate the explanatory power of unanticipated inflation in the capitalization rate equation. Furthermore, for most measures of the capitalization rate,

TABLE 6.5

OLS REGRESSION: INFLATION AND THE CAPITALIZATION RATE

$$\Delta \ln(\rho'_i)_t = \alpha + \beta\pi_t + \epsilon_t$$

Sample/ Independent Variable	i: 1	2	3	4	5
1965-77					
Constant	-25.69	0.10	-19.11	-63.70	-47.55
π	5.98**	0.24	4.36*	11.79	10.38
	(2.61)	(2.31)	(2.27)	(10.38)	(8.51)
R^2	.10	.00	.07	.03	.03
D-W	1.91	2.14	2.08	2.64	3.00
1965-87					
Constant	-14.94	-0.20	-37.58	-43.73	-19.22
π	2.21	-0.31	6.64**	7.46	3.68
	(1.48)	(1.42)	(2.13)	(6.39)	(5.31)
R^2	.02	.00	.10	.02	.01
D-W	1.83	1.89	1.98	2.84	3.01

*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

TABLE 6.6

OLS REGRESSION: INFLATION AND THE CAPITALIZATION RATE

$$\Delta\ln(\rho'_i)_t = \beta_o + \beta_1\dot{\pi}_t + \beta_2\pi^u_t + \epsilon_t$$

1965-77

Independent Variable	i: 1	2	3	4	5
Constant	-8.41	-6.44	-11.50	-8.34	21.86
$\dot{\pi}$	2.25	1.64	2.72	-0.16	-4.59
	(2.86)	(2.68)	(2.61)	(11.55)	(12.47)
π^u	12.64**	-2.28	7.29**	33.13**	37.15**
	(3.57)	(3.34)	(3.25)	(14.41)	(11.16)
R^2	.21	.02	.10	.11	.22
D-W	2.24	2.15	2.09	2.61	2.87

Quarterly observations.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

TABLE 6.7

OLS REGRESSION: INFLATION AND THE CAPITALIZATION RATE

$$\Delta \ln(\rho'_i)_t = \beta_o + \beta_1 \pi_t^{e} + \beta_2 \pi_t^{u} + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	1.84	0.22	-1.49	21.42	39.32
π^e	-1.11	-0.39	-0.50	-5.43	-7.90
	(1.77)	(1.79)	(2.36)	(7.72)	(6.37)
π^u	7.41**	-0.18	17.85**	27.69**	21.86**
	(2.20)	(2.22)	(2.92)	(9.56)	(7.88)
R^2	.12	.00	.30	.10	.10
D-W	2.01	1.90	2.06	2.88	3.04

Quarterly observations.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

TABLE 6.8

OLS REGRESSION: INFLATION AND THE CAPITALIZATION RATE

$$\Delta \ln(\rho'_i)_t = \beta_o + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

1965-77

Independent Variable	i: 1	2	3	4	5
Constant	0.69	-24.77	-34.71	-155.84	-55.37
π^u	12.55**	-2.10	7.53**	34.62**	37.93**
	(3.60)	(3.33)	(3.21)	(13.80)	(11.02)
RGNP#	-1.18	2.36	3.00	19.05**	9.97
	(2.17)	(2.01)	(1.94)	(8.33)	(6.65)
R^2	.22	.05	.15	.20	.26
D-W	2.21	2.29	2.22	2.75	2.90

Quarterly observations.
#Log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

TABLE 6.9

OLS REGRESSION: INFLATION AND THE CAPITALIZATION RATE

$$\Delta\ln(\rho'_i)_t = \beta_o + \beta_2\pi^u_t + \delta\Delta\ln RGNP_{t+1} + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	-5.16	-5.08	-8.61	-34.25	-23.69
π^u	7.51**	-0.05	17.89**	27.46**	21.53**
	(2.22)	(2.22)	(2.93)	(9.48)	(7.83)
RGNP#	0.33	1.20	1.52	8.45	6.10
	(1.29)	(1.29)	(1.71)	(5.51)	(4.55)
R^2	.12	.01	.31	.11	.10
D-W	1.94	1.94	2.09	2.93	3.05

Quarterly observations.
#Log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

unanticipated inflation dominates real activity in explanatory power. Thus, there appears to be a significant inverse relationship between unanticipated inflation and the capitalization rate. Furthermore, this relationship is not a result of inflation proxying for real activity.

Modigliani and Cohn [1979] argue that there is no rational reason that the true discount rate (defined as in equation (4.2) above) should be inversely related to the level of observed inflation. To the extent that our ρ' is an accurate measure of this "true" discount rate (ρ), then our Table 6.5 supports MC's proposition. MC argue that any observed inflation-capitalization rate relationship results from investors wrongly using a nominal discount rate (recall ρ' is a real required yield by definition). This hypothesis is not directly testable. However, since both π^e and π^u are components of nominal interest rates, their theory suggests a role for both in determining ρ. To the extent that we find only π^u matters, our results are not fully consistent with their investor irrationality hypothesis. We can conclude that there is an unexplained inverse relationship between unanticipated inflation and our residual measure of the earnings capitalization rate. To examine the role of π^u in our capitalization rate equation, we must define the components of Φ (the vector of variables driving ρ).

6.5 DETERMINANTS OF THE EARNINGS CAPITALIZATION RATE

Since ρ' is obtained using SP and P, its statistical significance in equation (6.1) has little usable economic information; except to support the low R^2s found by Fama and others in stock return models, which suggests stock returns are not fully explained by the included variables. To the extent that we can define some vector of macroeconomic variables (Φ) which determines ρ, then including these variables, rather than ρ', in our stock return model is desirable. Our goal is to replace ρ' in equation (6.2) with Φ.

Reilly, Griggs, and Wong [1983] argue that the earnings multiple (or by definition $1/\rho'$) is a function of the dividend payout ratio (DP), the rate of required return on capital (ϕr), and the expected growth rate in the real cash flow (assumed to be real dividends henceforth and denoted g_d). Furthermore, we can break down ϕ_r into its riskless component (i_{rf}) proxied for by the 3 month U.S. Treasury bill rate, and its market specific risk premium (rp). Applying the argument of Reilly, Griggs, and Wong (hereafter [RGW]) to 1/PE, we can write ρ' as

(6.3) $$\rho' = f(\Phi) = f(DP, g_d, i_{rf}, rp).$$

A. Dividend Payout

Given our five measures of earnings (P1-P5), we have five measures of the dividend payout (DP1-DP5, where $DP_i = D/P_i$, and D and P are time t flows). If investors place a premium on having cash flows explicitly paid out (i.e., cash dividends), then equation (6.3) suggests that $f'_{DP}<0$. If, on the other hand, investors are indifferent between future capital gains (resulting from retained earnings), and current dividends, then $f'_{DP}=0$. Before examining this question, we test the proposition that inflation impacts ρ' through DP.

Table 6.10 indicates that, for the linear case, there exists a significant inverse relationship between DP_i and unanticipated inflation (for all i). This, at least in part, explains the role of π^u in our ρ' equation. Furthermore, to the extent that DP is a relevant determinant of stock returns, the coefficient on π^u in equation (4.8) may be negatively biased.

TABLE 6.10

OLS REGRESSION: CAPITALIZATION RATE AND DIVIDEND PAYOUT

$$\Delta\ln(\rho'_i)_t = \alpha_0 + \alpha_1\Delta\ln(DP_i)_t + \epsilon_t$$

Sample/ Independent Variable	i: 1	2	3	4	5
1965-77					
Constant	2.80	2.40	3.42	3.95	3.24
DPi	-1.16**	-0.57**	-0.64**	-0.99**	-0.99**
	(0.19)	(0.10)	(0.15)	(0.03)	(0.04)
R^2	.43	.39	.29	.96	.94
D-W	1.79	2.21	2.08	1.88	1.86
1965-87					
Constant	0.39	-0.46	0.06	0.52	0.42
DPi	-1.13**	-0.74**	-0.98**	-1.01**	-1.01**
	(0.11)	(0.07)	(0.06)	(0.17)	(0.21)
R^2	.52	.52	.78	.97	.96
D-W	1.77	1.95	1.82	1.80	1.76

*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

B. Dividend Growth

To the extent that the PE ratio (and hence ρ') captures anticipated real dividend growth (as RGW argue), it is not suprising that ρ' is significant in our stock return equation. There are a number of ways to measure anticipated dividend growth. Rational expectations models (such as Fama's) may use actual future dividend growth. Adaptive expectations models employ averages of past growth rates.

Since we have argued that dividends are determined by real earnings, anticipated dividend growth should be determined by anticipated earnings growth or economic growth. We have already documented the existence of an inverse inflation-real activity relationship. However, the proposition that π^u proxies for real activity growth (or real dividend growth) in our ρ' equation is rejected by Table 6.9.

C. Risky and Risk-free Components of ρ'

Much of the research on the behavior of the earnings capitalization rate, and its role in determining stock values or returns, has focused on the risk premium component of this rate (see Chen, Roll, and Ross [1986], Keim and Stambaugh [1983], and Pindyck [1984, 1988]). On the other hand, some writers have ignored the role of the risk premium (see Modigliani and Cohn [1979]). We will address both the risky and risk-free components of ρ' in an effort to determine the origin of its inverse relationship with π^u. We can explicitly account for the risk-free component by subtracting the real 3 month Treasury bill rate (i_{rf}) from ρ'.[24] The remaining "risky" component of the capitalization rate will be referred to as rp (where $rp_i = \rho'_i - i_{rf}$ is a residual measure of the risk premium).

We want to determine if the inverse relationship between unanticipated inflation and the implied capitalization rate is a stock market phenomenon (i.e., a relation between π^u and rp) or a macroeconomic phenomenon (i.e., a relationship between π^u and i_{rf}). To determine this we examine the relationship between unanticipated inflation and rp. If we observe a significant positive relationship between π^u and rp, and no relationship between π^u and the real t-bill rate, then we can conclude that the impact of unanticipated inflation on stock returns stems from its impact on the risky component of the required yield (a stock market phenomenon). If, on the other hand, we observe no significant positive relationship between π^u and rp, and a significant positive relationship between π^u and the real t-bill rate, then we can conclude that the inverse inflation-stock return relationship stems from the impact of π^u on real interest rates in general (a macroeconomic phenomenon).

Table 6.11 examines this π^u-rp relationship for the post-1965 period (since this is the period characterized by an inverse inflation-stock return relationship). The results indicate that for the capitalization rates on inflation adjusted profits there is a significant positive relationship between π^u and the risk premium. If rp3-rp5 are accurate measures of the risky component of the true capitalization rate, then these findings are consistent with the hypothesis that π^u impacts real stock returns through the risky component of the required yield.

Table 6.12 simultaneously includes real activity in our rp equation. This does not eliminate the significant positive impact of π^u. Thus, there appears to exist a significant positive relationship between the level of unanticipated inflation and the risky component of the capitalization rate on inflation adjusted profits. Furthermore, this relationship is not accounted for by real activity.

To examine the relationship between π^u and the real t-bill rate (the riskless component of ρ'), we regress i_{rf} on anticipated and unanticipated

TABLE 6.11

OLS REGRESSION: INFLATION AND THE RISKY CAPITALIZATION RATE

$$\Delta(rp_i)_t = \beta_o + \beta_2\pi_t^u + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	-0.10	-0.05	-0.13	-0.18	-0.20
π^u	0.07 (0.09)	-0.11 (0.09)	0.30** (0.10)	0.46** (0.20)	0.42* (0.26)
R^2	.01	.02	.09	.06	.03
D-W	2.76	2.96	3.02	3.12	3.19

Quarterly observations.
*Significant at the 10% level.
**Significant at the 5% level.

TABLE 6.12

OLS REGRESSION: INFLATION AND THE RISKY CAPITALIZATION RATE

$$\Delta(rp_i)_t = \beta_o + \beta_2 \pi_t^u + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

1965-87

Independent Variable	i: 1	2	3	4	5
Constant	0.13	0.14	0.07	-0.25	-0.28
π^u	0.06	-0.12	0.29**	0.46**	0.42*
	(0.09)	(0.09)	(0.10)	(0.20)	(0.26)
RGNP#	-0.08	-0.07	-0.07	0.03	0.03
	(0.05)	(0.05)	(0.06)	(0.11)	(0.02)
R^2	.03	.04	.10	.06	.03
D-W	2.70	2.89	2.95	3.13	3.20

Quarterly observations.
#Log first difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

TABLE 6.13

OLS REGRESSION: UNANTICIPATED INFLATION AND THE RISKLESS REAL INTEREST RATE

$$\Delta(i_{rf})_t = \beta_o + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \epsilon_t$$

Independent Variable	Sample: 1965-77 (1)	(2)	Sample: 1965-87 (3)	(4)
Constant	1.05	0.74	0.90	0.47
π^u	0.37**	0.37**	0.19**	0.20**
	(0.11)	(0.12)	(0.09)	(0.10)
RGNP#	----	0.04	----	0.07
		(0.07)		(0.06)
R^2	.31	.32	.11	.13
D-W	2.57	2.62	2.57	2.63

Quarterly observations.
#Log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.
(standard errors)

inflation. Columns (1) and (3) of Table 6.13 (above) show that, for the 1965-77 and 1965-87 periods respectively, unanticipated inflation has a significant positive relationship with ex ante real t-bill rates. This suggests that investors have responded to unanticipated inflation by raising required yields in gerneral, in addition to the required yield on equities (but says nothing about the rationality of doing so). Moreover, columns (2) and (4) of Table 6.13 include real activity to show that the π^u-i_{rf} relationship is not accounted for by inflation proxying for real activity (in fact real activity enters insignificantly).

Given the finding of a significant relationship between π^u and a number of the components of ρ', and the role of ρ' in our stock return equation (see Tables 6.3 and 6.4), it is possible that the role of π^u in equation (4.8) stems from it proxying for excluded components of the capitalization rate.

6.6 Conclusions

We have shown that the **implied** rate at which earnings (for any definition except P2) are capitalized has significant explanatory power in a stock return model. Furthermore, we found that for inflation adjusted profits, the trailing PE ratio definition of the capitalization rate (ρ') dominates the forward looking definition (ρ'').

We then showed that there exists a significant inverse relationship between ρ' and unanticipated inflation, and that this relationship results from the impact of unanticipated inflation on both the risky and riskless components of ρ', as well as the dividend payout ratio. Moreover, this relationship is not explained by real activity, and thus will not be accounted for in equation (4.8). Whether these relationships support Fama's proxy hypothesis in general will be examined in Chapter VII below.

CHAPTER VII

REEXAMINING THE PROXY HYPOTHESIS

7.1 INTRODUCTION

The findings of Chapters V and VI suggest two testable hypotheses which can explain Fama's inability to fully account for the observed inverse inflation-stock return relationship. These hypotheses were introduced in Chapter IV, and are developed into testable propositions in this chapter:

Proposition I: Fama's inability to support his proxy hypothesis is the result of his failure to include the growth in real profitability (correctly defined) as an explanatory variable in his test equation.

Proposition II: Fama's inability to support his proxy hypothesis is the result of his failure to include Φ in his test equation.

In this chapter we utilize Fama's proxy hypothesis framework to test Propositions I and II. To do so, we develop augmented versions of Fama's original test equation (4.8) discussed in Chapter IV above.

7.2 AUGMENTED PROXY HYPOTHESIS: EARNINGS

One explanation for the finding of significant coefficients on either anticipated or unanticipated inflation in stock return models in the post-

1965 period is that the interaction of inflation with the U.S. tax code adversely affects the after-tax return on capital.

We showed in Chapter V that anticipated inflation has no significant impact on real profits, but that for inflation adjusted profit measures, unanticipated inflation had a significant inverse relationship with real profitability.

These findings indicate that we should proceed with a test of Proposition I. Tables 7.1-7.5 summarize the results of testing Proposition I for P1-P5 respectively. That is, we respecify Fama's proxy hypothesis test equation (4.8) as:

$$(7.1) \qquad r_t = \beta_o + \beta_1\pi_t^e + \beta_2\pi_t^u + \delta\Delta\ln(RGNP_{t+1}) + \psi\Delta\ln([P_i/\kappa]_{t+1}) + \epsilon_t,$$

where again we have lett the actual future values of RGNP and P proxy for the true expectations. We find that the inclusion of growth in real profitability does not alter Fama's finding under any definition of profit (P1-P5) for either the 1965-77 or 1965-87 sample period. That is, inflation retains its significant explanatory power despite the inclusion of real profitability (this holds for contemporaneous profits as well).

These results suggest that while there may be some role for real profitability in explaining stock returns (beyond that accounted for by real activity), respecification of (4.8) to account for this possibility does not explain the significant role of inflation in the stock return model. We thus turn our attention to the testing of Proposition II.

TABLE 7.1

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1 \pi_t^{\bullet} + \beta_2 \pi_t^{u} + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(ROC_1)_{t+1} + \epsilon_t$$

Independent Variable#	Sample 1965-77	1965-87
Constant	21.24	7.77
$\pi^{\bullet}$	-3.28	-0.47
	(2.32)	(1.30)
π^{u}	-11.27**	-5.66**
	(2.08)	(1.43)
RGNP	-0.32	0.95
	(1.89)	(1.58)
ROC1	0.38*	0.19
	(0.21)	(0.13)
R^2	.45	.22
D-W	2.33	1.96

Quarterly observations.
#Non-inflation variables are advanced one period and are in log first difference form.
*Significant at the 10% level.
**Significant at the 5% level.

TABLE 7.2

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1 \dot{\pi}_t + \beta_2 \overset{u}{\pi}_t + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(ROC2)_{t+1} + \epsilon_t$$

Independent Variable#	Sample 1965-77	Sample 1965-87
Constant	12.39	6.68
$\dot{\pi}$	-2.51	-0.54
	(2.26)	(1.30)
$\overset{u}{\pi}$	-11.40**	-5.61**
	(2.24)	(1.43)
RGNP	1.16	1.36
	(1.46)	(0.99)
ROC2	0.12	0.13*
	(0.09)	(0.07)
R^2	.43	.23
D-W	2.24	1.97

Quarterly observations.
#Non-inflation variables are in log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

TABLE 7.3

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1 \dot{\pi}_t + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(ROC3)_{t+1} + \epsilon_t$$

Independent Variable#	Sample 1965-77	1965-87
Constant	14.79	3.19
$\dot{\pi}$	-2.73	-0.36
	(2.19)	(1.31)
π^u	-10.41**	-5.90**
	(2.27)	(1.55)
RGNP	1.15	2.07
	(1.46)	(0.99)
ROC3	0.24*	-0.02
	(0.13)	(0.05)
R^2	.47	.21
D-W	2.31	1.91

Quarterly observations.
#Non-inflation variables are in log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

TABLE 7.4

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1 \pi_t^{e} + \beta_2 \pi_t^{u} + \delta \Delta \ln RGNP_{t+1} + \psi \Delta \ln(ROC4)_{t+1} + \epsilon_t$$

Independent Variable#	Sample 1965-77	Sample 1965-87
Constant	5.74	4.25
π^{e}	-1.64	-0.35
	(2.21)	(1.29)
π^{u}	-10.56**	-4.91**
	(2.44)	(1.51)
RGNP	2.16	1.63*
	(1.37)	(0.94)
ROC4	0.03	0.03*
	(0.02)	(0.02)
R^2	.43	.23
D-W	2.40	2.03

Quarterly observations.
#Non-inflation variables are in log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

TABLE 7.5

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1\dot{\pi}_t + \beta_2\overset{u}{\pi}_t + \delta\Delta\ln RGNP_{t+1} + \psi\Delta\ln(ROC5)_{t+1} + \epsilon_t$$

Independent Variable[#]	Sample 1965-77	Sample 1965-87
Constant	5.93	3.24
$\dot{\pi}$	-1.78	-0.26
	(2.28)	(1.30)
$\overset{u}{\pi}$	-11.56**	-4.91**
	(2.57)	(1.52)
RGNP	2.34*	1.79*
	(1.38)	(0.94)
ROC5	0.00	0.00
	(0.03)	(0.02)
R^2	.41	.22
D-W	2.25	2.00

Quarterly observations.
[#]Non-inflation variables are in log first-difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

7.3 AUGMENTED PROXY HYPOTHESIS: THE CAPITALIZATION RATE

Since ρ'_i is measured as a residual, including it in our proxy hypothesis test equation is problematic. Even if it is significant, we must determine the economic cause of its significance. Thus, instead of including ρ', we include the components of Φ which we found to be relevant in our analysis of Chapter VI.

A. The Dividend Payout

We found that the dividend payout rate was inversely related to both ρ' and π^u. Thus, if DP is a relevant component of our stock return model, then the coefficient of π^u in equation (4.8) may be negatively biased. Table 7.6 indicates that DP is insignificant in the post-1965 sample period and does not eliminate the explanatory power of π^u.

B. The Riskless Required Return

We showed in Chapter IV that unanticipated inflation and the riskless component of ρ' are significantly positively related. If the real riskless interest rate (i_{rf}) is driving π^u, and thus π^u only proxies for i_{rf} in stock return models, then simultaneous inclusion of the two variables should show significant explanatory power for i_{rf}, and an insignificant role for π^u. We thus estimate equation (4.8) including our measure of the riskless component of ρ'-- the real 3 month t-bill rate. Table 7.7 shows that the real t-bill rate does not enter significantly, and thus does not eliminate the role of π^u over either the 1965-77 or 1965-87 period, suggesting that its role in stock return determination is not the result of it proxying for i_{rf}.

TABLE 7.6

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1\pi^e_t + \beta_2\pi^u_t + \omega\Delta\ln(DP_i)_t + \epsilon_t$$

1965-1987

Independent Variable#	Model (1)	(2)	(3)	(4)	(5)
Constant	17.14	14.82	15.47	15.83	15.96
π^e	-1.92*	-1.37	-1.46	-1.58	-1.60
	(1.18)	(1.15)	(1.16)	(1.19)	(1.20)
π^u	-5.34**	-4.88**	-7.01**	-5.82**	-5.73**
	(1.47)	(1.46)	(1.60)	(1.51)	(1.44)
DP1	0.16	----	----	----	----
	(0.10)				
DP2	----	-0.17	----	----	----
		(0.07)			
DP3	----	----	-0.10*	----	----
			(0.05)		
DP4	----	----	----	0.00	----
				(0.00)	
DP5	----	----	----	----	0.00
					(0.02)
R^2	.18	.22	.19	.16	.16
D-W	1.79	1.98	1.91	1.86	1.85

Quarterly estimations.
#All DPi are in first difference form.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 7.7

OLS REGRESSION: AUGMENTED PROXY TEST

$$r_t = \beta_o + \beta_1 \pi_t^e + \beta_2 \pi_t^u + \delta \Delta \ln RGNP_{t+1} + \theta \Delta (i_{rf})_t + \epsilon_t$$

Independent Variable	Sample 1965-77	1965-87
Constant	3.90	4.35
π^e	-1.23	-0.59
	(2.27)	(1.32)
π^u	-12.66**	-5.31**
	(2.48)	(1.48)
RGNP#	2.22	2.07**
	(1.36)	(0.94)
i_{rf}	2.86	-1.94
	(2.81)	(1.76)
R^2	.42	.22
D-W	2.21	1.93

Quarterly observations.
#Log first difference form, and advanced one period.
*Significant at the 10% level.
**Significant at the 5% level.

C. The Risk Premium

Since unanticipated inflation and the risky component of ρ' (rp) are directly related, π^u could proxy for rp. However, Table 7.8 shows that, for the 1965-87 period, inclusion of rp in equation (4.8) does not eliminate the role of unanticipated inflation under any definition of profits (the same is true for the 1965-77 period).

7.4 THE COMPLETE MODEL

If equation (4.5) is the true model determining stock returns, then a correct proxy hypothesis test equation would be specified

$$(7.2) \qquad r_t = \beta_o + \beta_1\pi_t^e + \beta_2\pi_t^u + \psi\Delta(\ln ROC_i)_{t+1} + \gamma\Phi_i + \epsilon_t.$$

We have shown that π^u is related to both ROC and Φ. If the role of π^u in Fama's test equation (4.8) stems from π^u proxying for one of these two fundamental components of stock returns, then estimation of (7.2) should indicate $\beta_2=0$ (as well as $\beta_1=0$, $\psi>0$).

We let actual real dividend growth in period t+1 proxy for the true time t anticipation of dividend growth (g_d), and the residual rp proxy for the true risk premium. Table 7.9 reports the results of estimating (7.2). We find that in every case the explanatory power of anticipated inflation is insignificantly different from zero. Furthermore, we find that, with the exception of DP, the remaining regressors are signed as anticipated.[25] Moreover, the riskless required return (i_{rf}) and the risk premium (rp) are significant and signed as anticipated. However, as in the original proxy test equation (4.8), we find that, in every case, the explanatory power of π^u remains significantly negative.

Tables 7.10-7.12 estimate (7.2) for the partitioned sample. The

TABLE 7.8

OLS REGRESSION: AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1 \dot{\pi}_t + \beta_2 \pi^u_t + \delta \Delta \ln RGNP_{t+1} + \phi \Delta(rp_i)_t + \epsilon_t$$

1965-1987

Independent Variable	Model (1)	(2)	(3)	(4)	(5)
Constant	2.59	2.42	2.66	2.90	3.93
$\dot{\pi}$	-0.10 (1.24)	-0.14 (1.31)	-0.20 (1.31)	-0.31 (1.29)	-0.46 (1.29)
π^u	-5.37** (1.37)	-5.93** (1.46)	-5.19** (1.51)	-5.12** (1.47)	-5.25** (1.44)
RGNP#	1.61* (0.89)	1.87** (0.94)	1.87** (0.94)	1.99** (0.93)	1.94** (0.92)
rp1	-5.34** (1.64)	----	----	----	----
rp2	----	-2.06 (1.82)	----	----	----
rp3	----	----	-1.68 (1.52)	----	----
rp4	----	----	----	-1.24 (0.79)	----
rp5	----	----	----	----	-1.06* (0.59)
R^2	.29	.22	.22	.23	.23
D-W	2.06	1.96	1.96	1.95	1.95

Quarterly estimations.
#Log first-difference form, and advacned one period.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 7.9

OLS REGRESSION: FULLY AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1\dot{\pi}_t + \beta_2\pi^u_t + \psi\Delta\ln(ROC_i)_{t+1} + \gamma(\Phi i)_t + \epsilon_t$$

1954-1987

Independent Variable	i (1)	(2)	(3)	(4)	(5)
Constant	12.20**	11.13**	10.77**	12.86**	12.49**
	(4.08)	(4.02)	(4.18)	(4.98)	(5.08)
$\dot{\pi}$	-1.09	-0.96	-0.93	-1.24	-1.21
	(0.77)	(0.75)	(0.77)	(0.93)	(0.95)
π^u	-2.35**	-2.57**	-1.37	-2.99**	-3.58**
	(1.04)	(1.04)	(1.29)	(1.30)	(1.31)
$(ROCi)^{\#}_{t+1}$	0.20**	0.15**	0.11**	0.03*	0.03*
	(0.07)	(0.05)	(0.04)	(0.01)	(0.02)
$RDIV^{\#}_{t+1}$	0.03	0.02	0.08	0.30	0.34
	(0.24)	(0.24)	(0.25)	(0.30)	(0.30)
$DPi^{\#}$	-0.30**	-0.39**	-0.44**	-0.11**	-0.12**
	(0.08)	(0.06)	(0.06)	(0.03)	(0.03)
$i^{\#\#}_{rf}$	-15.21**	-19.05**	-17.13**	-5.12**	-3.72**
	(1.97)	(2.32)	(2.18)	(1.72)	(1.63)
$rpi^{\#\#}$	-18.25**	-22.12**	-19.26**	-5.90**	-3.84**
	(2.07)	(2.52)	(2.14)	(1.42)	(1.03)
R^2	.53	.54	.51	.29	.27

Quarterly estimations.
#Log first-ifference form.
##First-ifference form.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

results are consistent with our earlier findings. That is, we see that it is the 1965-72 period which accounts for the inverse relationship between unanticipated inflation and stock returns. While we are able to eliminate any role for anticipated inflation (at the 5% level) in all sample periods, and eliminate the explanatory power of unanticipated inflation in the 1954-64 and 1973-87 periods, the intervening 1965-72 period is characterized by a significant inverse relationship between unanticipated inflation and stock returns. Furthermore, this relationship is unaccounted for by our system (4.5).

7.5 CONCLUSIONS

We have shown that the inclusion of real profitability alone does not eliminate the explanatory power of unanticipated inflation. We showed in Chapter VI that unanticipated inflation affects the capitalization rate (ρ') through the dividend payout rate (DP), the riskless real interest rate (i_{rf}) and the risk premium (rp). However, inclusion of these components in our proxy hypothesis test equation does not eliminate the explanatory power of unanticipated inflation. This suggests that the inverse relationship between unanticipated inflation and real stock returns stems, at least in part, from the impact of π^u on inflation adjusted measures of real profitability, the dividend payout rate, the riskless required return, and the risk premium.

TABLE 7.10

OLS REGRESSION: FULLY AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1\dot{\pi}_t + \beta_2\overset{u}{\pi}_t + \psi\Delta\ln(ROC_i)_{t+1} + \gamma(\Phi i)_t + \epsilon_t$$

1954-1964

Independent Variable	i (1)	(2)	(3)	(4)	(5)
Constant	8.00	6.65	5.93	12.11	10.46
	(5.07)	(4.50)	(4.60)	(5.17)	(5.40)
$\dot{\pi}$	-0.51	-0.54	-0.01	-2.73	-2.52
	(5.07)	(4.50)	(4.60)	(5.17)	(5.40)
$\overset{u}{\pi}$	-3.16	-3.04	-2.32	-3.10	-4.89
	(2.89)	(2.64)	(2.61)	(2.82)	(2.99)
$(ROCi)^{\#}_{t+1}$	0.19*	0.30**	0.31**	0.04*	0.05*
	(0.11)	(0.10)	(0.11)	(0.02)	(0.03)
$RDIV^{\#}_{t+1}$	0.06	0.15	0.12	0.37	0.14
	(0.48)	(0.41)	(0.42)	(0.52)	(0.55)
$DPi^{\#}$	-0.52**	-0.47**	-0.49**	-0.31**	-0.28**
	(0.15)	(0.13)	(0.13)	(0.08)	(0.08)
$i_{rf}^{\#\#}$	-26.25**	-26.22**	-27.03**	-23.76**	-15.64**
	(6.17)	(5.58)	(5.55)	(7.22)	(6.16)
$rpi^{\#\#}$	-28.68**	-28.37**	-29.03**	-24.77**	-18.52**
	(5.63)	(5.10)	(5.07)	(6.06)	(5.19)
R^2	.61	.68	.68	.47	.42

Quarterly estimations.
#Log first-ifference form.
##First-difference form.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 7.11

OLS REGRESSION: FULLY AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1\pi^e_t + \beta_2\pi^u_t + \psi\Delta\ln(ROC_i)_{t+1} + \gamma(\Phi i)_t + \epsilon_t$$

1965-1972

Independent Variable	i (1)	(2)	(3)	(4)	(5)
Constant	17.94	24.33*	22.59*	25.18	25.16
	(14.03)	(14.00)	(13.60)	(18.17)	(15.47)
π^e	-3.68	-5.51	-4.93	-5.36	-5.34
	(3.52)	(3.56)	(3.45)	(4.50)	(3.78)
π^u	-7.31**	-8.74**	-7.39**	-12.00**	-11.64**
	(3.64)	(3.74)	(3.44)	(4.91)	(4.28)
$(ROCi)^{\#}_{t+1}$	0.09	0.03	0.08	0.00	0.00
	(0.17)	(0.13)	(0.14)	(0.05)	(0.03)
$RDIVl^{\#}_{t+1}$	-0.14	-0.22	-2.08	-0.06	0.18
	(0.37)	(0.38)	(0.35)	(0.50)	(0.43)
$DPi^{\#}$	-0.39**	-0.24*	-0.27*	-0.05	-0.24**
	(0.17)	(0.14)	(0.15)	(0.06)	(0.07)
$irf^{\#\#}$	-22.07**	-21.56**	-22.36**	1.79**	-11.09*
	(6.55)	(6.60)	(6.23)	(5.18)	(6.30)
$rpi^{\#\#}$	-26.00**	-25.42**	-25.83**	-2.56	-11.49**
	(5.65)	(5.62)	(5.23)	(2.80)	(3.82)
R^2	.65	.63	.67	.33	.50

Quarterly estimations.
#Log first-difference form.
##First-difference form.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

TABLE 7.12

OLS REGRESSION: FULLY AUGMENTED PROXY TEST EQUATION

$$r_t = \beta_o + \beta_1 \pi_t^{e} + \beta_2 \pi_t^{u} + \psi \Delta \ln(ROC_i)_{t+1} + \gamma(\Phi i)_t + \epsilon_t$$

1973-1987

Independent Variable	i (1)	i (2)	i (3)	i (4)	i (5)
Constant	21.31**	18.04**	16.66*	18.27*	20.13**
	(8.13)	(8.45)	(8.82)	(9.79)	(10.11)
π^{e}	-2.21*	-1.70	-1.60	-1.70	-1.88
	(1.17)	(1.19)	(1.24)	(1.38)	(1.31)
π^{u}	-1.54	-2.19	-1.19	-3.04	-3.70
	(1.57)	(1.61)	(2.26)	(1.88)	(1.90)
$(ROCi)^{\#}_{t+1}$	0.20*	0.12	0.07	0.03	0.02*
	(0.11)	(0.07)	(0.06)	(0.02)	(0.03)
$RDIV^{\#}_{t+1}$	0.07	0.82	0.29	0.45	0.44
	(0.47)	(0.49)	(0.51)	(0.55)	(0.57)
$DPi^{\#}$	-0.11	-0.39**	-0.40**	-0.13**	-0.18**
	(0.14)	(0.09)	(0.08)	(0.04)	(0.06)
$irf^{\#\#}$	-12.66**	-16.76**	-14.79**	-6.90**	-5.30**
	(2.53)	(3.34)	(3.09)	(2.33)	(2.24)
$rpi^{\#\#}$	-15.49**	-19.78**	-17.24**	-6.51**	-4.77**
	(3.01)	(3.98)	(3.30)	(2.12)	(1.65)
R^2	.57	.53	.50	.38	.36

Quarterly estimations.
#Log first-ifference form.
##First-ifference form.
*Significant at 10% level.
**Significant at 5% level.
(standard errors)

CHAPTER VIII

CONCLUSIONS

We have shown that there are significant differences in nonfinancial corporate earnings under different degrees of inflation adjustment. Thus, to the extent that these profit measures drive stock returns, the definition of earnings employed in a stock return model is important.

We document the inverse inflation-stock return relationship found by earlier researchers. In addition, we outline Fama's proxy hypothesis explanation of this anomaly. We then investigate the underlying assumptions of Fama's model in which real activity is proported to adequately explain stock returns. To do so, we examine the two components of a simple rational valuation model of equity values-- earnings and the rate at which these earnings are capitalized.

We find that inflation adjusted measures of real profitability retain explanatory power in a stock return model when real activity is simultaneously included. Furthermore, we document a significant inverse relationship between inflation adjusted measures of profit and unanticipated inflation. Moreover, this relationship is not explained by real activity.

We use the five earnings measures and the market value of equities in a simple rational valuation model to compute five measures of the capitalization rate. We show that these measures are significantly positively correlated with unanticipated inflation. Furthermore, we show that this relationship results (at least in part) from a significant relationship between unanticipated inflation and the dividend payout rate, the riskless required return, and the risk premium component of the capitalization rate, and is not accounted for by real activity.

Thus, the observed inverse stock return-unanticipated inflation relationship is both a macroeconomic phenomenon and a stock market phenomenon, and results from unanticipated inflation impacting inflation adjusted earnings, the dividend payout rate, and both discount rates in general and the risky component of the required yield on equities.

Finally, we address the question of whether the unanticipated inflation-stock return relationship results from inflation proxying for these components discussed above, or if its relationship with stock returns is genuine. The results show that the significant explanatory power of unanticipated inflation remains despite simultaneous inclusion of the profitability measures and the capitalization rate variables.

Thus, we are unable to support Fama's hypothesis that the inverse unanticipated inflation-stock return relationship is spurious, and instead conclude that the relationship results from the interaction of unanticipated inflation and components of a simple equity valuation model.

APPENDICIES

APPENDIX A

QUARTERLY MARKET VALUES OF EQUITY

Annual data are available for the market value of outstanding equity for all U.S. Nonfinancial Corporations. Quarterly data, however, are unavailable for this series. Since the annual data are end-of-year data, we must estimate the equity value for quarters 1-3 of each year. Quarterly data are available for all U.S. Corporations. We use these quarterly data for all corporations (Q_1-Q_4) to estimate the missing data for nonfinancial corporations (A_1'-A_3') for each year given the end-of-year values (A_4)

The estimation procedure for 1954 is

$$A_1' = [Q_1/\bar{Q}] \times (A_o \times A_1)^{1/2}$$

(A.1) $$A_2' = [Q_2/\bar{Q}] \times (A_o \times A_1)^{1/2}$$

$$A_3' = [Q_3/\bar{Q}] \times (A_o \times A_1)^{1/2}$$

Where:

A_i' = estimation of missing quarterly values (1^{st}-3^{rd}) for U.S. nonfinancial corporations.

Q^i = the actual quarterly values for all corporations.

A_o = the actual 1953 end-of-year value of equity value for all U.S. nonfinancial corporations [NFC].

A_1 = actual value NFC 1954.

Q = the geometric average of the end-of-year 1953 value of outstanding equity for all corporations and the end-of-year 1954 value of outstanding equity for all corporations.

The same procedure is followed in estimating the missing quarterly values for NFC in each year 1954-1987 using the equation system (A.1).

APPENDIX B

QUARTERLY BOND VALUES

As in Appendix A we are faced with interpolating quarterly data from available annual data. Only annual data are available on the market value and par value of long-term bonds and mortgages outstanding for U.S. NFC. We utilize the quarterly behavior of long-term interest rates to interpolate quarterly debt values.

We can estimate the market value of long-term debt (strictly speaking-- of consols) as:

(B.1) Market Value = Par Value/i

or in log linear notation

(B.2) $\ln(mv) = \ln(pv) - \ln(i)$.

In first difference form

(B.3) $\delta \ln(mv) = -\delta \ln(i)$ assuming a roughly constant par value.

Using quarterly changes in the log of the long-term government bond rate, we then approximate the behavior of the quarterly debt values between actual annual values by (B.3).

APPENDIX C

ARMA INFLATION FORECASTS

We utilize an ARMA(6,5) model of the log first difference of the CPI, with restrictions MA(1) through MA(4)=0, and AR(2), AR(4), and AR(5)=0. The predicted values are referred to as π^e, while the residuals are π^u.

The estimated π^e equation is:

$$\pi^e{}_t = 4.75 + \underset{(5.61)}{0.44\pi_{t-1}} + \underset{(6.21)}{0.51\pi_{t-3}} - \underset{(-2.37)}{0.19\pi_{t-6}}$$

$$+ \epsilon_t - \underset{(2.22)}{0.23\epsilon_{t-5}},$$

where $\pi_t=400*(\ln(CPI_t)-\ln(CPI_{t-1}))$, and ϵ_t is the time t error term associated with the equation, and t-statistics are in parentheses. The Box-Pierce Q statistic for the autocorrelations of π^u is insignificant (Q=7.638), thus π^u can be characterized as a white noise process.

While there exist models which employ explanatory variables beyond the autoregressive variables we use, we have found that our parsimonious model performs similarly in a predictive capacity. Econometric problems with using generated variables in regressions have been discussed by Hoffman [1987]. We outline these problems in Appendix D.

TABLE C.1

INFLATION EXPECTATIONS: ARMA(6,5)

Date	π	π^e	RESIDUAL π^u
1956.1	0.000	1.100	-1.100
1956.2	4.944	2.564	2.380
1956.3	2.938	3.051	-0.113
1956.4	3.400	2.446	0.954
1957.1	2.892	4.712	-1.820
1957.2	4.773	3.739	1.035
1957.3	2.837	5.502	-2.665
1957.4	1.411	2.893	-1.482
1958.1	5.595	3.846	1.749
1958.2	1.387	3.985	-2.599
1958.3	0.000	2.141	-2.141
1958.4	0.000	2.478	-2.478
1959.1	0.000	0.956	-0.956
1959.2	2.759	1.247	1.512
1959.3	1.829	0.693	1.136
1959.4	1.366	1.176	0.190
1960.1	0.000	2.568	-2.568
1960.2	3.169	1.834	1.335
1960.3	0.451	3.556	-3.105
1960.4	2.246	1.054	1.192
1961.1	0.000	3.428	-3.428
1961.2	0.448	0.507	-0.059
1961.3	2.231	2.765	-0.534
1961.4	0.000	0.800	-0.800
1962.1	1.776	1.530	0.246
1962.2	0.885	1.841	-0.956
1962.3	3.082	1.492	1.590
1962.4	-0.878	3.179	-4.057
1963.1	1.317	0.580	0.736
1963.2	1.749	3.329	-1.581
1963.3	1.741	0.887	0.854
1963.4	1.734	2.752	-1.018
1964.1	0.432	1.276	-0.844
1964.2	1.294	2.529	-1.235
1964.3	1.290	1.968	-0.678
1964.4	1.713	1.771	-0.058
1965.1	0.427	1.976	-1.548
1965.2	4.246	1.447	2.800
1965.3	0.422	3.505	-3.083
1965.4	2.524	1.123	1.400

TABLE C.1 (continued)

1966.1	3.756	4.147	-0.391
1966.2	3.309	2.316	0.993
1966.3	4.098	4.422	-0.324
1966.4	2.034	3.350	-1.316
1967.1	1.215	3.945	-2.730
1967.2	3.223	3.187	0.036
1967.3	3.992	3.098	0.894
1967.4	3.559	2.804	0.755
1968.1	4.697	3.267	1.429
1968.2	4.642	4.230	0.412
1968.3	4.209	4.766	-0.557
1968.4	4.917	4.974	-0.057
1969.1	5.970	5.083	0.887
1969.2	6.247	5.560	0.687
1969.3	5.432	5.601	-0.169
1969.4	6.069	5.571	0.498
1970.1	5.629	6.188	-0.559
1970.2	6.239	5.658	0.581
1970.3	4.106	6.010	-1.904
1970.4	5.410	4.598	0.813
1971.1	2.344	5.790	-3.446
1971.2	5.636	2.985	2.651
1971.3	2.298	5.447	-3.149
1971.4	2.935	1.726	1.209
1972.1	2.914	4.709	-1.795
1972.2	3.213	1.780	1.433
1972.3	3.822	4.197	-0.375
1972.4	3.471	2.521	0.950
1973.1	7.779	4.135	3.645
1973.2	7.933	5.546	2.387
1973.3	9.258	6.171	3.086
1973.4	8.760	8.495	0.265
1974.1	13.069	8.540	4.529
1974.2	10.483	11.797	-1.313
1974.3	12.861	9.307	3.555
1974.4	9.639	12.692	-3.053
1975.1	6.130	9.058	-2.927
1975.2	7.035	9.787	-2.751
1975.3	7.403	6.403	1.000
1975.4	6.548	6.359	0.189
1976.1	2.876	4.499	-1.623
1976.2	6.161	3.700	2.461
1976.3	5.836	5.411	0.425
1976.4	3.921	4.069	-0.149
1977.1	8.851	4.652	4.199
1977.2	8.000	6.412	1.589
1977.3	4.811	6.671	-1.860

TABLE C.1 (continued)

1977.4	4.539	6.709	-2.170
1978.1	7.664	6.084	1.580
1978.2	11.637	7.177	4.460
1978.3	7.708	7.274	0.435
1978.4	7.562	6.516	1.046
1979.1	12.422	9.014	3.408
1979.2	14.267	10.049	4.218
1979.3	12.348	10.856	1.492
1979.4	11.109	10.837	0.272
1980.1	16.857	12.111	4.746
1980.2	12.960	14.229	-1.269
1980.3	6.564	11.146	-4.582
1980.4	10.655	10.301	0.354
1981.1	9.926	10.195	-0.269
1981.2	9.244	7.847	1.397
1981.3	11.191	7.197	3.994
1981.4	2.856	7.663	-4.807
1982.1	1.987	5.955	-3.968
1982.2	10.619	5.659	4.960
1982.3	3.706	5.717	-2.012
1982.4	-1.094	2.938	-4.033
1983.1	1.368	2.877	-1.509
1983.2	5.693	2.179	3.514
1983.3	4.816	3.819	0.997
1983.4	0.930	1.491	-0.561
1984.1	2.381	2.829	-0.448
1984.2	3.806	4.494	-0.688
1984.3	7.634	3.811	3.823
1984.4	0.128	4.860	-4.732
1985.1	3.952	2.089	1.864
1985.2	4.290	6.491	-2.200
1985.3	2.253	2.471	-0.218
1985.4	3.603	4.285	-0.682
1986.1	-2.481	2.395	-4.876
1986.2	1.986	1.572	0.415
1986.3	2.346	2.595	-0.249
1986.4	0.984	0.025	0.958
1987.1	5.852	1.988	3.864
1987.2	5.290	3.116	2.174
AVG..	4.566	4.566	0.000

APPENDIX D

ERRORS IN MEASUREMENT

It is widely accepted that current stock values are, at least in part, a function of anticipated future cash flows which are not measureable without error. We have reduced this to a model in which current stock values (SP_t) depend on the rational anticipation of the cash flow next period ($E[C_{t+1}|\Omega_t]$).

Unfortunately, $E[C_{t+1}|\Omega_t]$) is unobservable, and in econometric studies will be measured with error. Like Fama [1981], we use actual observations as proxies for current anticipations. Fama recognizes that "...a shortcoming of the real stock return regressions...is the use of actual growth rates ... instead of [true] anticipated growth rates"(p. 555).

This "shortcoming" reduces to classical errors in variables, and can be illustrated. The general equation we wish to estimate is

$$(D.1) \qquad r_t = \alpha + \beta \Delta \ln E[C_{t+1}|\Omega_t] + \epsilon_t,$$

where r_t is the time t stock return, C_{t+1} is the time t+1 cash flow, E[ ] is the true expectations operator, Ω_t is the time t full information set, and ϵ_t is a random disturbance term (assumed to adhere to the classical assumptions).

Since we cannot observe $E[C_{t+1}|\Omega_t]$, we have proposed replacing it with the actual future growth rate C_{t+1}, or the actual current growth rate C_t.

Since both C_{t+1} and C_t approximate $E(C_{t+1}|\Omega_t]$ with error, bias results in both cases. We will outline the origination of the bias in the case of C_{t+1}, and then discuss the impact of this bias for both proxies. We can write the actual cash flow as:

(D.2) $$C_{t+1} = E[C_{t+1}|\Omega_t] + \xi_t,$$

where ξ_t is assumed to be normally distributed independent of ϵ_t, with zero mean, and variance σ^2_ξ. We can rewrite (D.2) as:

(D.2') $$E[C_{t+1}|\Omega_t] = C_{t+1} - \xi_t.$$

Substituting into (D.1) we get:

$$r_t = \alpha + ß\Delta\ln(C_{t+1} - \xi_t) + \epsilon_t,$$

$$= \alpha + ß\Delta\ln(C_{t+1}) + \epsilon_t - ß\xi_t,$$

(D.3) $$= \alpha + ß\Delta\ln(C_{t+1}) + \epsilon^*_t,$$

where $\epsilon^*_t = \epsilon_t - ß\xi_t$. The explanatory variable (C_{t+1}) is contemporaneously related to the error term (ϵ^*). That is:

$$Cov(C_{t+1}, \epsilon^*_t) = E[C_{t+1} - E(C_{t+1})]\epsilon^*_t,$$

$$= [\mu_t(\epsilon_t - ß\xi_t)],$$

$$= -ß\xi^2_t = -ß\sigma^2_t,$$

which suggests that the least squares estimator ß is biased. This bias results for both C_{t+1} (as illustrated) and for C_t. Furthermore, the bias, in both cases, is towards zero.

The fact that the bias is towards zero results in a different impact on our findings for C_{t+1} and C_t. Since we found the coefficient on C_{t+1} to be significantly greater than zero, dispite the presence of bias towards zero, the bias only reenforces our results. On the other hand, since we could not reject the hypothesis that the coefficient on C_t was equal to zero, we cannot rule out the existence of Type II error. That is, since the coefficient on C_t is biased towards zero, the true coefficient may be significantly greater than zero.

The potential solutions to this possible bias are limited. Thus, Kmenta has suggested that "...the tendency has been to avoid the issue by assuming that errors of measurement are so small that they can be safely neglected"(p. 312). One possible solution is the use of intrumental variables. For our purposes this would mean developing instruments for growth rates in real activity and real profitability, a task Fama equates to a search for the "holy grail of macroeconomics"(p. 555).

A second unobservable variable used in our analysis is expected inflation (and unexpected inflation). We approximate the true time t expectation $E[\pi_{t+1}|\Omega_t]$ using a simple ARMA model (see Appendix C) and denote the resulting proxy as π^e. Use of π^e (as well as the residual measure of unanticipated inflation π^u), while not resulting in bias, can result in inefficiency in the estimators.

Since this inefficiency can distort our hypothesis testing of the significance of π^e and π^u in equation (D.1) above, it is undisirable. Hoffman [1987] discusses the econometric problems which arise when using such generated variables, and proposes a procedure for testing the severity of these problems, and methods to improve the estimation. However, he concludes that "Though [the improvement is] appreciable in several cases, the potential for improved efficiency through GLS is generally smaller than observed generated regression bias"(p. 346). For this reason, and for comparability with Fama [1981], and Wahlroos and Berglund [1986], we estimate using OLS, while acknowledging the potential for inefficiency in our estimators.

NOTES

NOTES

[1]See Fama [1970].

[2]Fama [1981], p. 563, "... complete explanation of the expected inflation effect occurs only when the base growth rate ... is included in the stock return regressions."

[3]Lintner [1975], p. 269.

[4]Current cost uses a general price index, while replacement cost uses asset specific price indices to value assets.

[5]Davidson and Weil [1975], p. 29.

[6]NYSE Fact Book, various issues.

[7]See Keim and Stambaugh [1983].

[8]Replacement cost of capital is defined as the current cost measure of the net (of straight-line depreciation) capital stock taken from the Federal Reserve, Balance Sheets for the U.S. Economy, Release C.9, October, 1987.

[9]$\Delta \ln[x] = 400*(\ln[x]_t - \ln[x]_{t-1})$.

[10]Our measure of real stock returns $\Delta \ln[SP/\kappa]$ has a simple correlation coefficient of .97 with the value-weighted NYSE return, less the inflation rate (see Fama [1981], p. 554, note 4 for details). In most estimations below we will employ Fama's NYSE return to obtain comparable results.

[11]All profit measures used in this chapter (i.e., P1-P5) are fully defined in Chapter III above.

[12]Modigliani and Cohn [1979], p. 27.

[13]Modigliani and Cohn also argue that investors used a nominal discount rate rather than the appropriate real rate.

[14]Tables 4.1 and 4.2 define the real stock return ($\Delta \ln(SP/\kappa]$). See note 10.

[15]Determination of the exact onset of each period is difficult, and thus the sample partitioning is somewhat arbitrary. Table 4.2 is quantitatively not robust with respect to the choice of the sample partitioning. However, the thrust of the table is that no measure of cash flow, alone appears to consistently fully account for the behavior of stock returns. This conclusion exists regardless of the choice of sample partitioning.

[16]Unless stated otherwise, for the work that follows, to be more consistent with Fama [1981], we use the continuously compounded, annualized return on the with dividend, value-weighted NYSE index, less the rate of inflation measured by the rate of change in the CPI (see note 10) denoted r_t. Much of the work which follows was also estimated using the without dividend measure, and $\Delta\ln(SP/\kappa)$ without qualitative differences from the results reported.

[17]Appendix D discusses potential problems with using an auxillary equation to compute anticipated inflation.

[18]Wahlroos and Berglund [1986], p. 378. We have also confirmed, using our U.S. data, their findings in Finnish data that stock returns predict changes in real activity, and that inflation rates are negatively related to future growth in economic activity. These results are the underpinnings of Fama's proxy hypothesis.

[19]Fama tests numerous variations of this model using three different levels of aggregation. The work that follows below uses quarterly observations, and the sample period will be made explicit.

[20]That is, Fama argues that there are fundamental real determinants of equity values and returns (e.g., capital expenditures, and return on capital), and that anticipated economic growth (A_{t+1}) captures this explanatory power.

[21]The same approach is taken by Fama [1981] in his investigation of the role of real activity, real profiability, and capital expenditures in stock returns.

[22]The same may not hold in the case of forecasting returns. However, in attempting to explain the relationship between unanticipated inflation and contemporaneous stock returns, we are interested in contemporaneous relationships.

[23]It is understood that the significance of ρ in a stock return model has little useful economic information. This will be discussed below.

[24]We use an ex ante measure of the real riskless rate: $i_{rf}=i_t-(\pi^e)_t$, where i_t is the time t risk free nominal interest rate.

[25]Since DP had an inverse impact on ρ', and ρ' has an inverse relationship with stock returns, we expect DP to have a direct relationship with stock returns. However, we observe an inverse relationship.

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