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Asset Markets and the Cost of Capital

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A central theme of macro-economic theory throughout the twentieth century has been the sensitivity of capital formation to interest rates in financial markets. Theories of business fluctuations attribute great significance to variation in the pace of real investment, and attribute much of this variation to changes in the relative attractions for wealth-owners of physical capital, on the one hand, and money or obligations to pay money, on the other hand. Moreover, some of these changes are engineered by the monetary operations of governments and central banks; they represent a principal channel by which the authorities stabilize or destabilize the economy.

William Fellner's writings on these subjects place him in a tradition which includes, among others, Wicksell, Keynes, Schumpeter, Robertson, and Hayek. In addition to his many contributions to general macroeconomics and cycle theory, Fellner has advanced our understanding of the relation between technological change and capital formation and of business decisions with respect to risk. Our own approach to macroeconomics and its behavioral foundations has profited from our many years of contact with "Willy" at Yale.

Our paper concerns a concept which we have elsewhere baptized "q", the ratio between two valuations of the same physical asset. One, the numerator, is the market valuation: the going price in the market for exchanging existing assets. The other, the denominator, is the replacement or reproduction cost: the price in the market for newly produced commodities. We believe that this ratio has considerable macroeconomic significance and usefulness, as the nexus between financial markets and markets for goods and services.

Section 1 of the paper explains the rationale for "q", and its role in macroeconomic theory and policy. We consider also the determinants of

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q, both for the economy in aggregate and for specific assets and business firms.

Section 2 reports an empirical investigation of the factors determining differences in q's among non-financial corporations in the United States in each of the fifteen years 1960–1974. Although this study relies on microeconomic data, its motivation is, like that of Section 1, macroeconomic. We seek to estimate the changing market valuations of various characteristics of firms – growth, cyclical sensitivity, risk, leverage, earnings rate on replacement value of capital. From these estimates we construct measures of the cost of capital to American corporations, which we regard as better indicators of the impact of monetary policy and financial events on corporate investment than the nominal or real interest rates commonly used.

1. Valuation of Capital Stocks and their Earnings Streams

1.1. Used and New Goods

Markets for used durable producers' and consumers' goods are a central feature of capitalist economies. These may be – direct or indirect – markets for the goods themselves or for claims to the goods and to their fruits. Direct used goods markets provide everchanging market valuations both of non-reproducible real assets, like land and mineral deposits, and of reproducible assets, like buildings and equipment. In the case of reproducible assets, the current cost of producing identical or competitive goods is obviously an important factor in the valuation of an existing asset. Thus a rise in residential construction costs can be expected to raise the value of existing homes, and a rise in the price of new cars is "good" for the price of previous years' models. The reverse is also true. High valuations of existing stocks will lead both to increased production and higher prices of newly produced substitutes.

New and used prices can diverge significantly for extended periods of time, and the valuations of existing assets are more volatile than the costs or prices of their newly produced counterparts. An increase in the market valuation of houses relative to current cost of building will encourage residential construction. The incentive is the gain to be made by the excess of market price over replacement cost.

This profit is not wiped out immediately because construction takes time, and rapid construction is especially expensive, both for the individual builder and for the economy as a whole. In the longer run, however, the increase in stock brings market value into line with replacement cost, lowering the former and/or raising the latter. In equilibrium the volume of construction will meet demands for replacement and normal growth, and the size of the stock will be such that market value is the same as marginal production cost for the equilibrium volume of construction.

1.2. Business and Corporate Capital

The same mechanism applies to non-residential structures and producers' equipment. But there is an important difference. The various physical assets of a business enterprise are often designed, installed, and used in complex combinations specific to the technology. It is costly or impossible to detach and move individual assets or to apply them to alternative purposes. The valuation of the business as a whole as a going concern is generally much more relevant than the separate valuations of the assets on used goods markets.

Markets for businesses take several forms. Small unincorporated businesses are bought and sold directly or through brokers; see, for example, the advertisements in any Sunday *New York Times* or in trade journals. Corporations acquire other companies either by buying their assets or by acquiring their stock.

The most important markets, however, are those for corporate securities. In these markets ownership of corporate businesses, and other claims upon the assets, change hands daily. The securities markets provide, therefore, a continuing market valuation of the enterprise, and thus indirectly of the productive assets of the company. These markets are well organized and efficient. Their valuations are sensitive and volatile. Here, even more than in used goods markets, discrepancies arise and persist between the market valuations and the replacement costs of the assets which the market is indirectly and implicitly valuing. But here too we can expect the formation of new businesses and the expansion of existing ones to respond to such discrepancies.

As is so often the case, the point was expressed succinctly by Keynes, *General Theory* (p. 151):

> "[The] daily revaluations of the Stock Exchange, though they are primarily made to facilitate transfers of old investments between one individual and another, inevitably exert a decisive influence on the rate of current investment. For there is no sense in building up a new enterprise at a cost greater than that at which a similar existing enterprise can be purchased; whilst there is an inducement to spend

on a new project what may seem an extravagant sum, if it can be floated off on the Stock Exchange at an immediate profit."

This is the common sense justification for paying attention, as we have previously advocated,[1] to the ratio "q" of the market valuation of reproducible real capital assets to the current replacement cost of those assets. In the illustrative case of houses discussed above, q would be the ratio of market value to replacement cost, for an individual house, or for an aggregate stock. The same concept applies to a business or to corporate business in aggregate, though "replacement cost" must be interpreted to cover not only physical assets but other items on the firm's balance sheet.

Economic logic indicates that a normal equilibrium value for q is 1 for reproducible assets which are in fact being reproduced, and less than 1 for others. Values of q above 1 should stimulate investment, in excess of requirements for replacement and normal growth, and values of q below 1 discourage investment. We shall discuss below why the normal value for statistical representations of q may be different from 1.

1.3. Discounting Future Earnings

The simplest model of valuation of an earning asset says that its present value is the sum of discounted earnings at all future dates. For a house, the earnings are rents – cash or imputed, net of costs of operation and maintenance, taxes, etc. For the durable productive assets of a business, earnings are the net cash flows over their lifetimes. For a share of stock, the earnings stream includes all future dividends and other distributions.

The discount rates applied to expected earnings represent, in principle, interest costs: rates of return which the investor must pay to borrow funds to hold the asset or must sacrifice by holding smaller amounts of other assets.

The securities – debt, preferred stock, common stock – of a corporation are essentially claims to the earnings thrown off by the real productive capital assets of the business. The securities will rise in value when "the market" revises upward its expectations of future earnings, or revises downward its discount rates. Those discount rates are related to open market interest rates, which are powerfully influenced by monetary polices. The market may also take Federal Reserve actions into account

[1]See Tobin–Brainard (1968) and Tobin (1969); these are respectively Chapters 20 and 18 in Tobin (1971).

in judging future earnings. In any event it is a fact of common observation, especially in recent years, that the stock market, as well as the bond market, is highly sensitive to movements in short-term interest rates under the control of the monetary authority.

1.4. Valuations and Risks

As we stated at the outset, the margin of asset substitution between obligations to pay specified amounts of money and ownership of physical capital is an important one in macroeconomic models. Theorists have differed in the degree of substitutability assumed between bonds and capital. While Keynes' investment theory takes them as close or even perfect substitutes, we have emphasized that they are imperfect substitutes, with a margin of differential yield as important and as variable as liquidity preference theory finds between bonds and bills or bills and cash.[2] A principal reason for distinguishing, at an aggregate level, between bonds and capital is their difference in risk. The major risks on capital relate to real events – changes in technology, utilization, relative scarcities, and labor costs. The major risks on financial assets arise from uncertainties about future rates of inflation and interest.

Risk is also crucial at a disaggregated level. Differences in the magnitude and nature of risk are probably the most important factors leading to differences of required rates of return on investment in various firms and types of capital.

How would one expect valuations of assets to depend on the nature of their risks? Portfolio theory has provided some insights, which can be given precision under special assumptions [Lintner (1965), Sharpe (1964)]. The standard assumptions are that there exists a riskless asset, that investors may borrow as well as lend at the riskless rate, that they are concerned only about the mean and variance of the total return to their portfolio, and that they all agree on a joint probability distribution of asset returns. Then it can be shown that the relevant risk on any one asset is not the total variance of its return but only the "undiversifiable" part. This undiversifiable risk (which may be negative) reflects the covariation of the asset's rate of return with an overall market index of rates of return, in which assets are weighted by their relative supplies. If, for example, the asset's returns are independent of those on other assets, its "undiversifiable" risk reflects only its own weight in the index. Such an asset's own risk matters, but a single firm or particular investment in a large economy will

[2] See, for example, Tobin (1961); also Chapter 13 of Tobin (1971).

have a weight close to zero. On average, covariation of returns on business assets tends to be positive. Most assets have some undiversifiable risk.

The risk premium on a particular asset – the excess of its expected return over the riskless rate – depends on the amount of its undiversifiable risk and on a market-wide "price of risk". This common "price of risk", reflecting the aggregate supplies of the riskless and risky assets and the risk preferences of investors, provides all the information required to value the undiversifiable risk associated with any particular asset.

The simplicity of these results obviously reflects the very special nature of the underlying assumptions. Although relaxation of even one of these assumptions greatly complicates the problem of valuation, some of the qualitative characteristics of this valuation model probably survive.

For example, suppose that transactions costs limit the number of assets a typical investor can hold in his portfolio. The "undiversifiable" risk of a particular asset to him then depends on its covariation not with the entire market but with his own portfolio. Obviously an asset will be a higher proportion of the portfolios in which it is held than in the aggregate market "portfolio". Hence its own variance will be more important. In the extreme and unrealistic case where only one risky asset is held in each portfolio, its own variance is a complete and accurate measure of "undiversifiable" risk. In principle, it would be possible to relate risk premia to covariations with individualized portfolios, but as a practical matter, these are unobservable. The conclusion is that restrictions or economic limitations on the number of assets typically held in a portfolio make the estimation of undiversifiable risk difficult and increase the importance of own variance. But it is still possible to describe asset return throughout the market in terms of a riskless rate and a single "price of risk".

Relaxing other assumptions, e.g., the existence of a riskless asset, the possibility of borrowing and lending at the same rate, the homogeneity of expectations, further complicates matters. These complications not only make it difficult, both conceptually and empirically, to measure the relavant risks on particular assets. They also make it impossible to speak of, let alone estimate, a single price of risk.

In recent years there has been considerable empirical investigation of the effect of risk on the valuation of assets using the general analytic framework discussed above. Almost all of this work has focused on the market for equities. There are several conceptual difficulties with attempting to estimate the required rate of return on physical assets from equities markets alone. These have led us to look at the valuation of firms, not simply the valuation of their common stock issues.

First, even under the restrictive assumptions necessary for the simple valuation model, the list of assets should include corporate and government bonds as well as equities. Relaxation of those assumptions seems likely to make their omission even more important. In principle, even the risks on less marketable assets, such as houses, consumer durables, and human capital, are relevant to the valuation of stocks and bonds.

Second, the valuation of a firm's productive business assets may depend importantly on the firm's financial structure. It is true that the celebrated Modigliani–Miller theorem says that a firm's valuation should be independent of its financial structure, implying that a firm could theoretically estimate the required rate on a new investment just by looking in the stock market and observing the market's valuation of equities whose distribution of returns were proportional to those on the contemplated investment. But there are important reasons for believing that the valuation of a firm's physical assets and their returns cannot be divorced from its financial structure. These include corporate income taxation, which is not neutral as between debt interest and dividends; the implications of leverage for probability of bankruptcy and loss of control; economies of scale in borrowing which enable stockholders to borrow more cheaply through the corporation than individually. Looking directly at the market valuation of firms' total earnings, interest as well as common stock earnings, requires less restrictive assumptions than looking separately at the firm's various securities.

1.5. Effects of Inflation

What is the effect of inflation on the value of q? As usual, it is important to distinguish between anticipated and unanticipated inflation.

For anticipated inflation, a first approximation is (1) that q is independent of the inflation rate and (2) that q will not change over time as a result of the realization of anticipated inflation. The denominator of q moves, of course, with the prices of new capital goods in the commodity markets. The numerator will do likewise if both expected real earnings and the real interest rate used to discount them are independent of the expected rate of inflation. Stated in nominal terms, these sufficient conditions are that the dollar earnings anticipated at any future date are proportional to the price level expected at that date, and that the interest rate for that date varies point for point with the expected rate of inflation from now until then.

However, this first approximation, neutrality of inflation, fails in practice for several reasons:

Taxes are not neutral. In particular, nominal "earnings" which simply maintain the real value of an asset are taxed. Profits are overstated and over-taxed when depreciation is based on original cost.[3] This tends to lower q, but working in the other direction is the reduction of aftertax real interest rates due to the taxation of nominal interest.

Nominal interest rates do not accurately incorporate inflation premiums. Certain nominal rates are frozen or controlled – the zero rate on currency and demand deposits, the ceiling rates on savings and time deposits. Inflation expectations necessarily reduce the real rates on these assets and tend, therefore, to lower real rates in general.[4] But this q-raising effect can be offset by deliberate monetary policy.

Unanticipated inflation, or more generally upward revisions in expectations of future prices, will have additional non-neutral effects. The windfall gains of borrowers, including levered corporations, will be reflected in higher market valuations, but since similar gains cannot be expected to recur, marginal q's will not benefit. In the past, inflationary news was frequently considered a favorable sign for real business activity. Firming of prices was a symptom of strength in aggregate demand. Nowadays, however, inflationary news is more likely to be considered the harbinger of anti-inflationary policies – bringing recession, stagflation, or price controls, all damaging to the stream of earnings. Recent experience has firmly implanted this view in the market.

1.6. Market Valuation and Investment

The neoclassical theory of corporate investment is based on the assumption that the management seeks to maximize the present net worth of the company, the market value of the outstanding common shares. An investment project should be undertaken if and only if it increases the value of the shares. The securities markets appraise the project, its expected contributions to the future earnings of the company and its risks. If the value of the project as appraised by investors exceeds the cost, then the company's shares will appreciate to the benefit of existing stockholders. That is, the market will value the project more than the cash used to pay for it. If new debt or equity securities are issued to raise the cash, the prospectus leads to an increase of share prices. To state the point another way round, suppose the firm sells additional shares at the going market

[3]For empirical estimates of this and other non-neutral effects, see Shoven and Bulow (1975/6).

[4]For explanation, see Tobin (1969).

price. Will the proceeds suffice to purchase the earnings that justify that price? If they will do so, with margin to spare, then the joint operation – share issue and investment – benefits the original shareholders.

Clearly it is the q ratio *on the margin* that matters for investment: the ratio of the increment of market valuation to the cost of the associated investment. The crucial value for marginal q is 1, but this is consistent with average q values quite different from 1. A firm with monopoly power, or other sources of diminishing returns to scale, will have an average q ratio higher than its marginal q. The difference is the market's valuation of its rents or monopoly profits or "good will".

A similar but conceptually distinct problem arises from the heterogeneity of capital goods and from technological progress. The average q ratio for existing capital stocks may be a serious understatement of q for new capital goods of quite different nature. This occurs spectacularly when the new have rendered the old obsolete. The Schumpeterian phenomenon may occur within a single firm, but it is more likely to characterize whole industries or economies during periods of rapid innovation. It is at least conceivable to observe investment booms during periods when observed average q ratios are low and even declining.

Changes in factor prices make profitable new investments which promise to economize scarce factors at the same time that they lower the value of old capital goods adapted to previous prices. For example, the drastic increase in oil prices in 1973 lowered the q's for firms committed to high energy-using technologies, while making attractively profitable on the margin investments embodying energy-saving technologies.

Another dimension of heterogeneity is risk. This too can make q on the margin exceed average q. The new investments of a firm may be in a different "risk class" from the old, with different connections with the rest of the economy. They will make the firm's securities more attractive to investors by reducing the amount of undiversifiable risk they carry. Transactions costs and other limits on the sizes of individual portfolios make diversification within firms an efficient alternative to portfolio diversification across firms. This has been one of the incentives for conglomeration.

Nevertheless, the forces of continuity in the economy are strong. Especially for short-run variations of aggregate demand, we can expect that the same factors which raise or lower q on the margin likewise raise or lower q on average. This is confirmed by John Ciccolo's regressions of aggregate business fixed investment on eight quarters distributed lag values of q [Ciccolo (1975)]. These alone explain 40% of the 1953–73 quarterly variation of the ratio of gross investment to the capital stock, I/K. The eventual full effect of a 0.10 increase in q is to raise I/K by 0.08.

Investment would not be related to q if instantaneous arbitrage could produce such floods of new capital goods as to keep market values and replacement costs continuously in line. For reasons given above, such arbitrage does not occur. Discrepancies between q and its normal value do arise. The speed with which investment eliminates such discrepancies depends on the costs of adjustment and growth for individual enterprises, and for the economy as a whole on the short-run marginal costs of producing investment goods.

This is a different investment theory from what appears to be the Keynesian investment function of the *General Theory*, Keynes' condition that the marginal efficiency of capital equal the rate of interest determines not the flow of investment but the stock of capital. Specifically, it determines the capital/labor and capital/output ratios. In a stationary economy, satisfaction of the condition – at whatever level of the interest rate – means zero investment. In a growing economy, it means capital accumulation at the natural growth rate of the economy. (Since the capital stock will be larger the lower the interest rate, investment will also be larger the lower the interest rate. But this long-run steady state relationship is clearly not what Keynes had in mind in postulating an inverse relation between investment and interest rate.)

Since Keynes discusses at length independent variations in the marginal efficiency of capital and the rate of interest, he does not really imagine that investment adjusts the capital stock fast enough to keep them continuously equal. Indeed the true message is that investment is related to discrepancies between the marginal efficiency and the interest rate. This is the tradition of Wicksell and of Keynes' earlier work *The Treatise on Money*. The q ratio theory of investment follows this same tradition. Indeed under special conditions q could be equivalently defined as the ratio of the marginal efficiency of capital R to the interest rate r_k used to discount future earnings streams.[5]

[5]The marginal efficiency R is defined by the equation

$$V=\int_0^\infty E(t)\,\mathrm{e}^{-Rt}\,\mathrm{d}t,$$

where V is the cost of capital goods at time 0 and $E(t)$ their expected earnings.

$$\overline{MV}=\int_0^\infty E(t)\,\mathrm{e}^{-r_k t}\,\mathrm{d}t,$$

where $\overline{MV}$ is the market valuation of the capital goods and r_k the discount rate. If E is constant then

$$V=E/R,\qquad \overline{MV}=E/r_k,\qquad MV/V=R/r_k.$$

Several points deserve emphasis. First, the statistic q is observable as a ratio of market valuation and replacement cost, whereas R and r_k are not observable. Second, the discount rate r_k is not any observed interest rate on long-term bonds or other fixed-money-value obligations. Those interest rates are the discount factors for streams of payments with the risks and other characteristics of those instruments, while r_k is the discount rate for streams of return with the characteristics of earnings on business capital. The rates are related but not identical. Third, the rates r_k and R are in the same interest-rate numéraire. As discount for a stream of dollar earnings, they both would be nominal rates. As discount for a stream of earnings in constant dollars, they both would be real rates. The ratio q is the same either way.

The hypothesis that investment is related to the difference between R and r_k, or to the value of q, bears some resemblance to the "flexible accelerator" idea that investment is a function of the difference between a desired and actual capital stock. The desired stock appropriate to r_k is larger than the actual stock which yields R, when r_k is lower than R. Indeed the market value of the existing stock is a sort of estimate of the desired stock at replacement cost.[6]

1.7. A "q" Formulation of IS/LM Equilibrium

The investment function for a macroeconomic model could take the form $\Delta K/K = \varphi(q-\bar{q})+g$, where $\bar{q}$ is the normal value of q, perhaps 1, $\varphi(+) = +$, $\varphi(0)=0$, $\varphi(-) = -$, and g is the natural growth rate. Growth equilibrium occurs at that value of net output $\bar{Y}$ at which saving supports net investment gK, with $q=\bar{q}$. An "IS" locus in (q, Y) space will normally have $\partial q/\partial Y > 0$. As Y increases, saving increases at given value of q. Thus a higher value of q is required to induce additional investment, or to discourage saving. Consumer wealth rises with q, and consumption spending is stimulated by additional wealth.

An "LM" locus can also be constructed in (q, Y) space, for given *real* quantities of high-powered money and other government debts, and for a given expected rate of inflation. The financial system may contain any number of assets and determine any number of interest rates, as well as q. These outcomes will depend on Y, for the usual reason that Y affects the demands for money and for other assets. If long-run expectations of earnings, summarized in the marginal efficiency of capital, are insensitive

[6]This is exact if the elasticity of the marginal productivity of capital with respect to the stock is unity, so that $K^*r_k = KR$, where K^* is the desired stock corresponding to r_k.

to current Y, the LM locus will have $\partial q/\partial Y < 0$. Increasing transactions requirements for cash raise interest rates in general, and in particular raise the rate of discount of future earnings. But if the marginal efficiency of capital is sensitive to current Y, the sign of $\partial q/\partial Y$ may be positive: an increase in Y raises R faster than r_k. (In conventional IS/LM frameworks, this same phenomenon is usually modelled as an upward-sloping IS curve because marginal propensities to invest and to consume sum to more than one.)

Figure 1 shows these IS and LM curves. To preserve familiarity, q is measured downward on the vertical axis. Two alternative LM curves are drawn, the first on the assumption that the marginal efficiency R used in calculation of q is always $R(\bar{Y})$, based on earnings along the growth equilibrium path. The second LM curve, upward sloping, assumes R to be an increasing function of Y, $R(Y)$. Exogenous increases in R will shift the LM curve down, even though they generally raise interest rates. Expansionary monetary policy will also move the LM curve down, while lowering interest rates. Autonomous increases in consumer or government spending will, as usual, move the IS locus up.

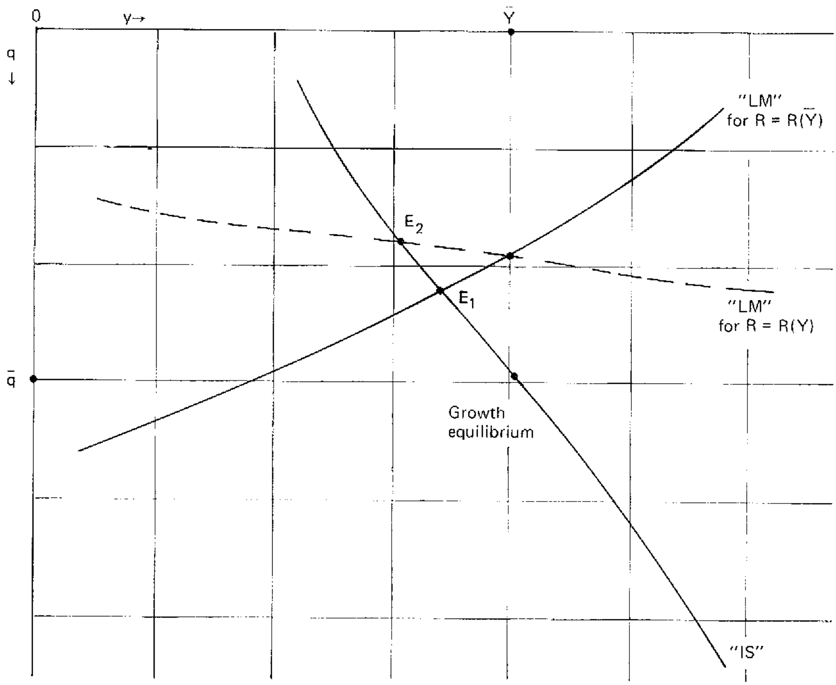

FIGURE 1. IS/LM analysis in (q, Y) space.

The above exposition embodies all the simplicities of aggregation of textbook macroeconomic models. To avoid misunderstanding, we reiterate our recognition that in fact there are many kinds of capital and accordingly many q's coexisting with different values. Moreover, there are channels other than "q's" by which monetary policies and events are transmitted to demands for goods and services. The most important of these are liquidity constraints of various kinds – credit limits, credit rationing, illiquidity of human capital and many other assets, rate ceilings, governmental restrictions on financial portfolios, etc. As these constraints are made to bind less or more tightly, spending effects occur which are inadequately modelled if related simply to prices of assets and commodities.

For these reasons, among others, it would be foolish to advocate any estimate of "q" as the sole indicator for monetary policy. But estimates of "q" are useful indicators. The fact that the indicator is in part policy-determined and in part endogenous is in this case a virtue. If "q" is low, we cannot tell whether the cause is pessimism about future profits or high discounts of future earnings, or whether, if it is the latter, the source is tight central bank policy or public asset preference. The indicated response for monetary policy is the same whichever the cause. Whether pessimistic earnings expectations, conservative asset preferences, or stingy supply of high-powered money is the reason for low q, the appropriate remedial action – and the only remedial action available to the monetary authority – is to expand the supply of bank reserves. The exceptions to the rule are the cases, discussed above, where marginal and avèrage q's are moving in opposite directions.[7]

2. Empirical Study of Determinants of "q" 1960–74

2.1. The "Fundamental" Approach

The remainder of the paper reports a statistical investigation of stock market determinations of q's for individual industrial corporations listed on the New York Stock Exchange 1960–74. The data used were read from the Standard and Poor "Compustat" tape.

The approach is, in stock market parlance, "fundamental". That is, differences among firms in stock market prices are attributed to earnings,

[7]But the relevance of this caveat should not be exaggerated. In early 1974 the q model threw off pessimistic predictions of fixed investment. Yet it was easy to think that, given the embargo and OPEC price increase of 1973, energy-related projects would make total investment much stronger than the model predicted. This proved not to be the case.

dividends, and observable characteristics of the firms and not to previous histories of stock prices themselves.

In most studies the market value of equities is made to depend upon the characteristics of the distribution of market yields (dividends and capital gains) rather than on the more fundamental characteristics of the firm. The distribution of market yields reflects fluctuation of market discount rates as well as fluctuation in the firm's earnings. It is difficult to construct a "bootstrap" model of asset markets in which the risk characteristics of market yields used in the valuation of assets are consistent with the fluctuations in value generated by the market itself. Further, it is difficult to know how firms in making investment, and financing decisions, should react to changes in the market's valuation of risk which reflect speculative movements, or to changes in capitalization rates in response to investor preferences. For these reasons, we have taken the direct and simple expedient of asking how the market values that which the firm has to sell, the claims on prospective earnings associated with the firm's investment in physical assets.

2.2. The Variables

For each of the fifteen years 1960–74 a cross-section regression is calculated for a sample of firms. The dependent variable is q for the firm. The explanatory variables are characteristics of the firm which, theory suggests, should affect its market valuation. These characteristics, which will be defined precisely below, are as follows:

"Beta" *Growth Rate.* The prior trend of the logarithm of earnings.

"Gamma" *Cyclical Sensitivity.* Past relationship of earnings to the national unemployment rate.

"X" *Covariance.* Observed relationship of firm's earnings to aggregate earnings, both relative to growth trends. This is calculated for the mean unemployment rate previously observed.

"Sigma" *Earnings Volatility.* Variability of firm's earnings around trend, whether due to business cycle (as indicated by unemployment rate) or to unexplained factors.

"PB" *Default Probability.* Estimated probability that earnings will fall short of fixed debt service charges.

"PD" *Vulnerability of Dividend.* Estimated probability that earnings will fall short of fixed charges plus preferred and common dividends.

"D/V" *Dividend Rate.* Common dividends per dollar of capital.

"E/V" *Earnings Rate.* Earnings per dollar of capital.

The firm's q is measured as the ratio of market value $\overline{MV}$ to invested capital at replacement cost, V. The numerator $\overline{MV}$ includes three aggregates; common stock, preferred stock, and long-term debt. The firm's outstanding common stock is valued at its end-of-year prices. However, the tape does not provide data on market values of preferred stock and long-term debt, only book values. We were therefore not able to take account of inter-firm variations in these valuations. But we have tried to improve on the book values, by eliminating year-to-year economy-wide sources of divergence between book and market value.

We have estimated the market value of the firm's preferred stock from its reported preferred dividends for the year, dividing this quantity by the published Standard and Poor index of preferred stock yield for December. This index varies from year to year but is, for any one year, the same for all firms. A similar expedient was used to convert book value of long-term debt to market value. An economy-wide annual index of the ratio of market value of corporate debt securities to their principal value was estimated. The index was estimated from the series on gross issues from 1941 to 1974, assuming that all bonds have 20-year maturity, are issued at par with a common equal to the average Baa yield in the year of issue, and in each subsequent year are valued to yield until maturity the average Baa yield of that year.

The denominator V, invested capital at replacement cost, is the sum of the book values of common stock, preferred stock, and long-term debt, corrected by a common annual index of the ratio of replacement cost to book value. The book value of securities is not identical to the book value of physical capital assets; there are various short-term financial assets and liabilities on the balance sheet. Ignoring these items, we have corrected the book value by estimating an economy-wide index of the ratio of current replacement cost of fixed capital assets (non-residential plant and equipment) to original cost. Our index assumes exponential depreciation at 5% per year, and uses the deflator for the fixed investment component of GNP. Multiplicative correction of book values by the index is the same for all firms in any given year. But by avoiding increasing understatement of replacement value during recent years of high inflation, the correction helps to preserve comparability of results from year to year.

The "earnings" of a firm in a year include debt service and preferred stock dividends as well as the earnings attributable to common stock. Our reasons for inclusive definition both of earnings and of the capital base of earnings were explained in Section 1.

In the fifteen annual cross-section regressions, the ratio of earnings to replacement value (E/V) is, of course, the most important variable explaining q, the ratio of market value to replacement value ($\overline{MV}/V$). Dividends paid on common stock, also measured relative to V, (D/V), may also influence q.

The other six characteristics used as regressors in the cross-section regression for year T are based on a time series regression specific to the firm using observations for the years 1955 through $1955+T-1$. This regression for firm i for year T takes the form

$$\ln E_{it} = \alpha_{iT} + \beta_{iT}t + \gamma_{iT}U_t + \epsilon_{it}, \qquad t = 1, 2, \ldots, T-1. \tag{1}$$

U_t is the standard series for national unemployment rate, in percent of labor force, average for the year. Regression (1) is estimated by ordinary least squares, but with recent observations weighted more heavily. Specifically, the weights are proportional to $\exp(-0.12(T-t))$. Regression (1) attempts to simulate what market investors in year T can infer from the simple statistical history of the earnings of the firm. Clearly it does not allow for many other sources of firm-specific information.

The firm characteristics "beta" and "gamma" are the estimates of β_{iT} and γ_{iT}. These characteristics vary across firms every year, and for each firm they are re-estimated every year. To define the remaining characteristics we must consider for each firm, for each year T, expected earnings

$$\ln \hat{E}_{it} = \alpha_{iT} + \beta_{iT}t + \gamma_{iT}\bar{U}_T, \tag{2}$$

where the coefficients α, β, γ are the estimates from the weighted OLS regression (1) already described and $\bar{U}_T$ is the simple arithmetic mean value of U for the years 1 through $T-1$. Thus $\hat{E}_{it}$ is an estimate of earnings at what an investor might regard as a cyclically normal unemployment rate. Let σ_{iT} be the standard deviation of $E_{it} - \hat{E}_{it}$ over the years of the regression, each deviation weighted in the same manner as the observations for the regression itself. The characteristic "sigma" is then σ_{it}/V_T. Dividing by the capital value V eliminates scale differences between firms. Sigma is a measure of the historical volatility of the firm's earnings, whether the variability was due to the business cycle, via U, or the factors other than trend and cycle represented by ϵ in equation (1).

PB is the estimated probability that earnings E_T will not exceed fixed debt charges I_T. Let s_{iT} be the standard deviation of $\ln E_{it} - \ln \hat{E}_{it}$, computed with the same decaying exponential weights used before. PB is then calculated on the assumption that $\ln E_{iT}$ is normally distributed with mean $\ln \hat{E}_{iT}$ and standard deviation s_{iT}. PD is similarly calculated as the probability that E_T will not exceed I_T plus preferred and common dividends. Note that these probabilities, like "sigma", allow for uncertainties about business cycle developments as well as other variability in firm earnings. Since these probability measures are used in regression along with "sigma", PB is really a measure of leverage. For given "sigma", a larger PB means a higher level of fixed charges, only measured in "probits" rather than dollars. Likewise, given "sigma" and PB, a high PD means a high dividend policy, again measured in "probits".

The remaining characteristic X requires further explanation. Consider the sample of firms used in year T, and let E_t be ΣE_{it} for that sample. A weighted regression of $\ln E_t$ on t and U_t, of the same form as (1), is computed on observations $(1, 2, \ldots, T-1)$. Likewise, $\ln \hat{E}_t$ is calculated according to equation (2). Then

$$X_{iT} = \frac{\text{cov}(\ln E_{it} - \ln \hat{E}_{it}, \ln E_t - \ln \hat{E}_t)}{\text{var}(\ln E_t - \ln \hat{E}_t)}, \tag{3}$$

where the covariance and variance are computed with the usual weights through year $T-1$.

The characteristic X is analogous to the β commonly calculated in portfolio analysis as a measure of the relationship of the yield, including appreciation, of an individual stock to the yield of an overall market index. It is this which is multiplied by the "price of risk" to get the risk premium for an individual stock. Here, however, in keeping with our "fundamentalist" approach, the elasticity X relates the earnings of an individual firm to aggregate earnings. It is a partial elasticity to the extent that growth trends are eliminated. Theory suggests that the market will downgrade firms whose earnings move with economy-wide earnings and prize firms whose earnings move counter to the aggregate. That is, q should be negatively related to X.

2.3. The Results

The cross-section regression computed for each year T, (1960–1974 inclusive), is simply linear and has been fit by ordinary least squares,

$$\begin{aligned} q_{iT} = {} & a_{0T} + a_{1T}\beta_{iT} + a_{2T} + a_{3T}X_{iT} + a_{4T}(\sigma_{iT}/V_{iT}) + a_{5T}\overline{PB}_{iT} \\ & + a_{6T}\overline{PD}_{iT} + a_{7T}(D_{iT}/V_{iT}) + a_{8T}(E_{iT}/V_{iT}) + u_{iT}. \end{aligned} \tag{4}$$

For each year T, as many firms were included as met the following conditions:[8] Earnings were positive in all years through T, and all the data necessary to compute regression (1), E_{iT}, D_{iT}, V_{iT}, and q_{iT} were available.

Table 1 summarizes the regressions, showing the sizes of the samples in each year and the values of R^2. Table 2 reports the mean values and standard deviations of q and the eight independent variables for each year. Tables 3–10, one table for each independent variable, give the coefficients of the fifteen cross-section regressions. Tables 11 and 12, and Figures 2 and 3, record some summary measures, and it is these results we shall discuss first.

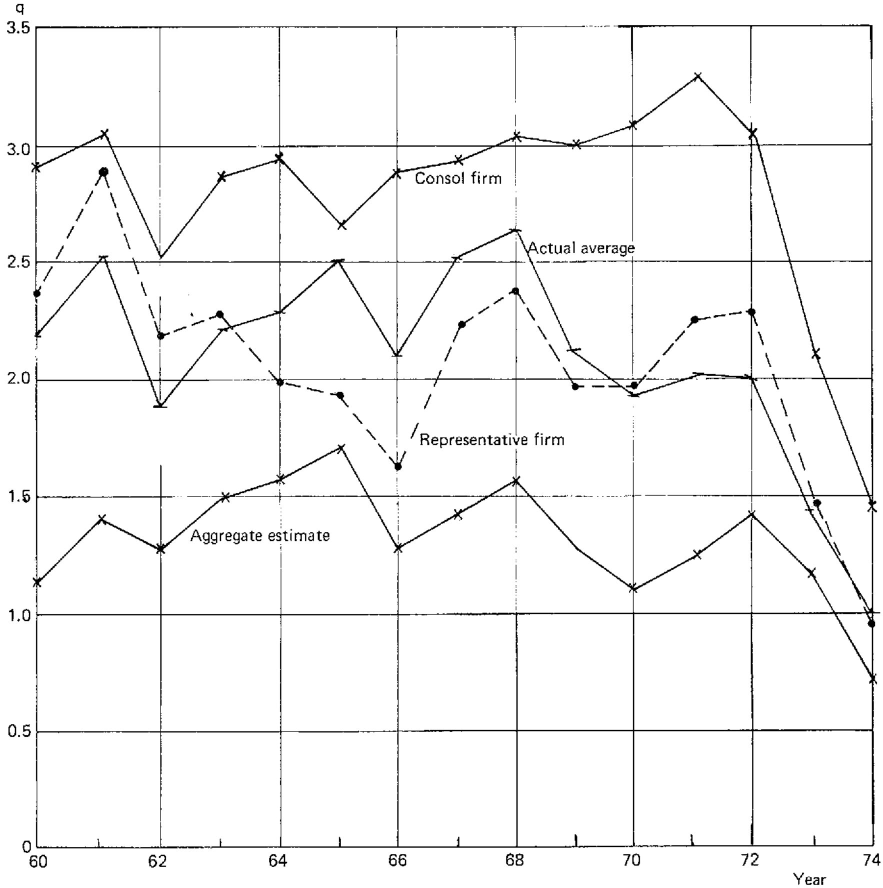

FIGURE 2. Alternative estimates of q, ratio of market to replacement value of corporate capital, 1960–74.

[8]Actually, two samples were assembled and two cross-section regressions computed for each year, one for all eligible companies, and one for dividend-paying companies only. Since the results were negligibly different, they will be presented only for the "all companies" samples.

TABLE 1

SUMMARY OF CROSS-SECTION REGRESSIONS, 1960–74.

	All companies		Div.-paying companies			All companies		Div.-paying companies	
Year	No.	R^2	No.	R^2	Year	No.	R^2	No.	R^2
1960	424	0.40	405	0.42	1968	409	0.48	399	0.50
1961	419	0.50	398	0.52	1969	406	0.46	394	0.48
1962	419	0.48	398	0.49	1970	397	0.44	383	0.47
1963	419	0.45	399	0.46	1971	395	0.49	373	0.54
1964	418	0.47	400	0.50	1972	392	0.49	370	0.54
1965	415	0.49	405	0.50	1973	392	0.36	376	0.38
1966	415	0.40	408	0.40	1974	384	0.24	371	0.30
1967	414	0.46	405	0.47					

TABLE

MEANS (STANDARD DEVIATIONS) OF

Year	q	Beta	Gamma	X
1960	2.21 (1.85)	0.104 (0.127)	−0.0925 (0.159)	1.145 (1.92)
1961	2.51 (2.10)	0.083 (0.128)	−0.0737 (0.156)	0.965 (1.92)
1962	1.88 (1.41)	0.081 (0.122)	−0.0754 (0.154)	0.983 (1.96)
1963	2.21 (1.83)	0.068 (0.105)	−0.0566 (0.146)	0.743 (1.91)
1964	2.29 (1.81)	0.069 (0.092)	−0.0574 (0.156)	0.672 (1.89)
1965	2.50 (2.25)	0.078 (0.079)	−0.0784 (0.153)	0.864 (1.67)
1966	2.11 (2.20)	0.083 (0.074)	−0.0954 (0.152)	0.990 (1.58)
1967	2.51 (2.37)	0.086 (0.072)	−0.1055 (0.150)	1.129 (1.63)
1968	2.54 (2.22)	0.084 (0.070)	−0.1007 (0.152)	1.148 (1.67)
1969	2.12 (1.88)	0.084 (0.068)	−0.0966 (0.150)	1.123 (1.68)
1970	1.92 (1.61)	0.084 (0.065)	−0.0954 (0.150)	1.130 (1.69)
1971	2.00 (1.70)	0.084 (0.066)	−0.0949 (0.132)	1.124 (1.53)
1972	1.99 (1.83)	0.087 (0.062)	−0.0840 (0.119)	1.188 (1.57)
1973	1.43 (1.84)	0.089 (0.058)	−0.0768 (0.116)	1.153 (1.54)
1974	0.97 (0.70)	0.094 (0.053)	−0.0736 (0.116)	0.965 (1.28)
Avg.[b]	2.08	0.084 (0.083)	−0.0838 (0.144)	1.021 (1.70)

[a]q = Ratio market to replacement value.
Beta = Past growth rate of earnings.
Gamma = Past relation to unemployment rate.
X = Relation firm earnings to economy earnings.
Sigma = Earnings variability.

By a "representative firm" we mean a hypothetical firm with characteristics fixed at the overall means (the simple average of the fifteen yearly means) for the period 1960–74. These are the figures in the bottom row of Table 2. By applying to these fixed characteristics the varying regression coefficients, we compute a time series of hypothetical q's for a representative American non-industrial corporation (column 1 of Table 11). This is not the same as the series of mean q's from Table 2 (also column 2 of Table 11), which apply to firms of changing characteristics. The two series generally conform, but diverge appreciably in several years. They are both plotted in Figure 2, together with Ciccolo's aggregate estimates of q. Given the differences of data base and statistical method, the *level* difference between our q's and Ciccolo's are not alarming. As should be expected, his aggregate estimate conforms better to our series of mean q than to our fixed-weight index.

To compare with the representative firm, we consider a non-existent "consol firm", with zero levels of all characteristics except the last two, D/V and E/V. They are put equal to each other and fixed at the overall mean of E/V for the period 1960–74. This theoretical consol firm is riskless, trendless, and cycle-free; it has no debt or preferred stock and pays out all its earnings at dividends. Its q series (column 3 of Table 11) is

2
REGRESSION VARIABLES, 1960–74.[a]

Sigma	*PB*	*PD*	*D/V*	*E/V*
0.0186 (0.017)	0.0106 (0.068)	0.0765 (0.155)	0.0415 (0.0301)	0.0906 (0.0456)
0.0169 (0.014)	0.0149 (0.096)	0.0726 (0.156)	0.0411 (0.0296)	0.0886 (0.0461)
0.0155 (0.014)	0.0176 (0.097)	0.0765 (0.155)	0.0380 (0.0287)	0.0846 (0.0439)
0.0144 (0.012)	0.0109 (0.068)	0.0770 (0.165)	0.0412 (0.0312)	0.0945 (0.0473)
0.0131 (0.010)	0.0106 (0.071)	0.0822 (0.168)	0.0422 (0.0324)	0.1047 (0.0496)
0.0121 (0.008)	0.0071 (0.044)	0.0730 (0.0145)	0.0428 (0.0317)	0.1107 (0.0483)
0.0122 (0.008)	0.0135 (0.072)	0.0971 (0.180)	0.0418 (0.0307)	0.1132 (0.0463)
0.0130 (0.008)	0.0218 (0.099)	0.1163 (0.200)	0.0392 (0.0285)	0.1003 (0.0449)
0.0129 (0.008)	0.0297 (0.123)	0.1433 (0.223)	0.0374 (0.0270)	0.0971 (0.0420)
0.0128 (0.007)	0.0398 (0.142)	0.1689 (0.246)	0.0353 (0.0259)	0.0944 (0.0400)
0.0127 (0.007)	0.0466 (0.151)	0.1671 (0.235)	0.0326 (0.0246)	0.0857 (0.0407)
0.0117 (0.007)	0.0355 (0.129)	0.1061 (0.176)	0.0296 (0.0236)	0.0815 (0.0388)
0.0112 (0.007)	0.0298 (0.112)	0.0763 (0.150)	0.0275 (0.0214)	0.0849 (0.0355)
0.0107 (0.007)	0.0375 (0.122)	0.1001 (0.178)	0.0262 (0.0197)	0.0949 (0.0337)
0.0103 (0.007)	0.0450 (0.131)	0.1276 (0.208)	0.0251 (0.0185)	0.0971 (0.0338)
0.0132 (0.009)	0.0247 (0.102)	0.1040 (0.183)	0.0361 (0.0269)	0.0949 (0.0424)

PB = Probability fixed charges not earned.
PD = Probability dividend not earned.
D/V = Ratio current div. to replacement value.
E/V = Ratio earnings to replacement value.
[b]Simple average of column.

also plotted in Figure 2. The consol series generally follows the contours of the other series. But the market has generally prized greater security and dividend pay-out.

Another summary form of the calculations is to compute the ratio of earnings to market value for our two hypothetical firms. These are estimates of the cost of capital to the firms. They are reported in Table 12 and Figure 3. For comparison, the Baa corporate bond rate is also plotted. Since our estimates of cost of capital are in principle *real* rates of return, the relevant comparison is with a Baa real rate, which has been computed by subtracting the geometric average inflation rate of the preceding five years.

Figure 3 makes two important points. First, the cost of capital relevant for investment decisions bears little relationship to the "real rate of interest" calculated by subtracting inflation rates from nominal interest rates. The tightness or ease of monetary policy and financial markets cannot be gauged by such naive calculations. Second, the effective real rate of interest is far from constant, contrary to a viewpoint of increasing currency.

The regression coefficients of Tables 3–10 provide some confirmations of theoretical expectations and some surprises and puzzles.

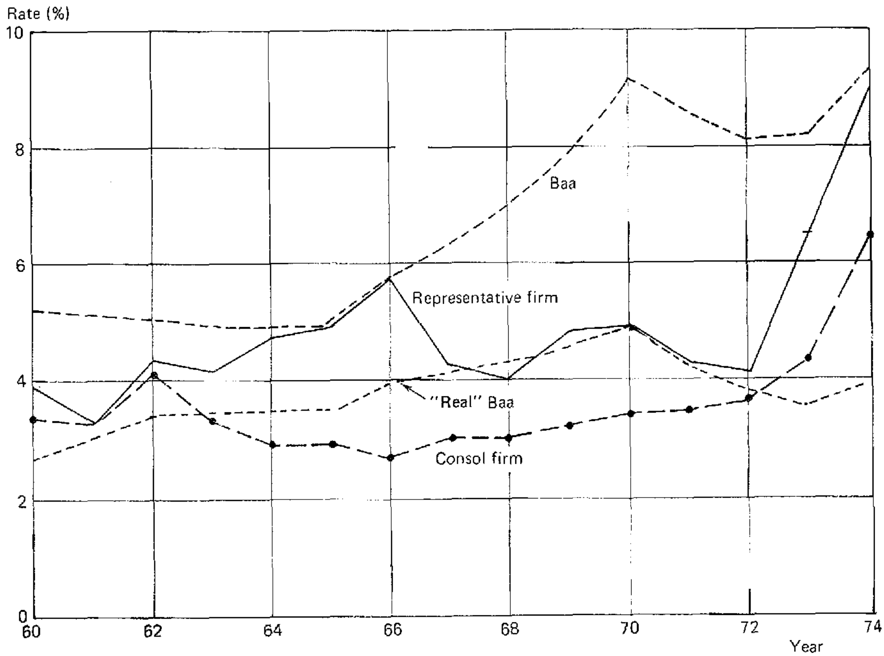

FIGURE 3. Cost of capital, alternative measures, 1960–74.

TABLE 3
EFFECT OF GROWTH RATE ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF BETA.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	2.1379	2.8	0.10398 (0.127)
1961	1.0601	1.4	0.08264 (0.128)
1962	1.1837	2.1	0.08072 (0.122)
1963	1.7500	2.0	0.06778 (0.105)
1964	1.5843	1.8	0.06858 (0.092)
1965	2.1020	1.7	0.07810 (0.079)
1966	4.3793	3.0	0.08335 (0.074)
1967	6.1046	4.1	0.08576 (0.072)
1968	8.2898	5.9	0.08440 (0.070)
1969	8.6692	6.8	0.08402 (0.068)
1970	7.3217	6.3	0.08404 (0.065)
1971	7.9576	6.9	0.08400 (0.066)
1972	7.1643	5.2	0.08718 (0.062)
1973	5.2383	4.9	0.08946 (0.058)
1974	3.4282	5.0	0.09400 (0.053)

[a]In 1960 addition of one percentage point (0.01) to growth rate raises q by 0.214.

TABLE 4

EFFECT OF SENSITIVITY TO UNEMPLOYMENT ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF GAMMA.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	−3.0713	1.5	−0.09251 (0.159)
1961	−1.5451	0.7	−0.07367 (0.156)
1962	−4.2588	2.8	−0.07540 (0.154)
1963	−4.6730	2.3	−0.05657 (0.146)
1964	−6.4126	3.2	−0.05744 (0.156)
1965	−4.9808	2.1	−0.07842 (0.153)
1966	0.4668	0.1	−0.09545 (0.152)
1967	−1.9421	0.4	−0.10548 (0.150)
1968	−8.9670	3.3	−0.10067 (0.152)
1969	−11.6678	4.1	−0.09658 (0.150)
1970	−9.3314	3.5	−0.09544 (0.150)
1971	−8.1916	2.9	−0.09489 (0.132)
1972	−4.4452	3.4	−0.08401 (0.119)
1973	−1.7786	2.5	−0.07680 (0.116)
1974	−0.2273	0.7	−0.07364 (0.116)

[a]Gamma is proportionate increase of firm earnings per percentage point unemployment. Gamma equal to −0.10 means that one more point of u reduces earnings 10%. In 1960 a firm with gamma = −0.10 has a 0.307 higher q than with gamma equal to zero.

mportance of E/V is, of course, to be expected. The striking fact e 10 is the sharp recent decline in the marginal value of earnings, ıctually accounts for more than the observed drop in mean q from 1974. In general, the mean value of the earning rate E/V has been table compared to the regression coefficient of this variable. In f our discussion of section 1, r_k has moved around more than R.

able 9 indicates, payment of common dividends has been valued ely throughout the period, especially during the last ten years. etation of this result is complicated by the fact that the alternative non dividends may be either earnings retention or payment of debt and preferred dividends. According to Table 8, the market does e dividend protection, given the dividend rate D/V. Likewise, says that the market is indifferent or negative regarding protection d debt service obligations. In combination with the expected e coefficients on "sigma", these three results could be interpreted n that the stock market likes leverage (contradicting Modigliani– and for given leverage prefers pay-out of common stock earnings retention.

ing now to the other three characteristics, we find significant ents of expected sign for "beta" and X. The market likes growth likes undiversifiable risk. On the other hand, cyclical sensitivity of

TABLE 5

EFFECT OF EARNINGS COVARIANCE ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF X.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	−0.3000	1.8	1.14480 (1.92)
1961	−0.1592	0.9	0.96503 (1.92)
1962	−0.3518	3.0	0.98342 (1.96)
1963	−0.3936	2.5	0.74344 (1.91)
1964	−0.5766	3.5	0.67228 (1.89)
1965	−0.5673	2.6	0.86427 (1.67)
1966	−0.0709	0.2	0.98973 (1.58)
1967	−0.2333	0.6	1.12853 (1.63)
1968	−0.7738	3.2	1.14776 (1.67)
1969	−0.9244	3.7	1.12272 (1.68)
1970	−0.7076	3.0	1.12995 (1.69)
1971	−0.5690	2.4	1.12376 (1.53)
1972	−0.1955	2.1	1.18810 (1.57)
1973	−0.0973	1.9	1.15283 (1.54)
1974	−0.0474	1.5	0.96502 (1.28)

[a] X is a measure of elasticity of firm earnings with respect to aggregate earnings. In 1960 a firm with an elasticity of one has a 0.3 lower q than a firm with zero elasticity.

TABLE 6

EFFECT OF EARNINGS VARIABILITY ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF SIGMA.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	−30.3908	5.3	0.01861 (0.017)
1961	−26.3363	4.2	0.01637 (0.014)
1962	−21.3649	4.7	0.01549 (0.014)
1963	−31.1917	4.7	0.01441 (0.012)
1964	−43.1204	5.7	0.01307 (0.010)
1965	−53.2205	4.5	0.01213 (0.008)
1966	−37.3147	2.9	0.01225 (0.008)
1967	−48.0175	3.8	0.01297 (0.008)
1968	−42.4623	3.7	0.01292 (0.008)
1969	−43.8442	4.2	0.01282 (0.007)
1970	−35.2073	3.9	0.01274 (0.007)
1971	−34.7516	3.3	0.01170 (0.007)
1972	−42.0332	3.5	0.01123 (0.007)
1973	−30.0797	3.7	0.01070 (0.007)
1974	−6.6970	1.4	0.01026 (0.007)

[a] Sigma is standard deviation of firm earnings unexplained by growth trend and normal unemployment, relative to replacement value. In 1960 a firm with sigma = 0.01 would have a 0.304 lower q than a firm with sigma equal to zero.

TABLE 7

EFFECT OF DEFAULT PROBABILITY OR LEVERAGE ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF *PB*.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	−0.0637	0.1	0.01056 (0.068)
1961	0.6858	0.6	0.01493 (0.096)
1962	0.9225	1.2	0.01761 (0.097)
1963	3.1154	2.8	0.01092 (0.068)
1964	3.3678	3.3	0.01062 (0.071)
1965	3.0404	1.5	0.00707 (0.044)
1966	1.7787	1.3	0.01351 (0.072)
1967	1.6707	1.5	0.02183 (0.099)
1968	0.0470	0.1	0.02966 (0.123)
1969	0.6882	1.1	0.03978 (0.142)
1970	0.1818	0.3	0.04660 (0.151)
1971	0.5602	0.8	0.03547 (0.129)
1972	1.8649	1.8	0.02981 (0.112)
1973	0.8353	1.3	0.03751 (0.122)
1974	−0.0526	0.1	0.04502 (0.131)

[a]*PB* is probability that firm's earnings fall short of fixed charges. In 1960 a firm with 0.01 probability has a 0.006 lower q than one with zero probability.

TABLE 8

EFFECT OF DIVIDEND VULNERABILITY ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF *PD*.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	1.8148	3.1	0.07654 (0.155)
1961	0.8375	1.2	0.07259 (0.156)
1962	1.3898	2.8	0.07647 (0.155)
1963	1.0604	2.0	0.07704 (0.165)
1964	1.6715	3.3	0.08216 (0.168)
1965	2.9236	4.1	0.07299 (0.145)
1966	2.0829	3.3	0.09711 (0.180)
1967	3.0965	5.1	0.11628 (0.200)
1968	2.8680	5.5	0.14331 (0.223)
1969	0.9346	2.3	0.16890 (0.246)
1970	0.8780	2.2	0.16712 (0.235)
1971	1.3137	2.4	0.10612 (0.176)
1972	0.7092	0.9	0.07633 (0.150)
1973	0.3249	0.7	0.10013 (0.178)
1974	0.3420	1.4	0.12762 (0.208)

[a]*PD* is probability that earnings fall short of fixed charges plus preferred and common dividends. In 1960 a firm with 0.10 probability has a 0.18 lower q than one with zero probability.

TABLE 9

EFFECT OF DIVIDEND RATE ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF D/V.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	6.5427	1.6	0.04148 (0.0301)
1961	0.3603	0.1	0.04109 (0.0296)
1962	5.5370	1.7	0.03797 (0.0287)
1963	7.1936	1.7	0.04120 (0.0312)
1964	10.4610	2.6	0.04225 (0.0324)
1965	5.4126	1.1	0.04282 (0.0317)
1966	21.2520	4.7	0.04177 (0.0307)
1967	14.5751	2.9	0.03923 (0.0285)
1968	17.8827	3.6	0.03741 (0.0270)
1969	21.6240	5.2	0.03532 (0.0259)
1970	23.8244	6.3	0.03261 (0.0246)
1971	25.2621	6.4	0.02959 (0.0236)
1972	17.6494	3.2	0.02754 (0.0214)
1973	14.4957	3.8	0.02625 (0.0197)
1974	10.6793	5.0	0.02513 (0.0185)

[a]In 1960 increasing D/V, rate of common dividend on replacement value, from 0 to 0.01 raises q by 0.065.

TABLE 10

EFFECT OF EARNINGS RATE ON VALUATION, 1960–74; REGRESSION COEFFICIENTS OF E/V.[a]

Year	Coefficient	t-ratio	Variable mean (std.dev.)
1960	21.5197	7.5	0.09061 (0.0456)
1961	31.7088	10.0	0.08857 (0.0461)
1962	20.1404	8.8	0.08459 (0.0439)
1963	22.3690	7.2	0.09454 (0.0473)
1964	20.3923	7.0	0.10467 (0.0496)
1965	30.2356	9.0	0.11072 (0.0483)
1966	17.6837	5.2	0.11320 (0.0463)
1967	27.1118	7.9	0.10032 (0.0449)
1968	22.6401	6.7	0.09710 (0.0420)
1969	15.6372	5.5	0.09442 (0.0400)
1970	10.3069	4.3	0.08571 (0.0407)
1971	13.8440	5.4	0.08152 (0.0388)
1972	24.1437	6.6	0.08492 (0.0355)
1973	10.9175	4.7	0.09488 (0.0337)
1974	3.9861	3.4	0.09711 (0.0338)

[a]E/V is ratio of earnings to replacement value. In 1960 increasing earnings rate from 0 to 0.10 raises q by 2.152.

TABLE 11

ESTIMATES OF q, RATIO OF MARKET TO REPLACEMENT VALUE OF CORPORATE CAPITAL, 1960–74.

Year	Actual average for year	Representative firm	Consol firm	Aggregate estimate[a]
1960	2.21	2.40	2.92	1.15
1961	2.51	2.85	3.04	1.40
1962	1.88	2.18	2.54	1.27
1963	2.21	2.27	2.85	1.48
1964	2.29	2.00	2.94	1.56
1965	2.50	1.93	2.65	1.70
1966	2.11	1.64	2.89	1.28
1967	2.51	2.23	2.93	1.41
1968	2.64	2.36	3.04	1.56
1969	2.12	1.97	2.97	1.26
1970	1.92	1.95	3.08	1.08
1971	2.00	2.24	3.27	1.21
1972	1.99	2.29	3.01	1.42
1973	1.43	1.45	2.19	1.18
1974	0.97	0.96	1.44	0.72

Computed for economy as a whole by John Ciccolo, fourth quarter estimates.

TABLE 12

MEASURES OF COST OF CAPITAL, 1960–74.

Year	Representative firm	Consol firm	Corporate Baa yield[a] (Moody's)	"Real" Baa rate[a]
1960	3.96	3.39	5.19	2.63
1961	3.32	3.34	5.08	3.00
1962	4.35	4.17	5.02	3.39
1963	4.17	3.34	4.86	3.47
1964	4.75	2.93	4.83	3.46
1965	4.91	2.95	4.87	3.46
1966	5.79	2.63	5.67	3.96
1967	4.25	3.00	6.23	4.11
1968	4.02	3.03	6.94	4.29
1969	4.81	3.21	7.81	4.54
1970	4.86	3.43	9.11	5.13
1971	4.23	3.45	8.56	4.24
1972	4.14	3.66	8.16	3.82
1973	6.54	4.32	8.24	3.59
1974	9.93	6.45	9.50	3.84

[a]Corporate Baa yield less geometrical value of increase of GNP deflator (in series) over previous five years.

earnings appears – ceteris paribus – to increase q. In interpreting this result, we must remember that cyclical variability of earnings also enters "sigma" and X, and contributes there to penalizing q. The coefficients of "gamma" in Table 4 means that the market prefers that whatever covariance a firm has with the aggregate earnings of other firms be due to their common dependence on the unemployment cycle rather than to other common influences.

We conclude that the theory of asset valuation sketched in section 1 is fairly well confirmed. However, the weights the market places on the different characteristics change from year to year. The most striking empirical result is the sharp fall in q, sharp rise in cost of capital, in 1973 and 1974. This is not due to a decline in earnings but to a spectacular rise in the discount applied to earnings. Tight anti-inflationary monetary policies were undoubtedly responsible.

3. References

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