Dynamics of Corporate Earnings

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Abstract:

Earnings are the flow of value created by corporations. I concentrate on the concept called EBITDA—earnings before interest, taxes, depreciation, and amortization. This measure captures the results of the substantive non-financial activities of corporations and corresponds to the rental price of capital multiplied by the quantity of capital. I measure earnings per dollar of capital for all U.S. corporations and at the level of 35 U.S. industries. I develop a competitive benchmark for the level of earnings, which takes account of adjustment costs, taxes, depreciation, and the financial opportunity cost of funds. I find that aggregate corporate earnings track the benchmark reasonably closely, leaving a relatively small unexplained component. Thus evidence of the flow of value gives little help in explaining the large discrepancies found in earlier work in the *level* of the market value of claims on corporations relative to the replacement cost of the capital stock. However, at the industry level, I find substantial volatility of the unexplained component of earnings.

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I. Introduction

Earnings are the flow of value accruing to a claimant. In standard corporate accounting, the claimant is the body of shareholders. The value of the claims of the shareholders—reflected in the corporation's value in the stock market—is the present value of future shareholder earnings. Those earnings are the net flow after satisfying the claims of debt holders. In addition, as recent experience has shown, shareholder earnings are buffeted by *changes* in the value of the financial claims of the corporation on other businesses. Where the market values of those claims are in doubt, there is corresponding doubt about shareholder earnings.

A great deal of business analysis of earnings cuts around most of these problems by adopting, implicitly, a different accounting framework. That framework combines all of the financial claims on a business rather than focusing on the shareholders' residual claim. In particular, the measure called EBITDA—earnings before interest, taxes, depreciation, and amortization—is a popular measure of business performance. It isolates the substantive results of business activities from changes in the firm's financial portfolio. The isolation cannot be completely successful. In particular, it is almost impossible in banks and other financial institutions whose business activities involve operating portfolios. In addition, borderline activities such as the sale of services or software to business partners often cannot be cleanly divided between operating and financial activities. Nonetheless, EBITDA is a useful measure. This paper is about the economics of EBITDA.

The first step is to measure earnings at the level of all U.S. corporations. The National Income and Product Accounts are the natural starting point for this exercise. The NIPA concept of profit is the residual from the sale of goods and services less costs of current inputs—it excludes the portfolio flows that complicate shareholder earnings. To bring profit up to EBITDA, I add corporate interest payments, taxes, and depreciation

(NIPA profit makes no deductions for amortization). I state earnings as a ratio to the estimated reproduction cost of corporations' tangible capital. Thus the earnings concept is earnings per dollar of tangible capital.

The second step is to develop a competitive benchmark for earnings. In a competitive economy, tangible capital services are supplied perfectly elastically to a corporation at a flow price that depends on taxation, depreciation, and risk. That is, the corporation must cover the costs of taxes and depreciation and repay the suppliers of finance for bearing risk. With perfect competition, earnings will equal the supply price of capital services. My benchmark considers risk as it is measured in modern financial economics as a determinant of the average value of earnings. The benchmark also incorporates adjustment costs. In the presence of adjustment costs, earnings include scarcity rents when the capital stock is growing. The benchmark uses an estimate of the coefficient relating Tobin's q to the growth of the capital stock to take these rents into account.

The third step is to compare measured earnings with the benchmark. I find that the benchmark accounts for most of the movements of the actual ratio of earnings to the replacement cost of the capital stock. This finding contrasts with my earlier work, which inferred the existence of intangible capital from the large gap between the market value of corporations and the value of their measured capital. The two findings are not strictly contradictory, however, because measured earnings are affected in two ways by intangibles, and the two effects could be largely offsetting. On the one hand, earnings include the flow of value that corporations enjoy from their stocks of intangibles. On the other hand, earnings deduct the current cost of forming new intangibles.

II. Measuring Earnings

The details of these calculations are in a spreadsheet available from Stanford.edu/~rehall. The starting point for earnings is corporate profits before tax for domestic business of U.S. corporations. To this I add interest paid and capital consumption allowances. The result is the nominal flow of domestic corporate EBITDA.

To calculate the value of corporate tangibles, I use data from the Fixed Asset data compiled by the Bureau of Economic Analysis in conjunction with the NIPA. This source reports the net value at current prices of equipment, software, and structures. I have not found a source for corporate inventories. I take private business inventories from the NIPA and multiply by the ratio of corporate to total capital consumption allowances to estimate the corporate component of inventory value.

Figure 1 shows the result of these calculations, stated as the ratio of earnings to tangible capital value. Annual earnings averaged about 16 percent of capital value over the period since 1948. They reached a maximum in the mid-1960s above 18 percent, declined to a trough of about 12 percent in the early 1980s, and have grown since then, through the last reported year, 2000 (because the earnings data are based on income tax records, they are reported with a considerable lag).

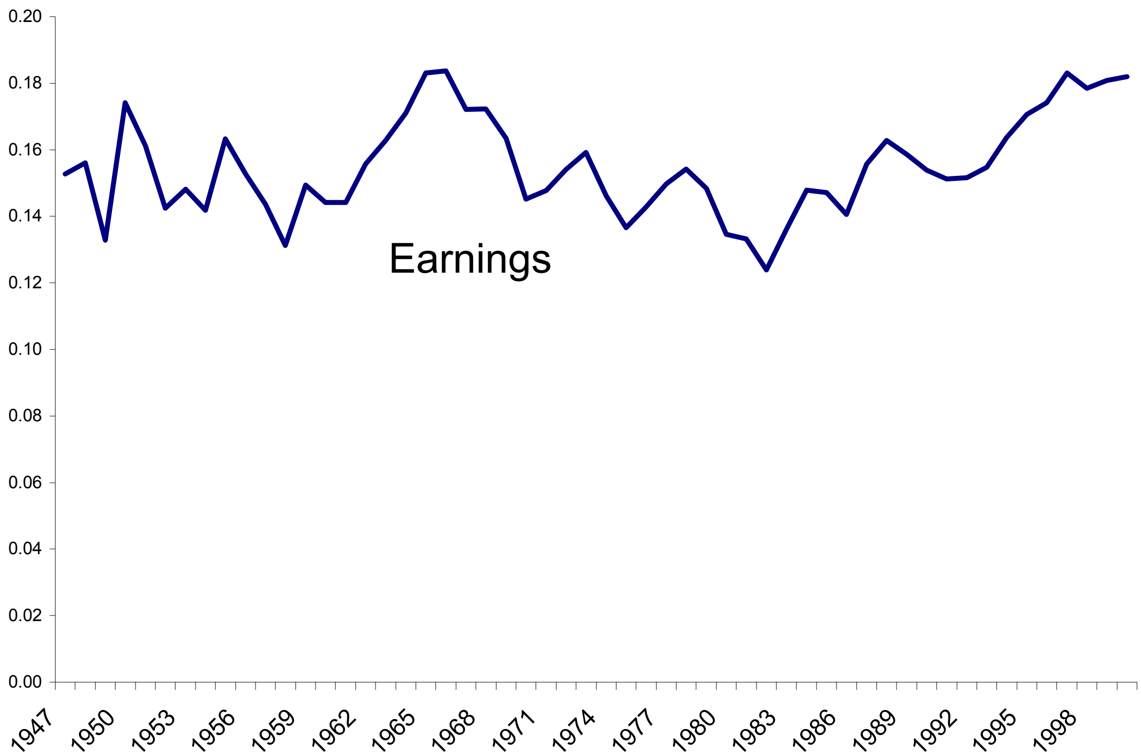

Figure 1. Ratio of Corporate Earnings before Interest, Taxes, Depreciation, and Amortization to Value of Corporate Tangible Capital, 1947-2000

III. The Competitive Benchmark

The competitive benchmark asks what level of earnings would just cover the cost of supplying capital services. More precisely, when earnings are at the benchmark level, the return to holding a unit of capital is worth, in present value, exactly the cost of acquiring the capital. This discussion covers much of the same ground as Hall and Jorgenson [1967]. The competitive benchmark is a relative of the rental or service price of capital, developed in the investment literature. I let r_K be the expected earnings of a machine and let $\tilde{p}_K$ be the market price of that machine. I then write the competitive benchmark for earnings as $\frac{r_K}{\tilde{p}_K}$. Absent factors such as earnings of intangibles, the actual earnings ratio presented in the previous section would have the same expected value as the benchmark.

The flow benchmark developed here is a close relative of the value benchmark considered in my earlier paper (Hall [2001]). The benchmark in the earlier paper for the total value of all financial claims on a corporation is the value of the capital stock held by the corporation. A direct arbitrage argument shows that the value of financial claims should equal the benchmark, as a corporation can issue claims and buy capital profitably if the claims are worth more than the capital, or an outsider can buy claims to obtain the underlying capital if the claims are worth less than the capital. The paper extended this principle to take account of adjustment costs. Consequently, my earlier paper did not examine the present value of earnings as a benchmark for corporate value.

The flow benchmark turns out to be more complicated than the value benchmark because risk plays an explicit role in the flow benchmark. Production takes time. The firm chooses factor inputs in one period and sells the resulting output in the next period. The decision takes into consideration the financial risk of the funds tied up in capital and inventories while production occurs. Where the value benchmark is a single number—the current replacement value of the capital stock—the flow benchmark is a random variable. The fundamental condition defining the flow benchmark is stochastic. But standard tools of modern finance enable the restatement of the flow benchmark in terms of an unconditional expectation easily computed from data on earnings.

A. Derivation of the flow benchmark

Under constant returns to scale, the value of a corporation per unit of capital is independent of its scale. Thus, without loss of generality, one can examine the value of a corporation that starts with one unit of capital in year $t = 1$ and allows it to depreciate without replacement. At a depreciation rate δ, the firm will hold $1-\delta$ units a year later, $(1-\delta)^2$ after two years, and so on. I take consumption goods as numeraire, so all prices are in real terms. Let $r_{K,t}$ be the earnings of a firm that uses one unit of capital in year *t* and chooses its other factor inputs optimally. For the moment, I abstract from complications involving taxation and adjustment costs. Then the value of the firm at time *t* (after paying out $r_{K,t}$) is

$$v_t = E_t \sum_{\tau=1}^{\infty} \frac{m_{t+\tau}}{m_t} (1-\delta)^{t+\tau-1} r_{K,t+\tau} , \tag{3.1}$$

where *m* is the stochastic pricing kernel—marginal utility in some general sense. Cochrane [2001] provides a thorough treatment of finance from this perspective. The present value relation implies the recursion,

$$v_t = E_t \left\{ \frac{m_{t+1}}{m_t} \left[(1-\delta)^t r_{K,t+1} + v_{t+1} \right] \right\}. \tag{3.2}$$

If the value benchmark holds, then $v_t = (1-\delta)^t p_{K,t}$ for all *t*. Thus

$$p_{K,t} = E_t \left\{ \frac{m_{t+1}}{m_t} \left[r_{K,t+1} + (1-\delta) p_{K,t+1} \right] \right\}. \tag{3.3}$$

Consequently, any random variable, $\hat{r}_{K,t}$, satisfying

$$1 = E_t \left[\frac{m_{t+1}}{m_t} \frac{\hat{r}_{K,t+1} + (1-\delta) p_{K t+1}}{p_{K,t}} \right] \tag{3.4}$$

could serve as a benchmark. The second factor inside the expectation is the return ratio, $\hat{R}_{K,t}$, corresponding to the benchmark earnings variable. Thus the criterion for the benchmark takes the compact form,

$$1 = E_t\left(\frac{m_{t+1}}{m_t}\hat{R}_{K,t}\right) \tag{3.5}$$

This property of return ratios is the bedrock principle of modern finance. It is useful to rewrite it as

$$E\frac{m_{t+1}}{m_t}\hat{R}_{K,t} = Cov\left(\frac{m_{t+1}}{m_t},\hat{R}_{K,t}\right)+\left(E\frac{m_{t+1}}{m_t}\right)\left(E\hat{R}_{K,t}\right)=1, \tag{3.6}$$

I define the risk premium as

$$\phi = -Cov\left(\frac{m_{t+1}}{m_t},\hat{R}_{K,t}\right) \tag{3.7}$$

and the return ratio, R_f, for a hypothetical risk-free one-period real bill as

$$R_f = \frac{1}{E\frac{m_{t+1}}{m_t}}, \tag{3.8}$$

so

$$E\hat{R}_{K,t} = \left(1+\phi\right)R_f \tag{3.9}$$

This equation states the implications of equation (3.4) in the form of the Capital Asset Pricing Model. Expected return is a positive function of risk.

With these ingredients, I can provide a more operational characterization of the benchmark than the general definition in equation (3.4). A benchmark return ratio is related to the benchmark earnings by

$$\hat{R}_{K,t} = \frac{\hat{r}_{K,t+1} + (1-\delta) p_{Kt+1}}{p_{K,t}}. \tag{3.10}$$

Consequently,

$$E\left(\frac{\hat{r}_{K,t+1}}{p_{K,t}}\right) = E\left(\hat{R}_{K,t}\right) - (1-\delta) E\left(\frac{p_{Kt+1}}{p_{K,t}}\right) = (1+\phi) R_f - (1-\delta)\pi . \tag{3.11}$$

Here π is the unconditional expectation of the rate of growth of the price of capital goods, $E\left(\frac{p_{Kt+1}}{p_{K,t}}\right)$.

I summarize in

> *Flow Valuation Theorem*: Among earnings distributions $\hat{r}_{K,t+1} / p_{K,t}$ with risk ϕ for firms with constant returns to scale, those that satisfy the valuation condition of equation (3.1) requiring the equality of the present value of earnings to the cost of acquiring the corresponding capital have unconditional mean $(1+\phi) R_f - (1-\delta)\pi$.

The theorem provides a two-step process for checking an observed time series of earnings against the flow valuation criterion. First, determine the risk of the earnings, ϕ, by calculating the covariance of the return with the pricing kernel, according to equation (3.7). Second, compare the mean of $r_{K,t+1} / p_{K,t}$ to the benchmark mean, $(1+\phi) R_f - (1-\delta)\pi$.

B. The flow benchmark with taxation and adjustment costs

The key issues in generalizing the flow benchmark to include taxation are easiest to explain in the special case where depreciation for tax purposes equals the actual age-related decline in the price of capital goods. I take account of adjustment costs by reinterpreting the price of capital goods, p_K. That price is the market price for newly produced capital goods in the absence of adjustment costs and is the internal shadow value of installed capital in the presence of adjustment costs. In the latter case, p_K is the market price, $\tilde{p}_K$, multiplied by Tobin's *q* (this is just the definition of *q*).

The ingredients in the benchmark are depreciation, taxation, capital goods prices, and the financial cost of capital. I will start with the last of these. I will also break down earnings into the form of revenue less cost. The return ratio for the funds invested in one unit of capital is:

$$R_{K,t} = \frac{\left(1-\tau_t\right) p_t x_t + \left[1-\left(1-\tau_t\right)\delta_t\right] p_{K,t+1}}{p_{K,t} + \left(1-\tau_t\right) w_t n_t}. \tag{3.12}$$

The numerator is the proceeds available at the beginning of the next period resulting from an investment in one unit of capital, comprising after-tax revenue $p_t x_t$, the depreciated value of the capital, $\left(1-\delta_t\right) p_{K,t+1}$, and the tax benefit from depreciation deductions, $\tau_t \delta_t p_{K,t+1}$. The denominator is the cash required per unit of capital, comprising the price of the capital $p_{K,t}$ and the cost of labor input net of taxes, $w_t n_t$. Here p is the price of output, x is the quantity of output per unit of capital, p_K is the price of capital goods, τ is the tax rate on business income, δ is the rate of depreciation, w is the wage, and n is employment per unit of capital. Additional non-capital inputs such as materials could appear here as well.

This formulation clarifies the role of risk in the determination of earnings. Risk arises from uncertainty about revenue per unit of capital and about the price of capital goods next period (I assume that tax rates and depreciation rates are known in advance). In the simplest case, where consumption goods are perfect substitutes for output and capital goods, so $p = 1$ and $p_K = 1$, and the risk premium arises only from uncertainty about output per unit of capital. On the other hand, the price of capital goods fluctuates in the presence of adjustment costs. The risk premium is likely to be positive in this case—favorable events raise the shadow value and lower marginal utility, so the covariance of the return with the pricing kernel is negative and the risk premium, ϕ, correspondingly positive. Similarly, if the adjustment costs are external, arising in the industries supplying capital goods, $p_{K,t}$ is the observed price, which is likely to be negatively correlated with marginal utility, and again the risk premium is positive.

IV. Measuring the Risk Premium

The past 20 years have seen a substantial accumulation of research on the pricing kernel. Much of the research—such as Fama and French [1996]—uses a generalization of the CAPM model to price risky returns. Cochrane [2001] provides a lucid explanation of the equivalence of the CAPM and stochastic pricing kernel approaches. Both involve combining time series information about covariances with information from a cross-section of assets whose market prices are known. If the result is the true stochastic pricing kernel, it can be used to value any risky return, such as the return to capital goods.

As I will show later in this section, all of my estimates of the risk premium, ϕ, are close to zero. I do not investigate some of the more elaborate pricing kernels developed by Chapman [1997] and others, but it seems unlikely that they are much correlated with earnings, whether or not adjusted for Tobin's q. On the other hand, I believe there is great uncertainty about the risk-free return ratio, R_f. The essential issue is the equity premium, which remains largely unexplained in the framework of modern financial economics despite the heroic efforts of many researchers. Grossman and Shiller [1981] were the first to expose the problem in the framework of the pricing kernel, though Mehra and Prescott [1985] is a more standard reference. No reasonable measure of marginal utility derived from aggregate consumption is sufficiently negatively correlated with stock returns to explain the much higher average returns from stocks in relation to debt. This statement places truly heroic efforts such as Campbell and Cochrane [1999] outside the realm of the reasonable. A more promising approach, I believe, is to disconnect the pricing kernel from aggregate consumption, but work in this area is still under way.

Two strong traditions in finance give diametrically different results on this point. First is the traditional Capital Asset Pricing Model or CAPM, in which the pricing kernel is a linear function of the return to a broad portfolio of stocks:

$$\frac{m_{t+1}}{m_t} = a - bR_{M,t} \tag{4.1}$$

One can always find values of a and b that will satisfy the two pricing conditions $E\frac{m_{t+1}}{m_t}R_{M,t} = 1$ and $E\frac{m_{t+1}}{m_t}R_{1,t} = 1$ for the stock market and one-year Treasury bills (see Cochrane [2001], p. 139 for the formulas). Using data from Robert Shiller (http://aida.econ.yale.edu/ ~shiller/data/chapt26.html), for returns from the S&P 500 and its predecessors and from the Federal Reserve Board for one-year Treasury bills, both stated in real terms by the consumption deflator, I find $a = 6.5$ and $b = 5.0$. The volatility of the implied pricing kernel is suspiciously high. Its elasticity with respect to the stock return at the sample mean is -5.5. By comparison, with constant relative risk aversion of 2 and consumption proportional to the level of the stock market, the elasticity would be -2. The traditional CAPM rationalizes the equity premium by invoking an implausible amount of volatility in the kernel. Hansen and Jagannathan [1991] showed that *all* stochastic pricing kernels that match the equity premium are highly volatile.

The second tradition links the kernel to consumption. In the case just mentioned of constant relative risk aversion, the kernel is

$$\beta\left(\frac{c_{t+1}}{c_t}\right)^{-\alpha} \tag{4.2}$$

Here β is the discount factor in preferences and α is the coefficient of relative risk aversion, taken to be two. Given a reasonable value for α such as 2, one can choose the discount factor so that the kernel prices one return correctly. But—as Grossman and Shiller [1981] first demonstrated—the consumption kernel then fails to price the other return correctly by a wide margin. Neither the return to the stock market nor the return to debt is much correlated with the marginal utility ratio. Hence the consumption-based kernel values both at essentially their expected values. The kernel cannot explain the much higher average return on stocks over debt.

Estimation of the risk premium for capital goods prices, ϕ, requires data on the price of capital goods. I measure the risk of both the market price of capital goods and the shadow value, the product of the market price and Tobin's q. I measure the market price as a Tørnqvist-Divisia index of the prices of corporate fixed capital and inventories from the sources described earlier. I measure Tobin's q from the first-order condition for quadratic adjustment costs,

$$q_t - 1 = \gamma\frac{k_{t+1} - k_t}{k_t} \tag{4.3}$$

In Hall [2002], I found that γ is approximately one at annual rates.

Table 1 presents estimates of the parameters of equation (3.9) for the cost of capital. The risk premiums are all tiny and three out of the four estimates are negative, suggesting that earnings provide a slight hedge against bad times. This conclusion holds when Tobin's q is included, even though q is quite pro-cyclical. The parameter R_f reported in Table 1, is the return ratio of a hypothetical risk-free one-year real Treasury bill. For the CAPM and the consumption-based kernel calibrated to Treasury bills, the return is a bit negative, whereas for the consumption-based kernel calibrated to the stock market, it is substantially positive. The two consumption kernels differ by the unexplained equity premium.

Pricing kernel	*Risk premium, ϕ*		*Risk-free return ratio, R_f*	*Expected value of capital return, $\gamma = 1$, $(1+\phi)R_f$*
	Market price of capital goods ($\gamma = 0$)	*With Tobin's q ($\gamma = 1$)*		
Stock-market CAPM	-0.0033	-0.0034	0.9922	0.9888
Consumption-based marginal utility, calibrated to stock market	-0.0001	0.0000	1.1014	1.1015
Consumption-based marginal utility, calibrated to Treasury bills	-0.0001	0.0000	0.9975	0.9976

Table 1. Estimates of Parameters of Cost of Capital

The results in Table 1 support the conclusion that the returns to capital are not risky, in the financial sense—they are not adversely correlated with general outcomes in the economy. Rather, the stock-market CAPM finds that earnings are a hedge against the market, with a slightly negative risk premium. The finding of zero or negative risk premiums holds for all three pricing kernels and for earnings based on the market price of capital goods and earnings based on the internal shadow value. On that account, one might expect that the cost of capital appropriate for the benchmark would be relatively low. It is tempting to conclude that capital goods prices are no more correlated with pricing kernels than are real returns to Treasury bills, so the cost of capital for the earnings benchmark should resemble the real return to Treasury bills. That is the message of the stock-market CAPM and the consumption kernel calibrated to Treasury bills. But the consumption kernel calibrated to the stock market looks at the facts differently. It assigns about the same amount of risk to capital goods as to the stock market and thus uses the average return in the stock market as the benchmark. The premium paid in the market for Treasury bills comes from some source other than low risk, according to the consumption kernel calibrated to the stock market. For example, Treasury bills may offer a convenience value of almost 8 percent per year.

Many other versions of the traditional CAPM are available—it could be calibrated to various portfolios of stocks or to stocks and long-term bonds, for example. Further, as in Chapman [1997] and the earlier work in the CAPM framework, the pricing kernel can depend on more than one variable. As long as these do not include the return to capital, the resulting kernels are unlikely to have substantial covariances with the return to capital, so the conclusion about the low risk of the return to capital seems likely to hold up.

The right-most column of Table 1 shows the expected return ratio for capital for the case $\gamma = 1$. The corresponding actual average return in the data underlying Figure 1 is 1.0464. This is about midway between the low returns predicted by the stock-market CAPM and the consumption kernel calibrated to Treasury bills, on the one hand, and the high return predicted by the consumption kernel calibrated to the stock market. Thus, in addition to the well-known puzzle of the equity premium, there are two puzzles about the return to capital—capital earns an unexplained premium over Treasury bills, and equity earns an unexplained premium over capital. Rather than trying to resolve these puzzles, I will use the average return to capital as the benchmark for the rest of the results in this paper.

The traditional CAPM claims to account for time variation in the expected returns to all assets. The expected return is the risk-free rate plus the risk premium. Attempts to pursue this approach make little sense for the present purposes. The real return to Treasury bills and other debt underwent a steep increase in the early 1980s. There is no comparable increase in expected returns to other assets, especially capital. The CAPM's property of constant premiums in expected returns does not seem to fit the facts at all well. Hence I will not try to use a benchmark for the expected return to capital that varies over time.

V. Other Components of the Benchmark

The returns shown in Figure 1 are EBITDA per dollar of capital valued at replacement cost. The corresponding benchmark stated in terms of the conditional expectation is

$$\frac{E_t\left(p_t x_t\right)-w_t n_t}{\tilde{p}_{K,t}}. \tag{5.1}$$

As before, $\tilde{p}_{K,t}$ is the market price of new capital. From equation (3.12), the conditional expectation of the return to capital is

$$E_t R_{K,t}=\frac{\left(1-\tau_t\right)E_t\left(p_t x_t\right)+\left[1-\left(1-\tau_t\right)\delta_t\right]E_t p_{K,t+1}}{p_{K,t}+\left(1-\tau_t\right)w_t n_t}. \tag{5.2}$$

I will approximate the conditional expected return by its unconditional value, $\bar{R}_K$. As I noted in the previous section, I have no way to measure the conditional expectation as a function of time. But I allow for time variation in the conditional expectation of revenue. In addition, as equation (5.2) indicates, the tax rate and the rate of depreciation vary over time. As a result, the earnings benchmark does vary over time, even though the return to capital is taken to be constant over time.

I solve equation (5.2) for the conditional expectation of revenue:

$$E_t\left(p_t x_t\right)=\frac{\bar{R}_K\left[p_{K,t}+\left(1-\tau_t\right)w_t n_t\right]}{1-\tau_t}-\frac{\left[1-\left(1-\tau_t\right)\delta_t\right]E_t p_{K,t+1}}{1-\tau_t}. \tag{5.3}$$

Thus, with $q_t=\dfrac{p_{K,t}}{\tilde{p}_{K,t}}$,

$$\frac{E_t p_t x_t - w_t n_t}{\tilde{p}_{K,t}} = \frac{\bar{R}_K - \left[1-\left(1-\tau_t\right)\delta_t\right] E_t \frac{p_{K,t+1}}{p_{K,t}}}{1-\tau_t} q_t . \quad (5.4)$$

This equation is close to the discrete-time version of Hall and Jorgenson's [1967] rental price of capital, but is not exactly the same because it is the expected value of the realized income, not the rent that would be set in advance in a competitive market for rental contracts. The latter would command a risk premium not included here—specifically, the conditional expectation of the ratio of the future to the current capital goods price would be replaced by the conditional expectation of the product of the pricing kernel and the price ratio.

The final step is to provide an empirical counterpart to the conditional expectation of the growth ratio of the real price of capital goods, $E_t \frac{p_{K,t+1}}{p_{K,t}}$. Although an econometric fishing expedition might turn up some variables with forecasting power, I believe that the most reasonable measure is its unconditional expectation, $\pi = 0.993$. The serial correlation of $\frac{p_{K,t+1}}{p_{K,t}}$ is slightly negative, but the confidence interval contains zero comfortably. Thus the benchmark is

$$\frac{\bar{R}_K - \left[1-\left(1-\tau_t\right)\delta_t\right]\pi}{1-\tau_t} q_t . \quad (5.5)$$

VI. Comparison of Actual to Benchmark Earnings

Figure 2 compares the actual earnings from Figure 1 with the benchmark of equation (5.5). The two agree reasonably closely. Of course, the agreement on overall level is by construction, as I chose the constant after-tax real return to capital to equal its average over this period. The benchmark captures the lack of trend in earnings through 1972, some of the decline from then until 1982, and most of the increase since then. The primary feature of actual earnings that eludes the benchmark is the bulge during the mid-1960s.

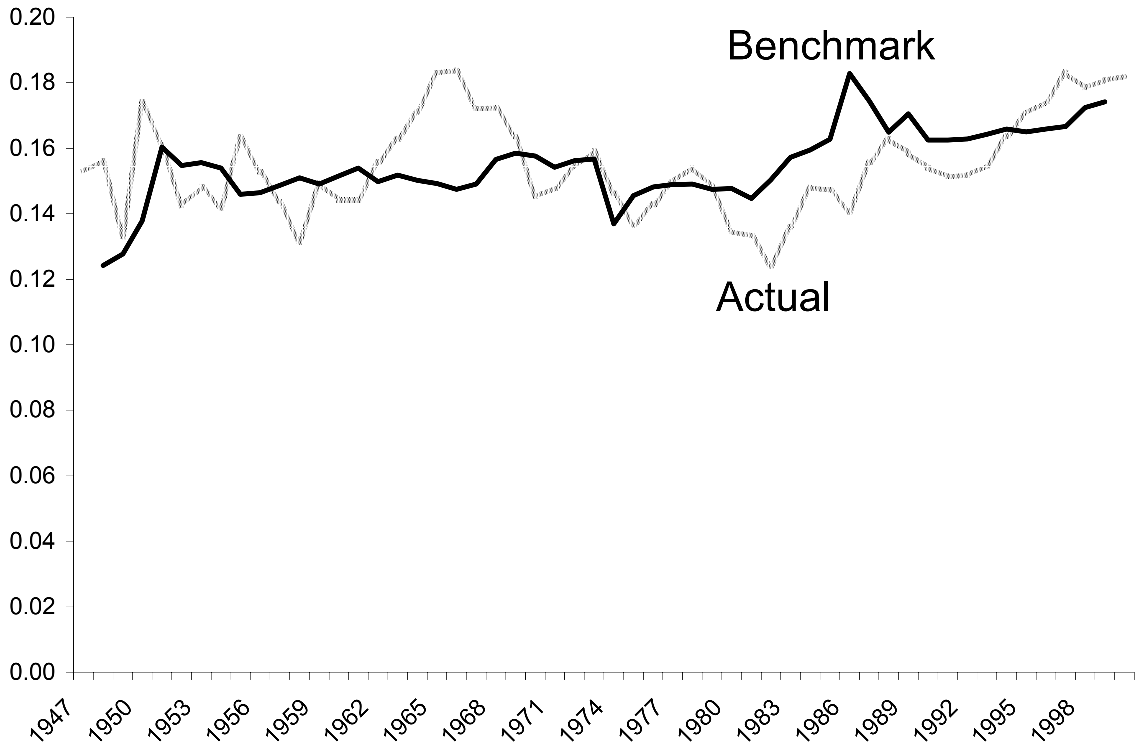

Figure 2. Actual and Benchmark Earnings

Figure 3 shows the contributions of the three variables in the benchmark: the rate of depreciation, δ_t, the corporate tax rate, τ_t, and Tobin's q_t. The scale of the figure is the same as the scale of Figure 2. The contribution is measured as the difference between the benchmark and a recalculation of the benchmark with the variable held constant at its average over the period.

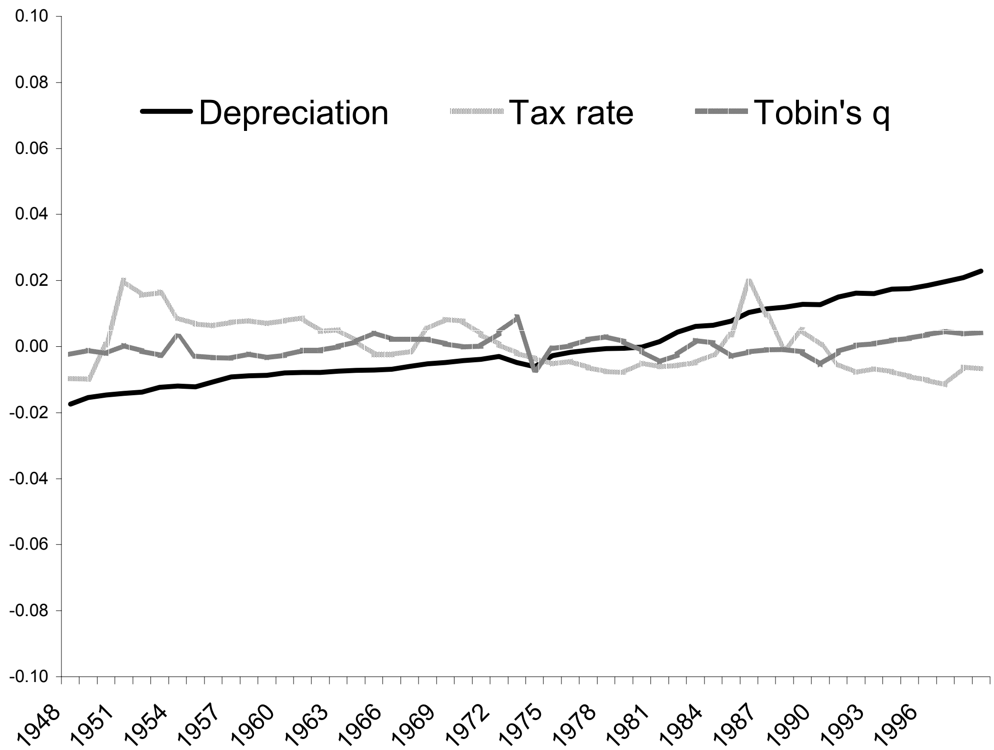

Figure 3. Components of Benchmark Earnings

Depreciation rises on a steady trend. An important part of the rise in the benchmark and, presumably, in actual earnings after 1982 comes from higher depreciation rates. These reflect the shift in the composition of corporate capital away from plant and toward equipment, and, within equipment, toward shorter-lived computers. On the other hand, the corporate tax rate has generally contributed a component trending downward, with upward spikes in the Korean War and before the tax reform of 1986. Finally, Tobin's q, as theory requires, makes only transitory contributions to the benchmark. With relatively low adjustment costs, the contributions are quite small. The zigzag movement in 1975 is an artifact of including inventories in corporate capital. I do so because the data underlying my estimates of the adjustment-cost parameter combine plant, equipment, and inventories. As a result, the inventory runoff of 1975 perturbs my estimate of q.

The aggregate data displayed in Figure 2 leave relatively little unexplained about earnings. In particular, there is little sign in the 1990s of any flow of earnings from intangibles or other factors that might explain the extraordinary level that the stock market reached during the 1990s. The contrast is striking between the small discrepancies separating actual and benchmark earnings in Figure 2, on the one hand, and the huge discrepancies separating the value of the stock market and other financial claims and its benchmark, the reproduction cost of the capital stock, in my earlier work on the stock market (Hall [2001]), on the other hand.

The results in Figure 2 support my earlier findings of low adjustment costs. If the residuals between actual earnings and the benchmark arose from rents earned from high adjustment costs, the residuals would be persistent. The serial correlation of the residuals is 0.60, far below the level that would correspond to high adjustment costs and completely consistent with the movements that would occur from random, transitory influences other than responses to adjustment costs.

VII. Industry Earnings

Dale Jorgenson's compilation of data for 35 U.S. industries reports EBITDA directly (Jorgenson and Stiroh [2000] and earlier papers cited there; see http://post. economics.harvard./faculty/jorgenson/data.html). It also includes data on the capital stock. It does not include the prices of new capital goods separately for each purchasing industry. In addition, for the preliminary results presented here, I do not have tax or depreciation rates separately by industry. Thus my measure of actual earnings per dollar of capital uses the overall price of new capital goods from the previous section in the denominator. My benchmark differs by industry only by the industry value of Tobin's q, inferred from industry-level capital-stock growth rates using equation (4.3). Jorgenson's data are for all businesses, not just corporations. In most industries, the great bulk of business activity is corporate, but in a few, such as agriculture and services, non-corporate businesses predominate.

Jorgenson's data are indexes, so it is not possible to recover the level of the ratio of earnings to the replacement cost of capital. Because I do not make use of the level other than to infer the constant value of the expected return to capital, little is lost from this limitation in the data. I calculate the ratio as an index that has the average value of one over the sample period.

Figures 4a and 4b show the results of these calculations for a representative selection of 8 of the 35 industries. The darker line is Tobin's q. The lighter line is the unexplained component of industry-level earnings—it is the actual ratio of earnings to the replacement cost of capital, adjusted to eliminate movements captured by the benchmark (that is, it is the ratio of the actual to the benchmark). I selected the 8 industries by ranking all 35 industries in the order of the variances of the unexplained components and then taking every fourth industry, starting with apparel, which ranked third from the lowest in variance.

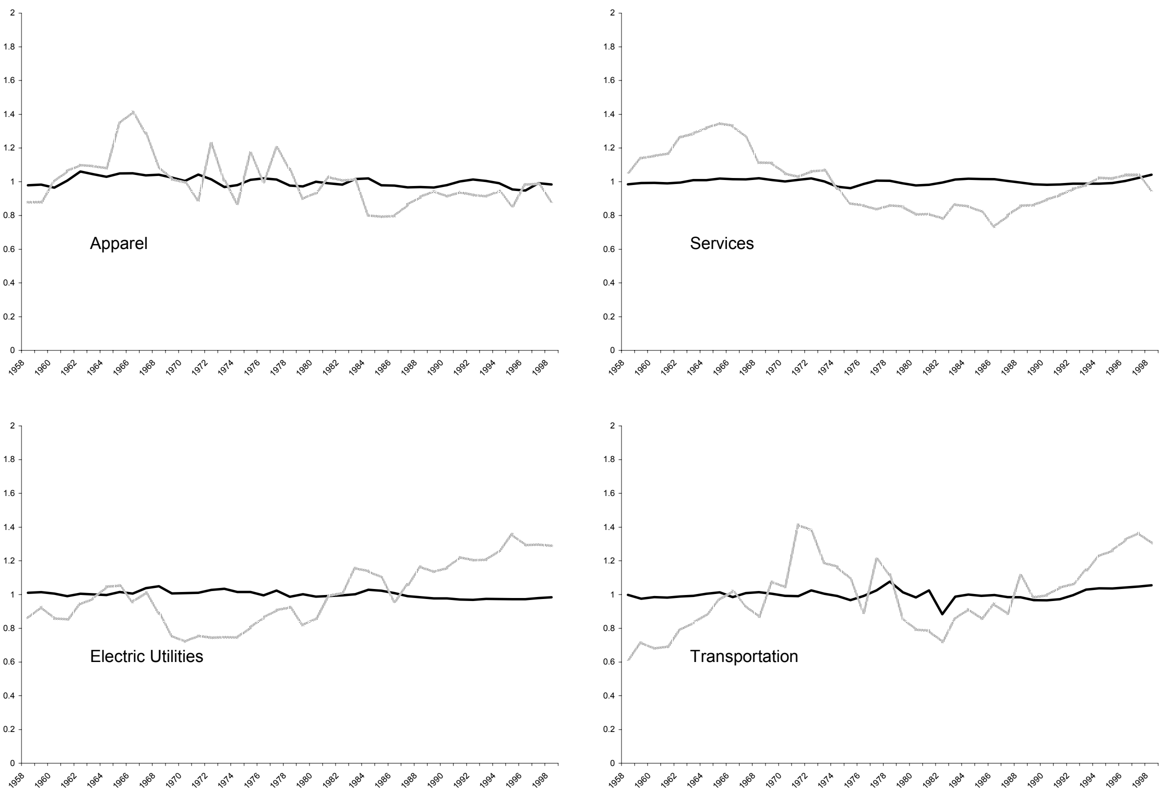

Figure 4a. Tobin's *q* (Darker Line) and Unexplained Component of Earnings (Lighter Line) for 4 Selected Industries with Lower Variances of the Unexplained Component

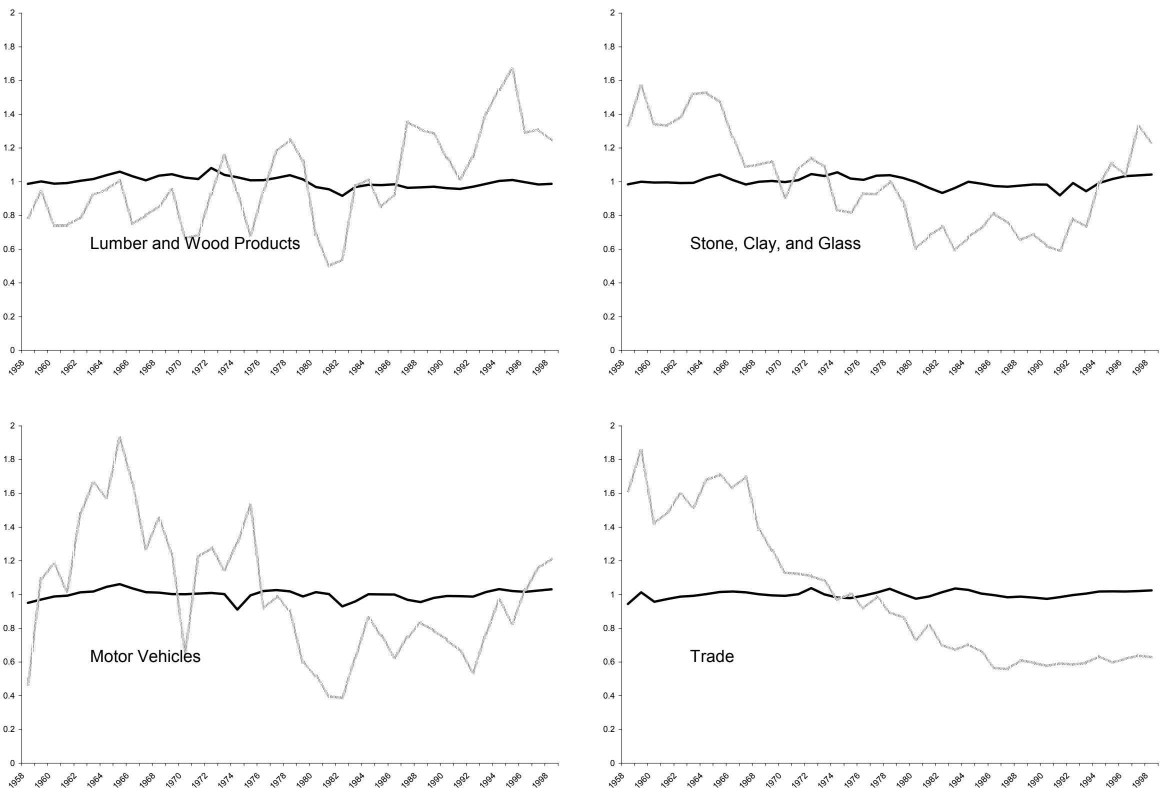

Figure 4b. Tobin's *q* (Darker Line) and Unexplained Component of Earnings (Lighter Line) for 4 Selected Industries with Higher Variances of the Unexplained Component

Even in the industries with low variances of the unexplained component of earnings, such as apparel and services, earnings have substantial unexplained volatility. The standard deviation of the unexplained component has a median across industries of 0.24 and ranges from 0.10 in gas utilities to 0.61 in coal and petroleum products.

Notice that the unexplained component is slightly positively correlated with Tobin's q. The coefficient of the regression of the unexplained component on q is about 1.5. This correlation does not imply an understatement of the adjustment-cost coefficient, γ, that I used to form q. The value of γ that resulted in zero correlation with the unexplained component would be a cousin of the least-squares estimate of γ in the framework of my earlier paper (Hall [2002]). Because there are good reasons to use the instrumental-variables estimate of γ, there is no reason to expect a zero correlation. Further, even if one did choose a higher adjustment cost, γ, in order to make q and the unexpected component of earnings uncorrelated, the resulting unexpected components would be quite similar to the ones shown in Figure 4. The figure would look hardly different if the fluctuations in q were multiplied by 2.5, because the volatility of q is so low.

I conclude that the movements of earnings not explained by the benchmark—the great preponderance of earnings movements—do not arise from rents associated with scarce capital on the upside or depressed earnings from capital surpluses on the downside. The fluctuations associated with those rents can be identified by their correlation with the rate of growth of the capital stock, measured by q. Instead, the large movements come from other sources. In resource-based industries, fluctuations in the value of the flow of extracted resources appear in the unexplained component. Some of the fluctuations correspond to familiar episodes in the histories of industries, such as the collapse of the auto industry in the early 1980s with high gas prices and increased competition from Japan. Although that episode might seem to fall into the category of negative rents, the behavior of investment in the industry does not support that hypothesis except around 1982. Finally, some of the unexplained components are likely the results of problems in the data.

VIII. Concluding Remarks

This paper on the flow of value created by corporations has close connections, both in approach and in conclusions, with my earlier paper (Hall [2001]) on the market values of corporations. Both use the same accounting framework, placing financial claims on one side and substantive business activities on the other side. Both take explicit account of rents from adjustment costs, either in the sense of flows of rents or the market values of those flows. At the aggregate level, however, the two papers reach different conclusions. Here I find that standard determinants of the flow of value—taxes, depreciation, and adjustment costs—account for most of the observed movements in the aggregate flow. In my earlier paper, I found large movements in market value per dollar of capital not explained by adjustment costs. I suggested that intangible capital as a potential explanation for the large discrepancy, though I noted that intangibles could not explain the negative discrepancy in the decade centered around 1980. In this paper, I do not find that those intangibles have generated earnings anywhere near large enough to explain the high levels of corporate value around 2000.

At the industry level, the two accounts coincide. Large movements in corporate value occur relative to a benchmark including adjustment costs and large movements in the flow of value occur relative to a flow benchmark as well. Because the Jorgenson (and underlying NIPA) data determine industry by establishment, whereas data on value are necessarily by company, it is a challenge to determine if the unexplained movements in value correspond to movements in the present value of the unexplained component of earnings. I have not attempted to investigate that topic to date. But the absence of a substantial unexplained component of aggregate earnings together with huge unexplained components of aggregate value show that there cannot be a close association of flow and value at the industry level.

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