NBER WORKING PAPER SERIES

CORPORATE EARNINGS TRACK THE COMPETITIVE BENCHMARK

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Working Paper 10150
http://www.nber.org/papers/w10150

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2003

This research was supported by the National Science Foundation under grant SOC SBR-9730341 and is part of the research program on Economic Fluctuations and Growth of the NBER. I am grateful to Andrew Abel, John Heaton, and numerous seminar participants for helpful comment. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

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NBER Working Paper No. 10150
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JEL No. E22, G10

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 in 5 selected 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. At the industry level, I find more volatility of both actual and benchmark earnings, with a high correlation between the two in 3 of the 5 industries.

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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 considers all of the financial claims on a business rather than focusing just 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—plant, equipment, and inventories. 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 found a 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 intangible capital, 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 Data Appendix describes the calculations and sources more fully. The complete details of all the calculations in the paper are in a set of spreadsheets 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 plant and equipment, $p_{K,t}K_t$, I use data from the Fixed Assets Tables compiled by the Bureau of Economic Analysis in conjunction with the NIPA. This source reports the net value at current prices of corporate equipment, software, and structures. I have not found a source for the value of corporate inventories, $p_{V,t}V_t$. 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.

I measure earnings as the residual of total revenue, Y_t, over payments to non-capital factors, W_t, divided by the value of the capital stock at the end of the period:

$$r_{C,t} = \frac{Y_t - W_t}{p_{K,t}K_t + p_{V,t}V_t}, \tag{2.1}$$

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, 2001 (because the earnings data are based on income tax records, they are reported with a considerable lag).

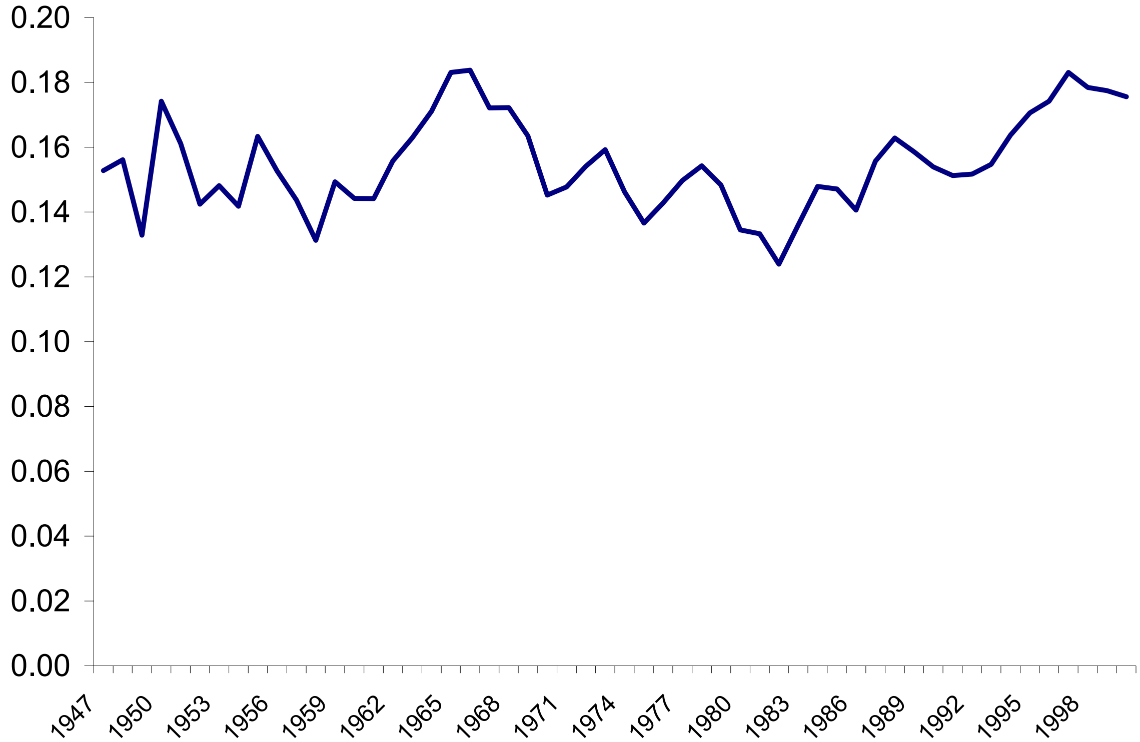

Figure 1. Ratio of Corporate Earnings before Interest, Taxes, Depreciation, and Amortization to Value of Corporate Tangible Capital, 1947-2001

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. For the moment, I will consider only one type of capital; later I will add inventories. I let r_K be the expected earnings of a machine and let $\tilde{p}_K$ be the purchase 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 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.

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 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 per dollar of capital value. Consider a firm that uses one unit of capital in year *t*, $1-\delta$ in period *t*+1, and so on. For the moment, I abstract from complications involving taxation and adjustment costs. Then the value of the firm at the beginning of period t' is

$$v_{t'} = E_{t'} \sum_{\tau=0}^{\infty} \frac{m_{t'+\tau+1}}{m_{t'}} (1-\delta)^{t'-t+\tau} r_{K,t'+\tau} p_{K,t'+\tau} , \tag{3.1}$$

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,

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

If the value benchmark holds, then $v_{t'} = (1-\delta)^{t'-t} p_{K,t'}$ for all *t* and t'. Thus

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

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

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

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

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

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

Equation (3.9) suggests two approaches to measuring the return to capital. One is to take the realized actual return over an appropriate period. The other is to measure the risk premium from the covariance of the realized return with an empirical stochastic discounter and apply the premium to the risk-free rate, according to the right-hand side of the equation. Economists who study securities markets have a strong preference for the second procedure, because the variance of realized returns for equities is high. Consequently, measures of average returns are unreliable but measures of covariances are adequately reliable. As I will explain shortly, the variance of the returns to capital is nowhere near as high as the variance of the returns to equity, so I use the realized average, $\bar{R}_K$. I will refer to this quantity as the financial cost of capital.

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

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

Consequently,

$$E\left(\hat{r}_{K,t}\right) = E\left(\hat{R}_{K,t}\right) - (1-\delta)E\left(\frac{p_{K,t+1}}{p_{K,t}}\right) = \bar{R}_K - (1-\delta)\pi . \quad (3.11)$$

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

I summarize in

Flow Valuation Theorem: Under constant returns to scale and with a financial cost of capital $\bar{R}_K$, among earnings distributions $\hat{r}_{K,t}$, those that satisfy the valuation condition of equation (3.1) have unconditional mean $\bar{R}_K - (1-\delta)\pi$.

The theorem provides a two-step process for checking an observed time series of earnings against the flow valuation criterion. First, determine the financial cost of capital, $\bar{R}_K$. Second, compare $r_{K,t}$ to the benchmark mean, $\bar{R}_K - (1-\delta)\pi$. Notice that the use of the realized average return to measure the financial cost of capital means that the comparison cannot show that the average of $r_{K,t}$ departs from the benchmark. The two are equal by construction. Rather, the comparison shows if there are briefer episodes of earnings above or below the benchmark.

B. Returns with adjustment costs, taxation, and inventories

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 purchase price, $\tilde{p}_K$, multiplied by Tobin's q (this is just the definition of q). I measure Tobin's q from the first-order condition for quadratic adjustment costs,

$$q_t - 1 = \gamma \frac{K_t - K_{t-1}}{K_{t-1}}. \quad (3.12)$$

The evidence across the industries considered in Hall [2003] suggests that a typical value for γ is about one, the value I adopt here. The results would be similar across a range of values consistent with that evidence and with other work on estimating adjustment costs from the Euler equation.

To take account of inventories, I let

$$\omega = \frac{p_K K}{p_K K + p_V V} \quad (3.13)$$

be the value share of fixed capital. The firm buys one dollar's worth of capital at the beginning of the period, divided with weights ω_t and $1-\omega_t$ between fixed capital and inventories. At the end of the period, the firm receives tax benefits (investment tax credit and depreciation deductions) attributable to the first period of $\omega_t \frac{x_{K,t}}{q_t}$ from fixed capital and $(1-\omega_t)x_{V,t}$ from inventories. The division by q_t reflects the fact that tax benefits for plant and equipment are awarded per dollar of acquisition cost, not per dollar of value. At the end of the period, the firm receives revenue of y_t, pays w_t for its other inputs, and pays tax on the difference. Thus the firm's after-tax earnings are $(1-\tau_t)(y_t - w_t)$. For the remainder of the paper, I consider the case where depreciation varies over time but is determined by the date when capital is installed. Thus the remaining value of the fixed capital is $\omega_t (1-\delta_t)\frac{p_{K,t+1}}{p_{K,t}}$ and of the inventories $(1-\omega_t)\frac{p_{V,t+1}}{p_{V,t}}$. Accordingly, the return ratio for the one dollar investment is:

$$\begin{aligned} R_{C,t} &= (1-\tau_t)(y_t - w_t) + \omega_t \frac{x_{K,t}}{q_t} + (1-\omega_t)x_{V,t} \\ &+ \omega_t (1-\delta_t)\frac{p_{K,t+1}}{p_{K,t}} + (1-\omega_t)\frac{p_{V,t+1}}{p_{V,t}} \end{aligned} \tag{3.14}$$

The literature on measuring the return to capital—notably Poterba [1998]—has not always included the last two terms, representing capital gains on capital goods. The rate of return without those terms is the own rate on capital, rather than the real rate based on treating consumption goods as numeraire. As a practical matter, the difference is small, because the prices of capital and consumption goods generally move together.

C. Measuring the return to investment

The formulation in equation (3.14) clarifies the role of risk in the determination of earnings. Risk arises from uncertainty about earnings per unit of capital and about the price of capital goods next period. In the simplest case, where consumption goods are perfect substitutes for output and capital goods, there is no uncertainty about capital goods prices and the risk premium arises only from uncertainty about output per unit of capital. On the other hand, the price of fixed 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.

The standard approach in modern finance is to measure the risk of a security's return from equation (3.7) and then to apply equation (3.9) to infer its expected return—see Cochrane [2001]. The reasons are twofold: First, persuasive evidence shows that expected returns vary over time (Campbell and Shiller [1998]). Second, realized returns have high dispersion with thick tails, so that estimates of expected returns from the sample mean of historical returns have large sampling errors while estimates of covariances are adequately precise.

I think the balance tips in the opposite direction for the return to corporate tangible capital. The dispersion of returns to capital is far less than for returns to the S&P 500. The standard deviation of the return to capital is 0.028 as against 0.150 for the S&P (return calculated from data from Robert Shiller's website). The standard error of the estimated mean for the return to capital is 38 basis points as against 207 basis points for the S&P. To put the difference most dramatically, it would take 1559 years of data for the S&P to measure its unconditional expected return with the same precision obtained here from 54 years of data for the return to capital.

The precision of estimation of the mean of the realized return to capital is sufficient to explore for variations over time. There is statistically unambiguous evidence of a slightly lower return in the second half of the sample period, from the mid-1970s onward. This was a period of *rising* real returns to debt, so a financial model such as the standard Capital Asset Pricing Model that portrays risky returns as the sum of a time-varying return to risk-free debt plus a constant risk premium would contradict the evidence from the mean of the realized return.

The compelling reason to avoid an inference of the expected return from a risk premium and a risk-free return, as in equation (3.9), is that finance has yet to resolve fundamental puzzles about measuring the stochastic discounter in equation (3.7) in a way that rationalizes the pricing of securities. The stochastic discounter needs to have extreme volatility to rationalize the equity premium (Hansen and Jagannathan [1991]) but the marginal rate of substitution from any but the most exotic preferences falls far short of that volatility (Campbell and Cochrane [1999]). Without much guidance about how to construct the stochastic discounter in practice, I am thrown back on the simple calculation of the mean of the realized return.

D. Components of the benchmark

The earnings shown in Figure 1 are earnings per dollar of capital valued at acquisition price. The corresponding benchmark stated in terms of the conditional expectation and q_t is

$$\left(\omega_t q_t + 1 - \omega_t\right) E_t\left(y_t - w_t\right). \tag{3.15}$$

From equation (3.14), the conditional expectation of the return to capital is

$$
\begin{aligned}
E_t R_{C,t} = &\left(1-\tau_t\right) E_t\left(y_t - w_t\right) + \omega_t \frac{x_{K,t}}{q_t} + \left(1-\omega_t\right) x_{V,t} \\
&+ E_t\left[\omega_t\left(1-\delta_t\right)\frac{p_{K,t+1}}{p_{K,t}} + \left(1-\omega_t\right)\frac{p_{V,t+1}}{p_{V,t}}\right]
\end{aligned}
\qquad . \tag{3.16}
$$

For the reasons discussed earlier, I will approximate the conditional expected return by its unconditional value, $\overline{R}_C$. I allow for time variation in the conditional expectation of revenue. In addition, as equation (3.16) 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 (3.17) for the conditional expectation of earnings per dollar of capital value:

$$
\begin{aligned}
&E_t\left(y_t - w_t\right) = \\
&\frac{\overline{R}_C - \omega_t \dfrac{x_{K,t}}{q_t} - \left(1-\omega_t\right) x_{V,t} - E_t\left[\omega_t\left(1-\delta_t\right)\dfrac{p_{K,t+1}}{p_{K,t}} + \left(1-\omega_t\right)\dfrac{p_{V,t+1}}{p_{V,t}}\right]}{1-\tau_t}.
\end{aligned}
\tag{3.17}
$$

Thus the benchmark for earnings per dollar of capital measured at acquisition price is:

$$
\begin{aligned}
&\tilde{r}_{C,t} = \left(\omega_t q_t + 1 - \omega_t\right) E_t\left(y_t - w_t\right) = \left(\omega_t q_t + 1 - \omega_t\right) \times \\
&\frac{\overline{R}_C - \omega_t \dfrac{x_{K,t}}{q_t} - \left(1-\omega_t\right) x_{V,t} - E_t\left[\omega_t\left(1-\delta_t\right)\dfrac{p_{K,t+1}}{p_{K,t}} + \left(1-\omega_t\right)\dfrac{p_{V,t+1}}{p_{V,t}}\right]}{1-\tau_t}.
\end{aligned}
\tag{3.18}
$$

With zero weight for inventories ($\omega_t = 1$), 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 empirical counterparts to the conditional expectations of the growth ratios of the real prices of capital goods, $E_t \frac{p_{K,t+1}}{p_{K,t}}$ and $E_t \frac{p_{V,t+1}}{p_{V,t}}$. Although an econometric fishing expedition might turn up some variables with forecasting power, I believe that the most reasonable measures are the unconditional expectation, $\pi_K = 0.990$ and $\pi_V = 0.989$ (both types of capital have become cheaper relative to consumption because of the rising relative price of services). 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

$$\tilde{r}_{C,t} = \left(\omega_t q_t + 1 - \omega_t\right) \frac{\bar{R}_C - \omega_t \frac{x_{K,t}}{q_t} - \left(1-\omega_t\right) x_{V,t} - \omega_t \left(1-\delta_t\right)\pi_K - \left(1-\omega_t\right)\pi_V}{1-\tau_t}. \quad (3.19)$$

The final step in the derivation of the benchmark is to relate the annual equivalents of tax benefits, $x_{K,t}$ and $x_{V,t}$, to actual tax provisions. Under the U.S. corporate income tax, in some years corporations received, in effect, a negative excise tax on some fixed capital in the form of an investment tax credit. In all years, corporations were entitled to depreciation deductions based on lifetimes that have varied substantially over time.

In principle, calculating the first-year equivalent of the investment tax credit and depreciation deductions is an intricate task, because the optimal pattern of ownership may involve tax-motivated transactions in each machine at various ages. Most of these are blocked by tax-benefit-recovery provisions in the law. I believe that a reasonable approximation can be based on a simple smoothing model. I calculate $x_{K,t}$ from the hypothesis that the flow associated with a given machine, $x_{K,t}\left[(1-\delta_t)\pi_K\right]^{t+\tau}$ has a present value equal to the present value of the actual tax credit and depreciation deductions. Let the latter be C_t and D_t. Then

$$x_{K,t}=\left[1-R_B^{-1}(1-\delta_\tau)\pi\right](C_t+D_t). \tag{3.20}$$

Here R_B^{-1} is the real discount ratio appropriate for the tax benefits, which have low financial risk. U.S. corporate tax law has always kept depreciation deductions constant in nominal terms, so the present value D_t projects changes in real deductions associated with changes in the price level. Also, the value of depreciation deductions depends on the tax rate prevailing when the deductions are taken, so D_t in principle involves expectations of future corporate tax rates, though these are probably little different from the rate prevailing at time *t*.

For inventories, U.S. tax law provides no depreciation or other incentive, but does impose an implicit capital gains tax because of the tax rule that firms deduct the cost of inventories only when the goods are sold. Thus

$$x_{V,t}=-\tau_t(f_t-1). \tag{3.21}$$

where f_t is the rate of growth of the nominal inventory price.

The rate of return from equation (3.14) averages 4.46 percent with a standard error of 0.38 percentage points. This corresponds reasonably closely to Poterba's [1998] estimate of 5.1 percent. Poterba does not decompose total corporate taxes as in equation (3.14), but rather simply treats all taxes paid as a deduction from the return.

IV. Comparison of Actual to Benchmark Earnings

Figure 2 compares the actual earnings from Figure 1 with the benchmark of equation (3.19). 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.

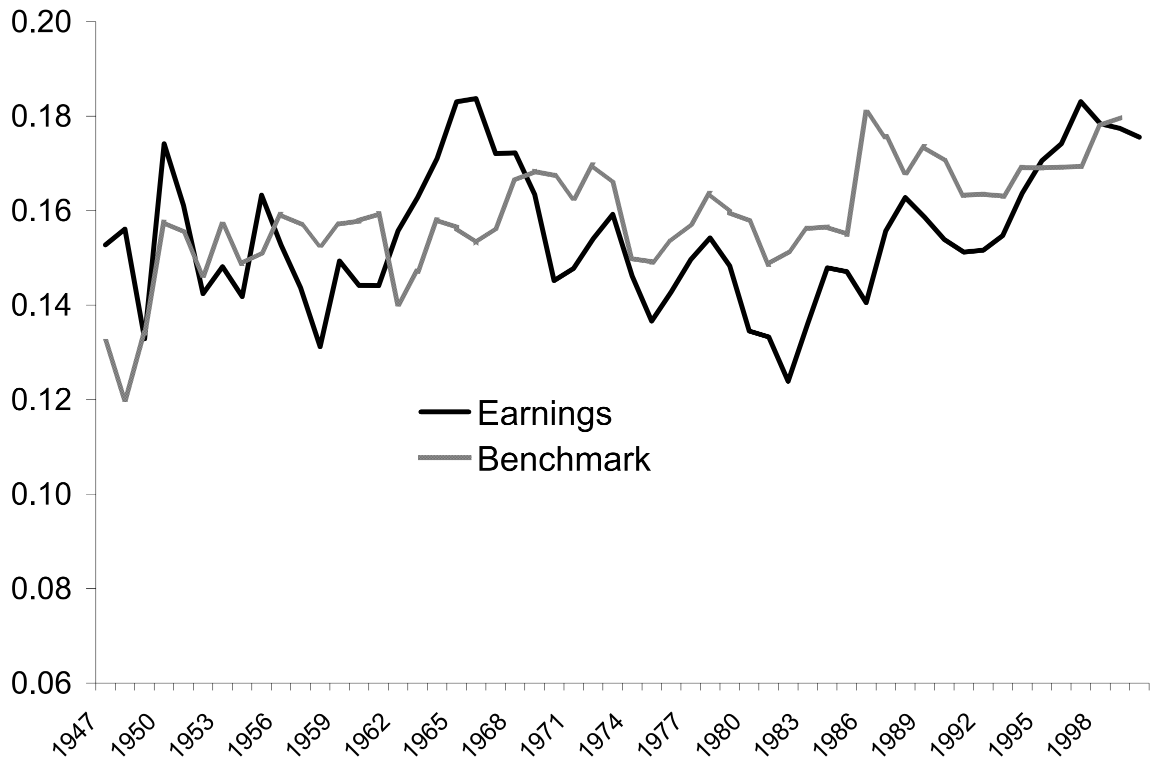

Figure 2. Actual and Benchmark Earnings

Figure 3 shows the contributions of five variables in the benchmark: the rate of depreciation, δ_t, the corporate tax rate, τ_t, Tobin's q_t, the tax incentives $x_{K,t}$ and $x_{V,t}$, and the inventory mix, ω_t. 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.

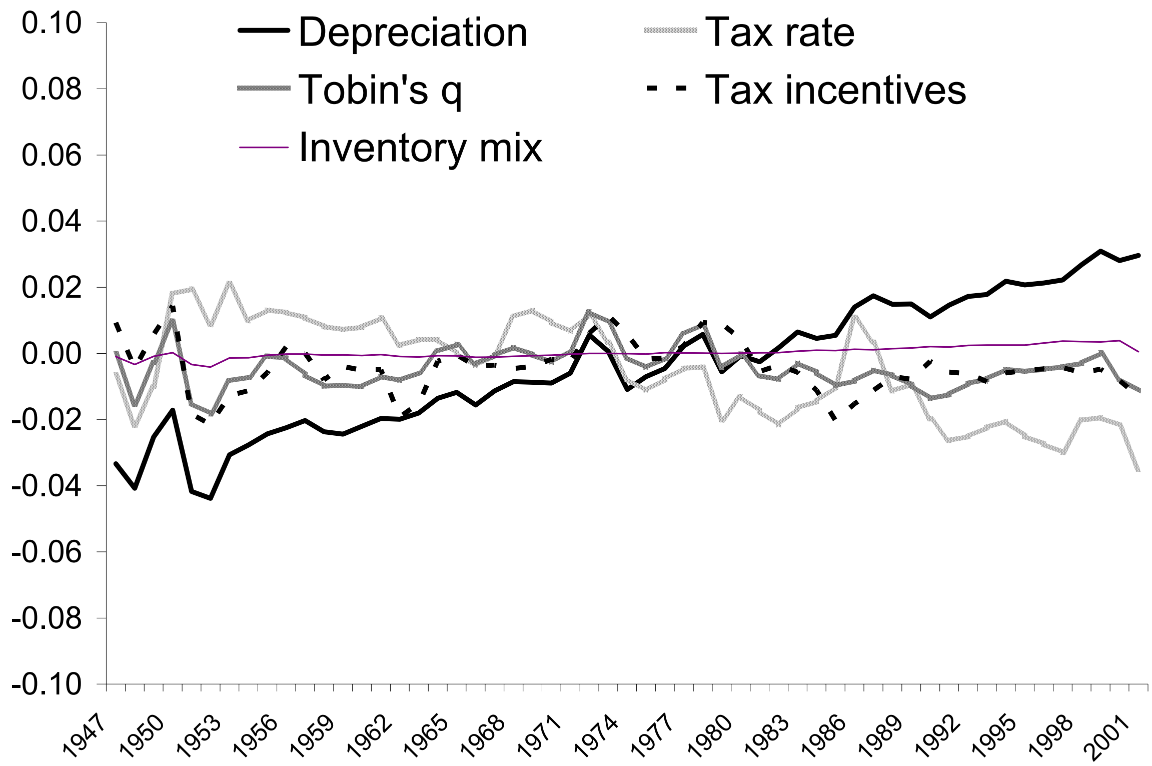

Figure 3. Components of Benchmark Earnings

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. Tobin's *q* makes only transitory contributions to the benchmark. With relatively low adjustment costs, the contributions are quite small. Tax incentives and the inventory mix make relatively small contributions.

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 0.62, 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.

V. Industry Earnings

The NIPAs do not provide detail to carry out calculations for corporations at the industry level. I am limited to calculations for all forms of business. The NIPA accounting system does not separate the earnings of capital from the earnings of labor for non-corporate entities, which are mainly proprietorships and partnerships. Logical methods for imputing earnings result in puzzlingly low returns to capital for non-corporate business—see Moskowitz and Vissing-Jørgensen [2002]. To avoid this problem, I limit the calculations to industries with small non-corporate sectors. The only measure that the NIPAs report for corporate and non-corporate businesses separately is capital consumption allowances. Further, the NIPAs do not provide consistent detail for fine industry breakdowns. Two key variables, inventories and net interest, are available only at roughly the 1-digit SIC level. Table 1 shows the corporate fraction measured by capital consumption allowances for the finest industry detail for industries that are at least 90 percent corporate.

Industry	*Percent corporate*
Manufacturing durables	97
Manufacturing non-durables	98
Communication	92
Utilities	94
Wholesale trade	94

Table 1. Ratio of Corporate to Total Capital Consumption Allowances by Industry, 1987

In these industries, I inflated corporate profits slightly to account for the fact that all other variables are measured at the total business level—I divided corporate profits by the counterpart of the percentage shown in Table 1, for each year. In all other respects, the calculations at the industry level are the same as those for total corporate business discussed earlier.

Figure 4 compares actual earnings per dollar of capital to the benchmark for the five industries. In three of the industries—non-durables, communication, and utilities—the agreement of actual and benchmark is striking. The match is even closer than for total corporate earnings. In durables and wholesale trade, actual earnings were well above the benchmark in the 1950s, fell below in the 1980s, and then recovered toward the benchmark in the 1990s.

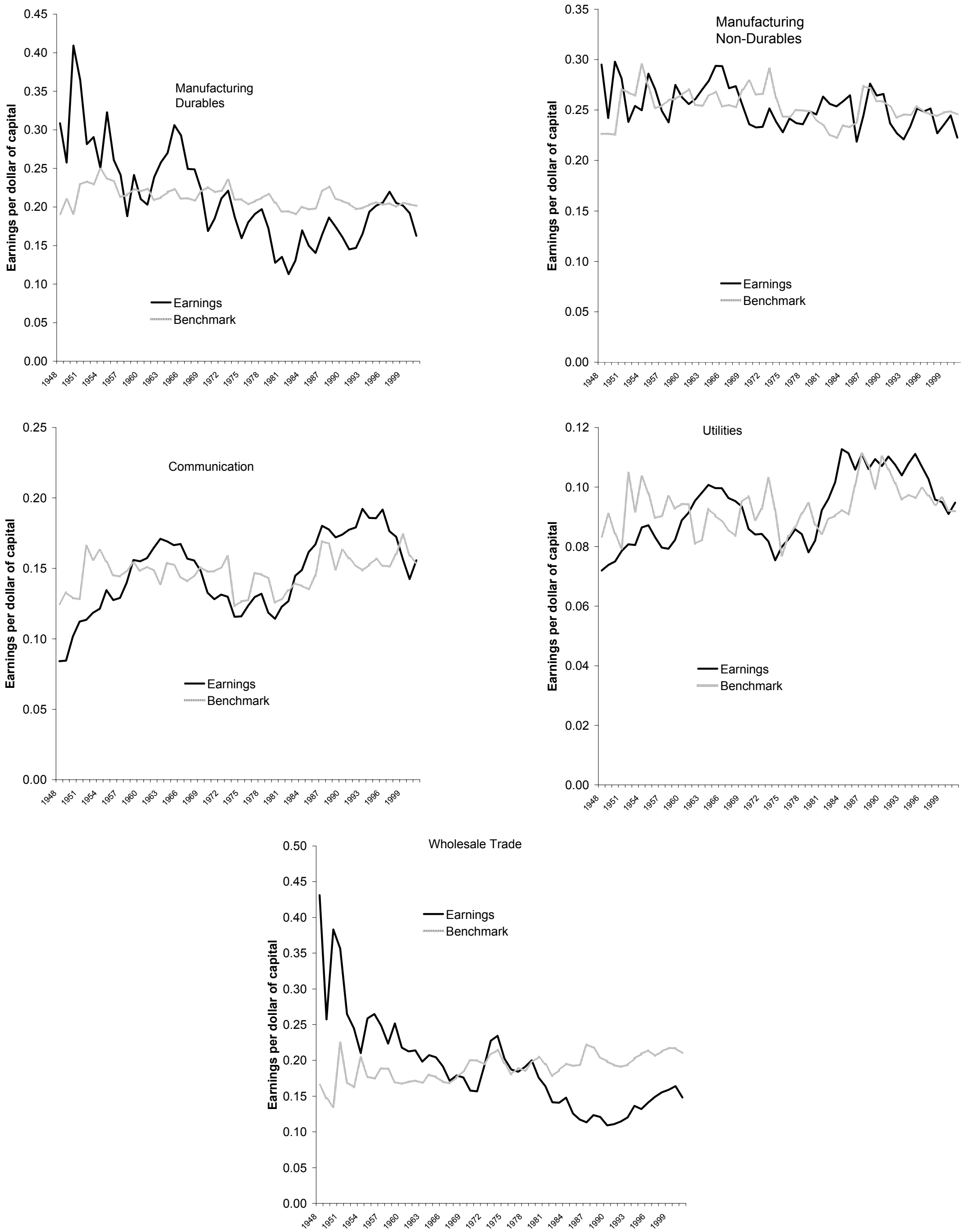

Figure 4. Actual and Benchmark Earnings per Dollar of Capital for Five Selected Industries

To investigate the nature of the departures of actual from benchmark earnings, I estimated the following descriptive regression:

$$\frac{r_{C,t}}{r_{B,t}} = a + bq_t + \frac{1}{1-\rho L}\varepsilon_t \,. \tag{5.1}$$

Here L is the lag operator, ρ is the serial correlation of the disturbance, and ε_t is the innovation in the disturbance. Table 3 shows the results.

Industry	*q coefficient, b*	*Standard error*	*Serial correlation, ρ*	*Standard error*
Manufacturing durables	1.39	(0.47)	0.65	(0.08)
Manufacturing non-durables	0.01	(0.55)	0.47	(0.21)
Communication	-0.64	(0.47)	0.85	(0.13)
Utilities	-1.04	(0.54)	0.75	(0.19)
Wholesale trade	1.10	(0.44)	0.71	(0.04)

Table 2. Regressions of the Ratio of Actual to Benchmark Earnings on *q*, with Autoregressive Error

The unexplained component is positively correlated with Tobin's q in the two industries with large departures of actual from benchmark earnings, durables and wholesale trade. The coefficient of the regression 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 Hall [2003]. 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 two, because the volatility of q is so low (see Figure 3).

I conclude that the movements of earnings not explained by the benchmark 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 movements come from other sources. Some of the unexplained components are likely the results of problems in the data. The estimates of the serial correlation parameter are 0.65 or higher for all industries but non-durables. Thus the forces that cause the discrepancies are quite persistent—the role of surprises in earnings or in capital prices must be relatively small.

Figure 4 shows noticeable differences in the level of earnings per dollar of capital across industries. These differences are reflected in the underlying rates of return, to the extent that differences in depreciation rates and other determinants do not account for them. Table 3 shows that the differences in rates of return are substantial. Some of the differences may result from variations in financial risk—manufacturing and wholesale trade may be riskier than communication and utilities, in the sense of having returns more negatively correlated with the stochastic discounter of equation (3.7).

Industry	*Rate of return (dollars per year per dollar of capital value)*
Manufacturing durables	8.0
Manufacturing non-durables	11.7
Communication	2.7
Utilities	4.2
Wholesale trade	7.2

Table 3. Rates of Return to Capital by Industry, 1948-2001

VI. Contribution of Earnings Discrepancies to Valuation Discrepancies

The value of a corporation includes the present value of the earnings it enjoys in excess of the benchmark. Let d_t be the discrepancy in year t between actual and benchmark earnings. If the risk of the discrepancy is the same as the risk of earnings in general, then the earnings discrepancy contributes

$$\tilde{v}_t = E_t \sum_{\tau=0}^{\infty} \bar{R}_C^{-\tau} d_{t+\tau} \tag{6.1}$$

to the value of the corporation. If the discrepancy follows a univariate AR(1) process with parameter ρ, the corresponding value component is

$$\tilde{v}_t = \frac{\bar{R}_C}{\bar{R}_C - \rho} d_t . \tag{6.2}$$

The AR coefficient ρ has the value 0.62 for total corporate earnings. Higher-order AR processes contributed nothing meaningful to the fit.

Figure 5 compares the present value of the earnings discrepancy, $\tilde{v}_t$, to the discrepancy between the market value of claims on corporations and the estimated value of their tangible capital, from Hall [2001]. The latter is measured by imputing Tobin's q for plant and equipment from equation (3.12) and dividing the resulting measure of plant and equipment value, together with the value of inventories, into the market value of corporate securities and other financial claims from my earlier work. Note that this measure is for non-financial corporations while my work in this paper on earnings is for all corporations. I have not found detailed data on financial claims for any sector that matches a sector for which I can carry out the NIPA-based earnings calculations. Figure 5 shows that the present value of the earnings discrepancy is tiny in comparison to the valuation discrepancy. Further, the two are only slightly positively correlated, with a correlation coefficient of 0.22. I conclude that the small earnings discrepancies uncovered in this paper do not help in understanding the volatility of the stock market.

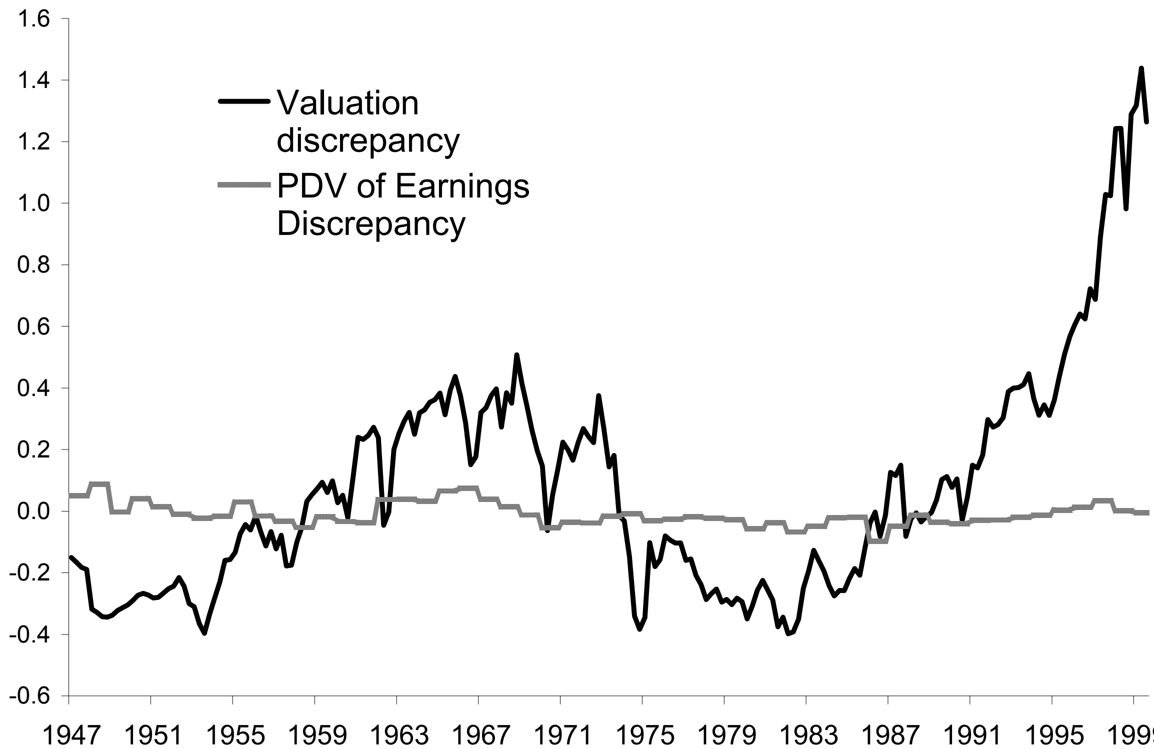

Figure 5. Comparison of Valuation Discrepancy and Present Value of Earnings Discrepancy

My earlier paper hypothesized that the valuation discrepancies arose from accumulation of intangibles. The finding that earnings discrepancies are not part of the explanation of the valuation discrepancy does not dispose of that hypothesis. When a corporation invests in intangibles, the amount of the investment is subtracted from earnings because it is treated as a current expense. Small earnings discrepancies may result from the offsetting effects of the earnings of intangibles—which are included in earnings—and the deduction of investment in intangibles. Let G_t be the stock of intangibles and suppose, for simplicity, that the price of intangibles in consumption units is a constant, normalized at one. Further assume that the risk of the earnings of intangibles is the same as the risk of earnings in general. Let the depreciation rate of intangibles be θ. Then the per-unit earnings of intangibles will be $\overline{R}_C + 1 - \theta$, according to equation (3.11). The amount mistakenly deducted from earnings is $G_t - (1-\theta)G_{t-1}$, gross investment in intangibles. The condition for exact cancellation is

$$G_t = \overline{R}_C G_{t-1} . \qquad (6.3)$$

That is, smooth growth of the flow of investment and thus of the stock of intangibles at a rate equal to the cost of capital will result in zero discrepancy between actual reported earnings and the benchmark based on tangible capital alone. Intangibles will be invisible in earnings.

The valuation discrepancy in Figure 5 does not follow a path of constant growth. Some other factor is at work. Consider the following possibility: Each period, the stock of intangibles rises or falls by a random amount g_t, unrelated to the formation of new intangibles. Assume that the present value of g_t as of period t–1 is zero. From equation (3.3), one can see that g_t will not appear in the earnings benchmark for intangibles. Further, g_t does not have any effect on reported earnings. Consequently, the law of motion of the stock of intangibles that leaves no trace on recorded earnings is

$$G_t = \overline{R}_C G_{t-1} + g_t . \qquad (6.4)$$

Figure 6 shows the random increment to intangibles, calculated as $G_t - \overline{R}_C G_{t-1}$ and expressed as a percent of total corporate value.

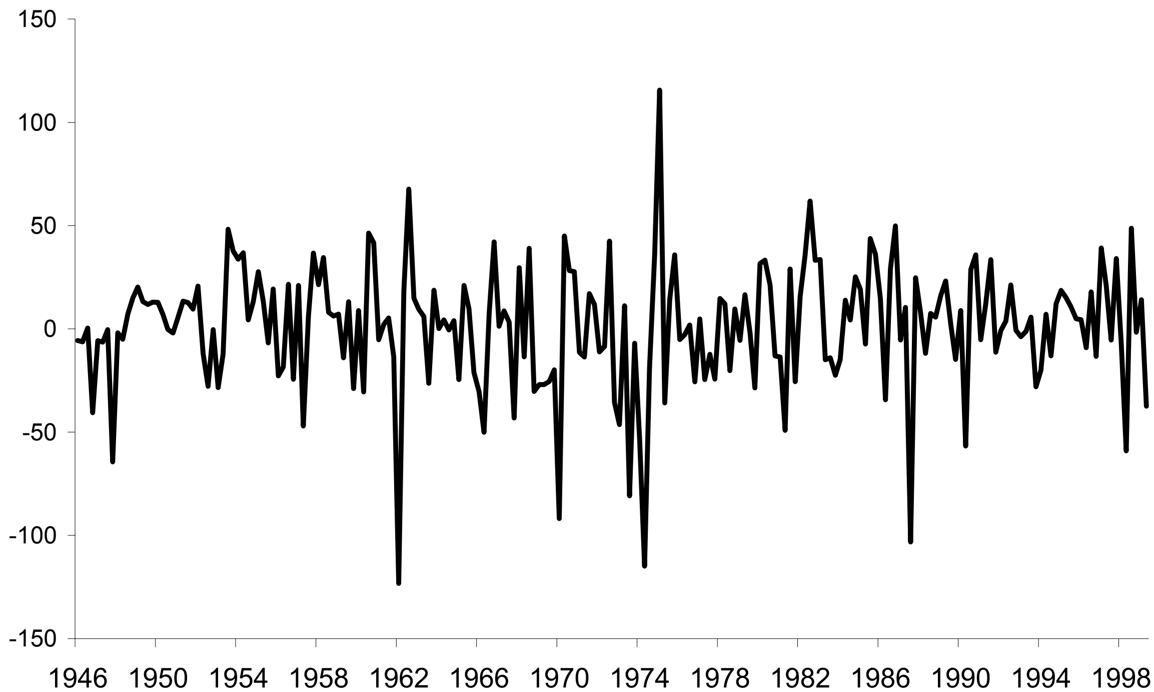

Figure 6. Increments to Intangibles—Quarterly Changes at Annual Rates, as a Percent of Total Market Value

These increments come very close to satisfying the condition of unpredictability—not surprisingly, because they are close to being capital gains on securities, which are known to be essentially unpredictable. But the increments are large, sometimes exceeding 100 percent at annual rates. The view that intangibles account for broad swings in corporate value, despite being invisible in corporate earnings, is at best at the borderline of credibility.

VII. 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. But the two papers reach quite different substantive 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, not explained by adjustment costs, in market value per dollar of capital. I suggested that intangible capital is a potential explanation for the large discrepancy, though I noted that intangibles could not explain the negative discrepancy in the decade centered around 1980. The earnings of intangibles are not visible in recorded earnings, but that finding may be the result of cancellation of their earnings and the costs of forming the intangibles. It takes large random additions to and subtractions from the stock of intangibles to reconcile the high amplitude of variations in the stock market with the low amplitude of variations in earnings.

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Data Appendix

Total corporate earnings for Figure 1. Corporate profits before tax and corporate interest from NIPA Table 1.15. Corporate capital consumption allowances from NIPA Table 6.22. Corporate earnings are the sum of the three components.

Corporate capital for Figure 1. Corporate fixed capital from NIPA Fixed Asset Table (FAT) 4.1. Business inventories from NIPA Table 5.12. I approximate the corporate fraction as the ratio of corporate capital consumption allowances to corporate plus non-corporate capital consumption allowances, NIPA Table 6.13. Total corporate capital is corporate fixed capital plus the approximate corporate share multiplied by total business inventories.

Plant and equipment depreciation rate for Figure 2. Calculated as the ratio of corporate depreciation, FAT 4.4, to corporate fixed capital, FAT 4.1.

Corporate tax rate for Figure 2. Calculated as the ratio of federal corporate income and excess profit taxes, IRS, NIPA Table 8.25, line 20, to total receipts less deductions, IRS, same table, line 1.

Price index for plant and equipment, Figure 2. Calculated as the ratio of nominal corporate fixed capital, FAT 4.1, to the corresponding quantity index, FAT 4.2.

Price index for inventories, Figure 2. From NIPA Table 7.16, implicit price deflators for private inventories.

Price index for consumption, Figure 2. From NIPA Table 7.1, implicit price deflator for consumption.

Tobin's q, Figure 2. Calculated from equation (3.12), with plant and equipment stock from FAT 4.2; adjustment cost coefficient $\gamma = 1$.

6-month Treasury bill rate, Figure 2. 1947-1958, imputed as the commercial paper rate, from the *Economic Report of the President,* less 0.138 percent. 1959-2001, *Economic Report of the President.*

Investment tax credit, Figure 2. Ratio of dollar amount of credit, line 25, NIPA Table 8.25, to nominal business fixed investment, NIPA Table 1.1.

Depreciation rate for corporate tax purposes, Figure 2. Inferred from IRS depreciation, NIPA Table 8.22, and investment in structures and equipment, NIPA Table 1.1, from the recursion $d_t = \frac{D_t - \sum d_{t-\tau}(1-d_{t-\tau})^\tau I_{t-\tau}}{I_t}$, with the restriction $.05 \le d_t \le .15$.

Present value of depreciation deductions, Figure 2. Calculated as $\frac{d_t}{d_t + r_t + .02}$ where *r* is the 6-month Treasury bill rate.

x for plant and equipment, Figure 2. Calculated from equation (3.20), with real discount rate $R_B^{-1}\pi = \frac{1}{1.03}$.

x for inventories, Figure 2. Calculated from equation (3.21), with inventory price from NIPA Table 7.16.

Weight for plant and equipment in total capital, ω, *Figure 2*. See sources for total corporate capital, Figure 1.

Total and corporate capital consumption allowances, Table 1. Corporate from NIPA Table 6.22, non-corporate from NIPA Table 6.13.

Value of plant and equipment, Figure 4. From FAT 3.1ES.

Value of inventories, Figure 4. From NIPA Table 5.12.

Corporate profits before tax, Figure 4. From NIPA Table 6.17

Net interest, Figure 4. From NIPA Table 6.15.

Corporate capital consumption allowances, Figure 4. From NIPA Table 6.22.

Non-corporate capital consumption allowances, Figure 4. From NIPA Table 6.13.

Depreciation, Figure 4. From FAT 3.4ES.

Plant and equipment price, Figure 4. Nominal capital from FAT 3.7 divided by real capital, FAT 3.8.

Inventories price, Figure 4. From NIPA Table 7.16.

Valuation discrepancy, Figure 5. From backup materials for Hall [2001], Stanford.edu/~rehall, total value of securities of the non-financial corporate sector divided by the sum of the calculated values of plant, equipment, and inventory, less one.