Tax Incentives versus Financial Reporting Costs: The Case of Internally Developed Intangible Assets

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Abstract: This paper develops and analyzes a model in which tax considerations and financial reporting considerations have countervailing effects on a firm's investments in internally developed intangible assets. It also proposes and estimates a new measure of tax preferences that reflects these investments, which do not generate book-tax differences. Our measure indicates that the economic effective tax rate was about 23 percent between 1988 and 2005, when the statutory tax rate was either 34 or 35 percent. By industry, our economic effective tax rate measure ranges from a low of 10 percent for pharmaceuticals (an industry with high investments in intangible capital relative to tangible capital) to a high of 33 percent for financial services.

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We thank (your name here!) for helpful comments.

1. Introduction

Internally developed intangible assets are an important and growing source of firm value. These investments include the development of intellectual property (including, but not limited to, R&D expenditures), the creation of brand value via advertising, and the generation of firm-specific human capital. The rise in importance of these assets strains existing systems of financial and tax accounting, which evolved in an era in which tangible and financial assets were dominant sources of firm value. This strain arises because in general, firms expense investments in internally developed intangible assets for both tax and financial reporting purposes. Blair and Wallman (2001) provide an overview of the economic, accounting and taxation issues associated with intangible assets.

We investigate investments in internally developed intangible assets in two ways. First, we present a model in which the tax advantages and financial reporting disadvantages of investments in intangibles both affect firm investment decisions. We show that the optimal mix of tangible and intangible assets could be inefficiently high or low relative to a benchmark case in which intangibles had neither tax advantages nor financial reporting disadvantages. For most plausible parameter values, however, the combined effect of tax advantages and financial reporting disadvantages induces an inefficiently low proportion of investment in intangible assets. This setting illustrates the tradeoff between tax incentives and financial reporting considerations.

Second, we propose a measure of the extent to which firms achieve an effective tax rate lower than the statutory tax rate due to investments in intangible assets. We estimate that firms faced an average economic effective tax rate of about 23 percent between 1988 and 2005, during which time the statutory rate was either 34 or 35 percent.

The literatures in public finance economics and financial accounting frame the issue of investments in intangible assets in very different ways. Public finance economists note that the ability to expense investments when made provides them with an effective tax rate of zero, which represents a substantial departure from tax neutrality (Gravelle 1994, 209). Fullerton and Lyon (1988), in an analysis restricted to investments in R&D and advertising, estimate the effect of expensing these investments for the 1983 tax year. Zero effective tax rates on investments in intangibles induces excessive private investment in intangibles.[1]

The financial accounting literature, in contrast, largely reflects a view that regarding investments in intangibles as expenses rather than assets induces underinvestment. Lev (2001, 95) argues that the inability of investors to distinguish operating expenses from investment in intangibles creates an information asymmetry that raises the cost of capital from such investments, thereby deterring them. Kanodia and Mukherji (1996) and Kanodia, Sapra, and Venugopalan (2004) develop this idea in formal models of firm investment decisions when capital market participants cannot distinguish operating expenses from intangible investments.

The accounting literature on the measurement of tax preferences has largely ignored the effect of investments in intangibles. This literature has largely focused on the accounting effective tax rate, the ratio of tax expense to pretax book income (Gupta and Newberry 1992; Shevlin and Porter 1992), or on related measures driven by book-tax

[1] This excessive investment could be socially beneficial, however, to the extent that intangible investments generate positive externalities because the firm cannot capture all of the benefits these investments create.

differences (Wilkie 1992; Wilkie and Limberg 1993). Because investments in intangibles are expensed for both book and tax purposes, measures that define tax preferences in terms of book-tax differences cannot detect tax preferences of the sort that we examine in this paper. Our study is similar in spirit to Dunbar and Sansing (2002), who examine the ratio of tax expense to the pretax market return on equity. The approach in this paper uses the levels of book and market asset values rather than market returns to estimate tax preferences, thereby mitigating the effects of noise in market returns that create measurement error in the Dunbar and Sansing tax preference measure. Nevertheless, our tax preference estimate is consistent with theirs.

In section 2 we derive the economic effective tax rate of a single project that features both tangible and intangible investments. In section 3 we show that the tax-favored treatment of intangible assets does not necessarily induce overinvestment in intangible assets. In section 4 derive a measure of tax preferences at the firm level. In section 5 we estimate our measure for U.S. firms between 1998 and 2005. Section 6 concludes. All proofs are in the appendix.

2. Economic effective tax rate

2.1 Basic model

A firm has access to a production technology that transforms current investments in tangible assets (*K*) and intangible assets (*N*) into output (*q*) in the following fashion:

$$f(K,N) = q. \tag{1}$$

The firm chooses its investments on date zero. The production technology generates output q on date one and on each succeeding date as long as both assets remain productive. Each unit of output generates an expected operating cash flow of $\mu > 0$. The date one operating cash flow, denoted *x*, is normally distributed with a mean of μq and a variance of σ^2. On each date, after the cash flow is received, the productivity of the intangible assets drops to zero with probability λ and the project is abandoned. With probability $1-\lambda$, the operating cash flow *x* continues at the same expected level, unless the project had been abandoned on a previous date. When the project is abandoned, the tangible assets survive with no reduction in value and are either sold at their historical cost *K* or redeployed within the firm in a new project. The intangible assets generate no further value to the firm once the project is abandoned.

Operating cash flows are taxed at a rate of τ. The tangible investment *K* is neither expensed nor depreciated for tax purposes because the tangible assets do not decrease in value over time. The intangible investment *N* is subject to one of two tax treatments. Under the *capitalization regime*, the investment *N* is capitalized and deducted under IRC §165 when the project is abandoned. Under the *expensing regime*, the firm takes a tax deduction for the full amount of the investment on date zero.

In this section, the firm chooses investments *K* and *N* to maximize the present value of the after-tax cash flows that the project generates, discounted at the firm's after-tax weighted average cost of capital ρ, less the after-tax cost of the investments. The present value of the project's expected after-tax cash flows, not including the after-tax cost of the investments, is

$$\sum_{j=1}^{\infty} \frac{[(1-\tau)\mu q + \lambda K](1-\lambda)^{j-1}}{(1+\rho)^j} = \frac{(1-\tau)\mu q + \lambda K}{\rho + \lambda}. \tag{2}$$

Under the expensing regime, the firm's date zero maximization problem is

$$\max_{K,N} \left\{ \frac{(1-\tau)\mu f(K,N) + \lambda K}{\rho + \lambda} - K - N(1-\tau) \right\}. \tag{3}$$

Under the capitalization regime, the firm's date zero maximization problem is

$$\max_{K,N}\left\{\frac{(1-\tau)\mu f(K,N)+\lambda(K+\tau N)}{\rho+\lambda}-K-N\right\}. \qquad (4)$$

While it is clear that the expensing regime is more favorable than the capitalization regime, it will be helpful for what follows to measure this difference by deriving the *economic effective tax rate* of the project. The after-tax rate of return under either regime is the value of ρ for which the value of the project specified in either (3) or (4) is zero. The pretax rate of return is the value of R for which the value of the project is zero when R replaces ρ and $\tau = 0$. In other words, R represents the internal rate of return on the project from the perspective of all stakeholders (bondholders, stockholders, and the government.) The economic effective tax rate on the project is $\frac{R-\rho}{R}$, denoted ϕ.

Proposition 1 derives the economic effective tax rate on the project under each regime.

Proposition 1: (a) Under the expensing regime, $\phi = \frac{\tau K}{K + N(1-\tau)} < \tau$.

(b) Under the capitalization regime, $\phi = \tau$.

The capitalization regime results in an economic effective tax rate equal to the statutory tax rate, regardless of the choices of K and N that maximize the value of the project. Relative to this outcome, the expensing regime yields a lower economic effective tax rate. The greater the level of investment in the internally developed intangible assets, the lower the economic effective tax rate under the expensing regime. This occurs because the returns to the capitalized tangible asset are fully taxed, whereas the returns to the expensed intangible assets are effectively tax-exempt.

In passing, we note that the *accounting effective tax rate*, defined as the ratio of tax expense to pretax financial accounting income, is often used as an indicator of tax-favored investments. In this setting, however, this measure is of no use whatsoever. The fact that the accounting information environment we study features book-tax conformity ensures that in every period, the accounting effective tax rate is τ, and is unaffected by the firm's mix of tangible and intangible assets. The fact that the accounting effective tax rate reveals book-tax differences instead of tax preferences motivates our search for a different measure.

3. Model of investment decisions

3.1 Investment in a full information environment

In this section, we develop and analyze a model that features the trade-off between tax considerations that increase private investment in intangible assets, and financial reporting considerations that decrease these investments. First, we develop a benchmark case in which the firm chooses investments K and N to maximize the present value of the after-tax cash flows that the project generates, discounted at the cost of capital ρ, less the after-tax cost of the investments. Financial reporting costs are absent in this benchmark case. We focus on the ratio of intangible investment to tangible investment under each tax regime. To do this, we impose additional structure on the problem by assuming that the firm has access to a Cobb-Douglas production technology of the form

$$f(K,N) = K^{\alpha} N^{\beta} \qquad (5)$$

with the productivity parameters $\alpha > 0$, $\beta > 0$, and $\alpha + \beta \leq 1$.

Proposition 2 characterizes the ratio $\frac{N^*}{K^*}$ associated with the solutions to the firm's maximization problem under the expensing regime characterized in (3) and the capitalization regime characterized in (4).

Proposition 2: In the full information environment:

(a) under the expensing regime, $\frac{N^*}{K^*} = \frac{\beta\rho}{\alpha(1-\tau)(\rho+\lambda)}$; and

(b) under the capitalization regime, $\frac{N^*}{K^*} = \frac{\beta\rho}{\alpha[\rho+\lambda(1-\tau)]}$.

A comparison of the investment ratios in proposition 2 shows that, not surprisingly, the fraction of investment in intangible assets is higher under the expensing regime than under the capitalization regime. Each ratio can be decomposed further into a ratio of two ratios, each featuring the productivity parameter of an asset divided by the after-tax cost of providing that asset. In each case, the tangible asset has a productivity parameter to after-tax cost ratio of $\frac{\alpha}{\rho}$; the cost of using the tangible asset is simply ρK because the asset does not depreciate. In each case, the intangible asset has a productivity parameter of β. Under the capitalization regime, the economic depreciation of the intangible asset is deductible, so the after-tax cost is $\rho+\lambda(1-\tau)$. Under the expensing regime, the after-tax cost is $(1-\tau)(\rho+\lambda)$. A comparison of the investment ratios shows that $\frac{N^*}{K^*}$ is higher under the expensing regime than under the capitalization regime by a factor of $1+\frac{\rho\tau}{(\rho+\lambda)(1-\tau)}$. The effect of the expensing regime on the investment ratio is increasing in the tax rate τ and the discount rate ρ, and is decreasing in the probability λ that the intangible assets will stop being productive.

3.2 Investment in an accounting disclosure environment

Having established the ratios of intangible to tangible investments in the full information environment under each tax regime, we turn to a model of firm investment behavior in a setting in which accounting measures of the firm's investment decisions are of first-order importance.

The tax and financial reporting system in this section has three properties. First, investments in internally developed intangible assets are expensed for tax purposes when the expenditure is made, i.e., the firm operates under the *expensing regime for tax purposes*. This treatment is consistent with the typical tax treatment of such expenditures. Second, the accounting system exhibits *book-tax conformity* in that the investments in internally developed intangible assets are also expensed for financial reporting purposes. Third, the accounting system exhibits *income aggregation* in that the accounting system reports period one pretax operating income of $y = x - N$, without providing a decomposition of y into its two components. Tax on operating earnings in period one is τy. So the accounting report issued at the moment that the first period operating cash flow is realized is a vector $(y(1-\tau), K)$, where the first element is the project's after-tax operating income and the second element is the project's tangible assets.

On date zero, the firm makes its investment choices. Investors do not observe these choices. On date one, four events occur. First, the firm receives its operating cash flow x and pays taxes of τx, retaining the difference. Second, the firm issues the accounting report $(y(1-\tau), K)$. Third, the current generation of investors sells its ownership interests to the next generation of investors. Current investors must sell their interests; competition among the next generation of investors forces the price to be equal to the present value of future cash flows that the project generates, conditional upon the accounting report. Fourth, the firm observes whether the project will generate cash flows in the future. If it will not, the project is abandoned and the tangible assets are sold for *K*.

To illustrate the importance of the aggregated income report of *y*, consider first the price *P* of the investors' claims (both bonds and stock) if the investors could observe the two components of *y*, *x* and *N*. If the investors knew *x*, they would know that expected future operating cash flows would continue to be *x* for as long as the assets were productive. Using this information, they would set the price of the claims to the firm's assets equal to

$$P = \lambda K + \sum_{j=1}^{\infty} \frac{[(1-\tau)x + \lambda K](1-\lambda)^j}{(1+\rho)^j} = \frac{x(1-\tau)(1-\lambda) + \lambda K(1+\rho)}{\rho + \lambda}. \qquad (6)$$

In this case, from the perspective of date zero, the present value of the project's future after-tax cash flows would be the sum of the expected price *P* from (6) and the expected date one after-tax cash flow, discounted one period. Because $E[x] = \mu q(K,N)$ this amount is

$$\frac{\mu(1-\tau)q(K,N)}{1+\rho} + \frac{(1-\tau)\mu q(K,N)(1-\lambda) + \lambda K(1+\rho)}{(\rho+\lambda)(1+\rho)} = \frac{(1-\tau)\mu q(K,N) + \lambda K}{\rho + \lambda}, \qquad (7)$$

which is the same as (2). So with a disaggregated accounting report, the firm would choose the investments on date zero consistent with proposition 1(a).

However, the inability of the investors to observe *x* creates a valuation problem on date one. Investors observe after-tax income $y(1-\tau)$ and tangible assets *K*. They know that $x = \frac{y}{1-\tau} + N$ and must infer x from the accounting report $\left(y(1-\tau), K\right)$. To do this, we assume that investors make a *conjecture* on date one that the firm invested θK in intangible assets on date zero.[2] Because y and K are reported on the firm's income statement and balance sheet, respectively, investors will infer that $x = \frac{y}{1-\tau} + \theta K.$ The value of θ is derived endogenously from the firm's objective of maximizing the present value of the date one operating cash flow plus the date one expected price less the after-tax cost of the investments. Of course, the conjectured value of θ must be consistent with the firm's equilibrium investment decisions.

The price on date one is

$$P = \frac{(1-\tau)(1-\lambda)E[x \mid y] + \lambda K(1+\rho)}{\rho + \lambda}. \tag{8}$$

Using the relations $x = \frac{y}{1-\tau} + \theta K$ and $y = (1-\tau)(x - N)$, (8) simplifies to

$$P = \frac{(1-\tau)(1-\lambda)(x - N + \theta K) + \lambda K(1+\rho)}{\rho + \lambda}. \tag{9}$$

On date zero, the firm maximizes the present value of the date one operating cash flow plus the date one expected price less the after-tax cost of the initial investments, yielding the following maximization problem.

$$\max_{K,N} \left\{ \frac{(1-\tau)\mu q(K,N)}{\rho + \lambda} - \frac{(1-\tau)(1-\lambda)(N - \theta K)}{(1+\rho)(\rho + \lambda)} - \frac{\rho K}{\rho + \lambda} - N(1-\tau) \right\} \tag{10}$$

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[2] Other conjectures are possible, so this equilibrium is not unique. If, for example, investors conjectured that the firm would choose $N = \eta$, the firm's investment choices would be different but the result would be qualitatively similar; the firm would underinvest in intangible assets compared to the full information case under the expensing regime.

Proposition 3 presents the firm's investment ratio in an accounting information disclosure environment under the expensing regime.

Proposition 3: In the accounting information environment and the expensing regime,

$$\frac{N^*}{K^*} = \theta = \frac{\beta\rho(1+\rho)}{(1-\tau)[\alpha(1+\rho+\rho^2+\rho\lambda)+\beta(1-\lambda)]}.$$

The effect of the accounting information system on the firm's investment ratio can be seen by dividing the investment ratio in proposition 3 by the investment ratio in proposition 2(a). In each case, the firm operates under the expensing tax regime. The difference is that the firm operates in the full information environment in proposition 3 but in the accounting information disclosure environment in proposition 2.

Comparing the investment ratio from proposition 3 to the investment ratio from proposition 2(a) shows that the accounting information environment decreases the investment ratio $\frac{N^*}{K^*}$ by a factor of $1-\frac{(\alpha+\beta)(1-\lambda)}{\alpha(1+\rho+\rho\lambda+\rho^2)+\beta(1-\lambda)}$. Financial reporting considerations induce firms to invest less in intangible assets relative to tangible assets. The key is aggregation in the accounting income statement. Because the financial reporting system subtracts investments in internally developed intangible assets from operating cash flows to arrive at net income, the firm responds to short-term incentives to boost stock price by underinvesting in intangibles assets. Note that investors are not being fooled here; the investment ratio that investors anticipate occurs in equilibrium. But a firm that chose, for example, the investment ratio from the full information environment in proposition 2(a) would drive down the value of the firm, as the unexpectedly high investment in intangibles would induce investors to underestimate the future operating cash flows *x*.

The effect of the accounting information environment on the investment ratio is exacerbated when λ is low or when ρ low. In either case, the first period operating cash flow becomes relatively less important than price, which increases the firm's incentive to underinvest in intangible assets on date zero. The effect is also exacerbated by a lower value of α or a higher value of β. The more important intangible assets are to the production process, the greater is the effect of accounting aggregation on the investment ratio.

Once the effect of accounting aggregation on the investment ratio is considered, the effect of the expensing regime becomes more nuanced. In the full information environment, the expensing regime induces overinvestment in intangibles relative to the capitalization regime. However, expensing can instead move the investment ratio toward the ratio in proposition 2(b) in the accounting information environment, as the tax incentives *for* intangible investment can mitigate the effects of accounting information aggregation *against* intangible investment. Proposition 4 summarizes these countervailing effects on investment ratios.

Proposition 4: The investment ratio $\frac{N^*}{K^*}$ under the expensing regime in the accounting information environment is higher than under the capitalization regime in the full disclosure environment if and only if $\left[\frac{\tau}{1-\tau}\right]\left[\frac{\alpha}{\alpha+\beta}\right] > \frac{1-\lambda}{\rho(1+\rho)}$.

Whether the firm invests too much or too little in intangible assets relative to tangible assets under the expensing regime and the accounting information environment compared to the capitalization regime and the full information environment depends on the terms $\frac{1-\lambda}{\rho(1+\rho)}$, $\frac{\tau}{1-\tau}$, and $\frac{\alpha}{\alpha+\beta}$. The first term reflects the importance of the first period cash flow compared to stock price. If it is high (that is, if cash flow is of great importance relative to price), then the firm will tend to underinvest in intangible assets in the accounting information environment, despite the tax advantage accorded intangible investments. The second term reflects the importance of taxes. The higher the tax rate, the more likely it is that the firm will overinvest in intangible assets in the accounting information environment under expensing. The tax term is multiplied by the term $\frac{\alpha}{\alpha+\beta}$. Therefore, the greater the importance of intangible assets, the less likely it is that the firm will overinvest in intangibles. Finally, when $\frac{1-\lambda}{\rho(1+\rho)} = \left[\frac{\tau}{1-\tau}\right]\left[\frac{\alpha}{\alpha+\beta}\right]$, the disclosure and tax effects are exactly offsetting, and the investment ratio in the accounting disclosure environment under the expensing regime is equal to the investment ratio in the full disclosure environment under the temporary capitalization regime.

Proposition 4 shows that the claim that the tax treatment of internally developed intangible assets leads to excess investment in intangible assets need not hold in the accounting information environment. If the appropriate benchmark is the investment ratio under the tax capitalization regime in the full information environment, then the expensing regime in the accounting information environment could lead to either overinvestment or underinvestment in intangible assets. For plausible values of the term $\frac{1-\tau}{\rho(1+\rho)\tau}$, however ($\approx 17$ if $\tau = 35\%$ and $\rho = 10\%$), either $\frac{\alpha}{\alpha+\beta}$ must be very close to zero or λ must be very close to one for the tax effect to outweigh the accounting information effect. In the context of our model, it is quite likely that the expensing of internally developed intangible assets just partially mitigates the much stronger effects of financial reporting on firms' incentives to make investments in internally developed intangible assets.

4. Model of the firm

In this section, we view the firm as an aggregation of projects and show the relations between firm value, book value, accounting earnings, and taxes. The firm at an arbitrary date zero consists of tangible and intangible assets with a book value of *K* and a market value $V = K[1+\theta(1-\tau)]$. Intangible capital decays at a constant rate λ; tangible capital does not decay. Intangible capital is replaced as it decays to preserve the equilibrium ratio θ of intangible to tangible capital. The firm increases its tangible capital and intangible capital at a constant rate *g*. The value of the firm's assets evolves in the following manner:

$$dV = gV\,dt + \sigma V\,dz \tag{11}$$

where *g* is the firm's growth rate due to reinvestment, σ is a variance parameter, and *dz* is the increment of a Wiener process. The firm's after-tax cash flows from operating and investment activities during the time interval *dt* are

$$\{[f(K,N)\mu - \theta K(\lambda+g)](1-\tau) - gK\}dt, \tag{12}$$

where the production function $f(K,N)$ exhibits constant returns to scale. The competitive equilibrium assumption requires

$$\begin{aligned}&\int_0^\infty e^{gt}\{[f(K,N)\mu - \theta K(\lambda+g)](1-\tau) - gK\}e^{-\rho t}\,dt\\&= K[1+\theta(1-\tau)],\end{aligned} \tag{13}$$

where ρ is the after-tax weighted average cost of capital associated with the firm's assets and capital structure. Equation (13) implies

$$\mu = \frac{K}{f(K,N)}\left[\frac{\rho}{1-\tau} + \theta(\lambda + \rho)\right]. \tag{14}$$

The competitive equilibrium assumption ensures that the after-tax rate of return is equal to the firm's cost of capital, ρ. The pretax rate of return R is the discount rate for which (13) holds when $\tau = 0$, which implies

$$R = \rho + \frac{\tau\rho}{(1+\theta)(1-\tau)}. \tag{15}$$

The economic effective tax rate, denoted ϕ, is the fraction of the pretax rate of return to equity that the government obtains via taxation.

$$\phi = \frac{R-\rho}{R} = \frac{\tau}{1+\theta(1-\tau)} = \frac{\tau K}{E[V]}. \tag{16}$$

We illustrate our model with the following example. A firm subject to a 35 percent tax rate invests \$8 million in a project on date zero. Half of the investment is in tangible capital and half is in intangible capital, so $\theta = 1$ and the after-tax cost of the initial investment is

$$\$4,000,000 + (1-.35)\$4,000,000 = \$6,600,000. \tag{17}$$

One third of the initial after-tax cost of the investment is provided by bondholders who receive 8 percent interest and two-thirds is provided by stockholders with a cost of equity capital of 13 percent, so

$$\rho = \frac{1}{3}\left[8\%(1-.35)\right] + \frac{2}{3}\left[13\%\right] = 10.4\%. \tag{18}$$

The project generates an expected pretax cash flow in perpetuity of $1,056,000; this amount includes the amounts needed to replace the intangible capital as it decays. The internal rate of return to all stakeholders is

$$R = \frac{\$1{,}056{,}000}{\$8{,}000{,}000} = 13.2\%. \qquad (19)$$

The expected annual cash flow is divided by paying $2,200,000 x 8% = $176,000 in interest to the bondholders; the government takes 35 percent of the remaining $880,000 of expected cash flow, leaving stockholders with an expected annual cash flow of $572,000, giving them their expected 13 percent annual return on their $4,400,000 equity investment. The project has an accounting effective tax rate of 35 percent because of book-tax conformity, but (16) implies an economic effective tax rate of about 21 percent.

5. Empirical estimation

Equation (16) implies that a way to estimate the economic effective tax rate is to multiply the statutory tax rate, τ, by the ratio of the book value of assets, *K,* to the market value of assets, V. This estimate is subject to measurement error because the market value of assets reflects the accumulated effect of the stochastic shocks to the value of the firm's assets, $\sigma V\, dz$. To mitigate the effects of measurement error, we focus on aggregate measures by industry of both the numerator and denominator.

For years 1988 through 2005, we calculate economic effective tax rates from (16) using accounting and stock price information to compute the ratio of book to market asset values and multiplying that ratio by the top corporate tax rate (34 percent for 1988-1992 and 35 percent for 1993-2005). We compute the market value of each firm's assets (V) by adding the market value of common equity to the difference between the book value of assets (B) and the book value of common equity. For example, to calculate the economic effective tax rate for the mining industry in 1988, we aggregate both the numerator and denominator across all firms in that industry in that year before taking our ratio measure.

Our final sample consists of 15,726 firms from the Compustat Industrial Annual File. We exclude 1,363 foreign firms, partnerships, and subsidiaries and 5,199 firms in untabulated industries. Table 1 reports the determination and industry makeup of the sample. We use the same industry classifications as in Barth et al. (1999).

Table 2 reports our empirical estimate of the economic effective tax rate, ϕ. Our results show that the average value of ϕ was 23 percent, during which time the top statutory rate was either 34 percent (1988-1992) or 35 percent (1993-2005). Our measure is consistent with the Dunbar and Sansing (2002) explicit tax rate measure of 26 percent. While immediate expensing of intangible assets does not lower a firm's accounting effective tax rate (because the investment is also expensed for financial reporting), investments in internally developed intangible assets are tax-favored in an economic sense because the timing of the deduction is available before the taxation of the income attributable to the investment. Accordingly, industries that use intangible capital face an economic effective tax rate that is lower than their accounting effective tax rate.

The economic effective tax rate differs across industries. By industry, our economic effective tax rates range from 10 and 33 percent. Industries with a relatively intensive use of intangible capital, such as R&D and advertising, face the lowest economic effective tax rates – pharmaceuticals (10 percent), chemicals (20 percent), food (16 percent), and computers (17 percent). Industries with a relatively intensive use of tangible capital face some of the highest economic effective tax rates – utilities (29 percent) and durables (25 percent).

Table 2 also shows a general decline in economic effective tax rates over time. On average the measure declines from 26 percent in 1988 to 21 percent in 2005. This is consistent with the growing importance of investments in intangible assets in the economy.

We can use our estimate of ϕ to estimate $\theta = \frac{N^*}{K^*}$ for our sample and for different industries. Rearranging terms in (16) yields

$$\theta = \frac{\tau - \phi}{\phi(1-\tau)}. \tag{20}$$

Using the statutory tax rate of 35 percent and our estimate of $\phi = 23$ percent implies that $\theta \approx 80$ percent for our sample. This suggests that our sample invests about $4 in internally developed intangible assets for every $5 invested in tangible assets. By industry, our estimate of θ ranges from a low of 9 percent for the financial services industry to a high of 385 percent for the pharmaceutical industry.

6. Conclusions

Our study of the tax and financial reporting issues associated with internally developed intangible assets yields two important insights. Because investors cannot distinguish between intangible investments and operating expenses in our model, managers have an incentive to underinvest in intangibles despite their favorable tax treatment. The net effect of financial reporting costs and tax benefits likely decreases the proportion of investment in intangible assets relative to a benchmark case in which such investments were capitalized and investors could distinguish intangible investments from operating expenses.

Second, we develop a tax preference measure that detects investments in intangible assets despite the fact they are expensed for both tax and financial reporting purposes. Our measure indicates that the economic effective tax rate was, on average, about 23 percent between 1988 and 2005. This rate varies substantially by industry, from a low of 10 percent for the pharmaceutical industry and a high of 33 percent for the financial services industry.

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Table 1
Sample Determination and Industry Distribution

	Panel Sample **1988-2005**
All firms on Compustat (Industrial Annual)	22,288
Partnerships, subsidiaries, foreign firms	1,363
Firms in untabulated industries	5,199
Final sample	15,726

Industry Distribution	**SIC**	**N**
Mining	1000-1999, excluding 1300-1399	445
Food	2000-2111	273
Textiles	2200-2790	598
Chemicals	2800-2824, 2840-2899	269
Pharmaceuticals	2830-2836	696
Extractive	2900-2999, 1300-1399	586
Durables	3000-3999, excluding 3570-3579 and 3670-3680	2,869
Computers	7370-7379, 3570-3579, 3670-3679	2,380
Transportation	4000-4899	839
Utilities	4900-4999	358
Retail	5000-5999	1,510
Insurance	6500-6999	748
Services	7000-8999, excluding 7370-7379	1,611
Financial	6000-6411	2,544

Table 2
Economic Effective Tax Rates
By Year and Industry

$\phi = (BVA/MVA)^* \tau$

Year	Mining	Food	Textile	Chemical	Pharmaceutical	Extractive	Durables	Computers	Transportation	Utilities	Retail	Insurance	Services	Financial	Mean ϕ
1988	.26	.20	.26	.25	.14	.28	.30	.23	.27	.31	.27	.30	.25	.34	.26
1989	.24	.18	.25	.23	.11	.25	.30	.25	.23	.29	.26	.29	.25	.33	.25
1990	.25	.17	.28	.24	.11	.26	.32	.26	.27	.30	.26	.32	.27	.34	.26
1991	.25	.16	.25	.22	.08	.26	.29	.24	.25	.28	.24	.30	.24	.33	.24
1992	.23	.16	.23	.21	.10	.25	.27	.23	.24	.28	.21	.30	.23	.32	.24
1993	.20	.18	.23	.20	.13	.25	.26	.21	.22	.29	.21	.27	.20	.33	.23
1994	.23	.19	.24	.20	.14	.25	.26	.21	.24	.31	.23	.28	.22	.34	.24
1995	.21	.16	.24	.19	.11	.23	.25	.17	.21	.30	.22	.27	.21	.33	.22
1996	.22	.15	.23	.18	.10	.21	.24	.15	.23	.30	.22	.26	.20	.32	.21
1997	.24	.12	.21	.16	.08	.19	.22	.13	.20	.28	.21	.25	.20	.31	.20
1998	.26	.12	.22	.16	.06	.20	.23	.10	.18	.28	.18	.30	.20	.31	.20
1999	.26	.15	.21	.17	.07	.19	.22	.07	.17	.31	.17	.31	.18	.32	.20
2000	.26	.14	.24	.20	.06	.18	.22	.09	.24	.28	.18	.30	.20	.31	.20
2001	.28	.16	.23	.20	.08	.21	.25	.12	.26	.30	.08	.30	.26	.32	.22
2002	.27	.17	.23	.18	.11	.24	.26	.16	.27	.32	.18	.31	.26	.33	.24
2003	.21	.17	.22	.17	.12	.22	.23	.14	.26	.30	.21	.28	.23	.32	.22
2004	.21	.17	.21	.17	.13	.21	.23	.14	.24	.29	.19	.27	.21	.32	.21
2005	.19	.17	.22	.18	.13	.19	.22	.14	.25	.28	.18	.27	.21	.32	.21
Mean ϕ	.24	.16	.23	.20	.10	.23	.25	.17	.23	.29	.21	.29	.22	.33	.23

Appendix

Proof of proposition 1: (a) From (3), the after-tax rate of return ρ under the expensing regime is

$$\rho = \frac{(1-\tau)[\mu q(K,N) - \lambda N]}{K + N(1-\tau)}. \tag{A1}$$

Setting $\rho = R$ and $\tau = 0$ yields the pretax rate of return

$$R = \frac{\mu q(K,N) - \lambda N}{K + N}. \tag{A2}$$

Substituting the values of ρ and R from (A1) and (A2) into $\frac{R-\rho}{R}$ yields the result.

(b) From (4), the after-tax rate of return ρ under the capitalization regime is

$$\rho = \frac{(1-\tau)[\mu q(K,N) - \lambda N]}{K + N}. \tag{A3}$$

Setting $\rho = R$ and $\tau = 0$ yields the pretax rate of return

$$R = \frac{\mu q(K,N) - \lambda N}{K + N}. \tag{A4}$$

Substituting the values of ρ and R from (A3) and (A4) into $\frac{R-\rho}{R}$ yields the result.

QED

Proof of proposition 2: (a) Differentiating (3) with respect to *K* and *N* yields the following first-order conditions where $\frac{\partial f(K,N)}{\partial K} = q_K$ and $\frac{\partial f(K,N)}{\partial N} = q_N$.

$$\frac{(1-\tau)\mu q_K}{\rho} = 1 \tag{A5}$$

$$\frac{\mu q_N}{\rho + \lambda} = 1 \tag{A6}$$

Setting the left-hand side terms from (A5) and (A6) equal to each other and substituting in the partial derivatives of (5) with respect to *K* and *N* yields the result.

(b) Differentiating (4) with respect to *K* and *N* yields the following first-order conditions.

$$\frac{(1-\tau)\mu q_K}{\rho} = 1 \tag{A7}$$

$$\frac{\mu q_N}{\rho + \lambda(1-\tau)} = 1 \tag{A8}$$

Setting the left-hand side terms from (A7) and (A8) equal to each other and substituting in the partial derivatives of (5) with respect to *K* and *N* yields the result.

QED

Proof of proposition 3:

Differentiating (10) with respect to *K* and *N* yields the following first-order conditions.

$$\frac{(1-\tau)\mu q_K(1+\rho)}{\rho(1+\rho)-\theta(1-\lambda)(1-\tau)}=1 \tag{A9}$$

$$\frac{\mu q_N(1+\rho)}{1+\rho+\rho^2+\rho\lambda}=1 \tag{A10}$$

(A9) and (A10) jointly imply

$$\frac{N^*}{K^*}=\frac{\beta[\rho(1+\rho)-\theta(1-\lambda)(1-\tau)]}{\alpha(1-\tau)(1+\rho+\rho^2+\rho\lambda)}. \tag{A11}$$

The investors' conjecture that $N=\theta K$ must be confirmed in equilibrium, which implies

$$\theta=\frac{\beta\rho(1+\rho)}{(1-\tau)[\alpha(1+\rho+\rho^2+\rho\lambda)+\beta(1-\lambda)]}. \tag{A12}$$

Substituting the value of θ from (A12) into (A11) yields the result.

QED

Proof of proposition 4: Dividing the investment ratio from proposition 3 by the investment ratio from proposition 2(b) and simplifying yields the result.

QED