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, the economic effective tax rate. This measure reflects both investments in intangible assets and the use of debt financing, neither of which generates book-tax differences. Our measure indicates that the economic effective tax rate was about 16 percent between 1988 and 2005, when the statutory tax rate was either 34 or 35 percent. On average, about two-thirds of the difference between our measure and the statutory tax rate is attributable to intangible assets and about one-third is attributable to the use of debt financing. Both the effect of intangible assets and the use of debt financing on our measure vary across industries.

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1. Introduction

We investigate two consequences of the immediate expensing of investments in internally developed intangible assets for both tax and financial reporting purposes. First, we present a model in which both the tax advantages and financial reporting disadvantages of immediate expensing affect firm investment decisions. We show that the optimal mix of investment in tangible and intangible assets could be inefficiently high or low relative to a benchmark case in which intangible assets had neither tax advantages nor financial reporting disadvantages. This setting illustrates the tradeoff between tax incentives and financial reporting considerations, and shows how financial reporting disadvantages can offset tax advantages of investments in intangible assets.

Second, we propose a measure of the extent to which a firm's activities are tax-favored when those activities do not generate book-tax differences. The accounting literature on the measurement of tax preferences has focused on the accounting effective tax rate, the ratio of tax expense to pre-tax book income (Gupta and Newberry 1992; Shevlin and Porter 1992), or on related measures driven by book-tax differences (Wilkie 1992; Wilkie and Limberg 1993). When a firm's activities are treated similarly in its tax and financial reports, 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 measure reflects the extent to which a firm's activities are tax-favored due to investments in intangible assets and the use of debt financing. Both investments in intangible assets and interest payments are expensed for both tax and financial reporting purposes. Accordingly, these activities do not reduce the firm's accounting effective tax rate, but they do reduce the government's claim on the firm's pre-tax cash flows. Our measure, which we call the economic effective tax rate, reflects the effects of investments in intangible assets and debt financing on a firm's tax burden that traditional financial accounting measures fail to capture. We estimate that firms faced an average economic effective tax rate of about 16 percent between 1988 and 2005, during which time the statutory rate was either 34 or 35 percent.

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) provides an overview of the economic, accounting and taxation issues associated with intangible assets.

Our interpretation of intangible assets is an expansive one. An intangible asset is a claim to future benefits that does not have a physical or financial embodiment (Lev 2001, 5). We distinguish investments in intangible assets from operating expenses, which consist of direct labor, direct materials, manufacturing overhead, marketing and administrative expenses that support current-period revenues with no direct effect of future cash flows (Kanodia, Sapra and Venugopalan 2004, 96). While intangible assets include legally protected intellectual property such as patents, it is not limited to what would be regarded as property in a legal sense. It includes firm-specific human capital of the workforce and organizational capital such as Wal-Mart's computerized supply chain.

Consistent with this view, we measure the value of a firm's intangible property indirectly, by taking the difference between the market value of the claims to the firm's assets and the book value of the firm's assets. Given our expansive definition of intangible assets, it is not plausible to estimate the value of a firm's stock of intangible capital directly by estimating, for example, a time series of R&D or advertising expenditures as in Fullerton and Lyon (1988). Using our approach, we estimate that approximately one-third of the value of firm assets in our sample consists of internally developed intangible assets.

The literatures in public finance economics and financial accounting frame investments in intangible assets in very different ways. Public finance economists note that the ability to expense investments in intangible assets when made provides them with an effective tax rate of zero, which represents a substantial departure from tax neutrality (Gravelle 1994, 209). Therefore, public finance economists generally claim that a zero effective tax rate may induce excessive private investment in intangible assets.[1]

Fullerton and Lyon (1988) show that effective tax rate measures that exclude the taxation of intangible capital are misleading. In an analysis restricted to investments in R&D and advertising, they estimate the effect of expensing these investments for the 1983 tax year. They estimate that about 11 percent of the assets in their sample were associated with intangible assets. Our higher figure of about 34 percent reflects both our more expansive view of intangible assets and the later time period that we study (1988-

[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.

2005). More recent corporate tax policy debates surrounding tax incentives and corporate investment have focused on this increasing importance of intangible assets, and the fact that these assets are already being expensed under current law. Both Neubig (2006) and Sullivan (2006) point out that tax incentives that offer immediate expensing or accelerated depreciation of investments in tangible property are less desirable than tax rate reductions because so many investments in internally developed intangible assets are already expensed under current law.

The financial accounting literature, in contrast, largely reflects a view that regarding investments in intangible assets as expenses rather than assets induces underinvestment. Lev (2001, 95) argues that the inability of investors to distinguish operating expenses from investments in intangible assets creates an information asymmetry that raises the cost of capital from such investments, thereby deterring them. Kanodia and Mukherji (1996) and Kanodia et al. (2004) develop this idea in formal models of firm investment decisions when capital market participants cannot distinguish operating expenses from expenditures on internally developed intangible assets. These models show that the nonobservability of intangible investments creates an incentive for the firm to cut back on these investments relative to a world where investors can disentangle intangible investments and operating expenses.

In section 2 we extend the model developed by Kanodia et al. (2004) to show how the interaction of tax and financial reporting treatment of investments in intangible assets has countervailing effects on a firm's investments in intangible assets relative to tangible assets. In section 3 we derive a measure of tax preferences by modeling the firm as a collection of projects that feature both tangible and intangible investments that are in part financed with tax-favored debt. In section 4 we estimate our measure for U.S. firms between 1988 and 2005. Section 5 concludes. All proofs are in the appendix.

2. Economic model of the tension between tax and financial reporting

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, has a mean of μq and a variance of σ^2. On each date j 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 in computing taxable income under Internal Revenue Code §165 when the project is abandoned. Under the *expensing regime*, the firm takes a tax deduction for the full amount of the investment N on date zero.

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 project'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

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

From equations (3) and (4), we can see that the expensing regime is more favorable than the capitalization regime. We show this by comparing the after-tax cost of the intangible investment under the expensing regime $N(1-\tau)$ to the after-tax cost of the intangible investment under the capitalization regime $N\left(1-\frac{\tau\lambda}{\rho+\lambda}\right)$.

2.2 Investment in a full information environment

Next we consider the trade-off between tax considerations that induce private investment in intangible assets, and financial reporting considerations that deter these investments. First, we develop a benchmark case in which investors can disentangle investments in intangible assets from operating expenses, and therefore, the financial reporting disincentive to invest in intangibles is absent. We refer to this as the *full information environment*. 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 after-tax weighted average cost of capital ρ, less the after-tax cost of the investments. We focus on the ratio of intangible investments to tangible investments 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

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

with the productivity parameters $\alpha > 0$, $\beta > 0$, and $\alpha + \beta < 1$. This functional form is consistent with the idea that investments in intangible assets and investments in tangible asset are made to support each other.

Proposition 1 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 1: 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 1 shows that 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, only 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 $1+\frac{\rho\tau}{(\rho+\lambda)(1-\tau)}$. Therefore, $\frac{N^*}{K^*}$ under the capitalization regime multiplied by $1+\frac{\rho\tau}{(\rho+\lambda)(1-\tau)}$ is equal to $\frac{N^*}{K^*}$ under the expensing regime. The difference between the investment ratio under the expensing regime and the investment ratio under the capitalization regime is increasing in the tax rate τ and the after-tax weighted average cost of capital ρ, and is decreasing in the probability λ that the intangible assets will stop being productive.

2.3 Investment in an accounting information 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 which we collectively refer to as the *accounting information environment*. 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 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 pre-tax operating income of $y = x - N$. The accounting report does not provide a decomposition of y into its two components, where x is the firm's date one operating cash flow and N is the firm's date zero investment in intangible assets. The tax on date one is τy. The accounting report issued at the moment that the first period operating cash flow is realized is a vector $\left(y(1-\tau), K\right)$, where the first element is the project's after-tax operating accounting 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 $\left(y(1-\tau), K\right)$. 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' ownership interests 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 intangible assets were productive. Using this information, they would set the price of the claims to the firm's assets on date one 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. Using the relation $E(x) = q(K,N)$, this amount is

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

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, on date one, investors face a valuation problem because of their inability to observe *x*. Investors observe after-tax income $y(1-\tau)$ and tangible assets *K*. They know that $x = y + N$ 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 $x = y + \theta K$. 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 its investments. Of course, the conjectured value of θ must be consistent with the firm's equilibrium investment decisions.

The price on date one is

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

Using the relation $E(x \mid y) = y + \theta K$, (8) simplifies to

$$P = \frac{(1-\tau)(1-\lambda)(y + \theta K) + \lambda K(1+\rho)}{\rho + \lambda}. \quad (9)$$

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. Using the relation $y = \mu f(K,N) - N$ yields the following maximization problem:

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

Proposition 2 presents the firm's investment ratio in the accounting information environment.

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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 environment under the expensing regime.

Proposition 2: In the accounting information environment,

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

The effect of the accounting information environment on the firm's investment ratio can be seen by dividing the investment ratio in proposition 2 by the investment ratio in proposition 1(a). In each case, the firm operates under the expensing regime. The difference is that the firm operates in the full information environment in proposition 1(a) but in the accounting information environment in proposition 2.

By comparing the investment ratios, $\frac{N^*}{K^*}$ from proposition 2 is smaller by a factor of $1-\frac{(\alpha+\beta)(1-\lambda)}{\alpha(1+\rho+\rho\lambda+\rho^2)+\beta(1-\lambda)}$ than $\frac{N^*}{K^*}$ from proposition 1(a). Therefore, the financial reporting treatment of investments in intangible assets induces firms to invest less in intangible assets relative to tangible assets. The key is aggregation in the financial reports. Because the income statement subtracts investments in internally developed intangible assets (*N*) from operating cash flows (*x*) to arrive at net income (*y*), the firm responds to short-term incentives to boost stock price by underinvesting in intangible 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 1(a) would drive down the date one 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 on firms' incentives to invest in intangible assets becomes more nuanced. In the full information environment, the expensing regime induces a higher ratio of intangible to tangible assets relative to the ratio under the capitalization regime. However, expensing can instead move the investment ratio toward the ratio in proposition 1(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 3 summarizes these countervailing effects on the investment ratio.

Proposition 3: The investment ratio $\frac{N^*}{K^*}$ under the accounting information environment is higher than under the capitalization regime in the full information 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 in 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 date one stock price relative to the date one operating cash flow. If it is high (that is, if the first period operating cash flow is of little importance relative to stock 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. The tax term is multiplied by the term $\frac{\alpha}{\alpha+\beta}$, which reflects the relative importance of tangible assets on output. 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 tax and financial accounting effects are exactly offsetting, and the investment ratio in the accounting information environment is equal to the investment ratio in the full information environment under the capitalization regime. In other words, the tax incentives to invest in intangible assets are completely mitigated by financial reporting disincentives to invest in intangible assets.

Overall, proposition 3 says 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 $\frac{N^*}{K^*}$ under the capitalization regime in the full information environment, then the accounting information environment could lead to either overinvestment or underinvestment in intangible assets.

3. Tax preference measure

In this section, we propose a tax preference measure that reflects the tax advantages of investments in intangible assets and the tax advantages of debt financing. In each case, the tax benefit does not change the firm's *accounting effective tax rate*, defined as the ratio of tax expense to pre-tax financial accounting income. This rate is often used as an indicator of tax-favored investments. In this setting, however, this measure is of no use whatsoever. Immediate expensing of both investments in internally developed intangible assets and interest payments for financial accounting and tax purposes ensures that in every period, the accounting effective tax rate is τ in our model. This measure is unaffected by both the firm's use of funds (i.e., mix of tangible and intangible assets) and its source of funds (i.e., mix of debt and equity). The fact that the accounting effective tax rate reveals *book-tax differences* instead of *tax preferences* motivates our search for a different measure, which we call the *economic effective tax rate.*

On date zero, the firm invests K dollars in tangible assets and N dollars in intangible assets. Intangible assets decay at a constant rate λ; tangible assets decay at a constant rate δ. Both types of assets are replaced as they decay. Investments in intangible assets are expensed for tax purposes when made; investments in tangible assets are capitalized when made and depreciated at their rate of economic decay δ. Therefore, the after-tax cost of the initial investment is $K + N(1-\tau)$ and the book value of the firm's assets is K. The firm generates expected after-tax cash flows from its investments of $(1-\tau)\left[\mu f(K,N) - \delta K - \lambda N\right]$ per unit of time. This cash is distributed to debt holders in the form of interest and equity holders in the form of dividends.

The value of the firm's assets is equal to the value of the firm's debt (*D*) plus the value of the firm's equity (*E*). The firm operates in an environment in which the value of the firm's debt and equity is equal to the after-tax cost of its investments.[3] Debt holders are paid the risk-free rate of interest, *r*, which is deductible when determining the corporate income tax. The interest payments between equity holders and debt holders do not affect firm value, but the tax savings generated from the interest deductions provide the equity holders with a risk-free stream of cash flows of $\tau rD.$ The after-tax cost of risky equity capital if the firm were an all-equity firm is ρ. Therefore,

$$\int_0^\infty (1-\tau)[\mu f(K,N)-\delta K-\lambda N]e^{-\rho t}dt+\int_0^\infty \tau rDe^{-rt}dt \\ =K+N(1-\tau)=E+D. \tag{11}$$

Equation (11) implies

$$\rho=\frac{(1-\tau)[\mu f(K,N)-\delta K-\lambda N]}{E+D(1-\tau)}. \tag{12}$$

The pre-tax rate of return *R* is the discount rate for which the present value of future pre-tax cash flows from the investments to all stakeholders (i.e., debt holders, equity holders, and the government) equals the pre-tax cost of the investments.

$$\int_0^\infty [\mu f(K,N)-\delta K-\lambda N]e^{-Rt}dt=K+N. \tag{13}$$

Equation (13) implies

$$R=\frac{\mu f(K,N)-\delta K-\lambda N}{K+N}. \tag{14}$$

[3] This implies that the firm does not earn abnormal expected returns on its investments. A setting in which the firm earns abnormal expected returns on certain identified assets can be recharacterized as one in which the firm owns additional unidentified assets. Our definition of intangible assets is an expansive one.

The economic effective tax rate ϕ for the firm represents one minus the private after-tax rate of return as a percentage of the total pre-tax rate of return. Using (12), (14), and using the relation that $K + N(1-\tau) = E + D$ implies

$$\phi = \frac{R-\rho}{R} = \frac{\tau(K-D)}{E+D(1-\tau)}. \tag{15}$$

This expression can be decomposed into two parts. The first part removes the effect of the tax deductibility of interest expense from both the numerator and denominator. This represents the effect of the deductibility of investments in intangible assets. The second term represents the effect of debt financing on the economic effective tax rate.

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

We illustrate our model with the following example. A firm subject to a 35 percent tax rate invests \$121 million in a project on date zero. The investment in tangible capital *K* is \$81 million and the remainder is in intangible capital *N* so the after-tax cost of the initial investment is

$$\$81{,}000{,}000 + \$40{,}000{,}000(1-.35) = \$107{,}000{,}000. \tag{17}$$

The initial after-tax cost of the investment is provided by equity holders who provide \$87,000,000 and the remaining \$20,000,000 by debt holders who receive the risk-free rate of 6 percent. The cost of equity capital for an all-equity investment is 15.73 percent. The project generates an expected pre-tax cash flow in perpetuity of \$24,200,000; this amount includes amounts needed to replace tangible and intangible capital as they decay. The internal rate of return to all stakeholders is

$$R = \frac{\$24{,}200{,}000}{\$121{,}000{,}000} = 20\%. \tag{18}$$

Debt holders and equity holders together invest $107,000,000, receiving a risky after-tax expected cash flow of $24,200,000 (1 − .35) = $15,730,000 and a risk-less cash flow of $20,000,000 (.06) (.35) = $420,000 from the tax deduction for interest expense. The present value of the risk-less future tax savings is $420,000 / .06 = $7,000,000. Using (12),

$$\rho = \frac{\$15{,}730{,}000}{\$100{,}000{,}000} = 15.73\%. \tag{19}$$

The economic effective tax rate is

$$\phi = \frac{R - p}{R} = \frac{20\% - 15.73\%}{20\%} = 21.35\%. \tag{20}$$

Finally, we need to show that our example is consistent with the idea that the firm's after-tax rate of return is equal to its after-tax weighted-average cost of capital. Because the projects generate an annual expected after-tax operating cash flow of $15.73 million and have an initial after-tax cost of $107 million, the weighted average after-tax cost of capital must be 14.7 percent. The cost of capital associated with the $107 million initial investment has three elements. First, $7 million associated with the present value of future tax deductions related to interest expense is funded by risk-less equity with a discount rate of 6 percent. Second, the $20 million funded by bondholders has an after-tax cost of 6% (1 - 35%) = 3.9%. Third, the cost of equity would have been 15.73 percent if the project were funded with all equity, which represents the risk-free rate of 6 percent plus an equity premium of 9.73 percent. Funding $20 million of the project with debt and $80 million with risky equity implies that the cost of risky equity must be 18.16 percent, as the same amount of risk is now borne by 20 percent less risky equity and

$6\% + \frac{9.73\%}{.8} = 18.16\%.$ Therefore, the weighted average after-tax cost of capital for the

firm is

$$\frac{(6\% \text{ x } \$7) + (3.9\% \text{ x } \$20) + (18.16\% \text{ x } \$80)}{\$107} = 14.7\%, \tag{21}$$

as required.

4. Empirical estimation

In this section, we estimate our tax preference measure that we derive in (15) for the time period 1988 through 2005. *K* is the book value of the firm's assets. *D* is the book value of the firm's short-term and long-term debt. *E* is the market value of the firm's equity plus the book value of its non-interest bearing liabilities.[4] τ is the top corporate tax rate of 34 percent for 1988-1992 and 35 percent for 1993-2005. Firm-level estimation of this measure is subject to measurement error because the market value of the firm's equity *E* reflects both the expected value of the firm's investments and the accumulated effects of stochastic shocks to the firm's stock price over time. To mitigate the effects of measurement error, we estimate economic effective tax rates in (15) by using aggregate measures of *K*, *D* and *E* by industry for each year.

Our 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).

[4] In Compustat, K is defined as data6; D is defined as data9 + data34; E is defined as data25*data199+data6-data60-data9-data34. For financial firms, interest bearing debt (included in our measure of D) also includes data53 from the annual bank file (i.e., bna).

Table 2 reports our empirical estimate of the economic effective tax rate ϕ. We tabulate the mean ϕ for each industry and for each year in the sample and we show the decomposition of our measure as in (16). The column denoted *A* is the economic effective tax rate considering only investments in intangible assets, ignoring the effect of the tax deductibility of interest payments. The column denoted *B* shows the effect of debt financing on our economic effective tax rate measure.

Our results show the average value for ϕ of 16 percent, during which time the top statutory rate was either 34 percent (1988-1992) or 35 percent (1993-2005). The average economic effective tax rate considering only the mix of tangible and intangible assets is 22 percent, while the use of debt financing further reduces the average economic effective tax rate by 6 percentage points.

While immediate expensing of intangible assets does not lower a firm's accounting effective tax rate, these investments are tax-favored relative to investments in tangible capital because the timing of the tax deduction is available before the taxation of the income attributable to the investment. By industry, the economic effective tax rates in column *A* range from 10 percent to 29 percent. Industries with a relatively intensive use of intangible capital 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).

While the expensing of interest payments in both tax and financial reports does not lower a firm's accounting effective tax rate, debt financing is tax-favored relative to equity financing because payment to equity holders are not tax deductible. The effect of debt financing on the economic effective tax rate also varies by industry. Industries with a relatively intensive use of intangible capital also use less debt financing in their capital structure. Table 2 shows that the smallest effects of debt financing on the economic effective tax rate occur in the pharmaceutical and computer industries, with a 2 and 3 percentage point decrease, respectively. Some of the largest effects of debt financing on the economic effective tax rate occur in industries with a relatively high use of tangible capital such as durables and utilities, with an 8 and 9 percentage point decrease. We conjecture that this relation exists because firms with high levels of intangible assets relative to tangible assets have limited collateral against which to borrow, making debt financing potentially more costly than firms with a significant tangible asset base. The use of debt financing appears to play a more significant role relative to intangible assets in reducing the economic effective tax rate for firms in the insurance and financial services industries.

Table 2 also shows a general decline in the economic effective tax rate ϕ over time. On average the measure declines from 19 percent in 1988 to 15 percent in 2005. This downward trend is consistent with the growing importance of intangible assets in the economy from 1988 through 2005. Additionally, investments in intangible assets play a more significant role over time relative to debt financing in reducing the economic effective tax rate below the statutory rate.

Our study is similar in spirit to Dunbar and Sansing (2002), who examine the ratio of tax expense to the pre-tax market return on equity. The approach in this paper uses the level 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. Our results suggest an average economic effective tax rate, ignoring the effects of debt financing, of about 23 percent between 1992 and 1996, while the Dunbar and Sansing (2002) explicit tax rate measure is 26 percent over the same time period.

5. 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 could increase or decrease the proportion of investment in intangible assets relative to a benchmark case in which such investments were capitalized for tax purposes and investors could distinguish intangible investments from operating expenses. These findings suggest that the financial reporting treatment of investments in intangible assets mitigates the tax incentives that encourage such investments.

Second, we develop a tax preference measure that detects investments in intangible assets and the use of debt financing, which are both tax-favored but do not generate book-tax differences. Our measure indicates that the economic effective tax rate was, on average, about 16 percent between 1988 and 2005. This rate varies substantially by industry, from a low of 9 percent for the pharmaceutical industry and a high of 21 percent for financial services firms. Additionally, we find that the effect of debt financing on the economic effective tax rate is smaller for firms with relatively high levels of intangible assets relative to tangible assets. These findings suggest accounting-based tax preference measures fail to reflect important tax preferences.

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Table 1
Sample Determination and Industry Distribution

Sample Determination	**N**
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	**Standard Industrial Classification**	**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

$$\phi = \frac{R-\rho}{R} = \frac{\tau K}{E+D} - \frac{\tau D(E+D-\tau K)}{(E+D)[E+D(1-\tau)]}$$

$$(A) \qquad\qquad (B)$$

The column denoted A reflects our economic effective tax rate measure considering only the mix of tangible and intangible assets held by the firms in our sample. The column denoted B reflects the effect of debt financing on our economic effective tax rate measure.

Industry	ϕ	*A*	*B*
Mining	.18	.23	.06
Food	.12	.16	.05
Textile	.17	.23	.06
Chemical	.15	.20	.05
Pharmaceutical	.09	.10	.02
Extractive	.18	.23	.04
Durables	.18	.25	.08
Computers	.14	.17	.03
Transportation	.17	.24	.06
Utilities	.20	.29	.09
Retail	.16	.21	.05
Insurance	.16	.29	.13
Services	.16	.22	.06
Financial	.21	.33	.12
Mean	**.16**	**.22**	**.06**

Year	ϕ	*A*	*B*
1988	.19	.26	.07
1989	.18	.25	.07
1990	.19	.26	.07
1991	.17	.24	.07
1992	.17	.23	.07
1993	.17	.23	.06
1994	.18	.24	.06
1995	.16	.22	.06
1996	.15	.21	.06
1997	.14	.20	.06
1998	.14	.20	.06
1999	.14	.20	.06
2000	.14	.20	.06
2001	.16	.22	.06
2002	.16	.24	.07
2003	.16	.22	.06
2004	.15	.21	.06
2005	.15	.21	.06
Mean	**.16**	**.22**	**.06**

Appendix

Proof of proposition 1: (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 $\frac{\partial f(K,N)}{\partial N} = q_N$.

$$\frac{(1-\tau)\mu q_K}{\rho} = 1 \tag{A1}$$

$$\frac{\mu q_N}{\rho + \lambda} = 1 \tag{A2}$$

Setting the left-hand side terms from (A1) and (A2) 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.

$$\frac{(1-\tau)\mu q_K}{\rho} = 1 \tag{A3}$$

$$\frac{(1-\tau)\mu q_N}{\rho + \lambda(1-\tau)} = 1 \tag{A4}$$

Setting the left-hand side terms from (A3) and (A4) 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 2:

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

$$\frac{(1-\tau)\mu q_K(1+\rho)}{\rho(1+\rho)-\theta(1-\lambda)(1-\tau)}=1 \qquad \text{(A5)}$$

$$\frac{\mu q_N(1+\rho)}{1+\rho+\rho^2+\rho\lambda}=1 \qquad \text{(A6)}$$

(A5) and (A6) jointly imply

$$\frac{N^*}{K^*}=\frac{\beta[\rho(1+\rho)-\theta(1-\lambda)(1-\tau)]}{\alpha(1-\tau)(1+\rho+\rho^2+\rho\lambda)}. \qquad \text{(A7)}$$

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

$$\theta=\frac{\beta\rho(1+\rho)}{(1-\tau)[\alpha(1+\rho+\rho^2+\rho\lambda)+\beta(1-\lambda)]}. \qquad \text{(A8)}$$

Substituting the value of θ from (A8) into (A7) yields the result.

QED

Proof of proposition 3: Dividing the investment ratio from proposition 2 by the investment ratio from proposition 1(b) and simplifying yields the result.

QED