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An Application of the Scholes and Wolfson Model to Examine the Relation Between Implicit and Explicit Taxes and Firm Market Structure

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ABSTRACT

A firm can take advantage of preferential tax provisions to lower its explicit tax burden. In the absence of market frictions, this differential tax treatment gives rise to differences in pre-tax returns across investments, defined as an implicit tax (Scholes and Wolfson 1992). Market structures that are other than perfectly competitive can impede the realization of implicit taxes (which represent lower pre-tax returns) by allowing firms to earn extra-normal after-tax returns (Wilkie 1992). This study estimates implicit tax rates and investigates the relation between a firm's implicit tax rate and two factors: (1) the pre-tax rate of return, and, (2) the potential market power of the firm, which could provide the opportunity to shift implicit (and explicit) tax burdens from the firm to consumers or labor. The results indicate that implicit taxes are significantly negatively related to the pre-tax rate of return and firm market structure characteristics. The interaction of pre-tax returns and firm market structure characteristics is positively related to implicit taxes, indicating that firm market structure may lead to a weakening of the strict negative relation between implicit taxes and pre-tax returns.

In a perfectly competitive market in equilibrium, all investments, at the margin, bear the same total tax rate. This tax rate is the sum of explicit taxes, those taxes paid to the taxing authority, and implicit taxes, those taxes that arise from pre-tax returns that vary from the tax-neutral equilibrium. The implication for tax policy is that even though a taxpayer may have a low explicit tax rate, that taxpayer will bear an offsetting implicit tax burden. Therefore, the taxpayer's total tax burden will not differ from that of other taxpayers that incur higher explicit taxes, but have correspondingly lower implicit taxes. However, this equilibrium total tax, including the implicit tax,

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may only be observable in a frictionless market (Scholes and Wolfson 1992) (hereafter referred to as S&W).

Market structures that are not perfectly competitive can impede the realization of implicit taxes by allowing firms to earn extra-normal after-tax returns (Wilkie 1992). Taxes are borne by one or more of three constituencies of the firm: capital providers (through profitability), consumers (through changes in price), and labor (through changes in wages or employment levels) (Pechman 1985). If increases (decreases) in tax burdens are to be borne by capital providers, firms do not change prices or adjust costs in response to tax changes. However, if a tax increase (decrease) is to be shifted away from capital providers and to consumers and/or labor, prices must be increased (decreased) and/or labor or other costs must be decreased (increased). In any case, firm pre-tax income will be affected. Therefore, firms' pre-tax returns are affected by two tax phenomena: the implicit tax that results when explicit taxes differ from the top statutory tax rate due to the use of tax preferences, and the potential ability to shift explicit and implicit taxes away from capital providers and to consumers or labor.

Tax policy makers often appear to be mainly concerned with explicit taxes. However, any analysis of tax effects on after-tax returns and cash flows must also consider implicit taxes to provide a complete picture of the total tax burden.

Previous research has examined the ability of firms within certain industries to capture the benefits of explicit tax savings rather than incurring an offsetting implicit tax cost. Shackelford (1991) examined financial institutions lending to employee stock ownership plans. Stickney et al. (1983) examined the costs and benefits of the tax-transfer leasing rules for a specific firm, General Electric, and its leasing subsidiary. Both studies provide evidence that when markets are other than perfectly competitive, reductions (increases) in explicit taxes may not be equally offset by increases (reductions) in implicit taxes.

An example of this potential is provided by the defense contract industry. Prior to 1987, defense contractors were able to use the completed contract method of accounting for tax purposes. This allowed the deferral of significant amounts of income and thus provided a large explicit tax savings (see Wheeler and Outslay 1986). These firms would have been expected to pay a large amount of implicit taxes in the form of lower contract prices they would have been expected to charge the Defense Department. However, if the defense contract market was not fully competitive, the defense contractors may have been able to capture some of the explicit tax savings for themselves (S&W 1992, 98). Therefore, market structure may have provided the opportunity to decrease the overall tax burden through the ability to affect prices.

The motivation for this study is to investigate whether implicit tax rates are related to market structure characteristics of a firm that indicate a firm's market power. Market power can provide the opportunity for firms to exercise some degree of control over prices and costs, rather than accepting market-driven prices. In this study, two market power variables are used: (1) a firm's industry market concentration ratio and (2) a firm's market share. The implication for tax policy is that evidence of a relation between implicit taxes and market structure could indicate that levels of total taxes borne by firms are affected by other than just their ability to use tax preferences. Tax burdens may also be affected by these market structure characteristics. Thus, this factor should be taken into account when examining total tax burdens.

This study has two primary objectives. The first objective is to estimate a firm's implicit tax rate based on the S&W (1992) model using financial statement information. The second objective is to investigate the relation between a firm's estimated implicit tax and two factors: (1) the firm's pre-tax rate of return, and (2) the market power of the firm as measured by market concentration and firm market share. Because firms operate in other than perfect markets, the relation between implicit tax rates and market power characteristics of firms operating in imperfect markets is examined. It is expected that pre-tax rate of return and the two market variables are negatively related to the estimated implicit tax rate.

The results of this study indicate a negative relation between firms' estimated implicit tax and their pre-tax rates of return. A negative relation between the estimated implicit tax and firms' market power characteristics, market concentration and firm market share, is also observed. Estimated implicit taxes are also related to the interaction of pre-tax returns and firms' market structure

characteristics. These findings suggest that the relation between implicit taxes and pre-tax rates of return is affected by the market structure in which the firm operates. The implication of these findings is that policy makers should examine the effects of explicit tax changes not only to the extent that the use of tax preferences lowers explicit taxes, but also in relation to the effects on pre-tax returns. This examination should take into account that inter- and intra-industry firm differences, other than just tax preferences, may affect tax burdens.

The remainder of the paper is organized as follows. First, a review of the literature on implicit taxes and industrial organization theory is presented. Second, a model to derive implicit tax rates from financial statement data is developed. Third, hypotheses regarding the relation between pre-tax rates of return and implicit taxes and firm market characteristics are presented. Finally, the results are analyzed and conclusions, limitations, and directions for future research are discussed.

LITERATURE REVIEW

The Scholes and Wolfson Model of Total Taxes

The S&W (1992) model defines total tax burden as follows:

$$\begin{aligned}\text{Total Tax Burden} &= \text{Implicit Tax} + \text{Explicit Tax} \\ &= (R_b - R_a) + (R_a - r^*) \\ &= R_b - r^*, \end{aligned} \tag{1}$$

where:

R_b = the risk-adjusted before-tax return on a fully taxable investment,
R_a = the risk-adjusted before-tax return on an alternative investment, and
r^* = the common after-tax return.

Implicit (IMPRATE) and explicit (EXPRATE) tax rates are calculated as follows:

$$\text{IMPRATE} = (R_b - R_a)/R_b, \text{ and} \tag{2}$$

$$\text{EXPRATE} = (R_a - r^*)/R_b. \tag{3}$$

Where $R_a = R_b$, the alternative investment is fully taxable and there is no implicit tax. By definition, the total tax rate equals the top statutory tax rate. Both rates are calculated as a percentage of the pre-tax return on a fully taxed investment. Therefore, explicit and implicit tax rates are perfectly inversely related.

A basic assumption of the S&W (1992) model, as presented above, is perfectly competitive markets. There are no transaction, monitoring, or information costs associated with engaging in any particular investment activity and there is costless entry/exit into capital markets. The risk-adjusted after-tax returns of all investments are equal and no one firm has the ability to affect prices. Therefore, prices (and thus, pre-tax returns) are set by the market and assets that are taxed differently will have different before-tax returns (as a result of the cost of the investment being bid up or the rate of return being bid down). Specifically, as explicit taxes increase (decrease), pre-tax returns increase (decrease) to maintain the after-tax equilibrium return.

This specification of the model assumes that the supply of tax-favored investments is inelastic (or fixed). In the short run, this is generally true since it takes time for producers of such investments to increase production in response to increased demand and price. Over the longer run, supply will increase (become more elastic) in response to the increased demand and price. However, demand for tax-favored investments is elastic only in the domain where taxpayers can obtain additional tax benefits from additional purchases of those investments. Once the ability to obtain additional tax benefits is reached, demand will become inelastic. Therefore, over the long run, a new equilibrium point will be obtained at a higher equilibrium price, reflecting this new level of supply and demand.

Concurrently, demand for non-tax-favored investments is decreasing and thus the price is being bid down for those investments. Over the long run, this results in a decrease in supply and the setting of a new equilibrium price, lower than the old equilibrium price. Therefore, although the model assumes short-run inelasticity of supply, the relations posited reflect long-run equilibrium conditions.

Tax Measures and Firm Characteristics

A firm's explicit tax rate is determined by the interaction of the extant tax law and the firm's operating, investment and financing decisions. This explicit tax rate differs from the top statutory tax rate to the extent that a firm's activities provide opportunities to take advantage of certain tax provisions. These tax provisions show up as differences between financial and tax accounting income. Researchers and tax policy analysts have used various measures of explicit tax burdens to examine equity and efficiency issues. However, while recent studies have acknowledged the presence and potential effects of implicit taxes, there has been little attempt to measure implicit taxes.

One of the more commonly used measures of explicit tax burden is the average effective tax rate (ETR), generally defined as the ratio of taxes to income. Specific definitions of the ETR measure vary across studies in the accounting and public finance literature, but one commonly used definition is the ratio of current tax expense (CTE) to pre-tax book income (PTI).[1]

ETRs vary across industries due to the uneven distribution of the effects of tax provisions (also referred to as subsidies or incentives), such as accelerated depreciation methods and percentage depletion (Siegfried 1974; Gupta and Newberry 1992). Wilkie (1988) found that ETRs not only vary with levels of tax preferences, but are also affected by variations in income.

Zimmerman (1983) found a positive, though not strictly monotonic, relation between firm size and level of ETRs. This relation was explained by the political cost hypothesis that holds that larger firms will bear higher political costs than smaller firms. However, Porcano (1986) found that the largest firms tended to have the lowest ETRs, with average ETRs, in general, well below the statutory rate. Kern and Morris (1992) replicated and extended Zimmerman (1983) and Porcano (1986) and found that by the mid-1980s there was no longer a significant difference between large and other firms, either across industries or within one-digit SIC categories. Zimmerman's (1983) "size effect" appeared to be more of an "industry effect," with only a few industries driving the results (notably, the oil industry).

These studies provide evidence of a relation between certain firm characteristics—in particular firm size—and levels of explicit tax, and propose that this relation may be driven by the differential inter-industry availability and use of tax preferences. However, the studies provide conflicting results, leading to the conclusion that it may be other more specific characteristics of a firm—related to firm size—that actually are related to levels of explicit taxes. Further, none of these studies examines the implicit tax cost associated with use of tax preferences. It may be that these firms pay an implicit tax for the explicit tax benefits.

Wilkie (1992) and Wilkie and Limberg (1993) developed an alternative measure to the ETR for the evaluation of relative tax burdens. The tax subsidy (TS) is defined as pre-tax book income (PTI) times the statutory tax rate (t) less current tax expense (CTE): $TS = (PTI \times t) - CTE$. The tax subsidy is the difference between a firm's current explicit tax liability and the explicit tax due had the firm's pre-tax accounting income been taxed at the highest statutory tax rate. Tax subsidies arise when accounting treatment differs for financial statement and tax purposes. These differences can be due to timing (for example, use of different depreciation methods) or permanent differences (for example, tax-exempt income or use of tax credits). This measure is scaled by stockholder's equity (SE) to derive the tax subsidy on equity ($TSE = TS/SE$), which can be compared across firms and over time.

Wilkie (1992) was motivated by the methodological problems involved with the use of average ETRs and the existence of implicit taxes. The study provides evidence of an inverse relation between pre-tax returns and tax subsidies, a result consistent with the implicit tax hypothesis. The relation was weaker than predicted (and the negative relation was not consistent across all years). Wilkie (1992) suggested that the somewhat weak results may be due to market frictions in an imperfect economy or to systematic measurement error.

Shackelford (1991) examined the shifting of tax benefits due to market frictions. Financial institutions were able to exclude from taxable income one-half of the interest income generated

[1] For a detailed discussion of the different definitions and their effects on research results, see Callihan (1994).

from loans to employee stock ownership plans (ESOPs), thus lowering their explicit tax rate on this income. This exclusion was enacted to encourage employee ownership by providing incentives to financial institutions to lend money for this purpose and to provide a lower cost of capital for ESOP loans. This lower cost of capital, as a result of lower interest rates, represents the implicit taxes paid by financial institutions to the borrower (ESOPs). The results showed that the interest rates charged by the lending institutions were not as low as they would have been in a perfectly competitive market, after considering the interest income exclusion.

Stickney et al. (1983) investigated the costs and benefits of tax-transfer leasing by examining the financial statements of General Electric and its leasing subsidiary. The tax-transfer leasing rules enacted by the Economic Recovery Tax Act of 1981 (ERTA), also known as the "safe-harbor leasing" rules, allowed certain leasing arrangements for tax purposes, even though they had no economic substance other than the transfer of tax benefits. The analysis showed that the price paid for tax benefits received did not fully reflect a lower pre-tax return proportionate to the level by which explicit taxes were reduced.

The results of these studies provide evidence of income tax shifting which may be related to market factors other than firm size. An investigation of firm market structure characteristics provides evidence of such factors while addressing the assumptions and restrictions of the basic S&W model.

Noncompetitive Market Structures and Tax Shifting

The structure-conduct-performance paradigm (S-C-P) of industrial organization theory provides a framework for examining the relation between market structure, ability to affect prices, and firm performance.[2] The basic premise of this paradigm is that the market structure within which a firm operates (competitive or noncompetitive markets) determines its conduct in that market (pricing behavior, advertising strategies, etc.) which, in turn, affects its performance (profitability and/or economic efficiency) (Mason 1939).[3]

A product market consists of a group of firms that offer products that are good substitutes for one another in the eyes of the buyer.[4] Markets are classified into four categories: perfect competition, monopolistic competition, oligopoly and monopoly (Scherer and Ross 1990). These categories of markets are defined with reference to market structure, conduct and performance characteristics.

At one end of the continuum is the monopolistic market.[5] Its structure consists of one seller. Therefore, that seller has considerable ability to affect prices and may be able to earn excessive profits.

In an oligopolistic market there are few sellers. Under this structure, sellers recognize that their pricing conduct is interdependent, so price collusion, either explicit or tacit, may occur (Chamberlin 1933). Therefore, the small group of firms exercise power over pricing collectively.

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[2] In this study, we focus on product markets for three reasons. The first reason is that it is difficult to categorize firms by input markets. This is because there is little publicly available information available to perform this type of categorization (Scherer and Ross 1990). Second, by examining the product side we actually are indirectly examining the input side since the input side for one firm (the buyer) is the product side for the other firm (the supplier). Third, examination of buyer concentration in specific industries has found that buyer concentration is generally lower than seller concentration. Further, where buying power exists it is generally enjoyed by firms that also enjoy large seller market shares (e.g., Wal-Mart) or in more concentrated industries (e.g., automobile industry as a buyer of tires) (Scherer and Ross 1990).

[3] Industrial organization research generally involves regression of variables representing market structure characteristics on a profitability measure such as the price-cost margin or Tobin's q ratio (see Schmalensee and Willig [1989] for an extensive review of the theories and empirical research in this area).

[4] Firms can also affect pre-tax returns by lowering costs. Monopolistic buying power provides the opportunity to effect this type of activity.

[5] Even though four categories are defined, market structure is more correctly described as a continuum where firms are classified "relative" to other firms based on the applicable market structure characteristics (Scherer and Ross 1990).

Under monopolistic competition, the number of sellers is greater than in an oligopolistic market, making it more difficult to practice price collusion. As the number of rivals grows, it is harder to coordinate this information. Additionally, a greater number of firms means there will be greater diversity of firm market shares within the industry. This makes it harder for the various firms to come to agreement on prices (Scherer and Ross 1990). Therefore, firms in this type of market have less ability to affect price, even collectively, and so generally earn only a normal profit.

On the other end of the continuum is perfect competition. There are many sellers with little or no ability to set prices; they are basically price-takers. Therefore, sellers in this type of market can expect, at best, to earn a normal profit.

In the context of taxes, the ability to affect prices and costs afforded by operating within a less-than-competitive market provides the ability to capture explicit tax savings at the firm level, without suffering the offsetting reduction in pre-tax returns (lower prices or higher costs) that otherwise would be predicted by the S&W (1992) model.

A key element of product market structure is the number of sellers in the market. This characteristic is commonly measured using a market concentration ratio. This measure is calculated by dividing the total sales of the top firms within a Standard Industrial Classification (SIC) code industry by the total sales for that industry (therefore, markets are defined in the domain of the product market). Sales of the top four, eight or 20 firms have been used to derive this measure with the most widely used measure being the four-firm concentration ratio (Scherer and Ross 1990, 71). The larger the ratio, the larger is the percentage of sales in an industry made by the top four firms within that industry, and thus the more highly concentrated is the industry. A monopolistic firm has a concentration ratio of 1.0, while firms in more competitive markets have lower ratios than those in oligopolistic markets. The concentration ratio is a proxy for the level of price collusion power within an industry and is useful in examining between-industry differences in profitability (Clarke et al. 1984).

Most industries are comprised of a number of firms of different size. Therefore, an individual firm's position within that industry, its market share, is also a market structure variable, which may affect a firm's conduct. A firm's market share can be measured by dividing total sales of that firm by total sales within the firm's industry. The higher this ratio, the greater is a firm's market share. Firms with higher market share are those firms that have exhibited superior efficiency, either through the ability to contain costs and/or the ability to differentiate their product within the industry (Clarke et al. 1984).

This study focuses on market structure from the seller side (product markets) of market power. But market power can also arise on the buyer side (input markets). Our product market emphasis is consistent with the body of industrial organization research in this area and is mainly due to the lack of publicly available quantitative data for input markets, analogous to seller concentration ratios and firm sales data. Analysis of input market concentration indicates that concentration is generally much lower than product market concentration. Further, firms that possess buying power tend to be firms that rank high on product-market-side market structure characteristics such as concentration and market share (Scherer and Ross 1990). Finally, by examining the product side of the market, we are indirectly examining the input side since the seller is also a buyer and any pricing power the firm has should be reflected in the pre-tax rate of return (since those returns reflect both prices and costs). Therefore, results must be interpreted keeping in mind that the market power variables may include the effects of both product and input markets.

ESTIMATION OF IMPLICIT TAXES

The S&W (1992) model provides a framework for the measurement of implicit taxes. Financial statement data measures of R_{bi}, R_{ai}, and r_i^* for firm I are derived as follows:

$$R_{bi} = \frac{(PTI_i - CTE_i)/(1 - t)}{SE_i} \tag{4}$$

$$R_{ai} = \frac{PTI_i}{SE_i} \tag{5}$$

$$r_i^* = \frac{PTI_i - CTE_i}{SE_i} \tag{6}$$

where,

PTI_i = pre-tax income of the ith firm,

CTE_i = current tax expense of the ith firm,

SE_i = stockholders' equity of the ith firm,[6] and

t = the top statutory tax rate.[7]

Conceptually, $((PTI_i - CTE_i)/(1 - t))/SE$, (equation (4)), represents the pre-tax return that would have been earned by the firm had it invested only in fully taxable assets: after-tax income ($PTI_i - CTE_i$) grossed up (by dividing by $1 - t$) to the fully taxable pre-tax rate of return, divided by stockholders' equity (SE_i). The difference between this term and the actual pre-tax rate of return of the firm (PTI_i/SE_i) represents the implicit tax borne by the firm, as described in the S&W (1992) model.

Therefore, implicit and explicit taxes are defined as follows:

$$IMPLICIT_i = \frac{(PTI_i - CTE_i)/(1 - t)}{SE_i} - \frac{PTI_i}{SE_i} = \frac{(PTI_i \times t - CTE_i)/(1 - t)}{SE_i}, \tag{7}$$

$$EXPLICIT_i = \frac{PTI_i}{SE_i} - \frac{PTI_i - CTE_i}{SE_i} = \frac{CTE_i}{SE_i}. \tag{8}$$

By substituting the above definitions into equations (2) and (3), implicit and explicit tax rates are derived, after simplification (SE drops out since all numerators and denominators are divided by SE), as follows:

$$IMPRATE = \frac{(PTI_i - CTE_i)/(1 - t) - PTI_i}{(PTI_i - CTE_i)/(1 - t)}, \tag{9}$$

$$EXPRATE = \frac{CTE_i}{(PTI_i - CTE_i)/(1 - t)}. \tag{10}$$

Pre-tax returns are affected by the level of risk of an investment. For example, bonds bearing the same stated interest rate and principal repayment amounts are priced differently based on the level of default risk associated with the issuer of each bond. The bonds carrying a higher default risk sell for a lower price. Therefore, to isolate the tax effects on pre-tax returns, these returns must be adjusted for differences in risk across the investments. This is reflected in the definitions of the variables in the S&W (1992) model. However, unlike the S&W (1992) model, equations

[6] Data definitions are as follows (Compustat item numbers in parentheses): PTI = Pre-tax income plus minority interests and income tax expense minus equity in unconsolidated subsidiaries (#18 + #49 + #16 − #55); CTE = Income tax expense minus deferred tax expense (#16 − #50); SE=Common stockholders' equity plus preferred stock and deferred taxes, minus investments in unconsolidated subsidiaries (#60 + #130 + #35 − #31).

[7] Using the top statutory tax rate in these equations is based on the assumption that the marginal investor has a marginal explicit tax rate equal to the top statutory tax rate. The value of t would be different under different assumptions for the marginal explicit tax rate of the marginal investor.

(4) through (10) involve differencing pre-tax returns within a firm to calculate that firm's explicit and implicit tax rates rather than comparing a firm's return to that of another benchmark investment which may have a different level of risk associated with it. Therefore, risk adjustment of returns is not required when using equations (4) through (10) to calculate explicit and implicit tax rates by firm (see appendix for an example and further explanation).

One problem encountered with using the implicit and explicit tax rate measures of the S&W (1992) model (equations (9) and (10)) is that they are directly inversely related and, thus, total tax will always equal the top statutory tax rate. To provide for a relaxation of the perfect competition assumption, the measure of implicit taxes shown in equation (7) is used as the dependent variable in the current study. Although negatively correlated with explicit tax, this equation does not force the sum of implicit and explicit tax to equal the statutory tax rate. The denominator in equation (7) is consistent with Wilkie (1992) and Wilkie and Limberg (1993), in their derivation of the tax subsidy on equity (TSE) measure.[8] This equation also addresses the bias problems found in the measurement of explicit taxes using ETRs when current tax expense (CTE) is not highly correlated with pre-tax returns (PTI) (Wilkie 1988).

To get a better understanding of what IMPLICIT is measuring, we further examine the definition of the numerator of IMPLICIT provided in equation (7). For this purpose, we define current tax expense as follows: CTE = (PTI − X) t, where X is defined as the difference between economic and tax income (arising from both timing and permanent differences, and including tax credits), which is the amount of tax preferences (or costs in cases where the tax preferences are less than the tax costs, such as nondeductible expenses included in PTI). Substituting this definition into equation (7) provides the following after simplification (dropping out SE):

$$\text{IMPLICIT} = [(\text{PTI} - (\text{PTI} - \text{X})t)/(1 - t)] - \text{PTI}. \tag{7a}$$

Rearranging terms results in the following:

$$\text{IMPLICIT} = [(1 - t)\,\text{PTI} + \text{X}t/(1 - t)\,] - \text{PTI}, \tag{7b}$$

$$\text{IMPLICIT} = \text{X}t/(1 - t). \tag{7c}$$

Therefore, IMPLICIT is the amount of tax preferences multiplied by the tax rate and then grossed up to a pre-tax value. In other words, it is the pre-tax value of the tax savings arising from the use of tax preferences. The measure is not dependent on PTI, except to the extent that X is correlated with PTI. Therefore, IMPLICIT is the theoretical amount of implicit tax (decrease in pre-tax returns) that would be observed in a perfectly competitive and frictionless economy to offset the explicit tax savings (X_t) realized due to the use of tax preferences (X).

This definition of implicit taxes is a combination of "potential" implicit taxes and "actual" implicit taxes. It measures "potential" implicit taxes to the extent that it is measuring the amount of implicit taxes that would arise under perfect market conditions, an unobservable condition. It represents "actual" implicit taxes to the extent that the financial statement data used to construct the variable already has impounded any effects of possible shifting of taxes away from the taxpayer. To the extent that it is measuring potential taxes, the measure is expected to be negatively related to pre-tax returns. To the extent that market power allows firms to shift taxes, this measure of implicit taxes is expected to be negatively related to market structure characteristics.

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[8] $$\text{IMPLICIT} = \frac{(\text{PTI}_i - \text{CTE}_i)/(1 - t) - \text{PTI}_i}{(\text{PTI}_i - \text{CTE}_i)/(1 - t)}$$

$$\text{TSE} = \frac{(\text{PTI}_i \times t - \text{CTE}_i)}{\text{SE}_i}$$

The numerators of the above definitions of implicit taxes can be reconciled as follows:

$$\begin{aligned}(\text{PTI} - \text{CTE})/(1 - t) - \text{PTI} &= \text{PTI} - \text{CTE} - \text{PTI}(1 - t)\\ &= \text{PTI} - \text{CTE} - \text{PTI} + \text{PTI} \times t\\ &= (\text{PTI} \times t) - \text{CTE}\end{aligned}$$

HYPOTHESES

The second objective of this study is to examine the relation between a firm's estimated implicit tax rate and its pre-tax rate of return and the firm's market structure characteristics. In perfect markets, as explicit taxes increase (decrease), pre-tax returns increase (decrease), and, in turn, implicit taxes decrease (increase) (S&W 1992). Therefore, the following hypothesis tests the relation between a firm's estimated implicit tax and that firm's pre-tax rate of return (all hypotheses are stated in the alternative form):

H_1: There is a negative relation between a firm's pre-tax rate of return and the firm's estimated implicit tax.

The S-C-P paradigm posits that firms in more highly concentrated industries have a greater ability to affect prices due to greater possibilities for collusive pricing behavior. This ability to affect price could affect the level of the pre-tax rate of return and, in turn, the level of implicit taxes that a firm actually bears. The four-firm concentration ratio provides a measure of industry concentration. The following hypothesis is proposed to examine the relation between a firm's estimated implicit tax and the firm's market power deriving from industry membership:

H_2: There is a negative relation between the four-firm market concentration ratio of a firm's industry and the firm's estimated implicit tax.

A firm's market share serves as a proxy for the firm's intra-industry market power that may derive from efficiency or product differentiation advantages (Shepherd 1986). The S-C-P paradigm predicts that this aspect of market structure could lead to higher levels of profitability. This could also lead to the ability to shift implicit taxes. The following hypothesis tests for a relation between this firm characteristic of market power and the estimated implicit tax:

H_3: There is a negative relation between a firm's market share within its industry and the firm's estimated implicit tax.

The preceding hypotheses assume that the relation between pre-tax rates of return and estimated implicit taxes will be the same at all levels of firm market structure characteristics. However, firms in more highly concentrated industries may be better able to lower their implicit tax burden. This will decrease the level of the negative relation predicted by H_1 between pre-tax rates of return and implicit taxes and would be expected if market power provides the opportunity for a firm to lower its implicit tax burden. Therefore, the following interaction hypothesis is tested:

H_4: There is a positive relation between the interaction of a firm's market concentration ratio and its pre-tax rate of return and the firm's estimated implicit tax.

Similarly, a firm with a high market share may be better able to lower its implicit tax burden due to its relatively greater market power. This will decrease the level of the negative relation predicted by H_1 between pre-tax rates of return and implicit taxes. Therefore, the following interaction hypothesis is tested:

H_5: There is a positive relation between the interaction of a firm's market share within its industry and its pre-tax rate of return and the firm's estimated implicit tax.

Sample

The sample includes all firms listed in the 1992 Compustat Annual Industrial Tape for the sample years 1982, 1987 and 1988, except the following:

1) firms in SIC code categories 0000–1999 (agriculture, natural resources, construction), SIC code categories 4000–4999 (public utilities and other regulated nonfinancial firms), and SIC code categories 6000–6999 (banks, insurance companies, and other financial firms);
2) foreign firms;
3) firms with missing financial statement or Census information for any year, and;
4) firms with negative stockholders' equity.

The sample years were chosen based on availability of market concentration ratios. The first and third exclusions eliminate firms for which Census data are not provided and firms in industries where regulatory or government authorities either set pricing or interfere with the market by restricting entry, thus distorting the relation of price and quantity which would exist in competitive markets. Further, some of these firms do not disclose sufficient information for calculation of the empirical variables used in this study (for example, banks do not disclose deferred tax expense). Missing data are also the reason for the second and third exclusions. The fourth exclusion eliminates firm data that would provide uninterpretable results. Within each two-digit SIC category, there are several different industries.[9] Because of the broadness of the two-digit code, the analysis is done at the four-digit SIC code level. Table 1 provides details of the sample selection process and table 2 provides a breakdown of the final sample by broad industry categories.

Independent Variables

Pre-tax rate of return (PTROE) is calculated by dividing a firm's pre-tax income (PTI) by its stockholder's equity (SE). Both PTI and SE are obtained from the Compustat data. PTI equals pre-tax income plus minority interests and income tax expense minus equity in unconsolidated subsidiaries. SE equals common stockholders' equity plus preferred stock and deferred taxes minus investments in unconsolidated subsidiaries.

Market concentration ratios (CR4) are calculated by the Census Bureau every five years, for years ending in 2 or 7. The data used in this study are for the years 1982 and 1987 (U.S. Department of Commerce 1992, 1990a, 1990b, 1990c, 1986, 1985a, 1985b, 1985c). Many of the tax law changes resulting from the Tax Reform Act of 1986 were only partially effective in 1987. Therefore, 1988 is also examined to determine if results for 1987 could be confounded by the transitional nature of the tax laws in effect for 1987. Market concentration ratios are assumed to be the same for 1987 and 1988.

[9] For example, SIC category 20, Food and Kindred Products, when broken down into three- or four-digit SIC codes includes meat packing plants, chewing gum, wines, manufactured ice, and fresh and frozen packaged fish.

TABLE 1
EFFECT OF SAMPLE SELECTION PROCEDURES ON SAMPLE SIZE

	Procedure	Sample
1.	All firm-years on 1992 Compustat Annual Industrial Tape for 1982, 1987 and 1988 years	7851
2.	Delete foreign firm-years	(555)
3.	Delete firm-years for which Census data is not provided (SIC codes 0 – 1999)	(462)
4.	Delete public utilities and other regulated nonfinancial firm-years (SIC codes 4000–4999)	(978)
5.	Delete financial institutions and insurance firm-years (SIC codes 6000–6999)	(1491)
6.	Delete firm-years with missing financial statement information	(3044)
7.	Delete firm-years for which matching Census data was not available	(636)
8.	Delete firm-years with negative stockholders' equity	(10)
9.	Total sample	675
10.	Sub-sample of firm-years with net operating losses	(95)
11.	Sub-sample of firm-years without net operating losses	580

TABLE 2
SAMPLE COMPOSITION BY GENERAL INDUSTRY CATEGORY

SIC Code[a]	Industry Category Description	Number of Firm-Years
20	Food and kindred products	12
21	Tobacco products	3
22	Textile mill products	17
24	Lumber and wood products	10
25	Furniture and fixtures	3
26	Paper and allied products	31
27	Printing and publishing	25
28	Chemicals and allied products	66
29	Petroleum and coal products	21
30	Rubber and misc. plastics products	16
32	Stone, clay and glass products	6
33	Primary metal industries	20
34	Fabricated metal products	20
35	Industrial machinery and equipment	76
36	Electronic and other electric equipment	58
37	Transportation equipment	39
38	Instruments and related products	71
39	Misc. manufacturing industries	12
50	Durable goods—wholesale	40
51	Nondurable goods—wholesale	14
57	Furniture and home furnishings stores	8
58	Eating and drinking places	17
59	Drugs and proprietary stores	18
70	Hotels and other lodging places	7
73	Business services	45
80	Health services	11
87	Engineering, management and related services	9
	TOTAL	675

[a]This information is presented at the two- rather than the four-digit SIC code category level to provide information about the general industry composition without listing the over 100 different industries represented in the four-digit SIC sample used in this research.

Firm i's market share within its industry (MS) is measured as the ratio of the firm's sales to total sales within its industry. The numerator (firm net sales) is obtained from Compustat (data item # 12) while the denominator (total sales for the firm's industry) is obtained from the U.S. Commerce Department Census data.[10]

[10] The Compustat database provides the net sales of the firm, as reported in the firm's financial statements. This database includes only firms listed on major stock exchanges. The Census data is based on survey information from a more inclusive sample of firms in an industry. There may be discrepancies between these databases with regard to SIC classification of a particular firm. However, because of the limited sample of firms included on Compustat, use of the Compustat data for the denominator would result in some industries showing a MS = 1.00 for firms in industries where there is clearly competition, for example, video tape rentals (SIC class 7840, CR4 = 0.055). Therefore, Census data was used to derive the denominator of MS.

Control Variables

Two year variables, YEAR87 and YEAR88, are included to control for differences in tax rates across the sample years. The Tax Reform Act of 1986 made significant changes in tax laws that broadened the tax base while lowering the tax rate. The IMPLICIT variable employs a tax rate in the definition. Since this rate is decreasing from 1982 to 1987 and 1988, the IMPLICIT variable is expected to decrease across these years accordingly (see equation 7c). The IMPLICIT variable is also expected to decrease due to broadening of the tax base that eliminated certain tax provisions that give rise to implicit taxes.

Regression Model

The following regression model is used to test H_1 through H_5 (predicted signs are indicated below each variable):

$$IMPLICIT_i = \beta_0 + \beta_1 PTROE_i + \beta_2 CR4_i + \beta_3 MS_i + \beta_4 PTROE_i{*}CR4_i + \beta_5 PTROE_i{*}MS_i + \beta_6 YEAR87_i + \beta_7 YEAR88_i + \varepsilon,$$

where:

$PTROE_i$ = firm i's pre-tax rate of return,
$IMPLICIT_i$ = IMPLICIT for firm i,
$CR4_i$ = market concentration ratio for firm i's industry,
MS_i = firm i's sales as a percentage of total sales of firm i's industry,
$PTROE_i{*}CR4_i$ = interaction term, $PTROE_i$ times $CR4_i$,
$PTROE_i{*}MS_i$ = interaction term, $PTROE_i$ times MS_i,
$YEAR87_i$ = 1 if year is 1987, 0 if year is 1982 or 1988,
$YEAR88_i$ = 1 if year is 1988, 0 if year is 1982 or 1987, and
ε = error term.

RESULTS

Descriptive statistics for the full sample are shown in table 3, panel A. Because the sample is drawn from Compustat, the firms tend to be large, with total assets ranging from $0.867 to $74,293 million, with a mean of $1,334 million. IMPLICIT ranges from −1.452 to 1.703, with a mean of −0.5% of stockholders' equity. A negative IMPLICIT indicates that a firm paid explicit taxes above the top statutory rate. This can occur when reductions in explicit tax due to the use of tax preferences are outweighed by items that increase taxes (for example, investment tax credit recapture, plant closure cost reserves, foreign and state taxes, reversal of prior year tax preference items).[11]

Tax rates calculated for firm years with NOL carryforwards include current year tax effects and the effects of NOLs generated in other years. This can distort the comparison of relative tax advantage across firms (Wilkie and Limberg 1993, 57). To determine whether this subset of firms introduces any bias into the analysis, the model is also tested excluding firms with NOL carryforwards. Descriptive statistics for the sub-sample of firm-years without current year NOL carryforwards are provided in panel B of table 3. The mean of IMPLICIT is slightly higher in the sub-sample excluding NOL firms, but otherwise, the composition of the sub-sample is similar to that of the full sample.

A correlation matrix is shown in table 4. The IMPLICIT variable is significantly positively correlated with PTROE, but the correlation is low (correlation coefficient = 0.153, p = 0.01) and

[11] IMPLICIT is defined using stockholders' equity (SE) in the denominator while more traditional measures of explicit taxes (ETRs) usually use some definition of pre-tax income (PTI) in the denominator. To examine the IMPLICIT measures derived in this study in relation to ETRs, we look at the relation between SE and PTI. Average SE is equal to $631 million while average PTI is equal to $104 million. Therefore, if PTI had been used in the denominator, average IMPLICIT would have been about −3.0% of PTI. The range of IMPLICIT with PTI as the denominator would also be larger than when using the SE denominator.

TABLE 3
DESCRIPTIVE STATISTICS (in millions)

	Mean	Standard Deviation	Median	Minimum	Maximum
Panel A: All Firm-Years, n = 675					
IMPLICIT	−0.005	0.143	0.002	−1.452	1.703
PTROE	0.169	0.325	0.186	−2.177	5.160
CR4	0.314	0.172	0.290	0.030	0.920
MS	0.067	0.117	0.022	0.0001	0.849
Total Assets	1334	5620	164.600	0.867	74293
Total Sales	1612	6974	225.054	0.780	97173
SE	631.048	2901	81.629	0.106	42592
PTI	103.921	567.752	12.293	−4703	7811
CTE	41.412	196.034	3.640	−287	2960
Panel B: Firm-Years Without NOLs, n = 580					
IMPLICIT	−0.012	0.106	0.007	−0.516	1.703
PTROE	0.208	0.285	0.197	−0.646	5.160
CR4	0.315	0.173	0.290	0.040	0.920
MS	0.069	0.121	0.022	0.0001	0.849
Total Assets	1307	5690	165.401	0.867	74293
Total Sales	1573	7002	232.156	2.102	97173
SE	642.730	3032	87.207	0.106	42592
PTI	118.987	563.747	14.564	−666.400	7811
CTE	40.201	193.504	4.989	−287	2960

Definition of Variables:

PTROE = pre-tax accounting income as a percentage of stockholders' equity
IMPLICIT = [((PTI − CTE)/(1 − t)) − PTI]/SE
CR4 = ratio of sales of top four firms in the four-digit SIC code industry to total sales in that industry
MS = ratio of firm I's sales to total sales in the firm's four-digit SIC code industry
Total Assets = Compustat data item #6.
Total Sales = Compustat data item #12.
SE = Common stockholders' equity plus preferred stock and deferred taxes, minus investments in unconsolidated subsidiaries
PTI = Pre-tax income plus minority interests and income tax expense minus equity in unconsolidated subsidiaries
CTE = Income tax expense minus deferred tax expense (#16 − #50)

is probably due to use of PTI in the numerator of the definition of both variables. The independent variable PTROE is correlated with MS (correlation coefficient = 0.091, p = 0.05), but not with CR4. CR4 and MS are significantly correlated (correlation coefficient of 0.295, p = 0.01), but this correlation is low. All of the variables are significantly correlated with size (proxied either by total assets or total sales), although the only economically meaningful correlation is between firm size and MS (correlation coefficients of 0.770 and 0.807 with total assets and total sales, respectively). This is as expected given the definition of MS (firm sales/total industry sales).

Results of the hypotheses tests are shown in table 5. The analysis is based on a procedure called monotonic regression, a nonparametric method of regression analysis (see Conover [1980] and Conover and Iman [1981] for a detailed description of this method). The percentile ranks of the independent variables are regressed on the percentile ranks of the dependent variable. Percentile

TABLE 4
CORRELATION ANALYSIS

	IMPLICIT	PTROE	CR4	MS	Total Assets
IMPLICIT					
PTROE	0.153*				
CR4	0.004	0.027			
MS	0.072	0.091**	0.295*		
Total Assets	0.126*	0.104*	0.197*	0.770*	
Total Sales	0.095**	0.172*	0.193*	0.807*	0.949*

Spearman rank correlations.
*Significant at the 0.01 level.
**Significant at the 0.05 level.

Definition of Variables:
IMPLICIT = [((PTI − CTE)/(1 − t)) − PTI]/SE
PTROE = Pre-tax accounting income as a percentage of stockholders' equity
CR4 = Ratio of sales of top four firms in the four-digit SIC code industry to total sales in that industry
MS = Ratio of firm I's sales to total sales in the firm's four-digit SIC code industry

ranks are calculated by sorting the variables in ascending order and assigning percentile ranks. Then a simple linear regression model and parametric statistical methods are employed to analyze the data. Monotonic regression can provide evidence of a monotonic, rather than a strictly linear, relation between the independent and the dependent variables. Nonparametric methods are almost always appropriate and are generally more efficient than parametric methods when the data are not normally distributed (Gibbons 1993; Hollander and Wolfe 1973). Analysis of the distributions of the data used in this study indicated some non-normality (for example, the distributions of several of the variables are skewed), as is often the case with financial statement data. In addition, monotonic regression lessens or eliminates the influence of outliers (Conover and Iman 1981).[12]

The overall regression is significant ($F = 31.362$, $p = 0.01$, adjusted $R^2 = 0.240$). PTROE is significantly negatively related to IMPLICIT ($t = -4.218$, $p = 0.01$, one-tailed test), indicating that PTROE increases as IMPLICIT decreases. This is consistent with the S&W (1992) model and H_1. IMPLICIT is significantly negatively related to firm market concentration, CR4 ($t = -3.216$, $p = 0.01$, one-tailed test) and firm market share, MS ($t = -4.122$, $p = 0.01$, one-tailed test). This is consistent with H_2 and H_3, respectively. IMPLICIT is significantly positively related to both of the interaction terms, PTROE * CR4 ($t = 3.098$, $p = 0.01$, one-tailed test) and PTROE * MS ($t = 5.765$, $p = 0.01$, one-tailed test). This result indicates that the negative relation between implicit taxes and pre-tax returns is weakened by the relative market power of firms in either highly concentrated industries or firms with high market shares. As market power increases (as measured by concentration and market share) the negative relation between implicit taxes and pre-tax rates

[12] Conover (1980) recommends analyzing the results using both rankings and the actual values. If both analyses provide similar results, the latter should be reported in the paper. However, if the results are different, he recommends the use of ranks since they are not affected by outliers and nonsymmetric distribution (Conover 1980, 337–338). If a monotonic relation exists, Conover and Iman (1983, 402–403) recommend the use of regression on the rank-transformed data. The regressions were also analyzed using ordinary least squares regression. The overall model was significant ($p < 0.001$), but there was no support for H_2 through H_4. This may indicate that the hypothesized relations are not strictly linear. Therefore, the nonparametric regression methodology is reported in this manuscript.

TABLE 5
REGRESSION ANALYSIS[a]

$$IMPLICIT_i = \beta_0 + \beta_1 PTROE_i + \beta_2 CR4_i + \beta_3 MS_i + \beta_4 PTROE_i{*}CR4_i + \beta_5 PTROE_i{*}MS_i + \beta_6 YEAR87_i + \beta_7 YEAR88_i + \varepsilon$$

Independent Variables and Expected Signs	All Firm Years (n = 675)	Firm-Years Without NOLS (n = 580)
Intercept	98.084*	109.450*
	(18.465)	(19.638)
$PTROE_i$	−0.388*	−0.414*
(−)	(−4.218)	(−4.185)
$CR4_i$	−0.187*	−0.171*
(−)	(−3.216)	(−2.415)
MS_i	−0.261*	−0.256*
(−)	(−4.122)	(−3.281)
$PTROE_i{*}CR4_i$	0.355*	0.286**
(+)	(3.098)	(2.143)
$PTROE_i{*}MS_i$	0.478*	0.442*
(+)	(5.765)	(4.401)
YEAR87	−0.446*	−0.484*
	(−9.203)	(−9.604)
YEAR88	−0.534*	−0.574*
	(−10.907)	(−11.250)
F statistic	31.362*	26.273*
Adjusted R^2	0.240	0.234

t-statistics in parentheses, one-tailed tests where expected sign noted, otherwise two-tailed tests.
*Significant at the 0.01 level.
**Significant at the 0.05 level.

[a]The regression is of the percentile ranks of the independent and dependent variables. To compute percentile ranks the variables are sorted in ascending order and assigned to percentiles.

Definitions of Variables:
IMPLICIT = [((PTI − CTE)/(1 − t)) − PTI]/SE
PTROE = Pre-tax accounting income as a percentage of stockholders' equity
CR4 = Ratio of sales of top four firms in the four-digit SIC code industry to total sales in that industry
MS = Ratio of firm I's sales to total sales in the firm's four-digit SIC code industry
PTROE*CR4 = Interaction term
PTROE*MS = Interaction term
YEAR87 = Indicator variable having a value of 0 if year is 1982 or 1988, 1 if year is 1987.
YEAR88 = Indicator variable having a value of 0 if year is 1982 or 1987, 1 if the year is 1988.

of return decreases. This result indicates that potential implicit taxes may not be actually lowering pre-tax returns of firms with greater market power.

The regression analysis is also provided for the sub-sample of firms without NOLs (n = 580). Again, the overall regression is significant (F = 26.273, p = 0.01, adjusted R^2 = 0.234). The results are similar to those for the full sample, as would be expected based on the composition of the full and sub-samples (see table 5).[13]

[13] The regression was also run including only firm years with positive values of IMPLICIT (n = 571). The results were similar to those for the full sample and thus are not reported here.

The two year variables, YEAR87 AND YEAR88, are significant (p-values <.01) and the signs of their coefficients are in the expected direction. The definition of IMPLICIT includes a tax rate for each firm-year. These rates declined from 1982 to 1987 and 1988. The tax base was also broadened from 1982 to the later years. Therefore, as the tax rate declines and the tax base increases, the value of IMPLICIT will decline also.

CONCLUSIONS, LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

When Congress studies the potential or actual impact of tax legislation on tax burdens, it generally focuses only on explicit taxes. But it is important to examine the full extent to which the Federal income tax system affects firm behavior and profitability. The S-C-P paradigm predicts that firms in more concentrated industries or firms with greater market share have a greater ability to affect price. If those firms use that ability, they can affect pre-tax profitability and may be able to shift some or all of their implicit tax burden to consumers and labor. This would affect after-tax profitability above and beyond the effects of explicit tax burdens alone. Conversely, a firm with a low explicit tax rate may actually be bearing an offsetting implicit tax burden. Banks have argued that this is the case, when defending their low explicit tax rates (S&W 1992, 98).

This study uses a sample of cross-sectional data across a variety of industries with potentially quite different market structures. Additionally, many of the firms in the study are involved in diverse industries so the SIC classifications are not truly descriptive of the markets within which these firms operate. Therefore, there is some bias against finding any significant relations. However, evidence is found of a negative relation between a firm's estimated implicit tax rate and the firm market structure characteristics. Implicit taxes are found to be negatively related to pre-tax returns, as predicted by the S&W (1992) model. However, this relation is mitigated by the interaction of firm market structure characteristics with pre-tax returns. The positive coefficients on the interaction terms indicate that firm market characteristics may weaken the negative relation between IMPLICIT and pre-tax rates of return. This provides evidence that market structure may provide opportunities for firms to decrease their potential implicit tax burden.

Prior research has examined the relation between explicit taxes and firm characteristics. The results of this study indicate that there is a relation between firm market structure and levels of implicit taxes. While not providing direct evidence that firms shift implicit taxes, the results show that there is a relation between firm industry membership and firm dominance within its industry and the level of implicit taxes. This should be factored into the modeling of the total tax effects, explicit and implicit, of explicit tax laws.

Limitations

Because financial statement data are used to estimate the independent and dependent variables, there may be systematic measurement error related to such data (Omer and Shaw 1991). Limitations of financial statement data include historical cost valuation, differences in accounting methods across firms and over time, and financial accounting rules for income taxes. Kinney and Swanson (1993) found the reliability of the Compustat data may be questionable, particularly for firm-years which include extraordinary items, discontinued operations, and net operating loss carryovers. Our results seem to be relatively robust to the latter item.

Directions for Future Research

Because of the limitations of cross-sectional data to fully capture the many aspects of market structure, particularly due to problems with classification of diversified firms into one SIC classification, a more refined analysis of these relations would involve an industry-specific study. This would allow a better definition of a broader range of market characteristics and the ability to focus on more specific tax provisions affecting levels of explicit and implicit taxes. An alternative approach would be an abnormal returns study. Firms with positive abnormal returns would be expected to have lower levels of implicit taxes in relation to their explicit tax rate levels. Finally, because this study is a first step in the measurement of implicit taxes, refinement of the implicit

tax measure is another area for further research. This would be consistent with refinements to the measurement of explicit taxes developed in prior research.

APPENDIX
SCHOLES AND WOLFSON (1992) MODEL ADJUSTED FOR RISK

These examples are provided based on the constraint of equal after-tax returns, in accordance with the S&W (1992) model. The examples would change if that constraint is relaxed.

The following example illustrates the calculation of implicit and explicit tax rates using equations (9) and (10). Assume that a firm has book PTI of $100 and tax depreciation in excess of book depreciation of $37.50, resulting in taxable income of $62.50 and CTE of $25. The marginal and average effective tax rate is 25 percent ($25/$100) and the statutory tax rate is 40 percent ($25/$62.50). In addition, the stockholder's equity equals $1,000. The firm's implicit and explicit tax rates can be calculated using equations (9) and (10) as follows:

$$\text{IMPRATE} = \frac{((100 - 25)/(1 - .4)) - 100}{(100 - 25)/(1 - 4)} = 20\%$$

$$\text{EXPRATE} = \frac{25}{(100 - 25)/(1 - .4)} = 20\%$$

Note that if the firm had invested in fully taxable assets, its PTI would have had to equal $125 ($R_{bi}$ = (100 − 25)/(1 − .4)) to yield the same after-tax income as it had under its current investment strategy. In both situations the book after-tax income would equal $75 ($100 − $25 for the firm's current investment strategy and $125 − $50 for an alternative fully taxable investment strategy). The PTI on fully taxable assets is comparable to the benchmark return on a fully taxable bond noted by S&W (1992) (labeled benchmark PTI in this paper). In this example, the implicit tax for the firm is $25 ($125 − $100), and the implicit and explicit tax rates are expressed as a percentage of the benchmark PTI, $125, the denominator in both equations (9) and (10).

The next example demonstrates that risk adjustment is not necessary when calculating implicit and explicit taxes using within-firm returns.

Assume that the returns for the firm are based on its level of risk (beta = 1.25). Therefore, pre-tax returns (PTI) for the firm assuming the average net level of risk (beta = 1) would be $80 ($100/1.25). The effective tax rate is again assumed to be 25 percent so CTE is $20 ($80 × 25%). With a 40 percent statutory tax rate, taxable income equals $50 ($20/.40) and tax depreciation in excess of book depreciation is $30 ($80 − $50). Implicit and explicit tax rates are calculated as follows:

$$\text{IMPRATE} = \frac{((80 - 20)/(1 - .4)) - 80}{(80 - 20)/(1 - .4)} = 20\%$$

$$\text{EXPRATE} = \frac{20}{(80 - 20)/(1 - .4)} = 20\%$$

The levels of implicit and explicit tax rates are unchanged even though returns have been adjusted for risk. Therefore, because the calculation of implicit and explicit tax rates using equations (9) and (10) does not involve comparison of returns of alternative investments with differing risk levels, no adjustment for risk is necessary.

In the above example, the relative level of explicit taxes is not changed. Let us now examine what happens when the level of explicit taxes is changed. Assume the firm again has PTI of $80, but now the excess of tax depreciation over book depreciation is $37.50, so that CTE is $17. Thus, the effective tax rate is 21.25% ($17/$80). The calculation of implicit and explicit tax rates is as follows:

$$\text{IMPRATE} = \frac{((80 - 17)(1 - .4)) - 80}{(80 - 17)/(1 - .4)} = 23.8\%$$

$$\text{EXPRATE} = \frac{17}{(80 - 17)/(1 - .4)} = 16.2\%$$

Consistent with the assumptions of this example, the explicit tax rate falls and the implicit tax rate rises. Further, it should be noted that in each of the above examples the implicit tax rate plus the explicit tax rate equals the statutory tax rate. This will only occur under conditions of perfectly competitive markets in equilibrium. In imperfect markets, the total tax rate may differ from the statutory tax rate.

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