PERSONAL TAXATION, CORPORATE AGENCY COSTS AND FIRM PERFORMANCE

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Abstract

This paper investigates the effect of personal-tax progressivity on management performance and agency costs by examining measures of corporate operating efficiency. We study a sample of US-based manufacturing and service firms and variations in across-state tax policy. Using matched-pair testing and regression analysis, we find evidence consistent with the hypothesis that increased personal-tax progressivity negatively impacts management productivity and is manifested in reduced firm efficiency. We control for several other factors that the literature suggests is relevant to firm operating efficiency and find that our results are robust.

Keywords: Corporate governance; Agency costs; Corporate performance; Personal taxes, Tax policy

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1. Introduction

Interest in tax policy has been spurred by recent developments in Eastern Europe, with a particular emphasis on the issue of how the burden of taxes should be distributed among individuals in different income groups. Since 1994, nine Eastern European countries have adopted a flat tax system.[1] This is in stark contrast to many Western European countries that maintain the more traditional progressive system that has several tax brackets and marginal rates that increase with personal income. Given the long-term trend toward economic integration and capital mobility, how tax policy may affect economic competitiveness is of increasing importance to public policy makers, investors and researchers alike. While economic competitiveness has many dimensions, one potentially important dimension that has received little attention to date is how personal taxes may impact firm efficiency. In this paper, we attempt to answer this question by analyzing the empirical relationship between personal-tax progressivity and firm operating performance.

The use of incentives to help align managers' interests with the interests of shareholders is pervasive both in theory and in practice. These incentives are intended to reduce agency costs and drive firm efficiency. While the relationship between incentive design and firm agency costs has received much attention, what has been largely ignored is how the taxation of incentives may impact agency costs.[2] In the financial economics literature, the dominant approach to assessing the impact of tax policy is the global contracting perspective, which requires that the tax positions of all parties to a contract be considered (Scholes and Wolfson, 1992). Under this framework, it is suggested that contract arrangements be set up in a manner that minimizes the present value of the total costs to all contracting parties. In practice, the analysis often exclusively focuses on tax payments instead of other contracting costs. The tax research dealing with managerial incentives generally

[1] The countries that have introduced some form of a flat tax system, along with the year of introduction, are: Estonia (1994), Lithuania (1994), Latvia (1995), Russia (2001), Serbia (2003), Ukraine (2004), Slovakia (2004), Georgia (2005) and Romania (2005) [Based on *The Economist* (April 16, 2005) article titled 'The Case for Flat Taxes'].

[2] For example, Holmstrom (1979), Grossman and Hart (1983), Gibbons and Murphy (1992) and Choe (2005) provide prescriptive theories of efficient compensation design. Coughlin and Schmidt (1985), Murphy (1985), Jensen and Murphy (1990) and Hall and Liebman (1998) provide descriptive analyses of compensation structure and its effect on performance. However, these papers do not address taxation.

analyzes tax effects on compensation design without addressing the potential impacts on managerial behavior. The extraction of private benefits, which may be thought of as an untaxed form of compensation, represents a cost to the shareholders but is not considered in the research. This general approach is illustrated in works of Miller and Scholes (1982), Hite and Long (1982), Abowd and Bognanno (1995), Austin, Gaver and Gaver (1998), Hall and Liebman (2000) and Klassen and Mawani (2000). Katascak (2004) also examines the relationship between tax policy and compensation design, but unlike the other cited papers, his model treats agency costs as endogenous and predicts that an increase in marginal personal-tax rates may diminish managerial effort.

Public and labor economics researchers recognize that there can be a wide range of behavioral responses to personal-tax policy changes, including changes in capital accumulation, labor supply, entrepreneurial activity, tax evasion and labor productivity. This recognition has influenced researchers to place more emphasis on assessing tax policy impacts by examining the response of aggregate economic measures, such as taxable income or gross domestic product, in order to capture the net effect of a variety of behavioral responses. While some of the specific responses, such as labor supply effects, have been studied extensively, there is limited direct research on productivity or worker effort effects. Feldstein (1999) suggests that workers subject to higher marginal rates of taxation may reduce their taxable income by exerting less effort (accepting less responsibility, avoiding travel, etc.) and by receiving 'compensation' in forms that are untaxed (i.e. various types of fringe benefits and perquisites). Although not expressed in the terminology of corporate governance research, it is clear that he is suggesting that personal taxation could impact corporate agency costs. Feldstein's suggestion that progressivity and high marginal tax rates may negatively impact work effort is consistent with the theoretical analyses of Sandmo (1994) and Andersen and Rasmussen (1999), however little empirical research has been directed at assessing this impact at the employee or firm level.[3]

In this paper, we examine whether personal-tax progressivity has an effect on managerial performance as reflected in their firms' operating efficiency. Progressivity is measured with respect to the total tax burden on individuals at different income levels.[4] A sample of US-based firms is subjected to matched pair testing and cross-sectional regression analysis to determine if tax progressivity is negatively related to firm performance. The main analytical results, based on both methodologies and three separate measures of performance, indicate a significant negative relationship between tax progressivity and firm performance, which is consistent with the theoretical prediction. We also test the robustness of our results by controlling for other factors suggested by the literature to be important to firm performance; we continue to find the significant negative relationship between personal-tax progressivity and performance.

In Section 2 of this paper we describe a simple theoretical framework in order to motivate the paper and develop the hypotheses for testing. Section 3 describes our data set and discusses our firm performance measures and our personal-tax progressivity variable. Also included is a discussion and description of other independent variables that serve as control factors. Section 4 presents our empirical tests and discusses the results. Section 5 concludes.

2. Theoretical framework: predicted effect of personal-tax progressivity on corporate agency costs

A managerial employment contract establishes an agency relationship, since the manager (the agent) is acting on behalf of the firms' owners (the principals) and has been delegated, either explicitly or implicitly, decision-making authority over some set of job-related factors. This decision-making authority gives managers, particularly senior managers and executives, control over firm resources. The agent-made decisions about how firm resources will be utilized affect both the economic performance of the firm and the personal utility that the manager derives from his or her position with the firm. Given that there is some optimal decision set (optimal from the point of view of the principals), deviations from the optimal levels constitute a 'purchase' of non-pecuniary benefits by the agent and results in a net dollar cost to the firm called the residual loss. Principals set up systems of incentives to minimize the overall agency cost, which includes the residual loss.[5] The performance incentives include pecuniary rewards such as bonuses and profit sharing and are typically subject to taxation at the personal level, whereas the non-pecuniary benefits associated with employment (i.e. perquisites, on-the-job leisure, etc.) are generally not taxed.

To illustrate the potential impact of personal-tax progressivity, we will consider a very simple model

[3] One notable exception is the research of Sillamaa (1999), who examines work effort responses to taxation in an experimental setting and finds that work effort increases when the top marginal tax rate is reduced. To the best of our knowledge, there has been no previously published research that has tested the hypothesized negative productivity effect of tax system progressivity using firm level performance data.

[4] Progressivity is a measure of tax function slope. A tax system is considered progressive if the effective tax rate increases with income; the greater the rate of increase, the more progressive the tax system is considered.

[5] This agency framework is similar to that of Jensen and Meckling (1976). The principal minimizes overall agency costs, which includes residual losses as well as the costs of monitoring and providing incentives to the agent.

in which a manager undertakes some set of duties for a firm. The manager maximizes utility, which is derived from both taxable pecuniary benefits and non-taxable non-pecuniary benefits (all other factors associated with employment that provide utility). Assume that the manager can perform at a normal level and receive a wage of *W* or can perform at a high level and receive a wage of *W* plus a positive bonus of *B*. The effective personal-tax rate in the normal and high income states are t_N and t_H respectively. High performance results in no utility from non-pecuniary benefits, while normal performance provides a strictly positive amount of utility associated with these non-pecuniary employment related factors. We also assume that after tax compensation is an increasing function of before tax compensation (the marginal personal-tax rate is always less than one) and that the marginal utility of consumption of purchased goods is positive.

The employee will choose to perform at the high level if the utility derived from earning $W + B$ exceeds the utility derived from earning *W* plus the utility derived from non-pecuniary benefits in the normal performance state. If we assume an additive utility function and denote U_G as the utility derived from the consumption of purchased goods and $\overline{U}_A$ as the utility derived from non-pecuniary benefits in the normal performance state, then the condition necessary for high performance can be stated as follows:

$$U_G\left(\left(1-t_H\right)\left(W+B\right)\right) > U_G\left(\left(1-t_N\right)\left(W\right)\right) + \overline{U}_A \quad (1)$$

If we set t_H equal to $t_N + P$, where *P* is a measure of personal-tax progressivity, this condition can be stated as:

$$U_G\left(\left(1-t_N-P\right)\left(W+B\right)\right) > U_G\left(\left(1-t_N\right)\left(W\right)\right) + \overline{U}_A \quad (2)$$

The left hand side of (2) is a decreasing function of *P*, while the right hand side is unaffected by *P*. Therefore, given fixed levels of t_N, *W*, *B* and $\overline{U}_A$, the high performance condition will be satisfied for levels of *P* below some point *P′* and will not be satisfied for levels of *P* above *P′*. This suggests that progressivity may be negatively related to performance. Alternatively, one can think of *P* as an exogenous variable and the compensation system component, *B*, as endogenous. In this case, the principal will adjust the size of the bonus *B* to ensure that the high performance condition will be met (assuming high performance is worth the cost of the necessary bonus). Here, we would see a positive relationship between *B* and *P*. Greater progressivity would necessitate a larger bonus in order to ensure high performance. The bonus is, of course, an agency cost, since it is a cost of aligning the interests of the agent and the principal. Although the principal is still able to elicit high performance, it is achieved at a higher cost to the firm when personal-tax progressivity is increased. In either case, greater progressivity may cause the overall efficiency of the firm to decline. In the former case, (where *B* is not endogenous) lower managerial performance may be utility maximizing and give the result of lower corporate operating efficiency. In the latter case, with *B* endogenous, a higher *B* is required but this results in less corporate productivity net of compensation costs.

It can also easily be seen that the above discussion and conclusions are not dependent on *P* being a positive value, as would normally be associated with a progressive tax system. The value of *P* can be positive or negative and the implication of a change in the value of *P* remains the same. As such, the hypothesized effect of an increase in personal-tax progressivity applies whether the tax system is initially regressive, proportional or progressive.

While our model is a very simplified representation, it does characterize the intuition behind the hypothesis. A pecuniary reward for good performance is less desirable if it is going to be taxed at a higher rate. In response to the higher tax rate, either the reward has to be increased or managerial effort will suffer. In a general equilibrium, with a continuous range of performance possibilities, we would anticipate tax policy changes to result in responses in both managerial effort (as measured by the residual loss) and the incentive system. However, since both responses are reflected in the firm's overall agency cost, we are drawn to the same conclusion that personal-tax progressivity is negatively related to managerial performance which is manifested in corporate operating efficiency.

Our hypothesis regarding the negative productivity impact of increased tax progressivity is generally consistent with the implications of several models and theories based on a variety of response mechanisms. Sandmo's (1994) promotion competition model predicts that taxation that reduces the after-tax income differential between a promotion and a no-promotion state reduces the aggregate level of effort within a firm. Feldstein and Wrobel (1998) hypothesize that greater personal-tax progressivity reduces economic efficiency based on the ability of high-skilled labor to relocate to more favorable tax jurisdictions. Katuscak's (2004) agency model predicts that increased taxation of executives weakly diminishes the equilibrium level of managerial effort. Alford's (2005) agency model, which includes imperfect monitoring of productivity and compensation discontinuities, also suggests a negative relationship between personal-tax progressivity and performance.

3. Data and variables

3.1. Data

Our sample consists of US-based firms in the manufacturing and service sectors with cross-sections

drawn from 1995 and 2002.[6] There were 1,761 firm observations in 1995 and 1,785 firm observations in 2002. Firm-specific accounting data was obtained from the Compustat database using annual report information. State data regarding taxation was obtained from four sources: (1) the Institute on Taxation & Economic Policy ([ITEP], 1996 and 2003); (2) the National Bureau of Economic Research; (3) the Federation of Tax Administrators[7] and (4) the Tax Foundation. We use an index developed by Ferris, Lawless and Noronha (2004) as a proxy for the state corporate legal environment. The state data for the appropriate year was then matched to the firms based on the firm's primary location of operation; except for the legal environment measure, which is matched to firms based on the firm's state of incorporation. A listing of variables, along with each variable's definition and source, is shown in Table 1.

All firms from the Compustat database were included in the sample if they met the following criteria: (1) primary location of operation was in the US; (2) the firm's primary industry was in either the manufacturing or service sector; and (3) the firm had more than 25 and fewer than 1000 employees (fewer than 250 for service sector firms).

This sample construction offered a number of significant advantages. By selecting only US firms, we largely control for a number of factors that may affect firm performance and variable measurement. These factors include federal regulations, the capital market environment, product market competition and the standard used in generating accounting data. By selecting only small firms, it is more likely that operations and personnel are more concentrated in one state and that the majority of management personnel are subject to the same state's tax system. Also, we are better able to control for industry related factors, since smaller firms tend to be less diversified across different industries.

3.2. Dependent variables: firm performance

Greater personal-tax progressivity is hypothesized to increase firm agency costs, through higher levels of non-pecuniary benefits and/or through higher costs of providing appropriate performance incentives. This effect should be reflected in various measures of firm operating performance. We use three accounting-based corporate performance measures because they are able to isolate the specific dimensions of corporate efficiency in which we are interested.

The first measure is the firm's expense ratio (ER), which is the ratio of selling, general and administrative expenses to sales. The ER is intended to capture how well the firm controls expenses, including certain types of perquisite consumption. The second measure is the firm's total asset turnover (TAT), which is the ratio of sales to total assets. The TAT indicates the efficiency with which the firm utilizes its assets. It reflects the performance outcome of past investment decisions, specifically, how productive the firm's assets are in generating sales. The third measure is the operating return on assets (OROA), which is the ratio of earnings before interest, taxes, depreciation and amortization to the total assets. The OROA reflects the overall operating efficiency of the firm.

Holding non-agency factors constant, a higher value for ER and lower values for both TAT and OROA are consistent with management choosing a lower level of effort to maximize their utility – leading to less cost control, less utilization of assets and an overall lower operating return. In addition, if the compensation function (*B* component) is adjusted to compensate for higher personal-tax progressivity then the same results for ER (a higher value) and OROA (a lower value) would be expected. Thus, we can use these variables as indicators of inferior corporate performance that results from higher incentive costs caused by higher personal-tax progressivity.

3.3. Personal-tax progressivity measurement

In order to test the personal-tax progressivity hypothesis, it is necessary to construct a variable that measures the progressivity of each state's tax system. Since all forms of state and local taxation (income taxes, excise taxes, sales taxes and property taxes) affect the purchased consumption of an agent, we are interested in the combined burden of the overall tax system.[8] Taking into consideration alternative forms of taxation, other than personal income tax, is particularly important in this context since personal income tax only accounts for about 22% of the total tax revenue of state and local governments (US Census Bureau, 2004). Sales, excise and property taxes are important forms of revenue for state and local governments. The existence and design of these forms of taxation, along with the structure of the personal income tax, together determine how the burden of taxation is distributed among individuals in different income groups.

Personal-tax progressivity can be measured in a variety of ways and the choice of the most suitable

[6] The sample was limited to these years based on availability of the tax progressivity measure that we used.

[7] The Federation of Tax Administrators (FTA) corporate tax data for 2002 was accessed on-line. For 1995, corporate tax data was taken from The Council of State Governments (1996), which sourced data from the FTA.

[8] It is not only the income tax that affects the agent's purchased consumption. For instance, with a sales tax of s and no income tax, X dollars of income can purchase $X/(G(1+s))$ units of a good with a price of G. This is equivalent to having no sales tax and an effective income tax rate of $t = 1-(1+s)^{-1}$, since it results in the same purchasing power given X dollars of pre-tax income and a good price of G.

index depends, in part, on the purpose for which it is being measured. Since we are attempting to assess how personal taxes affect firm efficiency based on behavioral responses of managers, it is desirable to measure progressivity over a relevant income range. Since all firm managers are delegated some decision making authority and may, therefore, influence firm agency costs, we measure personal-tax progressivity over the upper half of the income distribution.

The specific index used in this paper is a measure of the spread in tax rates, similar in form to that used by Feldstein and Wrobel (1998) and Gentry and Hubbard (2000, 2004). We measure personal-tax progressivity in terms of the difference in the tax rate at high and moderate income levels.[9] We define our tax progressivity measure as the effective tax rate on the highest 5% income group minus the effective tax rate on the middle 20% income group. Measuring the tax rates based on distributional positions within the state, as opposed to at specific dollar income levels, takes into account real income variations across states and may therefore be a better measure of state policy regarding the distribution of the tax burden (Chernick, 1997). The effective tax rate used in constructing the index is the percentage of income paid (directly or indirectly) for state and local taxes. This is measured net of the federal deductibility of state taxes. Information on the method (i.e. tax incidence assumptions) used to generate the effective tax data can be found in the source documents (ITEP, 1996 and 2003). Also, both Chernick (1997) and Reschovsky (1998) provide commentary on the ITEP methodology.

A potential problem with this measure of personal-tax progressivity is that it is not strictly predetermined, since behavioral responses to the tax system can affect the income distribution, which in turn influences the progressivity measure.[10] In order to deal with this potential endogeneity problem, we also perform two-stage least squares regressions in which we instrument for our progressivity measure. The instrumental variable is the top marginal personal income tax rate (total of state and federal income taxes) net of deductibility of state income tax on the federal return and federal income tax on the state return.[11] This variable has a high correlation with our progressivity measure and, since it depends only on variation in state tax laws and not, at least in any obvious way, on individual or firm responses to the tax system, it is considered exogenous.

3.4. Control variables

While we are interested in the potential effect of tax structure on firm performance, we must also control for other potentially important determinants of firm performance. The performance variables that we use are frequently found in financial economics and accounting research and we rely on the same control variables typically found in this research. First, it has long been thought that characteristics of the firm's financial structure can influence its performance (Berle and Means, 1932). Firm creditors provide monitoring of management behavior and the influence of creditors would increase as leverage increases. Also, high leverage requires operating cash flows to meet debt obligations and places the firm at risk of insolvency, which may increase managerial performance incentives (Jensen 1986). Leverage is measured as the ratio of total liabilities to total assets.[12]

Firm size may affect our performance variables for a variety of reasons, including potential economies of scale. Size is measured as the natural logarithm of firm net sales. The relative amount that a firm invests in fixed capital may affect firm agency costs since tangible assets are more easily monitored by outsiders than certain non-tangible assets. Furthermore, the relative investment in fixed assets is indicative of the firm's technology and may reflect a specific management strategy or reaction to local input cost conditions. We measure the relative investment in fixed capital using the fixed asset ratio, which is fixed assets divided by total assets. The squared values of the leverage, size and fixed asset ratio variables are also incorporated into the regression models to allow for nonlinearities in their relationships to performance. Two further firm-specific control variables are also incorporated into the analysis. The firm's sales growth is included, since it may be indicative of the firm's product lifecycle stage, and the firm's industry is included as a control for obvious reasons.

In addition to the firm-specific variables, there may be factors in the firm's operating environment, in addition to tax progressivity, that affect its performance. It should be noted that intranational

[9] This is conceptually similar to Gentry and Hubbard (2004). They use the difference in the marginal tax rate in an average successful state (finding a new job that pays more) and a benchmark state (the worker's current income level). We use the difference in the effective tax rate between a successful state (earning greater rewards through promotion, bonuses, etc.) and a benchmark state (income at a moderate level of productivity). In both cases, the progressivity index is a measure of the tax function average slope over some income range.

[10] We wish to use the tax parameter to explain agent behavior, however agent behavior may influence our tax parameter since it is based on both the statutory tax rates and the income distribution (income distribution may be influenced by responses to the tax system).

[11] The data is based on a taxpayer with a wage income of $250,000 who is married and is filing jointly. The data series is from the National Bureau of Economic Research TAXSIM model and information on the model and this data series are available from Feenberg and Coutts (1993) and the NBER website (www.nber.org/~taxsim).

[12] Another aspect of the ownership structure that is a possible determinant of performance is the equity distribution. Holderness (2003) provides a recent survey of the research and, based on the mixed evidence cited, he concludes that equity ownership characteristics appear to have little impact. Nonetheless, the omission of equity related control variables is further discussed in Sub-section 4.6.

variation in environmental factors is rarely considered in models explaining the accounting-based measures of performance used in this paper. Despite limited guidance in the literature, we attempt to identify the most relevant potential influences.

State and local government program spending is controlled for by incorporating a variable measuring the average tax burden. This variable is defined as the total state and local tax burden as a percentage of total income in the state. The state corporate income tax rate is also a potentially significant factor influencing firm performance, for which we control.[13] Finally, as noted by Cary (1974), the corporate legal environment varies within the US and affects investors' rights and potentially influences managerial behavior. Since corporate legal jurisdiction depends on the state of incorporation and not on the physical business location, we include in the analysis a state-dependent legal environment measure (LEM) based on the firm's state of incorporation. The LEM index used was developed by Ferris, Lawless and Noronha (2004).[14] Summary statistics for dependent and independent variables are provided in Table 2.

4. Empirical analysis: matched pair testing and regression analysis

4.1. Matched pair testing

Our initial examination of the potential impact of tax progressivity utilizes a matched pair testing technique. The advantage of this procedure is that it concentrates the analysis on those firms facing the most extreme tax environments, which may help overcome limited variation in our progressivity variable. The data set for the matched pair testing consists of a 1995 sample of 1,761 firms and a 2002 sample of 1,785 firms. Each sample is organized into quintiles based on the personal-tax progressivity measure. Firms in the highest progressivity quintile are matched to firms in the lowest progressivity quintile based on both industry (four digit primary SIC match) and firm size.[15] If no match based on these criteria is possible, the firms are excluded from testing. The performance of the matched firms is then compared in an attempt to determine if there are systematic differences based on the tax environment in which the firm operates. A data series of performance differences is created by subtracting the value of the low quintile firm performance parameter from the value of the performance parameter of the matched high quintile firm. This is done for all three of our performance measures (ER, TAT and OROA) in both cross-sections.

Two types of tests on the matched firms' performance differences are conducted for all three measures of firm performance. The first test is a simple matched pair t-test. The mean value and standard error of the mean for each performance difference data series is calculated. This is used to calculate a t-statistic; a p-value is reported based on the null hypothesis of zero mean difference with a two-sided alternative hypothesis.[16] Since this first test assumes a normal distribution of the performance difference data series, which may not hold, we also perform a second non-parametric test.

The second test is the Wilcoxon signed rank test, which utilizes the same three data series (difference in performance between the high quintile firm and its matched low quintile firm). It, however, tests the hypothesis that the median difference is zero and it makes no assumption regarding the form of the distribution. Again, a p-value based on a two-sided alternative hypothesis is reported.

Our model suggests that the firms located in a state with a higher level of tax progressivity should have inferior performance to a matched firm that operates in a state with a lower level of tax progressivity. As such, we would expect a positive mean and positive median difference for ER and a negative mean and negative median difference for both TAT and OROA.

4.2. Matched pair test results

The matched pair test results are presented in Table 3. From our high and low progressivity quintiles, we were able to create 129 firm matches in our 1995 sample and 157 firm matches in our 2002 sample. The average difference in the personal-tax progressivity index faced by high and low quintile matched firms was 3.14 in 1995 and 3.03 in 2002.

As shown in Panel A, the average performance of firms located in states with high personal-tax progressivity was inferior to that of the matched firms located in low progressivity states. This average performance difference was consistent across all three performance measures in both the 1995 and 2002 samples. We observe a positive mean difference for ER and a negative mean difference for

[13] We also tried including controls for the state's per capita income (based on U.S. Department of Commerce data (2003)) and a variable measuring the effective overall tax rate on the highest five percent income group (based on ITEP data (1996, 2003). The former was insignificant in most regression specifications. The latter was not consistently significant and it contributed to multicollinearity problems. Although not reported, the inclusion of these variables does not significantly change the results or conclusions with respect to our progressivity measure.

[14] As a robustness check, an alternative legal environment control variable (a dummy variable for incorporation in Delaware) was also tested in the regressions (as per Daines (2001)). Approximately 58% of our sample firms are incorporated in Delaware. This alternative control procedure leads to the same conclusions with respect to our progressivity measure.

[15] The natural logarithm of the high quintile firm's sales divided by the low quintile firm's sales had to be less than 0.405 in absolute value. This meant that the smaller firm's sales were at least 67% of the larger firm's sales.

[16] Statistical tests based on two sided alternative hypotheses are used because they are the standard in this type of literature. In actuality, given our one-sided hypothesis, our reported p-values may be divided by two to reflect one-sided tests.

both TAT and OROA. The performance differences are economically significant and consistent with the hypothesized impact of personal-tax progressivity. If we assume that the firm performance differences are normally distributed, the results associated with ER are statistically significant at the 1% level for both samples; the results for OROA are statistically significant at the 1% level for 1995 and the 5% level for 2002; the result for TAT is significant at the 10% level for 1995. Only the 2002 test associated with TAT was statistically insignificant (although it is significant at the 10% level given the more appropriate one-sided test).

The non-parametric test results are presented in Panel B. The median difference for all three performance measures in both years is consistent with the hypothesis. In addition, for both sample years the Wilcoxon sum of ranks is greater for positive observations (positive observations of the performance difference) for ER and greater for negative observations for both TAT and OROA. This is also consistent with the hypothesis. The Wilcoxon test indicates statistically significant results for all three performance measures for both years. All results are significant at the 5% level, with three of the six results significant at the 1% level.

Overall, the evidence from the matched pair testing is consistent in sign with the tax progressivity hypothesis and is statistically significant. Next, we investigate the robustness of our results by conducting regression analysis that includes additional control variables.

4.3. Regression testing

The cross-sectional data is pooled and analyzed with both ordinary least squares and two-stage least squares regressions.[17] While this methodology has certain drawbacks in terms of addressing potential omitted variables bias, it also has advantages in this context. First, even if we had annual data on the progressivity variable, it would tend to be stable, changing little from one year to the next. With low levels of temporal variation ('within subject variation') in the independent variable of interest, fixed effects estimation using panel data may not detect a relationship even if one exists (Zhou 2001). Second, we may expect that the relationship between annual changes in the tax system and annual changes in firm performance would be weak since the effect of altered managerial behavior may not be reflected immediately in the accounting-based performance measures. This leads us to believe that there could be a relationship between the levels of the variables, even if there is no apparent relationship in the annual changes. As such, we depend on pooled cross-sectional variation to determine if there is a potential relationship between personal-tax progressivity and firm performance.

In setting up our regression models for testing it was recognized that two of our three performance variables, ER and TAT, have skewed distributions and are, by construction, non-negative. Each is transformed by taking its natural logarithm.[18] The transformed variables are denoted LER and LTAT respectively. In using a semi-log model (log-linear) to explain these two performance measures, we assume that unit changes in our independent variables result in a constant percentage change effect on the ER and TAT variables. The hypothesized coefficient on our progressivity measure remains unchanged as a result of this specification.

The tax progressivity measure and all of the control variables discussed in Sub-section 3.4 are included in the regressions. As previously noted, the 2SLS regressions treat progressivity as endogenous and utilize an additional variable as an instrument, which is the statutory top marginal personal income tax rate in the state. Separate intercepts for each year are included and fixed industry effects are based on the firm's 2-digit primary SIC.

4.4. Regression test results

The regression results are presented in Table 4. The regressions examine the effect of personal-tax progressivity on the firm performance variables: LER, LTAT and OROA. The sign of the slope coefficient on progressivity is consistent with our theoretical expectation in all six regressions. Our hypothesis suggests that higher personal-tax progressivity should be associated with decreased performance (higher ER, lower TAT and lower OROA).

Based on OLS estimation, the slope coefficient on progressivity is statistically significant at the 1% level for all three performance measures. In the 2SLS regressions, the slope coefficient on progressivity is statistically significant at the 5% level for both LER and OROA, but is not significant for LTAT (*p*-value is 0.16). Consistent with the matched-pair testing, the overall regression results are generally supportive of the hypothesized negative impact of progressivity on firm performance.

It was also noted that our sample consists of a significant number of firms in financial distress; approximately 8% of the firms in the sample had a leverage variable of one or more. Since the situation of these firms is not representative of normal operating conditions and may significantly impact the coefficient estimates, we repeated the regressions

[17] Separate regressions on unpooled data were also run, testing each year's cross-section independently, with similar results (not shown).

[18] Regressions using the untransformed variables (ER and TAT) resulted in residuals that were highly skewed. Regressions using the transformed variables (LER and LTAT) resulted in residuals with distributions that more closely corresponded to a normal distribution.

with these firms excluded from the analysis. Similar results were found.

4.5. Sensitivity analysis: omitted variables bias

As with most empirical research, a significant area of concern is that our testing techniques could be subject to bias induced by the omission of significant control variables. In the case of the matched pair testing, the high and low quintile firms may systematically differ in terms of some other factor, apart from tax progressivity, and this other factor may actually be driving the apparent performance differences. In order to partially address this concern, the matched firms from the progressivity tests are compared in terms of ten other variables. These include: sales growth; two measures of firm leverage (ratio of liabilities to total assets and ratio of total long term debt to total assets); two measures of relative dependence on fixed assets (ratio of fixed assets to total assets and ratio of fixed assets to employees); firm size[19]; the relative income level in the firm's home state; and three tax variables of the firm's home state (average tax burden, the corporate tax rate and the effective tax rate on the highest 5% income group). For six of the ten variables there is no evidence of a systematic difference in the characteristics of the high and low quintile firms. The differences for several of the variables are both economically and statistically insignificant for at least one of the two years. Also, several variables have positive differences in one year and negative differences in the other. As such, there is no evidence to suggest that the performance difference between our high and low progressivity firms should be attributed to any of these six other factors that were not controlled for in the matching process.

For the four other variables (fixed asset to total asset ratio and the three tax related variables) there is some evidence of systematic differences between the high and low progressivity firms. To assess the potential effect of failing to control for these four factors, we regress the performance differences on the differences in each of the four variables. We find that these four factors appear to have little explanatory power with respect our performance differences. The F-statistic is insignificant and the adjusted R-squared is less than 2% for five of the six regressions (there are six regressions based on two sample years and three different performance measures). As such, we conclude that there is no substantive evidence that our matched pair test results are driven by these omitted control factors.

Our regression testing utilizes variables not included in our firm matching procedure and, as such, is less susceptible to omitted variables bias. As previously noted in Sub-section 3.4, a number of additional control variables, not reported in our main results, are tested in alternative regression specifications to help guard against this potential problem. Furthermore, it is expected that the omission of certain potential control variables may actually bias against the identification of a tax progressivity effect. We do not, for instance, control for characteristics of the firm equity structure, such as ownership concentration or structure. However, ownership concentration and structure may respond to exogenous environmental factors that affect firm agency costs (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998). If we assume that an increase in personal-tax progressivity would tend to drive up agency costs and lower firm operating performance, we should expect that the equilibrium level of ownership concentration (and other agency cost control mechanisms, such as the compensation system) would adjust to partially offset the negative effect of increased tax progressivity. As such, the effect of a change in progressivity may be obscured by the reaction of agency cost control mechanisms for which we have incomplete controls.

Another omitted variables issue stems from the nature of our data set. The number of firm observations from each state in our sample is not the same; the larger states contribute far more observations to the sample. This increases the risk of an endogeneity problem, as progressivity differences are more likely to be correlated with omitted state-related variables under these circumstances. As such, our results may be sensitive to omitted state effects.

This is particularly problematic in the matched-pair testing because California has the highest firm representation and is also one of the most progressive tax states. As a result, our high progressivity quintile of firms consists almost entirely of California firms in both years. The state representation is much broader in the low progressivity quintile and changes significantly from 1995 to 2002. Since our high progressivity group of firms consisted almost exclusively of California firms in both years, the observed performance differences in the matched firms could be driven by some other factor unique to California. Unfortunately, there is no conclusive way to test this. If we remove the California firms we decrease both the variation in progressivity across our matched firms (which is already low) and we also significantly reduce the sample size. Lack of significance is the end result.

To assess the potential bias in our regression results, we consider performing fixed state effects regressions using a partial set of state dummy variables.[20] Unfortunately, such regressions are subject to severe multicollinearity, which makes the regression coefficients and significance levels unreliable. Although there is no consensus on when

[19] Although size, as measured by firm sales, was controlled for in the matching procedure, it was checked anyway to ensure that good size matching had been achieved.

[20] A state dummy variable is assigned for each state contributing 5% or more of the firm observations.

multicollinearity is excessive, there are a number of guidelines suggested in the econometrics literature. Belsley, Kuh and Welsch (1980) suggest that a condition number in excess of 20 is suggestive of a potentially serious problem; the condition number associated with the explanatory variable matrix for our fixed state effects regression is 73. Another guideline, suggested by Klein (1962), indicates that if $R_k^2 > R^2$, then the multicollinearity is severe.[21] $R^2_{progressivity}$ is 0.71, which is well in excess of the coefficient of determination in each of the fixed state effects regressions. Finally, the variance inflation factor (VIF) with respect to the progressivity coefficient is 3.5. Allison (1999) suggests that a VIF exceeding 2.5 is problematic.

Recognizing that the fixed state effects model is subject to a severe multicollinearity problem indicates that, given our sample limitations, it is difficult to disentangle progressivity differences and state effects. In our sample, much of the variation in the progressivity measure is contributed by the firm observations from a small number of states, particularly California (a high progressivity state contributing the largest number of observations). Removing California firms from the sample reduces the standard deviation of the progressivity measure by 24% and reduces the sample size by 26%. Hence removing California firms from the sample may leave too little variation to detect progressivity effects, while specifically trying to control for omitted California (and other states') effects leads to high multicollinearity.

5. Conclusions

Most firms reward performance, either explicitly or implicitly, with greater taxable compensation to managers. If, however, greater compensation is subject to higher taxation, we would expect that the effectiveness of the reward will be diminished or that the firm will have to increase the size of the pretax reward.[22] This expectation is straightforward and intuitive but rarely discussed in the finance literature that analyzes firm performance or agency costs. In addition, there are many difficulties in attempting to empirically assess this expectation. The performance characteristics of an international sample of firms would be affected by a multitude of differential factors and is fraught with various measurement problems. A US sample, such as we have used, helps limit the number of control factors, but greatly limits the degree of tax-system variation in the sample. Despite the inherent analytical difficulties, the effect of personal-tax progressivity on firm performance is an important empirical issue to attempt to characterize.

To summarize our analytical findings, we have found evidence consistent with the hypothesized negative impact of personal-tax progressivity on managerial performance and firm efficiency. Our results are robust to various control variables suggested by the literature and hold under both a matched pair analysis and a regression analysis. The personal-tax progressivity hypothesis, if true, has significant public policy implications. In addition, the personal-tax progressivity hypothesis has potentially important methodological implications for other research into firm efficiency and agency costs. If a jurisdiction's personal-tax policy is a significant determinant of performance, then characteristics of the tax system, such as personal-tax progressivity, should be controlled for in cross-jurisdictional (particularly cross-country) studies of firm performance.

[21] R_k^2 is the coefficient of determination from a regression of explanatory variable k on the other explanatory variables in the original regression model. R^2 is the coefficient of determination of the original regression model.

[22] Similarly, if greater compensation is subject to lower taxation, we would expect that the effectiveness of the reward to be enhanced, leading to either greater productivity or a lower firm cost to provide appropriate incentives.

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Appendices

Table 1. Variables information

Variable	Definition	Source
ER	The firm's expense ratio calculated as selling, general and administrative expenses divided by net sales.	Compustat
LER	Natural logarithm of ER.	
TAT	The firm's total asset turnover calculated as net sales divided by total assets.	Compustat
LTAT	Natural logarithm of TAT.	
OROA	The firms operating return on assets, calculated as the earnings before interest, taxes, depreciation and amortization divided by the firm's assets.	Compustat
Progressivity	Progressivity measure, which is the effective tax on the highest 5% income group minus the effective tax on the middle 20% income group in the state in which the firm operates.	ITEP 1996 & 2003
Top marginal income tax rate	The maximum marginal personal income tax rate (combined state and federal income taxes) in the state in which the firm operates.	National Bureau of Economic Research
Leverage	Leverage as measured by the firm's ratio of total liabilities to total assets.	Compustat
Size	Size as measured by the natural logarithm of firm net sales.	Compustat
Fixed asset ratio	Fixed asset to total asset ratio as measured by the firm's net property, plant and equipment divided by the firm's total assets.	Compustat
Sales growth	Sales growth percentage, which is the annualized 3 year sales growth percentage based on sales data from annual reports.	Compustat
Average tax	Average tax, which is the total state and local tax burden as a percentage of total state income in the state in which the firm operates.	Tax Foundation
Corporate tax	Corporate tax, which is the state corporate income tax rate (or equivalent tax on corporate income) in the state in which the firms operates. Calculated net of federal tax deductibility if applicable. Where tax rate is not flat, the top marginal rate was used.	Federation of Tax Administrators
LEM	Legal Environment Measure, which is an index describing the corporate legal environment of the state where the firm is incorporated.	Ferris, Lawless and Noronha (2004).
Industry dummy	Industry effects used in the regressions were based on the primary standard industrial classification (SIC) code of the firm.	Compustat

Table 2. Summary statistics for variables

Variable	Mean	Median	Standard deviation	Minimum	Maximum
ER	0.932	0.370	5.966	0.010	213.962
TAT	1.153	1.045	0.891	0.000	13.932
OROA	-0.095	0.045	0.703	-29.060	1.162
Progressivity (%)	-2.857	-2.800	1.213	-6.320	-0.560
Top marg. inc. tax rate (%)	41.915	42.320	2.422	36.680	44.920
Leverage	0.542	0.398	0.870	0.016	25.820
Sales (millions $)	52.485	24.628	96.315	0.000	2744.191
Fixed asset ratio	0.199	0.140	0.176	0.000	0.937
Sales growth (%)	52.386	9.936	762.153	-100.000	41970.
Average tax (%)	10.141	10.100	1.050	6.900	13.000
Corporate tax (%)	7.643	8.840	2.342	0.000	10.750
LEM	15.143	16.660	3.995	5.780	27.770

Table 3. Matched pair testing: comparison of firms in most progressive tax environment and matched firms in least progressive tax environment

Panel A: Parametric Test of Performance Difference

	Progressivity	ER	TAT	OROA
Matches from 1995 sample (129 matches):				
Matches with parameter data for both firms	129	105	118	128
Hypothesized difference	-	positive	negative	negative
Mean difference	3.143	0.227	-0.152	-0.162
p-value	-	.0013	.0502	.0005
Matches from 2002 sample (157 matches):				
Matches with parameter data for both firms	157	113	155	155
Hypothesized difference	-	positive	negative	negative
Mean difference	3.030	.272	-0.118	-0.087
p-value	-	.0001	.1237	.0459

Panel B: Non-Parametric Test of Performance Difference

	Progressivity	ER	TAT	OROA
Matches from 1995 sample (129 matches):				
Matches with parameter data for both firms	129	105	118	128
Hypothesized difference	-	positive	negative	negative
Median difference	2.980	0.079	-0.112	-0.062
# of observations > 0 (mean rank)	-	66 (60.41)	47 (54.88)	43 (60.06)
# of observations < 0 (mean rank)	-	39 (40.46)	69 (60.96)	85 (66.75)
Wilcoxon signed rank z-statistic	-	3.849	2.240	3.674
p-value	-	.0001	.0251	.0002
Matches from 2002 sample (157 matches):				
Matches with parameter data for both firms	157	113	155	155
Hypothesized difference	-	positive	negative	negative
Median difference	2.440	0.157	-0.090	-0.074
# of observations > 0 (mean rank)	-	75 (63.03)	58 (76.23)	66 (73.16)
# of observations < 0 (mean rank)	-	38 (45.11)	93 (75.85)	89 (81.59)
Wilcoxon signed rank z-statistic	-	4.314	2.445	2.172
p-value	-	.0000	.0145	.0298

Firms were assigned to quintiles based on the progressivity measure. Firms in the highest and lowest quintiles were matched based on industry (same four digit primary SIC) and size (similar level of sales). Firms that could not be matched were excluded from testing. Differences are calculated as the high quintile firm performance parameter minus the performance parameter of its matched low quintile firm. In Panel A, the p-values are based on a standard t-test of the null hypothesis of zero mean difference (two-sided). In Panel B, the p-values are based on a normal approximation to the Wilcoxon signed rank test of the null hypothesis of zero median difference (two-sided with correction for both continuity and ties). Variable definitions and sources are provided in Table 1.

Table 4. Regressions of firm performance on personal-tax progressivity and control variables

	Dependent variable (and estimation method)					
	LER	LER	LTAT	LTAT	OROA	OROA
Independent variable	(OLS)	(2SLS)	(OLS)	(2SLS)	(OLS)	(2SLS)
Progressivity	0.067	0.032	-0.050	-0.023	-0.023	-0.024
	(0.012)***	(0.016)**	(0.013)***	(0.016)	(0.008)***	(0.011)**
Leverage	-0.115	-0.117	0.439	0.440	0.066	0.066
	(0.026)***	(0.027)***	(0.040)***	(0.040)***	(0.092)	(0.092)
Leverage squared	0.006	0.006	-0.016	-0.016	-0.037	-0.037
	(0.002)***	(0.002)***	(0.003)***	(0.003)***	(0.008)***	(0.008)***
Size	-2.627	-2.631	3.477	3.481	0.757	0.757
	(0.228)***	(0.229)***	(0.162)***	(0.161)***	(0.171)***	(0.170)***
Size squared	0.068	0.068	-0.095	-0.095	-0.019	-0.019
	(0.007)***	(0.007)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Fixed asset ratio	-0.270	-0.319	1.542	1.581	-0.422	-0.424
	(0.259)	(0.259)	(0.252)***	(0.252)***	(0.154)***	(0.151)***
Fixed asset ratio squared	-1.001	-0.950	-2.474	-2.516	0.549	0.550
	(0.420)**	(0.418)**	(0.368)***	(0.368)***	(0.249)**	(0.243)**
Sales growth	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)*	(0.000)**
Average tax	0.021	0.015	-0.013	-0.008	0.020	0.020
	(0.012)*	(0.013)	(0.014)	(0.014)	(0.008)***	(0.008)**
Corporate tax	-0.003	0.008	0.000	-0.009	0.000	0.000
	(0.007)	(0.007)	(0.008)	(0.008)	(0.003)	(0.004)
LEM	0.007	0.005	-0.017	-0.016	-0.004	-0.004
	(0.003)**	(0.003)*	(0.003)***	(0.003)***	(0.002)**	(0.002)**
Observations	2976	2976	3296	3296	3294	3294
Adjusted *R*-squared	0.520	0.519	0.532	0.532	0.630	0.630

Coefficient estimates with standard errors shown in parenthesis (robust to heteroskedasticity). Both year effects and industry effects are included, but not reported. Dependent (firm performance) variables are the natural logarithm of the expense ratio (LER), the natural logarithm of the total asset turnover (LTAT) and the operating return on assets (OROA). In the two-stage least squares regressions, progressivity is treated as endogenous and the statutory top marginal income tax rate is used as an instrument. Variable definitions and sources are provided in Table 1.
* Significant at 10%
** Significant at 5%
*** Significant at 1%