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Full Length Research Paper

New evidence on determinants of corporate effective tax rates

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This article attempts to explain the different levels of effective tax rates across firms and by means of quantile regression method, this article detect the variation in the sensitivity of firms' effective tax rates (ETRs) to return on assets, capital intensity, inventory intensity, leverage and firm size across the major quantiles of the ETR distribution. The key empirical results show that not all large firms enjoy the political power even though the result of OLS satisfies the political power hypothesis. This paper also indicates who can get the maximum benefits from tax preferences.

Key words: Effective tax rate (ETR), tax preference, political power hypothesis, political cost hypothesis.

INTRODUCTION

Ever since political power hypothesis and political cost hypothesis, assessing the relationship between firm size and effective tax rates (ETRs) have been a leading topic in literature. This topic remains highly relevant today. ETRs have been used by policy makers and interest groups in tax reform debates, especially those related to corporate tax provisions. ETRs are attractive in these debates because they conveniently summarize in one statistic, the cumulative effect of various tax preferences.

Empirical studies on the relation between ETRs and firm size have produced conflicting results. Zimmerman (1983) observes a positive association between ETRs and firm size while Porcano (1986) observes a negative association. No association between ETRs and firm size is found in Stickney and McGee (1982) and Shevlin and Porter (1992). Subsequent studies have tried to reconcile the conflicting results by using modified proxies, time period, data basis, and methodologies (Gupta and Newberry, 1997; Kern and Morris, 1992; Wilkie and Limberg, 1990; Holland, 1998; Kim and Limpaphayom, 1998; Derashid and Zhang, 2003; Liu and Cao, 2007).

Existing empirical research, in my view, suffers from important weaknesses. First, previous studies cannot adequately reflect the company's tax burdens. ETR is a function of the ratio of the tax preferences to book income, where tax preferences are items which cause taxable income to be different from book income. Firms' financing and investment decisions are likely to impact their ETRs because the tax code accords differential treatments. China for economic development gives tax incentives for different firms. Yao (2003) pointed out that the listed companies in China had more than ten kinds of different company tax rates before year 2002. Besides, Wu et al. (2007) and Liu and Cao (2007) also showed that Chinese local governments offered a variety of tax incentives to firms. In other words, there are different levels of ETR across firms. Second, who will receive the maximum benefits from the tax preferences? In the presence of tax preference heterogeneity, quantiles are points on the cumulative distribution function of a random variable. If we calculate the firms' ETRs in the sample and sort the firms according to their tax preferences, the quantiles divide the data into subsets. The marginal effects are likely to be different at the lower and higher quantiles than the mean and we can identify who gets the maximum benefits from tax incentives. Third, OLS estimates may not be representative of entire conditional dependent variable ETR distribution with great tax preference heterogeneity. The dependent variable ETRs and error term are independently but not identically distributed across firms, causing least-squares estimates to be inefficient, and, if the distributions have long tails, extreme observation have significant impacts on estimated coefficients.

In order to test potential differences in parameters between firms at different segments of the distribution of

ETR variable, quantile regression is more appropriate because it enables us to examine the whole distribution of the ETR variable. Instead of focusing on a single measure of the central tendency of the distribution, this study evaluates the relative importance of explanatory variables at different points of the ETR distribution. The quantile regression method allows us to portray the relationship between explanatory variable and effective tax rate for more successful and for less successful firms separately. The estimates of this method are considered robust in comparison with the inefficient produced by standard least squares (Koenker and Bassett, 1978; Buchinsky, 1995, 1998). This paper traces the distribution of ETR conditional quantile on its determinants and generates a much more complete picture of how explanatory variables affect the dependent variable.

This article finds that not all large firms may enjoy the political power even though the result of OLS satisfies the political power hypothesis. This paper also indicates who can get the maximum benefits from tax policies.

ECONOMETRIC FRAMEWORK

The quantile regression method was first proposed by Koenker and Bassett (1978). This method permits the effect of an explanatory variable to differ at different points of the conditional dependent variable distribution, and thus is capable of detecting the variation in the sensitivity of firms' ETRs to the proportion of firm size across the major quantiles of the ETR distribution. The general quantile regression model is:

$$y_i = x_i' \beta_\tau + u_{\tau i} \tag{1}$$

and quantile:

$$_{\tau}(y_i | x_i) = x_i' \beta_\tau , \tag{2}$$

where y_i equals the dependent variable of firm i, x_i' equals a vector of independent variables of firm i, β_τ equals the vector of parameters associated with the τ th quantile (percentile), and $u_{\tau i}$ equals an unknown error term. Unlike ordinary least squares, the distribution of the error term $u_{\tau i}$ remains unspecified in Equation 2.

We require only the conditional τ th quantile of the error term equals zero, that is, quantile $_{\tau}(u_{\tau i}|x_i) = 0.$ Quantile $_{\tau}(y_i|x_i) = x_i'\beta_\tau$ equals the τ th conditional

quantile of y given x with $\tau \in (0,1).$ By estimating $\beta\tau,$ using different values of $\tau,$ quantile regression permits

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different parameters across different quantiles of the dependent variable. In other words, repeating the estimation for different values of τ between 0 and 1, we trace the distribution of *y* conditional on *x* and generate a much more complete picture of how explanatory variables affect the dependent variable.

Furthermore, instead of minimizing the sum of squared residuals to obtain the OLS estimate of $\beta,$ the τ th quantile regression estimate β_τ solves the following minimization problem:

$$\min_{\beta} \left[\sum_{i \in \{i: yi \geq x_i'\beta\}} 2\tau |yi - x_i'\beta| + \sum_{i \in \{i: yi < x_i'\beta\}} 2(1-\tau) |yi - x_i'\beta| \right]. \tag{3}$$

Any quantile of the distribution of dependent variable conditional on independent variables can thus be obtained by changing τ continuously from zero to one and using linear programming methods to minimize the sum of weighted absolute deviations. Two additional features of quantile regression fit our data better than traditional OLS estimations. First, the classical properties of efficiency and minimum variance of the OLS estimator are obtained under the restrictive assumption of independently, identically and normally distributed error terms. When the distribution of errors deviates from normality, the quantile regression estimator may be more efficient than the OLS (Buchinsky, 1998). Second, because the quantile regression estimator is derived by minimizing a weighted sum of absolute deviations, the parameter estimates are less sensitive to outliers and long tails in the data distribution. This makes the quantile regression estimator relatively robust to heteroskedasticity of the residuals.

METHODOLOGY

Variables, data and summary statistics

The sample data used is collected from the Taiwan Economic Journal (TEJ) data base. It consists of companies listed in Chinese two largest stock markets, the Shanghai Security Exchange and the Shenzhen Security Exchange, in the four-year period 1998 to 2001. There are two reasons to choose the four-year period 1998 to 2001. First, the reason for choosing 1998 as the beginning year is that in that year, China started to move its accounting system close to the International Accounting System (IAS). Second, Yao (2003), Wu et al. (2007) and Liu and Cao (2007) indicated that the listed companies in China had more than ten kinds of different company tax rates and a variety of tax incentives, such a situation was easy to demonstrate the existence of tax preferences. For convenience of research, this study deletes some observations using the following criteria: firms with missing data; firms in financial sectors; and firms with negative pre-tax income or tax expenses in any year of the sample period. The resulting sample thus includes 421 firms. There are several ways to measure ETR, but no acceptable one has yet emerged. The key issues include how to determine tax

Table 1. Summary statistics of variables.

Variable	Mean	Std. deviation	Median	Skewness	Kurtosis	Jarque-Bera	Probability
ETR	0.1547	0.1212	0.1416	2.7162	16.7581	15361.53	0
SIZE	13.8235	0.8695	13.7612	0.3055	3.3296	33.8443	0
LEV	0.3584	0.1670	0.3467	0.2770	2.3838	48.2109	0
ROA	0.0922	0.0629	0.0819	3.2139	23.1401	31379.3	0
II	0.1133	0.1180	0.0819	1.9920	8.3301	3109.02	0
CI	0.3125	0.2069	0.2917	0.4758	2.5490	77.8542	0
RESID	2.54E-17	0.1145	-0.0225	2.9388	18.7480	199837	0

expenses, and how to calculate taxable income and the variability of ETR (Derashid and Zhang, 2003). In order to reflect a firm's ability to meet its tax obligations, this study follows previous research (Porcano, 1986; Kim and Limpaphayom, 1998; Liu and Cao, 2007) to accept the definition of Porcano (1986). The ETR is defined as (tax expenses - deferred tax expenses)/ (profit before interest and tax paid). To explore the marginal effects of explanatory variables on ETRs, the following firm-specific characteristics are taken as control variables: leverage (total liabilities divided by total asset value, denoted as "LEV"), capital intensity (net fixed assets divided by total assets, denoted as "CI"), inventory intensity (inventory divided by total assets, denoted as "II"), and return on assets (pre-tax profits divided by total assets, denoted as "ROA"). The reasons to choose these variables are based on previous studies (Porcano, 1986; Gupta and Newberry, 1997; Derashid and Zhang, 2003; Liu and Cao, 2007). The main explanatory variable, firm size (denoted as "Size") is measured as the natural logarithm of total asset value.

Table 1 presents a brief summary of the distributional properties of all variables and residuals of the OLS model. As can be seen from the table, all variables and residuals in OLS model are significantly skewed to the right, meaning that they have long right tails. Departure from normality is also highly apparent in the kurtosis. The small probability values of Jarque-Bera test lead to the rejection of the null hypothesis of a normal distribution. Such departure typically indicates that the set of slope coefficients of the conditional quantile functions are very likely to differ from each other and from the OLS slope parameters (Koenker, 2005). Therefore, it would not be accurate to draw conclusions based on mean regression and quantile regression may perform more efficiently and robustly than the OLS estimations in this study.

EMPIRICAL RESULTS

Empirical investigation is conducted by the quantile regression model at 9 quantiles, namely the 10^{th}, 20^{th}, 30^{th}, 40^{th}, 50^{th}, 60^{th}, 70^{th}, 80^{th} and 90^{th} quantiles. This allows us to examine the impact of explanatory variable at different points of the distribution of ETR. For comparison purposes, this study also provides the OLS estimates.

Table 2 presents the estimated parameters. The first column reports the results for ordinary least squares, and the second to tenth columns the results for quantile regression at the 0.10, 0.20, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9 ETR level quantiles, respectively. For the parameter estimates in Table 2, one, two, and three asterisks indicate statistical significance at the 10, 5, and 1% significance levels, respectively. The OLS estimates reported indicate that all explanatory variables are statistically significant at 1 or 10% level. While those slope coefficients may represent a plausible relationship between an explanatory variable and dependent variable; therefore, it is worth going beyond the average tendency and investigating the separate responses of ETR to explanatory variables at different quantiles of ETR distribution. The estimated coefficients on size variable are negative significantly different from zero in the six quantiles of 30^{th}, 40^{th}, 50^{th}, 60^{th}, 70^{th} and 80^{th} but in the three quantiles of 10^{th}, 20^{th} and 90^{th} are not significantly different from zero. The empirical results of quantile regression show that not all large firms may enjoy the political power even though the result of OLS satisfies the political power hypothesis and the results clearly indicate that the quantile of 70^{th} get the maximum benefits from tax preferences. The estimated coefficients on ROA, CI and II explanatory variables are all significantly different from zero. The results of LEV are not significantly different zero in the four low quantiles of the 10^{th}, 20^{th}, 30^{th} and 40^{th} while they are positive and significantly different from zero in the five upper quantiles of the 50^{th},60^{th},70^{th}, 80^{th} and 90^{th}. These findings suggest the effects of an explanatory variable to differ at different points of the conditional ETR distribution, and thus are capable of detecting the variation in the sensitivity of firms' ETRs to an explanatory variable across the major quantiles of the ETR distribution.

Conclusions

To consider the characteristics of tax preference in tax burdens, this study uses the tax incentives of Chinese government to reflect the different levels of ETR. For comparison purposes, this study is to employ both OLS and conditional quantile regression methods for the investigation of the impact of the explanatory variables on ETRs. The key empirical results of quantile regression show that not all large firms may enjoy the political power even though the result of OLS satisfies the political power hypothesis. Besides, this study also indicates who can get the maximum benefits from tax preferences. Other

Table 2. Marginal effects for the OLS and Quantile regression models.

Variable	OLS estimates	Quantile regression estimates								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Intercept	0.187*** (0.048)	0.048 (0.043)	0.072 (0.044)	0.0164*** (0.035)	0.208*** (0.035)	0.232*** (0.034)	0.248*** (0.032)	0.259*** (0.051)	0.244*** (0.091)	0.223 (0.079)
SIZE	-0.006* (0.003)	-0.002(0.003)	-0.004 (0.002)	-0.008*** (0.002)	-0.010*** (0.002)	-0.011*** (0.002)	-0.011*** (0.002)	-0.013*** (0.003)	-0.010* (0.006)	-0.003 (0.005)
CI	-0.290*** (0.046)	-0.103*** (0.029)	-0.092** (0.046)	-0.139** (0.038)	-0.132*** (0.043)	-0.142*** (0.036)	-0.138*** (0.044)	-0.120** (0.053)	-0.210*** (0.048)	-0.322*** (0.060)
ROA	0.162*** (0.013)	0.132*** (0.012)	0.0170*** (0.007)	0.159*** (0.007)	0.0154*** (0.012)	0.136*** (0.011)	0.133*** (0.014)	0.171*** (0.025)	0.228*** (0.019)	0.192*** (0.025)
II	0.124*** (0.025)	0.100*** (0.018)	0.147*** (0.025)	0.163*** (0.017)	0.158*** (0.018)	0.122*** (0.023)	0.137*** (0.023)	0.130*** (0.031)	0.154*** (0.040)	0.132** (0.060)
LEV	0.034* (0.017)	0.004 (0.014)	-0.000 (0.013)	-6.89E-05 (0.012)	0.010 (0.014)	0.026* (0.014)	0.036** (0.014)	0.104*** (0.026)	0.132*** (0.026)	0.131*** (0.034)

Standard errors are in parentheses. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

findings suggest that we can detect the variation in the sensitivity of firms' ETRs to return on assets, capital intensity, inventory intensive and leverage across the major quantiles of the ETR distribution.

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