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ETRs of Electronic and Non-Electronic Firms Listed on Taiwan Stock Market: Panel Models with Two-sided Censoring

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ABSTRACT

This paper seeks to investigate the determinants of ETRs (effective tax rates) for the firms listed on Taiwan's stock market. Since the dependent variable, ETR, is left-censored at zero and right-censored at the maximum corporate tax rate 25 %, the estimation for a panel data model with two-sided censoring suggested by Alan *et al.* (2008) is implemented in this paper. Our empirical data consist of panel data of 737 firms (345 in electronic and 392 in non-electronic industries) listed on Taiwan's stock market from 1997 to 2006. Several interesting empirical findings are obtained. First, neither the political power hypothesis nor the political cost hypothesis is empirically supported. Second, the effect of "leverage" is negatively significant from the regressions using the sample with all firms and the sub-sample with non-electronic firms; but is negatively non significant using the sub-sample with electronic firms. Third, for the capital intensity, the coefficient is significantly negative for the regressions using samples with all firms, electronic firms and non-electronic firms. Fourth, the coefficient of inventory intensity is insignificant for all regressions. Finally, the effect of ROA is positively significant for all regressions. In summary, since the political power hypothesis is not supported by listed firms on the Taiwan stock market, any unfairness from the tax advantage for larger firms is not statistically supported.

1. Introduction

By implementation of the Promotion Investment Act (PIA) before 1992 and the Promotion Industrial Upgrading Act (PIUA, also known as the Statute for Upgrading Industries) from 1992 to 2009, the Taiwan government has provided tax exemptions and incentives to encourage companies engaged in research and development, personnel training, the establishment of international brands, the purchase of automation equipment, and pollution control. The so-called "miracle of Taiwan's economic development" and the well-established high-tech industry resulted from these tax policies. Under these two acts, big business conglomerates have saved more than NT $1.5 trillion in tax payment during the past 50 years. After the expiration of the Statute for Upgrading Industries on Dec. 31, 2009, a so-called Industrial Innovation Bill was proposed by Taiwan's Executive Yuan (Cabinet) to continue attracting

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investment capital from Taiwan-based and foreign firms to create job opportunities and expand tax revenues. The Bill states that enterprises with investment for industrial innovation, and those cultivating talent to create jobs may be eligible to receive tax incentives. After the business income tax rate is cut to 17 % from 25 %, the new rate will equal that of Singapore and approach the 16.5% in Hong Kong and 12.5% in Ireland, becoming the second lowest in Asia.

Originally, clauses in the bill stipulated that only those among the world's 500 biggest enterprises with operations in Taiwan could apply for the 15 percent corporate income tax break. This is the incentive to foster international competitiveness such as promoting R&D or establishing operational headquarters in Taiwan. Since it was widely conceived that the bill was customized to favour foreign conglomerates, the plan has provoked strong suspicion and complaints from some business and industry leaders. At the last stage, the Taiwan Cabinet decided that all local small and medium-sized businesses irrespective of size or sector can apply for the incentives suggested in the bill. Among the issues of intense debate and strongly opposite arguments are why favor foreign enterprises and why favor large-scale firms. A widely-held conception is that large- scale firms in Taiwan have enjoyed greater tax incentives than small and medium-sized businesses. This issue concerns fairness and tax neutrality. The present paper is designed to provide empirical evidences to help resolve this question.

Due to its convenience for measuring the tax burden of a corporation, average effective tax rates (ETRs) have long been calculated by policy makers and cited by interest groups in tax reform debates, especially when those debates relate to corporate tax provisions. Governments provide tax incentives for firms subject to high levels of risk due to large amounts of capital investment, a lengthy production process, or uncertainty in activities such as mineral exploration (Stickney and McGee, 1982). Reduction of the corporate tax as a tool for stimulating a certain industry and elimination of certain tax preferences as a tool for pursuing social justification are also the focus of the tax policy debates. Tax incentives reduce the tax burden of firms and imply non-neutrality of the tax system. Proponents of neutrality argue that the market would more effectively price the risk factors faced by some firms. Furthermore, the contention that varying tax burdens across firms are inequitable is sometimes used as a justification for tax reform (Gupta and Newberry, 1997). In other words, a neutral empirical study of the variability of ETRs among firms is a way to check tax neutrality and social justification in a country.

Balancing efficiency and equity under the principle of revenue neutrality is the most important tax reform issue for a country. Tax exemptions and incentives are provided as tools to foster the industries having relative advantage and international competitiveness in the hope of improving the efficiency of an economy. On the other hand, imposing taxes on cooperative profit and raising tax levels are tools for smoothing income distribution and fairness improvement. In Taiwan, just as in the major countries of the world, conflict can occur between efficiency and fairness. Since Taiwan's economic development has focused on high-tech applications, corporations in that sector have enjoyed tax exemption from the Statute for Upgrading Industries over the past decade. Since that market is very big, a company can make a lot of money if the economy is performing well. As a result one need only be connected to the high-tech industry to have a high income, which in turn causes problems in terms of fairness.

Whether the ETRs are systematically related to firm size has been the focus of the tax policy debates and literature.

Theoretically, there are two different hypotheses suggested in the literature to explain the relationship between firm size and the level of ETRs. One, the *political cost hypothesis*, is that the higher visibility of larger and more successful firms might cause them to become victims of greater regulator actions and wealth transfers and as a result, incur a political cost in the form of a higher ETR (Zimmerman 1983). The second, *political power (or clout) hypothesis* holds that larger firms pay less tax less than their share of taxes because they devote more effort to tax planning and political lobbying. Empirically, studies on the relation between ETRs and f9rm size have produced confiicting results. Zimmerman (1983) observes a positive association between ETRs and firm size while Porcano (1986) observes a negative association. No significant correlation between ETRs and firm size is found in Stickney and McGee (1982) and Shevlin and Porter (1992).

Some studies have tried to reconcile the conflicting results by using variant ETR measurements, different time periods, countries, and methodologies (e.g., Gupta and New- berry,1997; Kern and Morris,1992; Wilkie and Limberg,1990; Holland, 1998; Kim and Limpa- phayom, 1998; Derashid and Zhang, 2003; Liu and Cao, 2007). Even though panel data models have been used to overcome the problem of model misspecification in studies on the determinants of ETRs (e.g. Gupta and Newberry,1997; Harris and Feeny, 2003; Liu and Cao, 2007), the censoring characteristic of ETRs is not considered in existing literature.

In our sample, more than 20 % of firms enjoy zero ETRs and 10 % pay less than the ceiling rate of 25 %. That is, 33 % of ETRs are two-side censored out at zero and 0.25. It is well known that the regression estimators are biased and inconsistent if the existence of censoring in the dependent variable is neglected. Therefore, this paper will employ the panel data models with two-sided censoring suggested by Alan *et al.* (2008) to study the determinants of ETRs for the listed electronic and non-electronic firms on the Taiwan stock market.

The remainder of this paper is organized as follows. Section 2 reviews existing studies on the ETRs for corporations in Taiwan. The econometric background of using panel data model to study the determinant of firms' ETRs is explored in section 3 based on the approach of Harris and Feeny (2003). Section 4 introduces the estimation of panel data models with two-sided censoring suggested by Alan *et al.* (2008). Empirical studies are investigated in section 4. Some conclusions and suggestions are presented in the last section.

2. Econometric Models

Suppose the firm i at financial year t earns positive taxable income y_{it} in which the gross taxburden, tax_{it}^{g}, of the firm i will be a share of taxable income with the statutory tax rate π_t i.e.,

$$tax_{it}^{g} = \pi_t y_{it}.$$

Furthermore, suppose there are K items of tax rebates, appropriate credits, tax incentives and preferences, the tax payable of firm i becomes $\pi_t y_{it} - \sum_{k=1}^{K} \Delta_{it}^{k}$ where $\sum_{k=1}^{K} \Delta_{it}^{k}$ is the total amount of tax reduction obtained by the firm. In addition, as the taxable income y_{it} is the net of gross profit π_{it} substracting from J tax shields and exemptions, i.e., δ_{it}^{j}, $j = 1, \ldots, j$, then $y_{it} = \pi_{it} - \sum_{j=1}^{J} \delta_{it}^{j}$. Therefore, the tax payable of the firm i is

$$\begin{aligned} tax_{it} &= \pi_t y_{it} - \sum_{k=1}^{K} \Delta_{it}^{k} \\ &= \pi_t \left[\pi_{it} - \sum_{j=1}^{J} \delta_{it}^{j} \right] - \sum_{k=1}^{K} \Delta_{it}^{k} \\ &= \pi_t \pi_{it} - \pi_t \sum_{j=1}^{J} \delta_{it}^{j} - \sum_{k=1}^{K} \Delta_{it}^{k} \end{aligned}$$

Given the definition of ETR, the payable tax divided by gross income, we have the ETR of firm i

$$ETR_{it} = \frac{tax_{it}}{\pi_{it}}$$
$$= \pi_t - \frac{\pi_t}{\pi_{it}}\sum_{j=1}^{J}\delta_{it}^{j} - \frac{1}{\pi_{it}}\sum_{k=1}^{K}\Delta_{it}^{k}.$$

This ETR determination equation suggests the following panel econometric model:

$$y_{it} = \lambda_t + x_{it}'\beta + \alpha_i + u_{it}$$

Which is the estimating equation of Gupta and Newberry (1997) and Harris and Feeny (2000, 2003). Harris and Feeny (2003) point out the model misspecification problem caused by the omission of λ_t in the estimated equation adopted in Gupta and Newberry (1997). As pointed out by Harris and Feeny (2003), the quantity $\frac{\pi_t}{\pi_{it}}\sum_{j=1}^{J}\delta_{it}^{j} - \frac{1}{\pi_{it}}\sum_{k=1}^{K}\Delta_{it}^{k}$ is being modeled by $x_{it}'\beta$ and the error term u_{it} is added to represent the prediction difference. In addition, α_i represents the individual effects for allowing for the unobserved firm heterogeneity. However, in the calculation of ETRs, zero value is given to the firm with a negative gross profit, i.e., $\pi_{it} < 0$. That is there will be number of firms having zero ETRs when the financial year t is in economic recession. Whenever there is a moderate proportion of firms having ETRs equal to zero (the smallest value of the valid ETRs), the data of ETRs are said to be left censored at zero. Moreover, there is a maximum cooperate tax rate set up by government tax system, say 25% in Taiwan. Therefore, the level of ETR in never larger than the maximum cooperate tax rate 25% in Taiwan. As ETR is the dependent variable, the panel regression model with censored dependent variable has to be considered. The panel data model with two-sided censoring suggested by Alan *et al* (2008) is implemented in this paper.

3. Panel Data Model with Two-sided Censoring

Since the effective tax rates are between 0 and 0.25 with a significant number of observations on either of the limits, the specification of the panel data model is

$$y_{it}^{*} = x_{it}'\beta + e_{it}$$
$$y_{it} = \begin{cases} a & if \quad y_{it}^{*} < a \\ y_{it}^{*} & if \quad a \le y_{it}^{*} \le b \\ b & if \quad y_{it}^{*} > b \end{cases} \qquad (1)$$

where e_{it} is stationary conditional on (x_{i1}, …, x_{iT}). The derivation of estimator for β suggested by Alan *et al* (2008) is briefly summarized as follows.

Define, for $a \le b$,

$$mami\{a, y, b\} = \begin{cases} a & if \quad y < a \\ y & if \quad a \le y \le b \\ b & if \quad y > b \end{cases}$$

so (1) can be written as

$$y_{it} = mami\{a, x_{it}'\beta + e_{it}, b\}.$$

Consider as individual, i, in two time periods, t and s. The distribution of $y_{it} - x_{it}'\beta$ will be the same as that of e_{it} except that the former is censored from below at $a - x_{it}'\beta$ and from above at $b - x_{it}'\beta$. The dotted line depicts the distribution of e_{it}, while the solid line gives the distribution of $y_{it} - x_{it}'\beta$, which typically has point mass at $a - x_{it}'\beta$ and $b - x_{it}'\beta$ (illustrated by the fatter vertical lines). Since $x_{it}'\beta$ will typically differ from $x_{it}'\beta$, the distributions of $y_{it} - x_{it}'\beta$ and $y_{it} - x_{it}'\beta$ (given(x_{it}, x_{is})) will differ even if $\{e_{it}\}$is stationary. However, it is clear that one could obtain identically distributed "residual" by artificially censoring $y_{it} - x_{it}'\beta$ and $y_{it} - x_{it}'\beta$ from below at $\max\{a - x_{it}'\beta, a - x_{is}'\beta\}$ and from above at $\min\{b - x_{it}'\beta, b - x_{is}'\beta\}$. One can then form moment conditions from the fact that the difference in these "re-censored" residuals will be orthogonal to functions of (x_{it}, x_{is}).

Also define functions $u_1(y_{it},\cdot)$ and $u_2(y_{is},\cdot)$ over the interval $-(b-a)$ to $(b-a)$ as follows

$$u_1(y_{it},d)=\begin{cases}\max\{y_{it}-d,a\} & for \quad b-a\ge d\ge 0\\ \min\{y_{it},b+d\} & for \quad 0\ge d\ge -(b-a)\end{cases}$$

and

$$u_2(y_{is},d)=\begin{cases}\min\{y_{is},b-d\} & for \quad b-a\ge d\ge 0\\ \max\{y_{is}+d,a\} & for \quad 0\ge d\ge -(b-a)\end{cases}$$

With these definitions, $u_1(y_{it},x_{it}'\beta-x_{is}'\beta)$ $-u_2(y_{is},x_{it}'\beta-x_{is}'\beta)$ will give the difference I in the re-censored residuals by artificially censoring $y_{it}-x_{it}'\beta$ and $y_{is}-x_{is}'\beta$ from below at $\max\{a-x_{it}'\beta,a-x_{is}'\beta\}$ and from above at $\min\{b-x_{it}'\beta,b-x_{is}'\beta\}$.

Let the functions $r_1(y_{it},\cdot)$ and $r_2(y_{is},\cdot)$ are defined over the interval $-(b-a)$ to $(b-a)$ as

$$r_1(y_{it},d)=\begin{cases}db+\frac{1}{2}d^2+\frac{1}{2}(y_{it}-d)^2 & for \quad d\le y_1-b\\ dy_{it} & for \quad y_{it}-b\le d\le a\\ dy_{it}-\frac{1}{2}d^2 & for \quad a\le d\le y_{it}-a\\ da+\frac{1}{2}(y_{it}-a)^2 & for \quad y_{it}-a\le d\end{cases}$$

and

$$r_2(y_{is},d)=\begin{cases}da-\frac{1}{2}(y_{is}-a)^2 & for \quad d\le -(y_{is}-a)\\ \frac{1}{2}d^2+dy_{is}- & for \quad -(y_{is}-a)\le d\le a\\ dy_{is} & for \quad 0\le d\le b-y_{is}\\ db-\frac{1}{2}d^2-\frac{1}{2}(y_{is}-b)^2 & for \quad b-y_{is}\le d\end{cases}$$

The functions $r_1(y_{it},\cdot)$ and $r_2(y_{is},\cdot)$ are constructed so their derivatives are $u_1(y_{it},\cdot)$ and $u_2(y_{is},\cdot)$, respectively. Finally, define

$$R(y_{it},y_{is},d)=r_1(y_{it},d)-r_2(y_{is},d).$$

Alan *et al* (2008) show that

$$\frac{\partial}{\partial d}R(y_{it},y_{is},d)=u_1(y_{it},d)-u_2(y_{is},d).$$

Suppose that

$$y_{it}=mami\{a,\delta+e_{it},b\}$$

and

$$y_{is}=mami\{a,e_{is},b\}$$

where e_{it} and e_{is} are identically distributed random variables with support on the whole real line. Then Alan *et al* (2008) prove that

$$\arg\max_{d\in[-(b-a),(b-a)]}E[R(y_{it},y_{is},d)]=\begin{cases}-(b-a) if\, \delta\le -(b-a)\\ \delta \quad if\, -(b-a)<\delta<(b-a)\\ (b-a) if\, \delta\ge (b-a)\end{cases}$$

If e_{it} is stationary conditional on (x_{it}, x_{is}) with support on the whole real line, then the set of solutions to

$$\max_b E[R(y_{it},y_{is},mami\{-(b-a),(x_{it}-x_{is})'b,(b-a)\})]$$

is

$$\{b: P[mami\{-(b-a),(x_{it}-x_{is})'b,(b-a)\}$$
$$=mami\{-(b-a),(x_{it}-x_{is})'\beta,(b-a)\}]=1\}.$$

Therefore, when the censoring points are a and b, the sample analog estimator is

$$\hat\beta_n=\arg\min_b\sum_{i=1}^{n}\sum_{1\le s,t\le T_i}w_{i,t-s}R[y_{is},y_{it},mami\{-(b-a),1,(x_{is}-x_{it})'b,(b-a)\}]$$

where the $w_{i,t-s}'$s are exogenous weights and T_i is the number of observations for the ith individual. $w_{i,t-s}=1/T_i$ is a trivial choice.

It is proved by Alan *et al* (2008) that $\hat\beta_n$ is consistent and asymptotically normal under appropriately conditions. Under random sampling

$$\sqrt{n}(\hat\beta_n-\beta)\to_d N(0,\Gamma^{-1}V+\Gamma^{-1}),$$

where

$$\Gamma=E\Big[\sum_{s<t}w_{i,t-s}1\{-(b-a)<(x_{is}-x_{it})'\beta<(b-a)\}$$
$$(1\{-(b-a)<(x_{is}-x_{it})'\beta<y_{is}-b\}-1\{-(b-a)<(x_{is}-x_{it})'\beta<y_{is}-a\}$$
$$-1\{a-y_{it}<(x_{is}-x_{it})'\beta<a\}+1\{b-y_{it}<(x_{is}-x_{it})'\beta<(b-a)\})$$
$$(x_{is}-x_{it})(x_{is}-x_{it})'\Big]$$

and

$$V=E[v_iv_i']$$

with

$$v_i=\frac{1}{T_i}\sum_{s<t}w_{i,t-s}1\{-(b-a)<(x_{is}-x_{it})'\beta<(b-a)\}$$
$$(u_1(y_{is},(x_{is}-x_{it})'\beta)-(u_2(y_{it},(x_{is}-x_{it})'\beta))(x_{is}-x_{it}).$$

Following standard arguments, these are consistently estimated by

$$\hat\Gamma_n=\frac{1}{n}\sum_{i=1}^{n}\Big[\sum_{s<t}w_{i,t-s}1\{-(b-a)<(x_{is}-x_{it})'\beta<(b-a)\}$$
$$(1\{-(b-a)<(x_{is}-x_{it})'\beta<y_{is}-b\}-1\{-(b-a)<(x_{is}-x_{it})'\beta<y_{is}-a\}$$
$$-1\{a-y_{it}<(x_{is}-x_{it})'\beta<a\}+1\{b-y_{it}<(x_{is}-x_{it})'\beta<(b-a)\})$$
$$(x_{is}-x_{it})(x_{is}-x_{it})'\Big]$$

and

$$\hat{V}_n = \frac{1}{n}\sum_{i=1}^{n}\hat{v}_i\hat{v}_i'$$

with

$$\hat{v}_i = \frac{1}{T_i}\sum_{s<t} w_{i,t-s} 1\{-(b-a) < (x_{is}-x_{it})'\hat{\beta}_n < (b-a)\}$$

$$(u_1(y_{is},(x_{is}-x_{it})'\hat{\beta}_n) - (u_2(y_{it},(x_{is}-x_{it})'\hat{\beta}_n))(x_{is}-x_{it}).$$

4. Empirical Studies

The sample data used in this study were collected from the Taiwan Economic Journal (TEJ) database. The sample consists of 737 firms (of which 345 firms are in the electronic industry and 392 the non-electronic industry) each year listed on Taiwan market from 1997 to 2006. For the measure of ETR, Zimmerman (1983) argues that operating cash flow is the best measure to use in the denominator since it eliminates the impact of accrual accounting procedures, which vary with firm size. On the other hand, Porcano (1986) contends its suggested measure is superior because it better reflects a firm's ability to meet its tax obligations. Since deferred taxation is not widely used in Taiwan except for a small number of firms, the definition of ETR in Porcano (1986) is used in this paper. That is, ETR is measured as tax expenses divided by profit before interest and taxes paid. It is worth mentioning that the negative ETRs are replaced with zeros (left censoring) and that ETRs larger than 0.25 (the maximum business tax rate set up by Taiwan government) are replaced with 0.25 (right censoring).Iin Taiwan, there are a total of 1867 (25.3%) of observations with zero ETRs (27.1% for electronic and 23.8 % for non-electronic firms) For the right censoring, there are 9% observations (7.8% electronic vs. 10.1% non-electronic) with ETR equal to 0.25.

To explore the marginal effect of firm size 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 rationale for choosing these variables is based on previous studies (e.g., 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. The summary statistics for the considered variables in this paper are displayed in Table 1.

For the level of tax burden (ETR), the average ETR for the whole sample is 0.1084, with electronic firms displaying a lower average level (0.1032) than non-electronic firms (0.11306). Based on the unconditional mean estimations, firms in the electronic industry enjoy greater tax preference than firms in the non-electronic industry. The average firm size is 14.72 for electronic firms and 15.10 for non-electronic firms. This indicates that the firm scale is larger for firms in non-electronic industry than in electronic industry. For leverage (LEV), capital intensity (CI) and inventory intensity (II), non-electronic firms have larger sample averages electronic firms. For the performance measure, ROA, firms in electronic industry have a higher average level than the non-electronic firms.

To compare the effect of censoring on regression results, two regressions with and without consideration of censoring are conducted for the combined sample of all electronic and non-electronic firms The fixed-effect panel models are estimated for regressions without considering two-sided censors and the empirical results are shown in the columns labeled "Without" in Table 2. The columns labeled "With" contain the estimated results based on the method of Alan et al. (2008) for the panel model considering two-sided censors.

In Table 2, the estimated coefficients of "SIZE" are different between the panel regressionswith and without considering two-sided censors. For the regressions without considering two-sided censors using the sample with all firms and the sample with electronic firms, the marginal effects of "Size" on ETRs is significantly negative. These two results support the political power hypothesis. However, the marginal effects become negatively insignificant from the regressions when considering two-sided censors for all firms and electronic firms (only significant at 10 %). For regressions using the sample with non- electronic firms, the marginal effects are positively but not significant for both cases with and without considering two-sided censors. To sum up, neither the political power hypothesis nor the political cost hypothesis is supported statistically from the panel regressions which consider two-sided censors for firms listed on Taiwan's stock market. Therefore, firm size is not a significant determinant of ETRs.

Since the interest cost of leverage is tax deductible but dividends are not in Taiwan, the capital structure is a factor which affects a firm's ETR. For a firm with more leverage, the higher the interest paid, the larger the tax deduction it enjoys. That is, a negative relation is expected between the ETR level and leverage amount. Table 2 shows that the estimated marginal effects of "LEV" on ETRs are significantly negative from regressions with and without consideration of two-sided censors using samples of all firms and of non-electronic firms. However, the marginal effects become negatively insignificant from both regressions with and without considering two-sided censors using the sample with electronic firms.

Since the choice of the fixed asset-depreciation method is encouraged by Taiwan's tax law, depreciation is reckoned as cost by the financial accounting standard and is tax deductible. This implies the greater proportion of fixed assets (e.g., capital intensity) a firm has, the more capital depreciation, the less taxable income, and the lower the ETR. Consequently, the relation between ETR and capital intensity is expected to be negative. Consistently, the estimated coefficients of "CI" are found to be significantly negative for all regressions. This shows that all firms in Taiwan enjoy tax benefit from using more leverage. However, the effects are different between electronic and non-electronic firms. The estimated coefficient is larger in absolute value from regressions using observations of electronic firms. This signifiess that electronic firms in Taiwan enjoy more tax deductibility through leveraging.

The estimated coefficients of the inventory intensity "II" are all statistically non significant for the regressions considered in this paper. That is, inventory intensity is not an important factor affecting the tax burden ofr firms listed on Taiwan's stock market.

Taxable income is calculated on the adjustment of financial accounting profit, and the amount of profit shows the earning ability of a company. In the theory of tax-burden impar tiality, ETR has nothing to do with earning abilities, but a positive relationship is found in Gupta and Newberry (1997). The estimated coefficients of "ROA", shown in Table 2, are all positive and significant at the 5 % level. This suggests that higher the profitability of a firm, the higher the ETR it pays. This result is expected and is consistent with that in Gupta and Newberry (1997). The rationale of this finding is that a firm with greater profitability usually gets more monitoring from the official tax bureau and then enjoys a reduced tax preference it. However, the estimated coefficient from the regression using observations of non-electronic firms is much greater than the one using electronic-firm observations. This indicates that electronic firms in Taiwan have been more protected than non-electronic firms.

5. Conclusions and Suggestions

This paper has investigated the determinants of ETRs (effective tax rates) paid by firms listed on Taiwan's stock market. Since the dependent variable, ETR, is left-censored at 0 and right-censored at 0.25, the panel data model with two-sided censoring suggested by Alan et al. (2008) was implemented in this paper. Our empirical data consisteds of a panel of 737 firms (345 in electronic and 391 in non-electronic industries) listed on Taiwan's stock market from 1997 to 2006.

Four main empirical findings are obtained. First, the firm size is a negative but statistically insignificant determinant on ETRs for firms listed on the Taiwan stock market when estimated through panel regressions with two-sided censors. This finding is different from the ones from regressions which do not consider two- sided censors. Since the estimator is biased in a regression without considering censors when the dependent variable does indeed have censors, the more reliable conclusion is that neither the political power hypothesis nor the political cost hypothesis is supported by our empirical results.

Secondly, similar to the findings for size, the effect of "leverage" is negatively significant for whole firms and non-electronic firms but is insignificant for the electronic firms. This result indicates that the more the firm leverages, the lower the effective tax rate paid by the firm. This relation is typical for non-electronic firm but does not apply to electronic firms.

Third, for the capital intensity, the coefficient is significantly negative for regressions using samples with all firms. This shows that higher the capital intensity of the firm, the lower the ETR it pays.

Fourth, while the coefficient of inventory intensity is insignificant for all regressions, ROA is positively significant for all regressions. This indicates that the better the performance of a firm have, the lower the effective tax rate paid.

Based on these empirical results, neither the political power hypothesis nor the political cost hypothesis is supported for the firms listed on Taiwan's stock market. This result reveals that the unfairness from the tax advantage for larger firms is not statistically supported.

Table 1: Summary Statistics for Firms Listed on Taiwan Stock Markets

ALL	ETR	SIZE	LEV	CI	II	ROA
Min	0.0000	6.908	0.0000	-0.01165	0.00000	-2.46428
Q_1	0.0000	13.995	0.2782	0.08092	0.05529	0.01153
Median	0.1028	14.812	0.4016	0.17406	0.11238	0.05367
Mean	0.1084	14.923	0.4091	0.21672	0.14671	0.04896
Q_3	0.1978	15.704	0.5198	0.32116	0.18532	0.10320
Max.	0.2500	20.167	2.1282	0.97772	0.92141	0.64409
Electron	ETR	SIZE	LEV	CI	II	ROA
Min	0.00000	6.908	0.0000	-0.01165	0.00000	-2.46428
Q_1	0.00000	13.810	0.2592	0.05967	0.05285	0.01508
Median	0.09488	14.580	0.3834	0.12042	0.10944	0.06878
Mean	0.10320	14.720	0.3902	0.17310	0.12627	0.05553
Q_3	0.19060	15.450	0.5035	0.24169	0.17487	0.12323
Max.	0.25000	20.170	2.0488	0.83455	0.76818	0.64409
Non-Elect	ETR	SIZE	LEV	CI	II	ROA
Min	0.00000	10.76	0.01024	0.0000	0.00000	-1.317964
Q_1	0.00188	14.17	0.29899	0.1240	0.05772	0.009558
Median	0.11333	15.01	0.41604	0.2295	0.11519	0.044293
Mean	0.11306	15.10	0.42574	0.2551	0.16470	0.043183
Q_3	0.20359	15.88	0.53624	0.3613	0.19465	0.087232
Max.	0.25000	19.90	2.12821	0.9777	0.92141	0.428378

Table 2: Estimated Results for Panel Data Model with Two-side Censoring

	All		Electronic		Non-Electronic	
	Without	With	Without	With	Without	With
SIZE	-0.0054177	-0.00775	-0.0068435	-0.0105	0.0017037	0.0005
t-value	(-2.0669)	(-1.529)	(-2.2896)	(-1.688)	(0.3464)	(0.360)
LEV	-0.0306183	-0.04075	-0.0229545	-0.03175	-0.0374301	-0.01275
t-value	(-2.7294)	(-1.973)	(-1.4994)	(-1.064)	(-2.3278)	(-2.107)
CI	-0.077941	-0.15425	-0.0742071	-0.1595	-0.0725664	-0.02025
t-value	(-4.5557)	(-4.689)	(-2.8576)	(-3.309)	(-3.089)	(-2.261)
II	0.0073774	0.0205	0.0277884	0.04075	-0.0276572	-0.0025
t-value	(0.3704)	(0.586)	(0.8879)	(0.801)	(-1.073)	(-0.260)
ROA	0.1266513	0.4365	0.1017450	0.3255	0.1931732	0.0945
t-value	(7.4663)	(10.837)	(5.5756)	(6.197)	(6.5707)	(9.944)

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