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Effects of Adopting Nonfinancial Performance Measures and Job Redesign on Employee Performance—A Field Empirical Investigation*

Chaur-Shiuh Young†
National Chung Cheng University

ABSTRACT: This paper reports the results of a longitudinal field study examining the effects of adopting both nonfinancial performance measures and job redesign on employee performance. A commercial bank was the research site. The bank adopted nonfinancial performance measures in July 1995 and redesigned credit-making jobs in its retail banking activities at five branches in January 1996. Prior to the job redesign, sales representatives were jointly responsible for all credit-making functions, including credit-extension and credit-verification. After the change, sales representatives were responsible only for credit-extension while credit verifiers handled credit-verification. Panel data for 17 sales representatives over 60 months (1993 through 1997) were obtained to assess the effects of adopting nonfinancial measures on employee performance. Using fixed-effects regression analysis, the results are shown to be consistent with the predictions of agency theory: although loan amounts and interest income decreased following adoption of nonfinancial measures to evaluate and compensate the performance of sales representatives, loan profit increased significantly. This paper also hypothesizes that employee performance increases with the fit between incentive systems based on nonfinancial measures and job design. The empirical tests of this prediction rely on an interrupted time-series design, using performance data of 51 sales representatives in the 1995-1997 period. After the change in job design—separation of the credit-making jobs—along with introduction of incentive systems based on nonfinancial measures, the treatment group demonstrated greater improvements in productivity and quality performance. This result supports the hypothesis developed.

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† Email: actycs@ccunix.ccu.edu.tw
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Data Availability: The confidentiality agreement with the bank that provided data for this study precludes disclosing its identity or disseminating data without its written permission.

I. INTRODUCTION

This paper examines the performance impact of both nonfinancial performance measures and job design incentive instruments. The Informativeness principle of agency theory indicates that performance measurement and reward systems should incorporate any measure that provides incremental information on managerial effort. However, firms traditionally have relied almost exclusively on financial measures, such as budgets, profits, and accounting returns for measuring performance (Balkcom et al. 1997). Recently, the perceived inadequacies in traditional accounting-based performance measurement systems have motivated many firms to integrate nonfinancial measures with financial measures (Ittner and Larcker 1998). For example, Kaplan (1990) summarized current research and noticed an increasing trend for the use of direct, operational measures of process improvements—in quality, delivery time, and productivity—to motivate and evaluate employees. In addition, Ittner et al. (1997) reported that 36% of the companies surveyed use nonfinancial measures in their executive compensation plans.

In Taiwan, there have also been calls from researchers for greater emphasis on nonfinancial measures. For example, Wu (1990) argued that firms should give equal consideration to financial and nonfinancial measures. Furthermore, according to Liang (1993), many firms now believe that the heavy emphasis placed on financial measures is inconsistent with their relative importance. In light of the increasing importance of nonfinancial measures and the scarcity of studies examining the performance consequences from their use, the first objective of this paper is to provide evidence for the performance impact of adopting nonfinancial measures in performance measurement systems.

Holmstrom and Milgrom (1991) emphasized that job design will affect the working incentives of agents. Therefore, in addition to performance evaluation and incentive plans, job design is an additional incentive instrument. To date, most current accounting empirical literature has focused on the motivating effects of incentive pay (Pavlik et al. 1993), and little evidence exists for the motivating effects of job design. Milgrom and Roberts (1995) proposed that the incentive structure choices in organizations present a complementary nature (which I refer to as “complementary management choices theory” thereafter). Holmstrom and Milgrom (1994) demonstrated that performance incentives, worker ownership of assets, and worker job design are complementary instruments for motivating workers. Since several activities compete for a worker’s attention, they expect that in an optimal system, the three instruments would have to be balanced to keep the various incentives in balance. Subsequently, accounting researchers have begun to investigate the complementarities between alternative management choices. In recent
work, researchers have examined complementarities among TQM, JIT and performance measures (Sim and Killough 1998), and between transfer pricing methods and organizational structure choices (Ghosh 1998). Drake et al. (1999) also demonstrated that the effectiveness of an accounting cost system is influenced by its interactive effect with incentive structure choices. Seeing that investigating the contingency variables affecting the performance consequences of various nonfinancial measures is beneficial (Ittner and Larcker 1998, 224), the second objective of this paper is to examine the joint effects of job redesign and nonfinancial measures incentive system on employee performance.

The bank used as a case in this paper (which I refer to as “the case bank” thereafter) adopted nonfinancial performance measures in 1995 and did an experiment that separated the job of making loans into two tasks—credit-verification and credit-extension in 1996. This context provides a good opportunity to empirically test the joint impacts of job redesign and nonfinancial measures incentive design on employee performance. Using panel data from a number of credit-making officers in the case bank, I found that both financial profit and nonfinancial performance improved following the implementation of a performance measurement system that included nonfinancial measures. In addition, field empirical analysis also shows that there are positive interactive effects of performance measures and job design choices, which is consistent with Milgrom and Robert’s (1995) theory of complementary management choices.

To date, most accounting research about nonfinancial performance measures has been mainly focused on studying high-level executives (for example, Ittner et al. 1997; Banker et al. 2000). However, what may happen in practice is that different levels of an organization look at different measures. Nanni et al. (1990), for example, argued that nonfinancial performance measures are more useful to front-line employees. Since little evidence exists on the impacts of including various productivity and performance measures in front-line employee’s performance evaluation systems (Young and Selto 1991), the results of this study supplement prior literature.

Traditional studies that investigate performance impacts of job design focus on how various job characteristics (such as variety, autonomy, and significance etc.) affect employees’ attitudes and behavior. In this line of research, job design affects employees’ performance by changing their recognition of job characteristics (such as an increase in job satisfaction) (Griffin 1991). However, job characteristics are only one factor that affects job design; the fit between job design and incentive pay is also important (Milgrom and Roberts 1992). In this study, I provide evidence for the performance impact of the interaction between employee job design and an incentive plan choice, which may expand the current empirical evidence about the performance impact of job design.

Taiwanese corporations are facing intense international competition, which has pushed management to improve their management control systems. Accordingly, academics should help to design effective incentive systems to encourage employee performance and create competitive advantages. Particularly, in service industries, such as the banking industry, the products that employees produce are almost intangible services, which make the measurement of product quality and employee performance even more difficult. Since the productivity and service quality of front-line employees are important sources of firm value creation, it is important to design an effective incentive system inducing employees’ efforts toward corporate objectives. My study analyzes longitudinal
archival data for a group of loan-making representatives from the case bank to provide empirical evidence regarding job design and incentive plan choices. The empirical results of this study have two implications for the design of employee incentive systems. First, most employees perform several activities as part of their jobs. If some activities are much more difficult to evaluate using financial measures and are not well compensated, then employees will neglect these activities, thus reducing the companies’ value. In this case, the management can compensate the employees based on nonfinancial measures to induce them to put efforts on these activities that were originally difficult to measure using financial measures. Second, in light of the empirical observation that a failure to consider complementarities between job design and compensation choices limits the positive impacts of compensation policy change on employees’ performance, the management may need to determine the job design and the compensation together to maintain a balance of incentives for the multiple activities.

The remainder of the paper is structured as follows. Section II describes the research site and introduces the incentive systems change that the case bank adopted. Section III reviews the literature and develops the hypotheses. Section IV details the research design. Section V presents the analysis of the results. Section VI summarizes, discusses limitations and concludes the study.

II. RESEARCH SITE AND INCENTIVE SYSTEMS CHANGE

The research site for this paper was a commercial bank, one of Taiwan’s main established banks, running both banking and trust activities. During the period of this study, the bank had total assets of approximately NT$593 billion, and had about 6% of the total loans and deposits held by the country’s established commercial banks at that time. As of 31 December 1997, the bank’s manpower resources totaled over 3,000 personnel. The bank has developed a reputation in the local market as a leading provider of sophisticated and advanced financial products. In order to cope well with Taiwan’s financial liberalization and internationalization, the bank makes continuous efforts to pursue innovation and to strive at providing customers with ever-better financial services. The research site was chosen for availability of significant data, permitting a test of the performance impacts of incentive design change.

The bank’s asset quality has long been a concern to its senior managers. At year-end of 1994, its non-performing loan ratio had deteriorated seriously and the management decided to reform the management control system in the consumer and retail-banking sector. A detailed review of internal documents at the bank indicated that prior to 1995, credit-extension amount was the only performance measure used to evaluate and compensate loan-making representatives. In July 1995, in order to focus and direct the efforts of employees towards company strategic objectives, the bank implemented an incentive plan for all loan-making representatives that tied their bonuses and job promotion to credit-extension amounts and nonfinancial measures—overdue loans ratio and peel-off ratio. Measurements of the financial and nonfinancial variables are described below.

Financial Performance Measures

*Credit-Extension Amounts (CAMOUNT).* Credit-extension amounts are defined as
loan amounts to customers that were made in the current period. In the computation of credit-extension amounts, I exclude the total personal loans from loans for employees, secured notes receivable discounted loans, and checking account overdraft credits, since these loans are not directly correlated with loan-making representatives’ credit-extension efforts.

**Interest Income per Representative (INT).** The interest income contribution for each loan-making representative, taking outstanding periods into account, is computed as follows: Interest Income per Representative = \( \sum_{i=1}^{n} \left( \frac{\text{the beginning loans balance} + \text{the period-end loans balance}}{2} \times \text{approbatory months} \times \text{monthly interest rate per case} \right) \), where \( i \) represents the individual loan cases, and \( n \) represents the number of loans in the current month.

**Loan Profit per Representative (PROFIT).** Loan profit per representative is computed as follows: Loan profit per Representative = (interest income - capital cost - operating cost - bad debts expense), where the definition interest income is described above. Bad debts expense is the actual credit loss of loans, which is traced and recognized at the date when loans were extended. For example, if a $10,000 loan that was extended in January 1993 incurs a $1,000 credit loss in May 1995, this $1,000 credit loss is recognized as a bad debts expense for January 1993.

According to the imputation formula used by the case bank, the operating cost of the four main products of secured loans, unsecured loans, loans for purchasing cars, and small unsecured loans is 1%, 1.5%, 1.25%, and 2% of loan amounts separately.

**Nonfinancial Performance Measures**

**Overdue loans ratio (OVERDUE).** The case bank uses the overdue loans ratio to evaluate loan-making representatives’ efforts in the credit-verification task. Senior managers believe that the overdue loans ratio is a lead indicator of future bad debts loss. The overdue loans ratio variable is measured as follows: Overdue loans ratio = (the sum of the principals of the loans that were made within the one recent year with principal or interest over one month past due) \( \div \) (the sum of the total outstanding loans that have been extended within the one recent year).

**Peel-Off Ratio (PEELOFF).** The case bank uses the peel-off ratio to measure loan-making representatives’ performance in customers’ service and maintenance. The peel-off ratio variable is measured by the following formula: Peel-Off Ratio = (the sum of the principals of the loans that are paid off before the due date) \( \div \) (the total loans balance at end of previous calendar year). The case bank employs the peel-off ratio to urge employees to improve customer services, such as by responding quickly to customers’ requests and paying attention to service attitudes, to prevent customers from pay-off or run-off before the loans are due. Senior managers believe that if customers pay off or run off before the loans are due, not only does the bank lose interest income that should have been earned, but also has to redouble effort to look for new customers. Thus, the peel-off ratio is a lead indicator of future cost and income for the case bank.

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1 Since the same imputation method is applied to all loan-making representatives, I believe that the method described above is reasonable and has little impact on the conclusions.
In January 1996, in five experimental branches the bank redesigned the loan-making job into two tasks—credit-verification and credit-extension. Prior to this job redesign, loan-making representatives were jointly responsible for all loan-making functions including credit-verification and credit-extension. After the change, loan-making representatives were responsible only for credit-extension, while credit verifiers handled credit-verification. In order to prevent employees from mixing up the different roles of credit-verification and credit-extension tasks, internal documents describing the guiding principles of each task were circulated to all chief offers and employees. According to the documents, credit verifiers were in charge of quality control and 60% of their bonus relied on the overdue loans ratio; loan-making representatives were in charge of the achievement of credit-extension objectives and 70% of their bonus relied on credit-extension amounts. In summary, the case bank adopted nonfinancial performance measures to evaluate and reward employees’ performance in July 1995, then redesigned the loan-making process in the retail-banking sector at five experimental branches in January 1996. Since by 1998 most branches had implemented job redesign that assigned the credit-extension and credit-verification tasks to different individuals, this study took 8 branches that had not implemented job redesign by December 1997 and those that had complete required data in research periods as control group branches for this study. Loan-making representatives in non-experimental branches faced only incentive changes of the inclusion of nonfinancial performance measures; whereas, in addition to the adoption of nonfinancial measures, loan-making representatives in experimental branches also faced an incentive structural change due to their job redesign. The time plot of event dates by which the case bank changed its incentive structure is shown in Figure 1 below.

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2. Credit verifiers’ other performance measures included average processing time (20%) and the number of processing cases (20%).

3. Loan-making representatives’ other performance measures include team cooperation and some special bonus points.
III. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Performance Impact of Adopting Nonfinancial Performance Measures

Regarding the question of what reason nonfinancial measures are used to complement financial measures, the literature provides some explanations. Johnson and Kaplan (1987) argued that, in general, computation of short-term accounting profits need some discretionary allocation, which cause the obtained profits figure to be meaningless in practice. Nonfinancial measures are the only better predictors of long-term profitability of enterprises. Kaplan and Norton (1996) indicated that information-age companies would succeed by investing in and managing their intellectual assets. Financial measures tell only the story of past events, which are inadequate for guiding and evaluating the path that information-age companies must make to create future value through investment in customers, suppliers, employees, processes, technology, and innovation. Furthermore, Rees and Sutcliffe (1994) pointed out that timeliness is critical for nonfinancial measures, since they provide feedback information that managers need to correct actions in time.

Agency theory provides a theoretical basis for explaining why a contract relies on nonfinancial measures. In theory, the bonus contract should give a non-zero weight to any performance measure that provides incremental information about the dimensions of managerial action that the owner wishes to motivate. Feltham and Xie (1994) suggested that since financial measures are imperfect and noisy indicators of an agent’s effort, nonfinancial measures can add value by inducing long-term oriented effort. Ittner et al. (1997) examined the factors influencing the relative weights placed on financial and nonfinancial performance measures in CEO bonus contracts. They showed that the potential benefit of using nonfinancial measures increases with the extent to which financial measures cannot capture a CEO’s long-run focused effort.

In agency settings, an agent will put too little effort on the task that is not appropriately captured by the performance measure (Holmstrom and Milgrom 1991; Feltham and Xie 1994). Some researchers have criticized that, if a manager’s compensation is only based on financial outcomes, he will overly emphasize short-run accounting returns, thus hindering long-term investments that would ultimately be of greater benefit to the company (e.g., Kaplan and Norton 1992; Bushman et al. 1996). Hemmer (1996) suggested that nonfinancial measures help refocus managers on the long-term aspects of their actions, and the use of nonfinancial measures could alleviate the problem of managerial myopia. In a related study, Hauser et al. (1994) analyzed the profit impact due to the use of customer satisfaction measures in incentive compensation and offered recommendations for measuring customer satisfaction. Banker et al. (2000) indicated that nonfinancial measures of customer satisfaction are significantly associated with future financial performance and that they contain additional information not reflected in the past financial measures. In addition, both nonfinancial and financial performances improve following the implementation of an incentive plan that includes nonfinancial performance measures.

This study assumes that loan-making representatives in the case bank allocated their time/efforts on several tasks such as credit-verification, credit-extension, and customer service. The case bank’s asset quality has long been an area of relative weakness. As described in Section II, the case bank used only credit-extension amounts financial
performance to evaluate and compensate loan-making representatives before July 1995. The steadily rising non-performing loans around 1994 have tended to restrict the case bank, which indicated that most loan-making representatives put most of their efforts on credit-extension tasks and neglected credit-verification tasks. The senior managers believe that asset quality-focused and customer-focused strategies are essential for the survival of this bank. The case bank introduced its new performance measurement and compensation systems that included ‘overdue loans ratio’ and ‘peel-off ratio’ nonfinancial performance measures for all loan-making representatives in July 1995 with the objective of rewarding employees for meeting the key objectives of asset quality and customer satisfaction.

As discussed in the agency theory, we can expect that after the implementation of the new plan, the loan-making representatives reallocated their efforts and increased the credit-verification effort and customer-service effort because of the inclusion of nonfinancial measures in the performance measurement systems. Therefore, this study specifies the following hypothesis:

**H1**: Implementation of an incentive plan based on ‘overdue loans ratio’ and ‘peel-off ratio’ leads to improvements in the two nonfinancial performance measures.

As previously stated, the case bank’s prior incentive plan was based mainly on credit-extension amounts. When non-zero weights were placed on the nonfinancial measures, the new plan provided slightly lower levels of incentives for achieving credit-extension amounts goals. This, in turn, would lead to a reduction in the credit-extension amounts after the implementation of the new performance measurement system, because some credit-extension effort is reallocated to credit-verification and customer-service efforts. Besides, in the banking context, a reduction in credit-extension amounts implies a decrease in interest revenue. Thus, my second hypothesis predicts an inferior credit-extension amount and then interest revenue following the implementation of the new performance measurement system:

**H2**: Credit-extension amounts and interest revenue decrease after the implementation of an incentive plan based on ‘overdue loans ratio’ and ‘peel-off ratio’ nonfinancial performance measures.

An important question arising from the use of nonfinancial measures is what would be the net economic benefits from incorporating nonfinancial measures into performance measurement systems. Singleton-Green (1993, 53) emphasized that the premise on which the use of nonfinancial measures is founded is that they will help companies to increase profits. If the nonfinancial and financial measures show no relationship--even allowing for time lags--then the results are not as predicted and people are clearly wasting their time with the nonfinancials.

Feltham and Xie’s (1994) analysis showed that when the principal’s expected gross payoff is a function of both short-term and long-term oriented efforts and if the use of the profit measure induces only short-term oriented effort, then the loss to the principal from the failure to induce the long-term oriented effort can be reduced by introducing a second
performance measure that independently reports on the long-term oriented effort. That is to say, when nonfinancial measures can provide information for employees’ long-term effort, then these measures are valuable. In a related study, Hauser et al. (1994) analyzed how and when rewarding employees on customer satisfaction is profitable. They proved that if satisfaction can be measured costless, the firm earns incremental profits by rewarding sales quantity and customer satisfaction, as opposed to just sales quantity.

In this context, an increase of credit-verification effort and customer-service effort after the adoption of overdue loans ratio and peel-off ratio implies a reduction of non-performing loans and an increase of customer satisfaction, all of which have a positive impact on credit-extension profits. Therefore, I expect the use of nonfinancial measures in performance measurement and incentive systems will have a positive value to the owners, and specify the following hypothesis:

**H3**: Credit-extension profits increase after the implementation of an incentive plan based on ‘overdue loans ratio’ and ‘peel-off ratio’ nonfinancial performance measures.

### Complementarity between Performance Evaluation Systems and Job Design

Job design is an important decision that determines the allocation of human resources and the type of decision authority. Traditionally, economists have viewed job design as technologically determined, not a choice that an organization could make. However, the considerations of interdependencies among incentives and the use of instruments other than compensation to control incentive problems have entered agency analyses more recently. For example, Holmstrom and Milgrom (1991) analyzed a model in which the employer can divide responsibility for many small tasks between two agents and can determine how performance in each task will be compensated. They obtained the following suggestive results. First, each task should be made the responsibility of just one agent. Second, tasks should be grouped into jobs in such a way that the tasks in which performance is most easily measured are assigned to one worker and the remaining tasks are assigned to the other worker. Milgrom and Roberts (1992) pointed out that grouping tasks according to their ease of measurement allows giving an appropriate level of incentives for each kind of job. If the easy-to-measure tasks were grouped together in one job and the hard-to-measure ones in the other job, then it would be feasible to provide strong incentives for the first task (in order to elicit great effort) and weak incentives for the second (in order to insulate the employee from risk).

When several activities compete for a worker’s attention, there is a tendency for the levels of incentives provided for the different activities of a worker to be complementary in the incentive problem. The intuition behind this observation is that increasing the incentive for just one task could cause a worker to devote too much effort to that one task while neglecting other aspects of the job, and that increasing incentives for all of the agent’s activities avoids this problem. Holmstrom and Milgrom (1994) suggested that if there were a desire to keep the various incentives in balance, one would expect that in an optimal system, the three instruments of asset ownership, contingent rewards, and job restriction would have to be similarly balanced. However, little empirical evidence exists
on the interaction between incentive instruments.

Drake et al. (1999) examined how accounting cost systems and incentive structure choices interact and found that profits are highest when the choices of cost systems are complementary to the designs of incentive structures. Hemmer (1999) studied how to best assign responsibilities and design reward structures. He suggested that if one were to change from the push to the pull responsibility assignment without also moving to a group type reward structure, product quality and firm profitability would decrease. In addition, Hemmer emphasized that introducing an additional measure of performance may change the optimal responsibility assignment. In related studies that adopt experimental research design, Chow et al. (1991) and Wageman (1995) found that when rewards are interdependent (independent) and jobs are interdependent (independent) simultaneously, the subjects gave the best performance. Wageman and Baker (1997) also examined the joint effects of task interdependence and reward interdependence on group behavior and performance. They developed a model that predicts that task and reward interdependence will interact to increase performance, and presented results of a laboratory experiment that confirms their prediction. The implication from previous research is that changes in the job design, if unaccompanied by changes in the design of the reward system, may not enhance performance.

In this study, the performance of credit-extension and credit-verification tasks can be separately measured and assessed after the inclusion of nonfinancial measures in the performance measurement system. However, the two tasks still differ systematically in the difficulty of measuring performance accurately in nature: the credit-verification task has a high error variance in measuring effort provision, whereas the credit-extension task has a low variance. Before the job redesign in January 1996, the heterogeneity in the tasks that loan-making representatives were assigned complicated the problem of providing incentives. Any attempt to provide strong incentives for the credit-extension task will only result in the loan-making representatives devoting relatively too much effort to the credit-extension task and too little to the credit-verification effort. Senior managers believed that job redesign could solve the problem. When credit-verification and credit-extension tasks were assigned to different individuals, the case bank then provided stronger incentives for effort provision in each task without imposing too much risk on loan-making representatives and credit verifiers. Therefore, we can expect that employees on the redesigned jobs would outperform other employees when job design and high-performance incentives instruments were used complementally for motivating employees.4 This study proposes the fourth hypothesis, as following:

\[ H4: \text{Employees on redesigned jobs outperform other employees when a nonfinancial incentive instrument is coupled with job design to motivate employees.} \]

4 This study uses the employee but not the branch as the unit of analysis. Since loan-making representatives were responsible only for credit-extension (sales creation) while credit verifiers handled only credit-verification (cost control) after the job redesign, I could not estimate the profits created by each employee. Thus here I focus only on the performance of credit-extension amounts, overdue loans ratio and the peel-off ratio.
IV. RESEARCH DESIGN

Sample Selection and Data Collection

The sample population for this study was comprised of sales representatives from branches of the case bank around the island. In order to examine the performance impact of including nonfinancial measures in the new incentive system, monthly data were obtained for a period of up to 60 months (beginning with January 1993) for the loan-making representatives in 8 branches that had not yet implemented job redesign. Employees from the branches with redesigned jobs were excluded because job redesign has potential impacts on loan-making representatives’ performance. In addition, the sample employees were required to have complete financial and nonfinancial data in the research periods. These restrictions yielded a sample of 17 employees consisting of a panel data with 1020 sample points (5 years × 12 months × 17 employees).

In order to determine the interaction effect of nonfinancial measures and job redesign, the factors of incentive instruments (hypothesis 4), credit-extension amounts, overdue loans ratio and peel-off ratio data were collected from January 1995 through December 1997 as available for the 51 representatives in the study with complete data. Because the case bank was using a staggered timetable to convert to the new job design, during the timeframe of this study some branches were implementing the job redesign while others were not. The treatment group, which began job redesign implementation in January 1996, consisted of 28 sales representatives. The control group consisted of 23 sales representatives located in the branches that did not implement job redesign until after the data collection for this study was complete.

Periodic visits were made to the case bank headquarters and branches to collect data and to meet with senior managers, branch supervisors and loan-making representatives. Data for this research were collected from multiple sources, including company internal documentation, archival records, interviews, and governmental publications (Financial Statistics Monthly and Business Cycle Indicators of Taiwan).

Model Specifications

Impact of Adopting Nonfinancial Performance Measures on Employee Nonfinancial Performance

In testing hypothesis 1, the following fixed-effects model is specified to take into account differences in behavior across individuals:5

\[
\text{OVERDUE}_i = \sum_{t=1}^{17} \alpha_t \text{SALMAN}_t + \sum_{j=0}^{n} \beta_j^O \text{BUSCYCLE}_{t,j} + \sum_{m=1}^{11} \mu_m^O \text{MONTH}_m
\]

5 To control for specific characteristics (such as experiences and abilities etc.) of individual representatives that may result in correlated residuals over time, this study includes intercept dummies for individual representatives (SALMAN) in these fixed-effects models. The individual effect is taken to be constant over time and specific to the individual cross-sectional unit. The other useful method is the random effects model, which views individual specific constant terms as randomly distributed across cross-sectional units (Greene 2000, 567-578). This study uses the Hausman test to decide which method should be used. Based on the Hausman test, which suggests that the individual effects are correlated with the other variables in the model, I then conclude that of the two alternatives considered, the fixed effects model is the better choice.
\[ \text{PEELOFF}_{it} = \sum_{i=1}^{17} \alpha_i \text{SALMAN}_i + \beta \Delta \text{INTRATE}_t + \sum_{m=1}^{11} \mu_m \text{MONTH}_m + \delta \text{NFP}_t + \epsilon_{it}^o \]  

(M1)

where:

- \( i = 1, \ldots, 17 \) represents the individual representatives,
- \( t = 1, \ldots, 60 \) represents the months in our sample period,
- \( j = 0, \ldots, n \) represents the lag length, which is decided by AIC,

\[ \text{OVERDUE}_{it} = \text{Overdue loans ratio for representative } i \text{ in month } t, \]
\[ \text{PEELOFF}_{it} = \text{Peel-Off ratio for representative } i \text{ in month } t, \]
\[ \text{BUSCYCLE}_t = \text{Business Cycle Coincident Index in month } t, \]
\[ \Delta \text{INTRATE}_t = \text{Absolute value of percentage change of the prime rate in month } t, \]
\[ \text{SALMAN}_i = \text{A dummy variable } =1 \text{ if representative } i, = 0 \text{ otherwise}, \]
\[ \text{MONTH}_m = \text{A month dummy variable } =1 \text{ if month } m, = 0 \text{ otherwise}, \]
\[ \text{NFP}_t = \text{A dummy variable representing time periods following new incentive system implementation, taking the value 1 for July 1995 and later, and 0 before July 1995}, \]

\[ \epsilon_{it}^o \] and \[ \epsilon_{it}^p = \text{Random error terms}. \]

In model M1, to control for some economy-wide factors that affect overdue loans ratio, I include the Business Cycle Coincident Index (labeled BUSCYCLE) as a control variable. Business cycles have a significant impact on overdue loans ratio. When business cycle indicators drop, indicating that the economy is heading toward a recession, the overdue loans ratio will go up, and vice versa. In order to control the effect of macroeconomic shifts on the employees’ credit-verification performance, this study gathers business cycle coincident index data from the ‘Business Cycle Indicators of Taiwan’ edited by the Council for Economic Planning and Development.

Because the impact of business cycle on overdue loans ratio may have time lags, I also include lagged Business Cycle Coincident indexes to account for the lagged effects. Since there is no formal theory to identify the specific number of lags for a business cycle, Akaike Information Criterion (AIC) is used to determine the lag length. Monthly dummies are also included to control for the impact of seasonality on nonfinancial performances.

The model M2 includes absolute value of percentage change of the prime rate (\( \Delta \text{INTRATE} \)) to control the impact of interest rate changes on peel-off ratio. Here, 30% of the case bank’s customer banking business has fixed interest rates. When the prime rate goes up, the bank will notify those customers who have adjustable interest rates that their monthly payments have to be increased, causing customers to keep an eye on the interest rate. When another bank’s interest rate is lower, the customer may peel off (shift to another bank). As to those cases that have fixed rates of interest, when prime rates go down, the customers may choose to terminate the loans from the case bank. On these
grounds, $\Delta$INTRATE is included to control the impact of prime rates change on the peel-off ratio.

The NFP dummy variable captures the average impact of the nonfinancial performance measurement system across the representatives. Hypothesis H1 is tested by examining whether $\delta^C$ and $\delta^I$ coefficients of the NFP dummy variable for the two models of nonfinancial measures are significantly negative.

**Impact of Adopting Nonfinancial Performance Measures on Employee Financial Performance**

Testing the second hypothesis concerning reductions in credit-extension amounts and interest income after the implementation of the plan involves estimating the following models to capture the impact of the incentive plan on CAMOUNT and INT:

\[
\begin{align*}
\text{CAMOUNT}_i = & \sum_{j=1}^{n} \beta_i^{C} \text{SALMAN}_{ij} + \sum_{j=0}^{n} \theta_j^{C} \text{BUSCYCLE}_{i-j} + \sum_{m=1}^{M} \mu_m^{C} \text{MONTH}_m \\
& + \delta^C \text{NFP}_i + \epsilon_i^{C} \quad (M3)
\end{align*}
\]

\[
\begin{align*}
\text{INT}_i = & \sum_{j=1}^{n} \beta_i^{I} \text{SALMAN}_{ij} + \sum_{j=0}^{n} \theta_j^{I} \text{BUSCYCLE}_{i-j} + \sum_{m=1}^{M} \mu_m^{I} \text{MONTH}_m \\
& + \delta^I \text{NFP}_i + \epsilon_i^{I} \quad (M4)
\end{align*}
\]

where:

- $\text{CAMOUNT}_i$ = Real value of credit-extension amounts for representative $i$ in month $t$,
- $\text{INT}_i$ = Real value of interest income for representative $i$ in month $t$,
- $\epsilon_i^{C}$ and $\epsilon_i^{I}$ = Random error terms and other terms are as defined above.

Growth in credit-extension amounts and interest income over time due to inflation is obviated through dividing the financial variables by the Customer Price Index (using the 1991 as base price) to obtain real value of financial performances. In models M3 and M4, I include current and lagged Business Cycle Coincident indexes to control the impact of the market capital demand condition on the financial variables. It is expected that a depression (flourishing) of the economy will decrease (increase) the market demand of the capital, which will then lessen (enlarge) the representatives’ performance of CAMOUNT and INT. Therefore, $\theta_j^{C}$ and $\theta_j^{I}$ are expected to have positive signs.

Monthly dummies are also included to control for the impact of seasonality on financial performances. Hypothesis 2 is tested by examining whether the coefficients $\delta^C$ and $\delta^I$ in models M3 and M4 are significantly negative.

Testing the third hypothesis H3 that an incentive plan based on nonfinancial measures leads to increased profits involves the estimation of the model M5, which is similar to model M3 and M4:

\[
\begin{align*}
\text{PROFIT}_i = & \sum_{i=1}^{n} \beta_i^{LP} \text{SALMAN}_{i} + \sum_{j=0}^{n} \theta_j^{LP} \text{BUSCYCLE}_{i-j} \\
& + \sum_{m=1}^{M} \mu_m^{LP} \text{MONTH}_m + \delta^{LP} \text{NFP}_i + \epsilon_i^{LP} \quad (M5)
\end{align*}
\]
where:

\[ \text{PROFIT}_{it} = \text{Real value of loan profit imputation for representative } i \text{ in month } t, \]
\[ \varepsilon_{it}^{LP} = \text{Random error terms and other terms are as defined above.} \]

Hypothesis 3 is tested by examining whether the coefficient \( \delta^{LP} \) in model M5 is significantly positive.

**Performance Impact of Job Redesign Complemented with a Nonfinancial Incentive System**

In hypothesis 4, we also hypothesize that employee performance increases with increasing fit between incentive systems based on nonfinancial measures and job design. Using performance data of 51 sales representatives in the 1995-1997 period, the empirical tests of this prediction rely on the interrupted time-series design as follows:

\[
\Delta \text{CAMOUNT}_i = \sum_{d=1}^{4} \alpha_d^C \text{DISTRICT}_d + \beta_i^C \text{JD}_d + \beta_i^C \text{MPOW95}_i + \varepsilon_i^C \quad (M6)
\]
\[
\Delta \text{OVERDUE}_i = \sum_{d=1}^{4} \alpha_d^O \text{DISTRICT}_d + \beta_i^O \text{JD}_d + \beta_i^O \text{MPOW95}_i + \varepsilon_i^O \quad (M7)
\]
\[
\Delta \text{PEELOFF}_i = \sum_{d=1}^{4} \alpha_d^P \text{DISTRICT}_d + \beta_i^P \text{JD}_d + \beta_i^P \text{MPOW95}_i + \varepsilon_i^P \quad (M8)
\]

where:

\( i = 1, \ldots, 51 \) represents the individual representatives,
\( d = 1, \ldots, 4 \) represent the individual districts, \( d=1 \) if Taipei; \( d=2 \) if Taoyuan, Hsinchu or Miaoli; \( d=3 \) if Taichung; \( d=4 \) if Tainan or Kaohsiung,
\( \Delta \text{CAMOUNT}_i = \text{Average credit-extension amounts over 1996 and 1997 compared to the average amounts in 1995 for representative } i, \)
\( \Delta \text{OVERDUE}_i = \text{Average overdue loans ratio over 1996 and 1997 compared to the average ratio in 1995 for representative } i, \)
\( \Delta \text{PEELOFF}_i = \text{Average peel-off ratio over 1996 and 1997 compared to the average ratio in 1995 for representative } i, \)
\( \text{DISTRICT}_d = \text{District dummy variable } =1 \text{ if district } d, =0 \text{ otherwise, } \)
\( \text{JD}_d = \text{A dummy variable } =1 \text{ if representative } i \text{ belongs to the branch that implemented job design, } =0 \text{ otherwise, } \)
\( \text{MPOW95}_i = \text{Average number of sales representatives for the branch to which representative } i \text{ belonged in 1995,} \)
\( \varepsilon_i^C, \varepsilon_i^O \text{ and } \varepsilon_i^P = \text{Random error terms.} \)

In empirical accounting studies, organizational size is often used to control an organization’s performance difference, which is a very important control variable. Small branches can use social controls, such as direct monitoring, to coordinate and communicate with their members. However, large branches may need formal mechanisms to control incentives. Because incentive control mechanisms may have greater benefits to larger branches, this study uses average numbers of sales representatives for a branch in
1995 (the year just before the job design implemented) to control the size effect in model M6-M8 as a control variable.

The performance of a sales representative may also be affected by the economic condition of the district where he works. For instance, his location in a higher growth district, not the incentive mechanisms that the case bank adopted, may contribute to higher credit-extension amounts. Thus, the case bank’s branches are divided into four districts (Taipei; Taoyuan, Hsinchu or Miaoli; Taichung; Tainan or Kaohsiung), using the district dummy variable (DISTRICT) to control the district economic factor.

It is hypothesized in H4 that after the change in job design—separation of the credit-extension and credit-verification jobs—together with introduction of incentive systems based on nonfinancial measures, the treatment group will demonstrate greater improvements in productivity and quality performance. Hypothesis 4 is tested by examining whether the individual $\beta_i$ coefficients of the JD dummy variable for the three models M6-M8 are significant.

V. EMPIRICAL RESULTS

Impact of Adopting Nonfinancial Performance Measures on Employee Performance

Descriptive Statistics

Table 1 presents the descriptive statistics using data from the 17 sales representatives. The high standard deviations in the performance variables show the possible seasonal variations, personal distinguishing characteristics, or outliers. I control for these factors by including fixed effects and seasonal dummy variables in the empirical models. The impact of influential observations was examined using the criteria outlined in Belsley, Kuh and Welsch (1980). The re-estimated parameters after omitting the influential observations are presented in the sensitivity analyses to demonstrate robustness of the results. The Jarque-Bera test was employed to verify the normality assumption. The estimated $\chi^2$ statistics show that all variables do not exhibit normality. These variables were transformed by taking logarithms and re-estimated the models. The parameter estimates remain qualitatively the same.

Impact of Adopting Nonfinancial Performance Measures on Employee Nonfinancial Performance

Impact on Overdue Loans Ratio

Estimates of the impact of adopting nonfinancial performance measures on overdue loans ratio are presented in Table 2. Heteroskedasticity is tested using the Breusch and Pagan test. Since Breusch – Pagan’s chi-square statistic indicates heteroskedasticity, I apply White’s (1980) procedure to correct the covariance matrix and get the asymptotic standard errors and test statistics. The pooled least square model and the fixed effect model are compared using F test. The F statistic shows that individual representatives’ constants are not completely equal ($F = 3.74, p = .000$), which suggests that giving every representative a constant in the model to control personal characteristic related
heteroskedasticity is appropriate. Since the assumption that all the representative fixed-effect constants are equal does not hold in every model, the fixed-effect model estimates are discussed below.

Table 1 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>First Quartile</th>
<th>Median</th>
<th>Third Quartile</th>
<th>Jarque-Bera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit-extension amounts</td>
<td>3840.79</td>
<td>4380.26</td>
<td>7446.8</td>
<td>14893</td>
<td>22338</td>
<td>2919.04</td>
</tr>
<tr>
<td>Interest income</td>
<td>1576.28</td>
<td>2092.93</td>
<td>5007.2</td>
<td>10014</td>
<td>15021</td>
<td>10020.13</td>
</tr>
<tr>
<td>Loan profit</td>
<td>109.39</td>
<td>145.03</td>
<td>166.40</td>
<td>559.28</td>
<td>952.17</td>
<td>5274.42</td>
</tr>
<tr>
<td>Overdue loans ratio</td>
<td>3.75</td>
<td>8.29</td>
<td>24.05</td>
<td>48.1</td>
<td>72.15</td>
<td>112234.5</td>
</tr>
<tr>
<td>Peel-off ratio</td>
<td>3.81</td>
<td>8.78</td>
<td>29.24</td>
<td>58.49</td>
<td>87.73</td>
<td>165817.0</td>
</tr>
</tbody>
</table>

Table 2 Impact of Adopting Nonfinancial Measures on Overdue Loans Ratio

Model (M1):

\[ OVERDUE_{it} = \sum_{j=1}^{17} \alpha_i^{O} SALMAN_{jt} + \sum_{j=0}^{n} \beta_j^{O} BUSCYCLE_{t,j} + \sum_{m=1}^{11} \mu_m^{O} MONTH_{m} + \delta^{O} NFP_t + \epsilon_{it}^{O} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t - stat</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSCYCLE</td>
<td>-0.022</td>
<td>(—)</td>
<td>0.0233</td>
<td>-0.951</td>
<td>0.171</td>
</tr>
<tr>
<td>BUSCYCLE</td>
<td>-0.003</td>
<td>(—)</td>
<td>0.0014</td>
<td>-2.075</td>
<td>0.019</td>
</tr>
<tr>
<td>NFP</td>
<td>-1.694</td>
<td>(—)</td>
<td>0.7241</td>
<td>-2.340</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Adj. \( R^2 = 0.0943 \), Model F = 2.37 (p = 0.00), Breusch – Pagan Chi-squared = 996.6645.

As displayed in Table 2, the coefficient of lagged Business Cycle Coincident Index is negative and significant (\( p = .019 \), one-tail), indicating business cycles have a lag effect on overdue loans ratio. The M1 model is significant (\( p = .000 \), adjusted \( R^2 = .094 \)) with the coefficient \( \delta^{O} \) negative (–1.69) and significant (\( p = .01 \), one-tail). This suggests that, after controlling the effects of personal heteroskedasticity, business cycle conditions and seasonality, adopting nonfinancial measures resulted in an increase in loan assets quality as measured by the overdue loans ratio (OVERDUE) measure.

Table 3 displays the analyses of the PEELOFF model M2. The results in Table 3 show a significant result for the PEELOFF model (\( p = .000 \), adjusted \( R^2 = .165 \)). The coefficient \( \delta^{O} \) is negative (–12.33) and significant (\( p = .015 \), one-tail), indicating a decrease in peel-off ratio (PEELOFF) measured after the adoption of nonfinancial measures.
measures. With regard to the control variable $\Delta$ INTRATE, the coefficient $\beta^c$ is positive and significant ($p = .004$, one-tail). This result supports the prediction that a large change in prime rate may cause customers to monitor the interest rates of their loans, leading to an increase in the peel-off ratio.

**Table 3 Impact of Adopting Nonfinancial Measures on Peel-Off Ratio**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors b</th>
<th>t - stat</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta$ INTRATE</td>
<td>0.007</td>
<td>(+)</td>
<td>0.003</td>
<td>2.463</td>
<td>0.004</td>
</tr>
<tr>
<td>NFP</td>
<td>-12.329</td>
<td>(−)</td>
<td>5.699</td>
<td>-2.163</td>
<td>0.015</td>
</tr>
</tbody>
</table>

Adj. $R^2 = 0.165, \quad$ Model F = 2.37 ($p = 0.00), \quad$ Breusch – Pagan Chi-squared = 963.9345.

*See the section — Model Specifications — for variable definitions.

Prior to July 1995, senior managers emphasized only financial measures (credit-extension amounts) to evaluate loan-making performance, which caused representatives to neglect the importance of credit-verification and customer service tasks. The case bank introduced its new incentive plan for all sales representatives in July 1995 with the objective of rewarding employees for meeting the objectives of asset quality and customer satisfaction. Hypothesis 1 then predicts that the implementation of an incentive plan based on ‘overdue loans ratio’ and ‘peel-off ratio’ will lead to improvements in these two nonfinancial performance measures. Taken together, the results shown in Tables 2 and 3 provide evidence to support H1. Introduction of the nonfinancial measures led the employees to reallocate more effort to the credit-verification and customer service tasks, which support to the corporate long-term benefits.

**Impact of Adopting Nonfinancial Performance Measures on Employee Financial Performance**

**Impact on Credit-Extension Amounts**

The estimation results of the impact of adopting nonfinancial performance measures on credit-extension amounts (model M3) are presented in Table 4. The results of model M3 reveal that the overall regression is significant ($p = .000$) with an adjusted $R^2$ of 0.178. The coefficient of the NFP variable $\delta^c$ is negative (-127.43) and significant ($p = .006$, one-tail). Consistent with the prediction of H2, this result suggests that, after controlling the effects of personal heteroskedasticity, business cycle conditions and seasonality, adopting nonfinancial measures resulted in a decrease in credit-extension amounts. Table 2 also shows that the coefficients of the current and lagged Business Cycle Coincident Index are positive and significant, showing that a depression (flourishing) of the economy will decrease (increase) the market demand of the capital, which then lessen (enlarge) the representatives' performance of CAMOUNT.
Table 4 Impact of Adopting Nonfinancial Measures on Credit-Extension Amounts

Model (M3):  
\[
CAMOUNT_t = \sum_{i=1}^{17} \beta_i C_{it} \cdot SALMAN_i + \sum_{j=0}^{n} \theta_j C_{BusCycle_{t-j}} + \sum_{m=1}^{11} \mu_m C_{MonthBusCycles_{t}} + \delta^C NFP_t + \epsilon_{it}^C
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors b</th>
<th>t-stat</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSCYCLE_{t-1}</td>
<td>2.814 (+)</td>
<td>0.949</td>
<td>2.965</td>
<td>0.0015</td>
<td></td>
</tr>
<tr>
<td>NFP</td>
<td>-127.430 (-)</td>
<td>50.700</td>
<td>-2.513</td>
<td>0.0060</td>
<td></td>
</tr>
</tbody>
</table>

Adj. R^2 = 0.178, Model F = 6.92 (p = 0.00), Breusch – Pagan Chi-squared = 314.578.

a See the section – Model Specifications for variable definitions.

b White’s (1980) asymptotic standard errors.

Impact on Interest Income

A decrease in credit-extension amounts will result in a corresponding decrease in interest income. This study also estimates the INT model M4 to reinforce the empirical evidence provided in the CAMOUNT model M3. Table 5 presents an estimate of the INT model, showing that overall regression is significant (p = .000) with an adjusted R^2 of 0.112. The coefficient of current Business Cycle Coincident Index is positive and significant at the .10 level, showing that current market business conditions have a marginal favorable impact on interest income of loans. The coefficient of the NFP variable \( \delta^I \) is negative (-56.89) and significant (p = .001, one-tail) showing that on average the adoption of nonfinancial measures decreases interest income per representative by NT$.57 million.

In summary, the results in Table 4 and 5 provide evidence to support the hypothesis that credit-extension amounts and interest income decrease after the implementation of an incentive plan based on ‘overdue loans ratio’ and ‘peel-off ratio’ nonfinancial performance measures.

Impact on Loan Profit

The impact of incentive plan changes on loan profit per representative is shown in Table 6. The overall regression is significant (p = .000) with an adjusted R^2 of 0.201. As predicted, the coefficients of current and lagged Business Cycle Coincident Index are positive and significant, suggesting that market business conditions have a favorable impact on loan profit per representative. The coefficient \( \delta^{LP} \) for NFP is positive (9.57) and significant (p = .02, one-tail), supporting hypothesis 3 that loan profits increase following the implementation of an incentive plan based on nonfinancial measures. The results are consistent with the expectations of the senior managers.

Overall, these results imply that following the adoption of nonfinancial measures to evaluate and compensate the performance of sales representatives, overdue loans ratio and peel-off ratio were reduced, and that loan amounts and interest income also decreased...
significantly, resulting in a net favorable impact on loan profit.\(^6,\) \(^7,\) \(^8\)

**Table 5 Impact of Adopting Nonfinancial Measures on Interest Income**

Model (M4):  
\[
\text{INT}_{it} = \sum_{i=1}^{17} \beta_i \text{SALMAN}_i + \sum_{j=0}^{\infty} \theta_j \text{BUSCYCLE}_{t-j} + \sum_{m=1}^{11} \mu_m \text{MTH}_{m} + \delta^i \text{NFP}_i + \epsilon_{it}
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t - stat</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSCYCLE(_t)</td>
<td>7.362</td>
<td>(+)</td>
<td>5.432</td>
<td>1.355</td>
<td>0.088</td>
</tr>
<tr>
<td>NFP</td>
<td>-56.887</td>
<td>(−)</td>
<td>18.265</td>
<td>-3.115</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Adj. \(R^2 = 0.112,\) Model \(F = 5.01 (p= 0.00),\) Breusch – Pagan Chi-squared = 422.702.  

\(^a\) See the section — Model Specifications — for variable definitions.  
\(^b\) White’s (1980) asymptotic standard errors.

**Table 6 Impact of Adopting Nonfinancial Measures on Loan Profit**

Model (M5):  
\[
\text{PROFIT}_{it} = \sum_{i=1}^{12} \beta^i_0 \text{SALMAN}_i + \sum_{j=0}^{\infty} \theta^i_j \text{BUSCYCLE}_{t-j} + \sum_{m=1}^{11} \mu^i_m \text{MTH}_{m} + \delta^i \text{NFP}_i + \epsilon^i_{it}
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t - stat</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSCYCLE(_t)</td>
<td>3.411</td>
<td>(+)</td>
<td>0.462</td>
<td>7.385</td>
<td>0.000</td>
</tr>
<tr>
<td>BUSCYCLE(_{t-1})</td>
<td>0.052</td>
<td>(+)</td>
<td>0.031</td>
<td>1.719</td>
<td>0.043</td>
</tr>
<tr>
<td>NFP</td>
<td>9.570</td>
<td>(+)</td>
<td>4.660</td>
<td>2.054</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Adj. \(R^2 = 0.201,\) Model \(F = 5.06 (p= 0.00),\) Breusch – Pagan Chi-squared = 609.1015.  

\(^a\) See the section — Model Specifications — for variable definitions.  
\(^b\) White’s (1980) asymptotic standard errors.

**Performance Impact of Job Redesign Combined with a Nonfinancial Incentive System**

**Descriptive Statistics and Preliminary Test Outcomes**

I now discuss the impacts of job redesign complemented with a nonfinancial

\(^6\) The variance-inflation factor (VIF) collinearity diagnostic is used to identify possible problems due to multicollinearity in the models estimated above. The estimated results show that the variance-inflation factor measure of each explanatory variable is far below 10. This suggests that multicollinearity does not present a problem in making inferences.

\(^7\) An observation was considered as influential if the computed studentized residual metric exceeded 3. The regression results after deleting 27 influential observations suggest that the sign and significance of the coefficients are similar.

\(^8\) Product mix change will affect the performance of loan-making representatives. For example, representatives who mainly made small-unsecured loans can improve their overdue loans ratio performance by switching to the products of secured loans. To test the sensitivity of the results to the possibility of changes in the product mix change, the models were re-estimated using house loans data only. The results (not shown here) did not significantly differ from those obtained in Tables 2 through 6, suggesting that the performance shifts for representatives are not attributed to product mix change.
incentive system on employee performance. Employee performances were measured both prior to and after the job redesign, i.e., for each of the three performance measures (credit-extension amounts, overdue loans ratio, and peel-off ratio) a pre-test variable was computed as the mean of the 1995 measures. A post-test variable was computed as the mean of the 1996 and 1997 measures. Only sales representatives with both pre-test and post-test data were included in the sample. Therefore, there were 23 sales representatives in the control group and 28 sales representatives in the treatment group with usable data.

Descriptive statistics of performance variables for these 51 sales representatives are shown in Table 7. The outcomes reported in Table 7 show that the credit-extension amounts increased over 14.6% in the treatment group, compared to a 16.7% decrease in the control group. The differential change in credit-extension amounts was significant ($F = 5.75, p = .02$), indicating that the treatment group representatives were more productive than the control group representatives at credit-extension amounts. The overdue loans ratio decreased by 44.2% in the treatment group but only 1.8% in the control group. This difference was significant ($F = 16.8, p = .0001$), indicating that the treatment group achieved positive results in controlling loan assets quality. As also shown in Table 7, the peel-off ratio decreased for both the treatment and control groups, decreasing 41% in the treatment group but only 5% in the control group. While this difference was not statistically significant in the ANOVA analyses ($F = 2.77, p = .103$), the Wilcoxon Z statistic shown in the last column of Table 7 was significant ($p = .027$). The preliminary statistical analysis indicates that the job redesign combined with a nonfinancial incentive system has a positive impact on employee performance.

**Regression Results of the Effect of Job Redesign Combined with a Nonfinancial Incentive System on Performance**

Estimates of the effect of job redesign combined with a nonfinancial incentive system on employee performance are presented in Table 8. As shown in Panel A of Table 8, the regression estimates based on model M6 show that the coefficient $\beta_1^C$ of JD is positive and significant ($p = .04$), indicating that after the change in job design along with introduction of incentive systems based on nonfinancial measures, the treatment group demonstrated greater improvements in credit-extension productivity. The results in Table 8, Panel B show that the coefficient $\beta_1^O$ of JD is negative and significant ($p = .022$). This suggests that employees on the redesigned jobs outperformed other employees in terms of overdue loans ratio when a nonfinancial incentive instrument is coupled with job design to motivate employees.

The regression estimates based on model M8 are displayed in Panel C of Table 8. The results in Table 8, Panel C reveal that the coefficient $\beta_1^P$ of JD is negative (- .30) as predicted but not significant ($p = .41$). A possible explanation is that loan-making representatives may not be able to look after both sides of credit-extension tasks. After the change in job design, the representatives spent most of their time visiting potential new customers outside the branches, which made them less able to handle customer complaints or demands within the branches. Therefore, although the treatment group manifested greater improvements in peel-off ratio performance after the change in job design, the improvements were limited.
Taken together, these regression results reinforce the idea that the two instruments of performance evaluation and job design are interdependent. In this setting, although the performances of credit-extension and credit-verification tasks can be separately measured after the inclusion of nonfinancial measures in the performance measurement system, the two tasks differ systematically in the difficulty of measuring performance accurately in nature, which complicates the problem of providing incentives. When credit-verification and credit-extension tasks were assigned to different individuals, the case bank then provided stronger incentives for effort in each task without imposing too much risk on loan-making representatives and credit verifiers. This complementary design resulted in greater improvements in productivity and quality performance in the treatment group. Therefore, support is shown for hypothesis 4, that employees on the redesigned jobs would outperform other employees when a nonfinancial incentive instrument is coupled with job design to motivate employees.\(^9\)

Chow et al. (1991) and Wageman and Baker (1997) predict that task and reward interdependence will interact to increase performance, presenting results of a laboratory experiment that confirmed their prediction. The field empirical evidence provided in this study is consistent with both Chow et al.’s (1991) and Wageman and Baker’s (1997) experimental findings.

VI. CONCLUSIONS AND SUGGESTIONS

This paper examines the performance impact of both nonfinancial performance measures and job design incentive instruments. Panel data for 17 sales representatives over 60 months (1993 through 1997) were obtained to assess the effects of adopting nonfinancial measures on employee performance. Consistent with agency theoretical predictions, this analysis documented that financial performance as measured by loan amounts and interest income decreased, but nonfinancial performance improved following the adoption of nonfinancial measures with a net favorable impact on loan profit. These results illustrate a justification for many companies increased reliance on nonfinancial performance measures. Thus, additional nonfinancial performance measures have incremental value because they provide diverse performance measures that can be used to induce actions that are more congruent with the principal’s gross payoff. Furthermore, consistent with the theory of complementary management choices (Milgrom and Roberts 1995), this study also documents that a coordinated move to adopt

\(^9\) Different loan products have different characteristics, which causes the product mix to affect employee performance. For example, a representative making a larger proportion of secured loans will have a lower overdue loans ratio than others who make larger proportions of unsecured loans. Whether the greater improvements for the treatment group in productivity and quality performance are ascribed to product mix shift is a competing explanation deserving further investigation. The models M6, M7 and M8 were re-estimated using house loans data only, indicating that the parameter estimates remain qualitatively the same.
### Table 7 Descriptive Statistics and Preliminary Tests

<table>
<thead>
<tr>
<th></th>
<th>Control Group (n = 828)</th>
<th>Treatment Group (n = 1008)</th>
<th>Change</th>
<th>ANOVA F – stat b</th>
<th>Wilcoxon Z – stat c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit-extension amounts (ten thousand NT dollars)</td>
<td>2973.409 (1272.023)a</td>
<td>2475.923 (636.2331)</td>
<td>-16.7%</td>
<td>2737.641 (1075.974)a</td>
<td>3136.861 (1173.921)</td>
</tr>
<tr>
<td>Overdue loans ratio (%)</td>
<td>2.611512 (1.345037)</td>
<td>2.5658 (1.5524)</td>
<td>-1.80%</td>
<td>2.987634 (1.774855)</td>
<td>1.665807 (0.993824)</td>
</tr>
<tr>
<td>Peel-off ratio (%)</td>
<td>3.522469 (2.559784)</td>
<td>3.359321 (1.531838)</td>
<td>-4.63%</td>
<td>3.507456 (2.481836)</td>
<td>2.082355 (1.406586)</td>
</tr>
</tbody>
</table>

a Standard errors in parentheses.

b Between group significance test using a standard ANOVA analysis (p-values in parentheses).

c Between group significance test using the Wilcoxon Rank Sums test (p-values in parentheses).
Table 8 Regression Results for the Effects on Performance from Job Redesign Combined with a Nonfinancial Incentive System

Panel A: Effect on Credit-extension Amounts
\[ \Delta C_{AMOUNT} = \sum_{d=1}^{4} \alpha_d^{C} DISTRICT_d + \beta_1^{C} JD_i + \beta_2^{C} MPOW95_i + \epsilon_i^{C} \]  
(M6)\(^b\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t-stat (p-values)</th>
<th>VIF</th>
<th>Adj. (R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRICT(_1)</td>
<td>168.38</td>
<td>( ? )</td>
<td>444.57</td>
<td>0.38 (0.71)</td>
<td>2.719</td>
<td>.101</td>
</tr>
<tr>
<td>DISTRICT(_2)</td>
<td>950.19</td>
<td>( ? )</td>
<td>469.35</td>
<td>2.03 (0.05)</td>
<td>1.137</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_3)</td>
<td>-335.41</td>
<td>( ? )</td>
<td>826.59</td>
<td>-0.41 (0.68)</td>
<td>1.567</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_4)</td>
<td>-278.23</td>
<td>( ? )</td>
<td>386.35</td>
<td>-0.72 (0.47)</td>
<td>1.369</td>
<td></td>
</tr>
<tr>
<td>(JD_i)</td>
<td>1015.39</td>
<td>(+ )</td>
<td>589.84</td>
<td>1.72 (0.04)</td>
<td>4.388</td>
<td></td>
</tr>
<tr>
<td>(MPOW95_i)</td>
<td>46.09</td>
<td>(+ )</td>
<td>54.25</td>
<td>0.85 (0.20)</td>
<td>6.894</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Effect on Overdue Loans Ratio
\[ \Delta O_{VERDUE} = \sum_{d=1}^{4} \alpha_d^{O} DISTRICT_d + \beta_1^{O} JD_i + \beta_2^{O} MPOW95_i + \epsilon_i^{O} \]  
(M7)\(^b\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t-stat (p-values)</th>
<th>VIF</th>
<th>Adj. (R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRICT(_1)</td>
<td>-0.24</td>
<td>( ? )</td>
<td>0.68</td>
<td>-0.35 (0.73)</td>
<td>2.719</td>
<td>.335</td>
</tr>
<tr>
<td>DISTRICT(_2)</td>
<td>-0.076</td>
<td>( ? )</td>
<td>0.72</td>
<td>-0.11 (0.92)</td>
<td>1.137</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_3)</td>
<td>0.69</td>
<td>( ? )</td>
<td>1.27</td>
<td>0.54 (0.59)</td>
<td>1.567</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_4)</td>
<td>0.79</td>
<td>( ? )</td>
<td>0.59</td>
<td>1.34 (0.18)</td>
<td>1.369</td>
<td></td>
</tr>
<tr>
<td>(JD_i)</td>
<td>-1.87</td>
<td>( - )</td>
<td>0.90</td>
<td>-2.07 (0.02)</td>
<td>4.388</td>
<td></td>
</tr>
<tr>
<td>(MPOW95_i)</td>
<td>-0.05</td>
<td>( - )</td>
<td>0.08</td>
<td>-0.63 (0.27)</td>
<td>6.894</td>
<td></td>
</tr>
</tbody>
</table>

Panel C: Effect on Peel-Off Ratio
\[ \Delta P_{EELOFF} = \sum_{d=1}^{4} \alpha_d^{P} DISTRICT_d + \beta_1^{P} JD_i + \beta_2^{P} MPOW95_i + \epsilon_i^{P} \]  
(M8)\(^b\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Predicted Sign</th>
<th>Standard Errors</th>
<th>t-stat (p-values)</th>
<th>VIF</th>
<th>Adj. (R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRICT(_1)</td>
<td>-0.58</td>
<td>( ? )</td>
<td>0.93</td>
<td>-0.62 (0.54)</td>
<td>2.719</td>
<td>.075</td>
</tr>
<tr>
<td>DISTRICT(_2)</td>
<td>1.15</td>
<td>( ? )</td>
<td>0.99</td>
<td>1.16 (0.25)</td>
<td>1.137</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_3)</td>
<td>-1.89</td>
<td>( ? )</td>
<td>1.74</td>
<td>-1.09 (0.28)</td>
<td>1.567</td>
<td></td>
</tr>
<tr>
<td>DISTRICT(_4)</td>
<td>0.20</td>
<td>( ? )</td>
<td>0.81</td>
<td>0.24 (0.81)</td>
<td>1.369</td>
<td></td>
</tr>
<tr>
<td>(JD_i)</td>
<td>-0.30</td>
<td>( - )</td>
<td>1.24</td>
<td>-0.24 (0.41)</td>
<td>4.388</td>
<td></td>
</tr>
<tr>
<td>(MPOW95_i)</td>
<td>-0.09</td>
<td>( - )</td>
<td>0.11</td>
<td>-0.81 (0.21)</td>
<td>6.894</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) The number of observations was 51.
\(^b\) See the section — Model Specifications — for variable definitions.
nonfinancial measures and implement job redesign had greater improvements in employee performance. This result implies that changes in the design of the reward system, if unaccompanied by changes in the task design, may not come close to achieving all the benefits that are available through a coordinated move.

This study brings up several suggestions for the businesses and accountants in industry. First, the Taiwan financial system has been undergoing liberalization since the late 1980s. Major reforms have included the introduction of sixteen new private banks in 1992 and the relaxation of restrictions on non-bank financial institutions and on foreign banks. This has created an environment of intensified competition. To succeed in a highly competitive environment, a bank has to guide employees’ efforts toward producing the services that the customers want, which includes all nonfinancial ingredients of success. The bank must be able to turn this improved service into profits, and to be certain that the ingredients are complete, it needs to pay attention to nonfinancial performance measures. Second, steadily rising non-performing loans have created difficulties for many Taiwanese banks recently. According to their regulations, banks are required to assign credit-extension and credit-verification jobs for one case to separate individuals. Nevertheless, according to my understanding, many regional Taiwanese commercial banks did not actually appoint separate employees to conduct credit-verification tasks. Those banks that have not separated credit-extension tasks from credit-verification tasks and that suffer from poor asset quality can refer to the results of this study to redesign their employee incentive systems to consider task and reward interdependence. Third, as businesses move towards nonfinancial measures, financial accountants should make sure that they have something to contribute to prevent from getting sidelined. Financial staff can get involved with the management reporting system by designing, measuring and reporting the nonfinancial measures that the management needs.

Limitations

There are some limitations to this study. The firm-specific nature of this study limits the ability to generalize the results to other businesses. However, the research site is representative of other commercial banks in the banking industry. Birnberg et al. (1990, 40) indicated that, “Statistical conclusions and internal validities are often low in field research due to measurement difficulties and the lack of control over variables.” These are general limitations in field studies. Although data on macroeconomic variables are used to control for the exogenous factors affecting employee performance, recognizing that there is no carefully designed control group, readers still need caution in the interpretation of the performance impacts of adopting the nonfinancial measures in my analyses. Another limitation pertains to data availability. Since loan interest income and profit measures were not available per loan-making representative, I impute the two measures for every representative. The inherent arbitrariness and errors in the measurement of loan interest income and profit also limit my findings.

Future Research

Many companies have implemented the Balanced Scorecard system, which complements traditional financial accounting measures with customer, internal, and innovation and learning perspectives on nonfinancial measures (Kaplan and Norton 1992,
1996). Academic researchers can evaluate the effectiveness of introducing various nonfinancial performance measures and investigate what is the appropriate balance between financial and nonfinancial measures of performance.

Research on complementary choices within accounting is beginning to appear. Since accounting information plays an important role in management control systems, research to develop a framework to identify the contextual factors that may contribute to complementary accounting choices will be fruitful.

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REFERENCES


Hemmer, T. 1999. Performance measurement systems, incentives and the optimal

10 See Drake et al. (1999, 342) for recent studies.
allocation of responsibilities. Working paper, University of Chicago, Chicago.
contracts, asset ownership, and job design. *Journal of Law, Economics, and
Organizations* 7 (Supplement): 24-52.
Ittner, C., D. Larcker, and M. Rajan. 1997. The choice of performance measures in annual
____________. 1998. Innovations in performance measurement: Trends and
School Press.
Masters dissertation, Chinese Culture University, Taipei, Taiwan.
Milgrom, P., and J. Roberts. 1995. Complementarities and fit Strategy, structure, and
organizational change in manufacturing. *Journal of Accounting and Economics* 19
(March/May): 179-208.
measurement: Balancing financial and nonfinancial measures of performance.
Rees, W., and C. Sutcliffe. 1994. Quantitative nonfinancial information and income
measures: The case of long term contracts. *Journal of Business Finance and
Accounting* 21 (April): 331-347.
Sim, K., and L. Killough. 1998. The performance effects of complementarities between
manufacturing practices and management accounting systems. *Journal of
Management Accounting* 10: 325-346.
Quarterly* 40 (March): 145-180.
and reward interdependence on group performance. *Journal of Organizational
Behavior* 18 (2): 139-158.
White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct
Wu, A. 1990. Management accounting reformation in the nineties: Future directions and

非財務性衡量指標與徵授信分工對員工績效之影響—實地實證研究

楊朝旭
國立中正大學會計系助理教授

摘要：本研究之目的是探討「非財務性績效衡量指標」與「工作設計」此二項誘因工具對員工績效之影響。績效評估為管理會計的重要功能之一。傳統上，公司使用諸如盈餘、投資報酬率、或單位成本等財務指標，來衡量並激勵經理人的績效，然而，近來非財務性衡量指標已扮演越來越重要的角色。例如，Kaplan (1990) 归納一些學者的研究結果指出，實務界對於諸如品質、產品循環時間及生產力之改善，越來越傾向以直接的、營運性的指標來衡量及激勵績效。另外，Ittner et al. (1997) 也報導美國已有 36% 的公司於其總經理獎酬計畫中，使用非財務性績效衡量指標。

國內早有學者提倡非財務績效指標的觀念，如吳安妮 (民 79) 指出，企業應兼顧財務與非財務性衡量指標。雖然杜榮瑞 (民 82) 發現我國企業採用非財務性衡量指標的比例尚低，但是梁靜舒 (民 82) 的調查顯示，主管對非財務性衡量指標之重視並不亞於財務指標。由上可知，儘管實務上對於非財務性衡量指標之使用尚不如財務性衡量指標普遍，但是在觀念上顯然已愈趨重視非財務性衡量指標。鑑於非財務性指標日益受到重視，卻少有學者探討非財務指標採用後對績效的影響 (Ittner and Larcker 1998)，本研究欲瞭解的第一個問題為：採用非財務性衡量指標對於第一線員工之工作績效有何影響？

的學者也開始重視管理制度互補性的研究 (Drake et al. 1999), Ittner and Larcker (1998) 並指出誘因工具間的配合如何影響員工之績效是值得探討的議題。因此，本研究的第二個問題為：相較於僅採用非財務性衡量指標，非財務性衡量指標與工作設計此二誘因工具配合使用後，員工的績效是否較佳？

本研究採用「實地實證」研究方法，實地研究對象為一家商業銀行，此個案銀行在進行「徵信、授信分工」時，也同時進行公司主管所謂的「新式績效考核制度（額外納入非財務性衡量指標來評估績效）」之實驗，此情境提供我們一個極佳的機會，可實際驗證「工作設計」與「非財務性衡量指標」這兩種誘因工具對員工績效之影響。本研究所謂的工作設計為徵信、授信分工，非財務性衡量指標指授信不良率與脫落率兩個指標。研究期間為1993-1997; 該行於1995年7月開始採用非財務性績效衡量指標，並自1996年1月選擇五家分行實施徵、授信分工。吾人首先利用個案銀行17位授信員連續60個月所構成的縱查資料 (panel data)，以固定影響模型 (fixed-effects model) 分析非財務性績效衡量指標對員工績效的影響（主題一）。本研究另以實施徵、授信分工前後，51名授信員的績效資料，採中斷的時間序列設計 (interrupted time-series design)，檢定非財務性績效衡量指標與工作設計配合採用後，員工的績效是否較佳（主題二）。本研究的實證結果如下：

一、採用非財務性衡量指標對員工績效的影響
（一）採用非財務性衡量指標對員工非財務績效的影響

1. 對授信不良率之影響：授信不良率模型 (M1) 之分析結果列示於表2。非財務指標虛擬變數 (NFP) 之係數 -1.69 顯著為負，亦即採用授信不良率非財務指標後，其授信不良率降低約 1.7%，顯示控制了單位異質性、景氣狀況與季節性因素對授信不良率之影響後，採用授信不良率非財務指標改善了授信員的授信品質。

2. 對脫落率之影響：脫落率模型 (M2) 之分析結果列示於表3，非財務性指標虛擬變數 (NFP) 之係數為 -12.33 顯著為負，意味著採用非財務衡量指標後，脫落率顯著降低。

整體而言，上述的結果支持假說一，亦即銀行授信人員之績效考核制度中，加入授信不良率和脫落率之非財務性衡量指標後，該項非財務績效改善了。過去完全強調授信量的考核下，授信員容易忽略徵信工作與客戶服務工作。為使員工的努力方向與公司的長期利益一致，公司採用授信不良率及脫
落率非財務性衡量指標來考核授信員的績效，此舉確實引導員工增加徵信工作與客戶服務工作的努力程度。

（二）採用非財務性衡量指標對員工財務績效之影響

1. 對授信金額的影響：有關採用非財務性衡量指標對授信金額的影響，其估計結果如表 4 所示。非財務指標虛擬變數 NFP 之係數顯著為負，意味著採用非財務性衡量指標後，授信金額顯著減少（降低了約 127 萬）。

2. 對利息收入的影響：授信金額的降低會導致利息收入的減少，故本研究也以模式（M4）分析非財務指標採用後授信員利息收入績效的改變，其迴歸結果列示於表 5。非財務指標虛擬變數 NFP 之係數顯著為負（-56.89），亦即採用非財務指標後，設算之利息收入降低約 57 萬。

整體而言，表 4 及表 5 的迴歸結果支持研究假說二：銀行授信人員之績效考核制度中，加入非財務性衡量指標後，其授信金額與利息收入（收入面）財務績效均變差。

3. 對授信利潤之影響：關於採用非財務性衡量指標對授信利潤之影響，其迴歸結果如表 6 所示。與假說三的預期一致，非財務指標虛擬變數 NFP 之係數顯著為正，表示個案銀行採用非財務性衡量指標兩年半後，設算授信利潤有顯著的改善。

上述結果可知，銀行授信人員之績效考核制度中，加入授信不良率與脫落率非財務性衡量指標後，雖然授信員努力的重分配導致其授信金額與利息收入財務績效變差，但授信員的授信不良率與脫落率非財務績效變佳，整體而言，授信利潤有顯著的改善。

二、非財務指標與工作設計配合採用對員工績效之影響

此部分以授信金額、授信不良率及脫落率資料完整的 51 名授信員為樣本，檢視非財務性衡量指標與工作設計配合採用對員工績效的影響。模式（M6）至（M8）之分析結果列示如表 8。授信金額模式（M6）及授信不良率模式（M7）的估計結果顯示，實施徵、授信分工之授信員授信金額改善較大，授信不良率降低較多。本研究對此結果的解釋為：雖然採用非財務性衡量指標後，可引導授信員平衡分配授信推廣與風險控管兩方面之努力，但此卻導致授信工作的誘因低於公司要求的水準。徵、授信分工之後，授信員的獎酬視授信金額而定，且授信員不再需要處理繁複的文書作業，而可全力推廣授信，故實施徵、授信分工之授信員，其授信金額增加較多；至於徵信工作則由徵信員專門負責，在徵信員的獎酬視徵信品質而定的情況下，徵信員會努
力徵信，故實施徵、授信分工之授信員，其授信不良率降低較大。在脫落率模式 (M8) 方面，雖然實施徵、授信分工的授信員脫落率降低較多，但統計結果並不顯著。可能原因為：分工之後，授信員著重於授信推廣，故其在行外的時間大幅增加，而無法兼顧處理客戶來電抱怨或要求服務。

綜合上述之分析，吾人發現在控制分行規模、地區經濟因素下，實施徵、授信分工之分行的授信員，其授信金額增加較多，授信不良率降低較大，表示非財務指標與工作設計誘因工具的配合採用對員工績效有正面的影響。此實地實證結果支持 Chow et al. (1991) 與 Wageman and Baker (1997) 的實驗發現：當報酬與工作相依性間的配適性提高時 (亦即報酬與工作兩者同為相依或獨立時)，績效較佳。

總而言之，本研究的證據顯示，銀行授信人員之績效考核制度中，加入授信不良率與脫落率非財務性衡量指標後，授信員的授信不良率與脫落率非財務績效均有改善；此外，存在非財務績效衡量指標之獎酬制度下，配合實施徵、授信分工的授信員，其授信金額及授信不良率績效顯著較徵、授信合一之授信員為佳；此結果與 Milgrom and Roberts (1995) 的「管理制度互補性選擇理論」一致。

本研究對學術研究與實務界應具有以下貢獻：

一、目前會計文獻對於非財務績效衡量指標的實證研究，多著重探討高階經理人而忽略了第一線的員工 (如 Ittner et al. 1997; Banker et al. 2000)。一些學者認為，非財務性績效衡量指標對低階員工較為有用 (如 Nanni et al. 1990)，但少有實證證據評估各種生產力和績效衡量指標如何影響員工行為 (Young and Selto 1991)。此外，一般探討工作設計效果的組織面研究，多著重於各種工作特性 (諸如工作的變化性、重要性、自主性等) 如何影響員工的態度和行為。在這類研究中，工作設計主要是透過員工對工作認知的改變 (例如：員工之工作滿足感的提昇)，進而影響員工績效 (Griffin 1991)。然而工作設計除考量上述工作滿足感等因素之外，尚可藉由工作設計與激勵制度配合以提高績效 (Milgrom and Roberts 1992)。本研究探討工作設計與非財務指標獎酬制度配合採用，對第一線員工績效的聯合影響，將有助於擴充這方面的實證文獻。

二、台灣企業界正面臨著日益激烈的競爭壓力，促使管理當局必須改善其管理及控制方式，學術界應協助公司設計適當的誘因制度，俾激勵員工改
善績效並創造公司之競爭優勢。尤其像金融業這類的服務業，員工生產之產品是無形的服務，故如何衡量產品品質與員工績效便更形困難，由於第一線員工的生產力與服務品質是創造公司價值的重要來源，因此，如何設計一套有效的誘因制度，引導員工增加生產力與改進服務品質，是值得思考的問題。本研究以個案銀行消費性貸款授信人員為樣本，驗證非財務指標與徵、授信分工對員工績效的影響。相信本研究之實證結果，不僅對個案銀行在其他作業活動之誘因設計上提供方向，同時亦可作為其他企業組織的參考。

關鍵字：實地實證研究、非財務性績效衡量指標、工作設計。
The Impact of Tax-Exempt Stock and Land Capital Gains on Corporate Effective Tax Rates*

Ming-Chin Chen a†
National Chengchi University

Suming Lin b
National Taiwan University

Tien-Hsun Chang c
KPMG CPAs (Taiwan)

Abstract: Capital gains on stock and land transactions have long been exempt from income tax in Taiwan. However, there is strong criticism of both of these exemptions because they are seen as violating the equity principle and may cause deterioration to the government's fiscal system. Using financial statement data on both listed and over-the-counter companies, this study provides evidence on the impacts of the two tax-exempt items on corporate effective tax rates. The empirical results show that companies with greater stock and land capital gains have significantly lower effective tax rates, and \textit{vice versa}, suggesting that these two tax exemptions result in inequitable distribution of corporate tax burdens. We also find, among others, that affiliated companies tend to have lower effective tax rates than their non-affiliated counterparts, supporting the argument that affiliated companies have the advantage of reducing tax burdens and that corporate-affiliations may be tax-motivated.

Key Words: Effective tax rate, Stock capital gain, Land capital gain, Affiliated enterprises, Political cost hypothesis

I. INTRODUCTION

Corporate effective tax rates (hereafter ETRs) provide convenient statistics on corporate tax burdens, and are usually defined as the proportion of current tax expenses to pretax income. Variations in ETRs reflect variations in preferential tax treatment across different corporations, and such preferential tax treatment is clearly a distortion of the overall fairness of the tax system. Consequently, in any of the major tax reforms, ETRs

* The authors wish to thank two anonymous referees for their helpful suggestions and comments.
† Corresponding author. E-mail: mingchin@nccu.edu.tw
have long provided a focus for the tax policy debate.\(^1\) For example, the Taiwanese government enacted the Integrated Income Tax System in 1998 under a stated policy of launching a new tax system in pursuit of equitable principles. Furthermore, as the statistics published by the Ministry of Finance (MOF) (1998) showed, the top 100 manufacturing companies had an average ETR of around only 13.8\(%\),\(^2\) far below the nominal tax rate of 25\%.

The MOF’s statistics revealed an important implication—that there exist substantial preferential tax treatments within the income tax system which enable large corporations to avoid paying their taxes at the nominal income tax rate. Furthermore, the availability of preferential tax treatments also varies for corporations across different industries. Of all preferential tax treatments, the tax exemptions on stock and land capital gains\(^3\) have received the loudest criticism. For example, in February 2000, Duan Wei, the then-Director General of the Directorate General of Budget, Accounting and Statistics (DGBAS) of the Executive Yuan, pointed out that while the average GDP growth rate for the period from 1992 to 1999 was around 8.49\%, the average increase in annual tax revenues was only around 4.9\% for the same period, resulting in tax revenue elasticity of approximately 0.58. Therefore, increases in tax revenue have not kept pace with the growth in national GDP, creating instability in the state of health of government fiscal revenues. Duan Wei suggested, therefore, that the government should become concerned over the obvious distortion in the tax system arising from the tax-exemptions on stock and land capital gains.\(^4\)

Despite the loud criticism of these tax exemptions, there is still very little micro-level evidence of their overall impact on Taiwan’s corporate ETRs, due largely to limitations stemming from the non-availability of data. Furthermore, stock and land capital gains are not disclosed as separate items in corporate financial statements. The main objective of this study is to explore empirically the impact of the two exemptions on corporate ETRs in Taiwan, using proxy variables constructed from financial statement data. In May 2000, the then-Minister of Finance, Jia-Dong Shu, stated that as a result of the worsening fiscal deficit, the government could not rule out raising taxes to meet the vast and growing expenditure on social welfare, and that wage earners were currently bearing a heavier tax burden than capital gains earners, a clear indicator that the current tax system is inequitable.\(^5\) Therefore, the evidence from this study may have implications for the government in planning future tax reforms.

Although prior ETR literature in the US has found that corporate ETRs vary with

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\(^1\) For example, Citizens for Tax Justice (CTJ 1985, 2) indicated that, “the 250 corporations surveyed in this report were able to pay absolutely nothing in federal income taxes, and receive outright tax rebates in at least one of the five years from 1981 to 1985.” The CTJ reports were widely believed to have an important influence on the enactment of the Tax Reform Act of 1986, which has been referred to as the most important tax reform in recent 30 years in the U.S. (Birnbam and Murray 1987).

\(^2\) Of these, due to substantial tax incentives, seven corporations located in the Hsinchu Science-based Industrial Park have the lowest average ETR of only 4.07\%.

\(^3\) As prescribed in the provisions of Item 16 of Article 4 and Article 4-1 of the Income Tax Law.


firm characteristics - such as firm size, financing and investment policies, operating profitability, and industry membership - the relationship between ETRs and these firm characteristics has not been examined in a complete model in Taiwan (Tsai 1993; Lin and Yang 1994). Moreover, affiliated enterprises have been playing an increasingly important role in Taiwan’s business environment. One adverse impact on tax equity by affiliated enterprises is that they may engage in non-arm’s length transactions among related parties in order to shake off their tax liabilities. In this study, we also explore the impacts of affiliated enterprises on corporate ETRs; thus, a further objective of this study is to extend the ETR literature in Taiwan by incorporating tax rules and the business environment into the empirical model.

The rest of this paper is organized as follows. Section II reviews the previous research on corporate ETRs in the US and Taiwan, and presents the theoretical arguments on the impact of stock and land capital gains and affiliated companies on Taiwanese corporate ETRs. Section III discusses the research methods, including the research hypotheses, the empirical model and the sample selection procedures. Section IV presents our empirical results. Finally, Section V provides the research results and concludes with a discussion on the limitations of this study.

II. LITERATURE REVIEW

Siegfried (1974) conducted one of the first comprehensive studies of ETRs across industries and found that the variations in ETRs were largely due to the effects of tax subsidies, such as accelerated depreciation methods and percentage depletion, indicating that the distribution of corporate tax burdens was uneven. His study suggested that lower ETRs may be indicative of the political power possessed by a firm, and that ETRs may be used in the evaluation of tax policy. Following Siegfried’s seminal work, subsequent researchers have frequently used ETRs as an important indicator in the research of tax distribution issues.

Along with Siegfried (1974), extensive subsequent studies on ETRs have devoted their attention to examining the relationship between ETRs and firm size (Stickney and McGee 1982; Zimmerman 1983; Porcano 1986; Shevlin and Porter 1992; Manzon and Smith 1994). Two counter arguments have been proposed to explain the relationship between ETRs and firm size. The political cost hypothesis argues that larger firms bear higher political costs, and because taxes are part of political cost, larger firms tend to have higher ETRs. Conversely, the political power hypothesis argues that larger firms possess greater political influence and economic resources that facilitate access to tax-favored treatments, and therefore, larger firms are more likely to have lower ETRs. However, the empirical results are mixed. Zimmerman (1983) found a positive relationship between ETRs and firm size consistent with the political cost theory, whereas, Siegfried (1974) and Porcano (1986) observed a negative correlation between ETRs and firm size, supporting the political power theory. Stickney and McGee (1982), Shevlin and Porter (1992), and Manzon and Smith (1994), on the other hand, observed no correlation between ETRs and firm size.

Along with discussions on firm size, ETRs may also be affected by firms’ operating, investment and financing policies. Using a cluster analysis, Stickney and McGee (1982) examined the cross-sectional relationship between firm characteristics and ETRs, with
their empirical results showing that firms with the lowest ETRs tended to be highly leveraged, heavily capital intensive, and involved in natural resource industries, thus benefiting from the percentage depletion method. Shevlin and Porter (1992) examined the impacts of the Tax Reform Act of 1986 (hereafter TRA 86) on corporate tax burdens. They decomposed the changes in ETRs into a tax rate effect, a tax rule effect, and an income effect. Their analyses indicated that the observed changes in ETRs from pre- to post-TRA 86 were largely due to the base-broadening tax rule changes in TRA 86 dominating the statutory tax rate reductions, consistent with the stated objectives of the TRA 86.

Gupta and Newberry (1997) used panel data spanning TRA 86 to examine the impact of TRA 86 on corporate tax burdens. Their results showed that post-TRA 86, ETRs increased, and that base-broadening rules dominated the reductions in corporate statutory tax rates contained within the TRA 86, consistent with the findings of Shevlin and Porter (1992). In addition, they observed a negative ETR-firm size relationship after TRA 86, in contrast to the positive relationship which existed prior to TRA 86. Their results also showed that ETRs had an overall positive association with profitability, and a negative association with capital intensity.

The above research suggests that corporate ETRs are associated with certain firm characteristics such as, firm size (Siegfried 1974; Zimmerman 1983; Porcano 1986), leverage (Stickney and McGee 1982; Gupta and Newberry 1997), intensity of capital assets (Stickney and McGee 1982; Gupta and Newberry 1997), profitability (Shevlin and Porter 1992; Gupta and Newberry 1997), and industry membership (Stickney and McGee 1982; Gupta and Newberry 1997). Whether these factors are associated with corporate ETRs in Taiwan remains unanswered. In the regression model of this study, we will examine the relationship between ETRs and these firm characteristics.

Turning to prior ETR studies in Taiwan, using 1984 and 1986 audited tax returns of profit-seeking enterprises, Chou et al. (1989a) found that the highest tax burdens were borne by the service sector, with the manufacturing sector bearing the second highest burden, and the agricultural sector the lowest. The manufacturing sector also enjoyed greater tax incentives than the service sector. Using the 1984 and 1986 tax returns of profit-seeking enterprises, Chou et al. (1989b) found that large firms and corporations obtained greater tax incentives than small firms and non- corporations. Both studies indicated that tax incentives were an important factor in the uneven distribution of tax burdens among firms and industries.

Using data from the 1981-1991 financial statements of listed companies in Taiwan, Tsai’s (1993) findings were consistent with the political cost hypothesis, that large firms tended to have higher ETRs. In contrast, using panel data on listed companies spanning the period from 1984 to 1992, Lin and Yang (1994) observed a negative ETR-firm size relationship, consistent with the political power hypothesis. They indicated that the average ETR of listed companies was around 15.2%, far below the top statutory tax rate, which was 35% in 1984, 30% in 1985, and 25% from 1986 and beyond. In addition, they found that the wholesale and retail industry had the highest ETR of 27.6% because the non-manufacturing industry did not qualify for the tax incentives prescribed in the Statute.

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6 See: Callihan (1994) for a detailed literature review of corporate effective tax rates.
for Stimulating Investment, strongly indicating that the distribution of tax burdens across industries was inequitable.

Statistics from the China Credit Information Service, LTD (CCIS) (1998, 88-90) indicate that affiliated enterprises are playing an increasingly important role in Taiwan’s economy. In 1986, the total number of employees in affiliated enterprises accounted for around 4.33% of Taiwan’s total labor market; by 1996, this had risen to 6.36%, an increase of around 47%. The total revenues for affiliated enterprises also increased during the same period, from 28.72% of real GNP in 1986, to 44.79% in 1996, an increase of around 56%. There was a greater likelihood of the affiliated enterprises having lower ETRs than non-affiliated enterprises, given that tax laws tend to favor affiliated companies. For example, the Statute for Stimulating Investment granted newly established manufacturing companies tax exemptions for five consecutive years on income from certain qualifying products, thereby encouraging firms to form new affiliated companies instead of expanding their existing companies. Moreover, affiliated companies can take advantages of transfer pricing between related-parties to further reduce their tax burdens. Finally, during our sample period, a corporation’s 80% of dividend income may be exempted from income tax, provided that the dividend-paying companies had paid taxes on the earnings. This additional tax-exemption on dividend income may well provide an additional tax advantage for affiliated companies. We predict, therefore, that listed and OTC affiliated companies are more likely to have lower ETRs than their non-affiliated counterparts.

To summarize, the previous ETR studies in Taiwan have mainly focused on the ETR-firm size relationship; the existence of such a relationship, however, remains unresolved. Furthermore, the previous literature has failed to address the impact on ETRs of a firm’s investments, financing policies and operating characteristics. Our empirical model aims to explore the impact of all these factors on Taiwan’s corporate ETRs.

III. RESEARCH METHODS

Hypothesis Development

Capital gains on ‘listed’ stocks have consistently been exempted from income tax since 1976, with one exception in 1989 when exemptions were removed. In 1990, however, the government further amended the income tax law to exempt all stock capital gains (Chen et al. 1987, ch.9, p.7). Consequently, cross-holding stocks of affiliated companies and ballooning stock prices essentially bore no income tax liability. A further major tax loophole in Taiwan has been the long-standing exemption of land capital gains from income tax. Prior to 1986, an individual’s land capital gains were exempt from income tax, but during that year, the government further amended the income tax law to exempt all land capital gains, for both individuals and profit-seeking enterprises.

Reasons for the formation of affiliated enterprises include: (1) the pursuit of better operating performance; (2) to qualify for tax benefits provided by the Statute for Stimulating Investment; (3) to facilitate mutual guarantee and investments; (4) to reduce taxes by cost allocation. Items (2) and (4) are both tax motivated.

The authors thank the referees for this valuable observation.

The purpose of granting this exemption to profit-seeking enterprises was to ease the tax burdens of profit-seeking enterprises and to provide a level playing field for the construction industry.
Although land capital gains in Taiwan are subject to the land value increment tax, on transfer of the land title, the calculation of the tax base for the incremental value is based on the government-announced value, which is far below the actual market value and restated only once a year. Thus, it is possible for a land transaction to bear no capital gain tax, provided the disposal is made within one year of the acquisition of the land. Nevertheless, during our sample period, from 1986 to 1997, capital gains on listed and OTC stocks, and on land, remained tax-exempted (with the single exception of 1989 when stock capital gains were taxable - we explain how we deal with this problem later). In calculating a firm’s ETR, holding constant its pretax income (i.e., the denominator of ETR), having greater amounts of tax-exempt (nondeductible) stock and land capital gains (losses) will result in lower (higher) income tax expenses (i.e., the numerator of ETR), and hence lower (higher) ETRs. We, therefore, propose our research hypotheses as follows:

- **H1a:** *ceteris paribus*, listed and OTC companies with greater stock capital gains are more likely to have lower ETRs.
- **H2a:** *ceteris paribus*, listed and OTC companies with greater stock capital losses are more likely to have higher ETRs.
- **H3a:** *ceteris paribus*, listed and OTC companies with greater land capital gains are more likely to have lower ETRs.
- **H4a:** *ceteris paribus*, listed and OTC companies with greater land capital losses are more likely to have higher ETRs.

However, stock and land capital gains, or losses, are not separately disclosed in corporations’ financial statements. In our research design, we use gains (losses) from the disposal of investments as the proxy variable for stock capital gains (losses), and gains (losses) on the disposal of assets as the proxy variable for land capital gains (losses). Admittedly, gains (losses) from the disposal of investments and land may include other taxable (deductible) gains (losses) that may introduce measurement noises into our proxy variables. Nevertheless, the effects of these measurement noises do not jeopardize our hypotheses (we will explain this in the variable definitions) and, hence, should have no confounding effects in the inference of our empirical results.

**Empirical Model and Variable Definitions**

**Empirical Model**

Based on prior ETR studies, along with Taiwan’s tax laws and business environment, we propose an ETR regression model for empirical analysis of listed and OTC companies in Taiwan as follows:

\[ ETR_i = \beta_0 + \beta_1 \text{SIZE}_i + \beta_2 \text{R\&D}_i + \beta_3 \text{CAPINT}_i + \beta_4 \text{DEBT}_i + \beta_5 \text{ROA}_i + \beta_6 \text{INVG}_i + \beta_7 \text{INVL}_i + \beta_8 \text{ASTG}_i + \beta_9 \text{ASTL}_i + \beta_{10} \text{GROUP}_i + \beta_{11} \text{LISTED}_i \]

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10 Jian-Shuan Wang, the former Minister of Finance, estimated that tax revenues could increase by NT$50 billion a year, if the land value increment tax was based on the actual transaction price, rather than the government-announced price (Chinese Tax Affair 2000, 8).
Variable Definitions

Table 1 lists the operational definitions and TEJ codes for the variables in the ETR regression model.

**ETR (Effective Tax Rate)**

In this study, we use two ETR measurements. ETR′ is defined as income tax expenses divided by pretax income, and is used to measure corporate tax burdens in the descriptive analyses, because its meaning is easier to interpret. Scholes and Wolfson (1992) indicated that a firm’s effective tax rate is an important factor in financing decisions. Consequently, ETR’ may not be appropriate for use as the dependent variable in the regression model, in that the denominator of ETR′ is affected by a firm’s interest expenses, and that leverage is also included as one of the explanatory variables in the regression model, ETR′ may be subject to the problem of endogeneity. Therefore, we use ETR, defined as income tax expenses deflated by pretax income before interest (EBIT), as the dependent variable in the regression model. Pre-interest earnings are used in the denominator for ETR to mitigate the endogeneity problem of leverage in calculating ETRs. Therefore, ETR reflects firms’ effective tax burdens, while holding financing decisions constant.11

**SIZE (Firm Size)**

SIZE, defined as the natural logarithm of net sales, is used to control for the firm size effect in the regression model. As discussed above, the political cost hypothesis predicts a positive relationship between ETR and firm size whereas the political power hypothesis predicts a negative relationship (Zimmerman 1983; Siegfried 1974; Porcano 1986). Accordingly, the predicted correlation between SIZE and ETR is uncertain.

**R&D (R&D Expenses) and CAPINT (Capital Asset Intensity)**

Investments by firms can be either tangible or intangible (knowledge-based); therefore, we use capital intensity and R&D expenditure to examine the impact of firms’ investment decisions on ETRs. R&D, defined as R&D expenses deflated by total assets, is used to measure a firm’s R&D intensity. While R&D expenditure is immediately deductible in tax returns, its benefits are typically realized over long periods (Gupta and Newberry 1997). Taiwan’s tax law also provides substantial investment tax credits for R&D expenditure; therefore, R&D is an important tax shield with the predicted correlation between R&D and ETR being negative.

CAPINT, defined as net PP&E scaled by total assets, is used to measure a firm’s capital asset intensity. Capital asset investments, such as property, plant and equipment, can enjoy accelerated depreciation methods and substantial investment tax credits in Taiwan. Therefore, the predicted estimated coefficient on CAPINT is negative (Stickney and McGee 1982; Gupta and Newberry 1997).

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11 Because the financial accounting standard for income tax expenses in Taiwan was not introduced until 1995, most companies did not report current tax expenses separately in financial statements. Thus, we have used income tax expenses, instead of current income tax expenses, in the numerator of ETR, due to the limitation on data availability.
Table 1 Variable Definitions and TEJ Codes*

<table>
<thead>
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<th>Variables</th>
<th>Definitions</th>
<th>TEJ Codes</th>
<th>TEJ Accounts</th>
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</thead>
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<td>Income tax expenses / EBIT</td>
<td>T3910</td>
<td>Income tax expenses</td>
</tr>
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<td></td>
<td></td>
<td>T3900 + T3510</td>
<td>Pre-tax income + Interest expense</td>
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<td>SIZE</td>
<td>In (Net sales)</td>
<td>T3100</td>
<td>Net operating revenues</td>
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<td></td>
<td></td>
<td>T0010</td>
<td>Total assets</td>
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<td>CAPINT</td>
<td>Net fixed assets / Total assets</td>
<td>T0400 - T0410</td>
<td>Fixed assets - Land</td>
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</tr>
<tr>
<td>ROA</td>
<td>Pre-tax income / Total assets</td>
<td>T3900</td>
<td>Pre-tax income</td>
</tr>
<tr>
<td>INVG</td>
<td>Gains on disposal of investments / Total assets</td>
<td>T3434</td>
<td>Gains on disposal of investments</td>
</tr>
<tr>
<td>INVL</td>
<td>Losses on disposal of investments / Total assets</td>
<td>T3534</td>
<td>Losses on disposal of investments</td>
</tr>
<tr>
<td>ASTG</td>
<td>Gains on disposal of assets / Total assets</td>
<td>T3440</td>
<td>Gains on disposal of assets</td>
</tr>
<tr>
<td>ASTL</td>
<td>Losses on disposal of assets / Total assets</td>
<td>T3540</td>
<td>Losses on disposal of assets</td>
</tr>
<tr>
<td>GROUP</td>
<td>Dummy variable for affiliated companies</td>
<td>Explained later</td>
<td></td>
</tr>
<tr>
<td>LISTED</td>
<td>Dummy variable for listed companies</td>
<td>Explained later</td>
<td></td>
</tr>
<tr>
<td>Ik</td>
<td>Dummy variables for industries</td>
<td>Explained later</td>
<td></td>
</tr>
</tbody>
</table>

*: See TEJ financial statement data manual for codes and account definitions.

DEBT (Leverage)

DEBT, measured as long-term liabilities scaled by total assets, is used to control for the impact of financing policies on ETRs. Under Taiwanese tax law, although interest expenses are deductible in tax returns, dividends are not; therefore, firms with greater leverage are more likely to have lower ETRs, and thus the expected estimated coefficient of DEBT is negative (Stickney and McGee 1982; Gupta and Newberry 1997).

ROA (Returns on Assets)

ROA, defined as pretax income divided by total assets, is used to determine the profitability of firms. The income effect hypothesis predicts that if a firm’s fixed tax shields are relatively constant, increases in taxable income will result in higher ETRs (Shevlin and Porter 1992; Gupta and Newberry 1997). ROA is designed to control for the income effect in the ETR model, with the expected estimated coefficient of ROA being positive.

INVG (Gains on Disposal of Investments)

INVG, defined as gains on the disposal of investments scaled by total assets, is used...
to proxy for the tax-exempt stock capital gains. Under H1a, the predicted relationship between INVG and ETR is negative. As discussed above, in addition to stock capital gains, gains on the disposal of investments may include other taxable capital gains that may conceivably introduce measurement errors in the INVG. If our assumption holds—that INVG are tax-exempt stock capital gains—then by definition, ETR \[= \frac{\text{Income tax expenses}}{(\text{Other EBIT} + \text{INVG})}\] will decrease as INVG increases, because INVG increases in the denominator of ETR, but not in the numerator. This result is consistent with the prediction of H1a. Conversely, if our assumption does not totally hold (i.e., INVG contains taxable capital gains), then ETR = (Income tax expenses + INVG x t%)/(Other EBIT + INVG), where t% is the tax rate. Consequently, ETR will not decrease as taxable INVG increases, because taxable INVG increases in both the denominator and the numerator of ETR. This relationship suggests that if our assumption does not totally hold, the measurement errors run against supporting H1a; therefore, the potential measurement noise in INVG should not be a confounding factor if the empirical results support our hypothesis.

**INVL (Losses on Disposal of Investments)**

INVL, defined as losses on disposal of investments scaled by total assets, is used to proxy for the non-deductible stock capital losses. Under H2a, the predicted correlation between INVL and ETR is positive. In reasoning similar to the measurement problem described for INVG, INVL may also contain tax-deductible capital losses. If our assumption holds—that INVL are nondeductible stock capital losses—then ETR \[= \frac{\text{Income tax expenses}}{\text{Other EBIT} - \text{INVL}}\] will increase as INVL increases, because INVL decreases in the denominator of ETR, but not in the numerator. This association is consistent with the prediction of H2a. Nonetheless, if our assumption does not totally hold (i.e., INVL contains tax-deductible capital losses), then ETR = (Income tax expenses - INVL x t%)/(Other EBIT - INVL), where t% is the tax rate. Consequently, ETR will not increase as the tax-deductible INVL increases, because the tax-deductible INVL decreases in both the denominator and the numerator of ETR. This relationship suggests that if our assumption does not totally hold, the measurement errors in INVL run against supporting H2a; hence, the potential measurement noises in INVL should not be a confounding factor if the empirical results support our hypothesis.

**ASTG (Gains on Disposal of Assets)**

ASTG, defined as gains on the disposal of assets scaled by total assets, is used to proxy for tax-exempt land capital gains. Under H3a, the predicted correlation between ASTG and ETR is negative. Besides land capital gains, ASTG may also include capital gains from the disposal of other taxable assets. However, similar to the explication of INVG, if our assumption that ASTG are tax-exempt land capital gains does not totally hold, the potential measure errors will run against supporting H3a. At the risk of becoming repetitive, and for the sake of conserving space, we will not repeat the explanations.

---

12 The regression results are qualitatively similar by scaling INVG, INVL, ASTG and ASTL by net sales.
ASTL (Losses on Disposal of Assets)

ASTL, defined as losses on disposal of assets, is used to proxy for non-deductible land capital losses. Under H4a, the predicted relationship between ASTL and ETR is positive, and in a vein similar to the potential measurement errors in ASTG, ASTL may also contain capital losses from the disposal of other tax-deductible assets. However, as explained in the case of INVL, the potential measurement errors run against supporting H4a. Therefore, the potential measurement errors should not be a confounding threat if the empirical results support H4a.

GROUP (Affiliated Companies)

GROUP is a dummy variable used to control for the differences between affiliated and non-affiliated companies. GROUP equals one if companies are affiliated, and zero if they are non-affiliated. The classification of affiliated and non-affiliated companies is based on the survey by China Credit Information Service, LTD (CCIS) (1998). As discussed above, affiliated companies have more avenues available to them to reduce their tax burdens and, thus, the expected estimated coefficient on GROUP is negative. Admittedly, the classification based on the 1998 survey may be subject to measurement errors because the composition of affiliated enterprises may well have varied during our entire sample period of 1986-1997. In order to mitigate this problem, we also conduct additional tests as discussed in the regression results.

LISTED (Listed Companies)

The dummy LISTED equals one if firms are listed companies, and zero for OTC companies. LISTED is used to control for the differences in firm characteristics between listed and OTC companies.

Ik (Industry categories)

The dummy variables Ik are used to control for differences in competition and the availability of tax incentives across different industries. The classification of industries is based on the categories used by the Taiwan Stock Exchange. The ‘conglomerate’ industry and ‘others’ are combined into one category, because there are only a few samples in both industries. In the regression model, we designate the electronics industry as the excluded group, and use 17 Ik’s dummies to present 17 other industries (see Table 2 for the industry list). The electronics industry is believed to receive the most favorable tax treatment; therefore, the expected estimated coefficients of Ik are positive.

Data Sources and Sample Selection

The sample firms of this study include companies with stocks listed in the Taiwan Stock Exchange (TSE) and the Over-the-Counter (OTC) markets from 1986 to 1997. Financial statement data were obtained from the Taiwan Economic Journal (TEJ) to compute all variables. The income tax rate schedule of profit-seeking enterprises has remained unchanged since 1986, allowing controlling for both the tax rule and the tax rate effects (Shevlin and Porter 1992).

Excluding the banking and insurance industry, a sample of 5,712 firm-years was obtained from the TEJ financial statement data file. The following firms were deleted: (i) those without the required data in the TEJ file to calculate the variables in the regression
model; (ii) those with negative earnings - the ETRs of these firms are difficult to interpret; (iii) those with negative ETRs - Taiwanese tax law does not allow a tax refund for firms with negative ETRs; and (iv) those with zero or negative net sales in the TEJ data file.

Accordingly, this study uses a total of 4,244 firm-years. Table 2, Panel A, shows the sample compositions by industries, categorizing them as Listed and OTC companies, and affiliated and non-affiliated companies. Table 2, Panel B, lists the number and percentage of firms in each sample year. Since there are an unequal number of firms in the sample year, the sample of this study contains an unbalanced panel data.

**Table 2 Sample Compositions by Industries and Years**

**Panel A. Sample Compositions by Industries**

<table>
<thead>
<tr>
<th>Industries</th>
<th>Listed Companies</th>
<th>OTC Companies</th>
<th>Non-affiliated Companies</th>
<th>Affiliated Companies</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>CEMENT</td>
<td>93</td>
<td>3%</td>
<td>0</td>
<td>0%</td>
<td>47</td>
</tr>
<tr>
<td>FOODS</td>
<td>264</td>
<td>8%</td>
<td>12</td>
<td>1%</td>
<td>238</td>
</tr>
<tr>
<td>PLASTICS</td>
<td>179</td>
<td>5%</td>
<td>17</td>
<td>2%</td>
<td>135</td>
</tr>
<tr>
<td>TEXTILES</td>
<td>437</td>
<td>13%</td>
<td>47</td>
<td>6%</td>
<td>380</td>
</tr>
<tr>
<td>ELECTRIC &amp; MACHINERY</td>
<td>187</td>
<td>6%</td>
<td>84</td>
<td>10%</td>
<td>244</td>
</tr>
<tr>
<td>ELECTRIC APPLIANCE &amp; CABLE</td>
<td>129</td>
<td>4%</td>
<td>43</td>
<td>5%</td>
<td>138</td>
</tr>
<tr>
<td>CHEMICALS</td>
<td>172</td>
<td>5%</td>
<td>64</td>
<td>8%</td>
<td>219</td>
</tr>
<tr>
<td>GLASS &amp; CERAMICS</td>
<td>63</td>
<td>2%</td>
<td>4</td>
<td>0%</td>
<td>67</td>
</tr>
<tr>
<td>PAPER &amp; PULP</td>
<td>55</td>
<td>2%</td>
<td>0</td>
<td>0%</td>
<td>37</td>
</tr>
<tr>
<td>STEEL &amp; IRON</td>
<td>238</td>
<td>7%</td>
<td>54</td>
<td>6%</td>
<td>282</td>
</tr>
<tr>
<td>RUBBER</td>
<td>82</td>
<td>2%</td>
<td>6</td>
<td>1%</td>
<td>48</td>
</tr>
<tr>
<td>AUTOMOBILE</td>
<td>52</td>
<td>2%</td>
<td>0</td>
<td>0%</td>
<td>33</td>
</tr>
<tr>
<td>ELECTRONICS</td>
<td>631</td>
<td>19%</td>
<td>292</td>
<td>35%</td>
<td>678</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td>286</td>
<td>8%</td>
<td>85</td>
<td>10%</td>
<td>262</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>150</td>
<td>4%</td>
<td>34</td>
<td>4%</td>
<td>106</td>
</tr>
<tr>
<td>TOURISM</td>
<td>67</td>
<td>2%</td>
<td>7</td>
<td>1%</td>
<td>69</td>
</tr>
<tr>
<td>WHOLESALE &amp; RETAIL</td>
<td>99</td>
<td>3%</td>
<td>0</td>
<td>0%</td>
<td>76</td>
</tr>
<tr>
<td>OTHERS</td>
<td>216</td>
<td>6%</td>
<td>95</td>
<td>11%</td>
<td>255</td>
</tr>
<tr>
<td>Total</td>
<td>4300</td>
<td>100%</td>
<td>844</td>
<td>100%</td>
<td>3314</td>
</tr>
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</table>

**Panel B. Sample Compositions by Years**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>179</td>
<td>4.22</td>
<td>216</td>
<td>5.09</td>
<td>252</td>
<td>5.94</td>
<td>294</td>
</tr>
<tr>
<td>309</td>
<td>7.28</td>
<td>435</td>
<td>10.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>432</td>
<td>10.18</td>
<td>478</td>
<td>11.26</td>
<td>524</td>
<td>12.35</td>
<td>313</td>
</tr>
<tr>
<td>401</td>
<td>9.45</td>
<td>411</td>
<td>9.68</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IV. EMPIRICAL RESULTS

Descriptive Statistics

Table 3 summarizes the descriptive statistics of the selected variables. The average ETR in the sample period was only around 14.2%, far below the top statutory tax rate, indicating that the listed and OTC companies enjoyed substantial tax-favored treatments.\(^{13}\)

Table 4 presents the Pearson correlation coefficients for the selected variables. The results show that ETR, as well as ETR', are significantly and negatively related with INVG and ASTG, and positively related with INVL and ASTL, consistent with the predictions of our research hypotheses.

Table 5 presents the mean ETR' of our samples by industries in each sample year, revealing that the mean ETR' differs across industries, with the electronics industry having the lowest mean ETR' of less than 13% in most of the sample years. The traditional industries such as foods and tourism apparently bore higher tax burdens, each with a mean ETR' in excess of 15% for most of the sample years.

Empirical Results of Multiple Regression Models

The sample period for this study spans a total of 12 years, from 1986-1997. As stated earlier, the government did impose a tax on stock capital gains in 1989. To control for this noise in 1989, we form a sub-sample excluding 1989 from our sample period to conduct an additional regression analysis. Moreover, to control for potential structural changes in our data set due to the long sample period, we also form another sub-sample using the more recent sample years of 1992-1997 to conduct a further regression analysis. Table 6 summarizes the regression results for the three data sets - the full sample period of 1986-1997, the full sample period excluding 1989, and the recent sample period of 1992-1997. In the three regression results contained in Table 6, the adjusted R\(^2\) are all around 20% and there are no significant differences in signs and p-values of the estimated coefficients for all explanatory variables, suggesting that the regression results are not sensitive to the selection of sample periods.\(^{14}\) Our regression results are therefore discussed as follows:

Stock and Land Capital Gains and Losses

Table 6 shows that the estimated coefficients of INVG and ASTG are significantly negative, while the coefficients on INVL and ASTL are positive, consistent with the predictions of our research hypotheses. The results indicate that listed and OTC companies report substantial stock and land capital gains (losses) in their financial statements that have significant impacts on their ETRs. Companies with greater stock and

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\(^{13}\) The average ETR' without deleting the four extremes is about 15.3%, which is close to the calculations in Lin and Yang (1994).

\(^{14}\) In estimating the regression model, we did not use panel data methods because our sample period spanned the period from 1986 to 1997. It may not be appropriate to assume that the firms’ unobservable characteristics were the same throughout the 12-year sample period, and thus may violate the assumption of panel data methods.
land capital gains (losses) are more likely to have higher (lower) ETRs, suggesting that companies take advantage of the two tax-exemptions to reduce their tax burdens.

Table 3 Descriptive statistics for Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Std. Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETR</td>
<td>0.108</td>
<td>0</td>
<td>0.584</td>
<td>0.079</td>
<td>4244</td>
</tr>
<tr>
<td>ETR’</td>
<td>0.142</td>
<td>0</td>
<td>1.000</td>
<td>0.101</td>
<td>4244</td>
</tr>
<tr>
<td>SIZE</td>
<td>14.460</td>
<td>7.238</td>
<td>18.398</td>
<td>0.112</td>
<td>4244</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.002</td>
<td>0</td>
<td>0.412</td>
<td>0.011</td>
<td>4244</td>
</tr>
<tr>
<td>CAPINT</td>
<td>0.321</td>
<td>0</td>
<td>0.950</td>
<td>0.189</td>
<td>4244</td>
</tr>
<tr>
<td>DEBT</td>
<td>0.078</td>
<td>0</td>
<td>1.161</td>
<td>0.094</td>
<td>4244</td>
</tr>
<tr>
<td>ROA</td>
<td>0.085</td>
<td>0</td>
<td>4.675</td>
<td>0.098</td>
<td>4244</td>
</tr>
<tr>
<td>INVG</td>
<td>0.005</td>
<td>0</td>
<td>1.973</td>
<td>0.035</td>
<td>4244</td>
</tr>
<tr>
<td>ASTG</td>
<td>0.004</td>
<td>0</td>
<td>2.736</td>
<td>0.046</td>
<td>4244</td>
</tr>
<tr>
<td>INVL</td>
<td>0.001</td>
<td>0</td>
<td>0.077</td>
<td>0.004</td>
<td>4244</td>
</tr>
<tr>
<td>ASTL</td>
<td>0.001</td>
<td>0</td>
<td>0.065</td>
<td>0.003</td>
<td>4244</td>
</tr>
</tbody>
</table>

*: Deleting 12 firms whose ETR’ is greater than 100%

Table 4 Pearson Correlation Coefficients and P-Values for Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>ETR</th>
<th>ETR’</th>
<th>SIZE</th>
<th>R&amp;D</th>
<th>CAPINT</th>
<th>DEBT</th>
<th>ROA</th>
<th>INVG</th>
<th>ASTG</th>
<th>INVL</th>
<th>ASTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETR</td>
<td>1</td>
<td>0.8187</td>
<td>0.0417</td>
<td>-0.0044</td>
<td>-0.2152</td>
<td>0.1311</td>
<td>-0.0621</td>
<td>-0.0667</td>
<td>0.0454</td>
<td>0.0471</td>
<td></td>
</tr>
<tr>
<td>ETR’</td>
<td>0.8187</td>
<td>1</td>
<td>-0.0228</td>
<td>-0.0202</td>
<td>0.0043</td>
<td>-0.0999</td>
<td>-0.0289</td>
<td>-0.0749</td>
<td>-0.0685</td>
<td>0.0596</td>
<td>0.0834</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0417</td>
<td>-0.0228</td>
<td>1</td>
<td>-0.0047</td>
<td>-0.517</td>
<td>0.0237</td>
<td>0.0156</td>
<td>0.0021</td>
<td>0.0043</td>
<td>0.0033</td>
<td>0.0040</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.0044</td>
<td>-0.0202</td>
<td>-0.517</td>
<td>1</td>
<td>-0.1123</td>
<td>-0.0472</td>
<td>0.0601</td>
<td>-0.0022</td>
<td>-0.0115</td>
<td>-0.0266</td>
<td>-0.0202</td>
</tr>
<tr>
<td>CAPINT</td>
<td>-0.2152</td>
<td>0.0043</td>
<td>0.0237</td>
<td>-0.1123</td>
<td>1</td>
<td>-0.3258</td>
<td>-0.1399</td>
<td>-0.0129</td>
<td>-0.0195</td>
<td>-0.0322</td>
<td>-0.0259</td>
</tr>
<tr>
<td>DEBT</td>
<td>0.1311</td>
<td>-0.0999</td>
<td>0.0237</td>
<td>-0.0472</td>
<td>-0.3258</td>
<td>1</td>
<td>-0.2598</td>
<td>-0.3996</td>
<td>-0.0129</td>
<td>-0.0195</td>
<td>-0.0322</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.0621</td>
<td>-0.0749</td>
<td>0.0156</td>
<td>0.0601</td>
<td>-0.2598</td>
<td>-0.3996</td>
<td>1</td>
<td>-0.1046</td>
<td>-0.2142</td>
<td>-0.0444</td>
<td>-0.0967</td>
</tr>
<tr>
<td>INVG</td>
<td>-0.0667</td>
<td>-0.0685</td>
<td>0.0021</td>
<td>-0.0022</td>
<td>-0.3258</td>
<td>-0.2598</td>
<td>-0.1046</td>
<td>1</td>
<td>0.7063</td>
<td>-0.0161</td>
<td>-0.1987</td>
</tr>
<tr>
<td>ASTG</td>
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<td>0.0596</td>
<td>0.0043</td>
<td>-0.0115</td>
<td>-0.0266</td>
<td>-0.0322</td>
<td>-0.2142</td>
<td>-0.0161</td>
<td>1</td>
<td>0.7859</td>
<td>-0.2318</td>
</tr>
<tr>
<td>INVL</td>
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<td>0.0834</td>
<td>0.0033</td>
<td>-0.0266</td>
<td>-0.0259</td>
<td>-0.0322</td>
<td>-0.967</td>
<td>-0.1987</td>
<td>-0.7859</td>
<td>1</td>
<td>0.0333</td>
</tr>
<tr>
<td>ASTL</td>
<td>0.0834</td>
<td>0.0834</td>
<td>0.0040</td>
<td>-0.0202</td>
<td>-0.0259</td>
<td>-0.0322</td>
<td>-0.0001</td>
<td>-0.1987</td>
<td>-0.7859</td>
<td>0.0333</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: P-Values are in parentheses
<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
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<tr>
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<td>8</td>
<td>0.1832</td>
<td>8</td>
<td>0.1960</td>
<td>8</td>
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<td>8</td>
<td>0.1871</td>
<td>8</td>
<td>0.1707</td>
<td>8</td>
</tr>
<tr>
<td>FOODS</td>
<td>0.1771</td>
<td>17</td>
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Other Explanatory Variables

In Table 6, the coefficient of SIZE is significantly positive, lending support to the political cost hypothesis (Zimmerman 1983). Larger listed and OTC companies in Taiwan are more likely to bear greater tax burdens, resulting in higher political costs. The findings are consistent with those of Tsai (1993) but inconsistent with the findings of Lin and Yang (1994). Lin and Yang, however, included fewer explanatory variables in their regression model and, thus, their results may be subject to the problem of omitted variables.

The coefficients of the two investment explanatory variables, R&D and CAPINT, are statistically insignificant, contradicting our expectations of these variables. We cannot, therefore, make conclusions as to the impact of investment tax shields on ETRs in Taiwan. This may be due to the existence of limitations on the deductible credit amount - no more than 50% of the total amount of income tax payable each year - reducing the impact of investment tax shields on ETRs. Furthermore, the mean R&D in Table 3 is only around 0.2% of total assets, which is hardly significant for this to be an important tax shield.

In line with our expectations, the coefficient of DEBT is negative and significant, supporting the impact of debt tax shields on ETRs. Companies with greater leverage are more likely to have lower ETRs; therefore, in order to reduce their tax burdens, firms may prefer debt financing to equity financing. Consistent with our expectation, the coefficient on ROA is positive and significant, lending support to Shevlin and Porter's (1992) income effect. The results indicate that companies with greater profitability tend to have higher ETRs.

Turning to the industry effect, all the industry dummies in Table 6 are positive and significant, except for the Paper & Pulp industry for which only a few samples were available. The results provide evidence that the electronics industry enjoys significantly lower ETRs than all other industries, suggesting that the Electronics industry also enjoys the most substantial tax benefits. The coefficient of LISTED is also negative and significant, indicating that, ceteris paribus, listed companies have lower ETRs than OTC companies.

As expected, the coefficient of GROUP is negative and significant, suggesting that affiliated companies have more available media to shake off their tax liabilities and thus, have lower tax burdens than their non-affiliated counterparts. Table 7 presents the average ETRs of affiliated and non-affiliated companies for each sample year. With the exception of 1995, affiliated companies average ETRs were lower than those of non-affiliated companies throughout the sample period. As discussed earlier, the classification of affiliated and non-affiliated companies is based on the 1998 CCIS survey. Using the more recent period of 1994-1997, we further conduct a t-test on the differences in mean ETRs between affiliated and non-affiliated companies. The results show that during this more recent period, the average ETRs of affiliated and non-affiliated companies were 10.43% and 11.46%, respectively, with a t-statistic of around 2.08, and a p-value of 0.0373. Therefore, these analyses also support the proposition that affiliated companies bear significantly lower tax burdens than their non-affiliated counterparts.

Sensitivity Analysis on the Exclusion of Electronics

Since the electronics industry represents the largest composition of the sample, and
since those within this industry tend to have the lowest ETRs, we conduct a sensitivity analysis excluding electronics companies from the regression model to examine whether our empirical results are sensitive to the sample compositions. The regression results, excluding the electronics companies, are similar to those obtained from the full sample. The signs and p-values of the coefficients on INVG, INVL, ASTG, ASTL, SIZE, R&D, CAPINT, DEBT, ROA, GROUP, and LISTED are not significantly different from the results in Table 6.15 Therefore, our empirical findings are not sensitive to the sample compositions.

Table 6 Multiple Regression Results for ETR Models

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<td>P-value</td>
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N: 4244
Adj-R²: 0.2097
F Value: 42.201
Prob-F: 0.0001

15 In order to conserve space, the regression results are not reported.
Table 7 Average ETRs of Samples by Affiliated and Non-affiliated Companies

| Year | Non-affiliated Companies | | | Affiliated Companies | | |
|------|----------------------------|----------------------------|-----------------------------|-----------------------------|
|      | Average ETR | N | Average ETR | N | Total |
| 1986 | 0.1250 | 125 | 0.1022 | 54 | 179 |
| 1987 | 0.1260 | 152 | 0.0990 | 64 | 216 |
| 1988 | 0.1072 | 179 | 0.0838 | 73 | 252 |
| 1989 | 0.1083 | 212 | 0.0937 | 82 | 294 |
| 1990 | 0.1106 | 230 | 0.0845 | 79 | 309 |
| 1991 | 0.1143 | 343 | 0.0968 | 92 | 435 |
| 1992 | 0.1113 | 345 | 0.0904 | 87 | 432 |
| 1993 | 0.0983 | 385 | 0.0783 | 93 | 478 |
| 1994 | 0.0928 | 424 | 0.0837 | 100 | 524 |
| 1995 | 0.1238 | 249 | 0.1269 | 64 | 313 |
| 1996 | 0.1247 | 329 | 0.1162 | 72 | 401 |
| 1997 | 0.1254 | 341 | 0.1007 | 70 | 411 |
| Total | 0.1122 | 3314 | 0.0949 | 930 | 4244 |

V. CONCLUSIONS

Using 1986-1997 financial statement data, this paper examines the determinants of ETRs of listed and OTC companies in Taiwan. Our empirical results show that listed and OTC companies report substantial stock and land capital gains (losses) in their financial statements which have significant impact on their ETRs. Therefore, the results suggest that the two exemptions cause a tax loophole which allows companies in Taiwan to shake off their tax liabilities without bearing any financial reporting costs (i.e., they may report substantial stock and land capital gains to increase earnings in financial reporting without having to pay the income tax).

The current stock transaction tax rate is 3‰, which does not take into consideration the loss of tax revenues from exempting stock capital gains. Moreover, the loss of tax revenues, and the exemption on stock and land capital gains may have adverse impacts on both the stock and land markets. The under-taxing of stock transactions may, in part, motivate investors in Taiwan to adopt a short-term focus and approach to the stock market, resulting in a high turnover rate within Taiwan’s stock market. Affiliated companies can take advantage of this tax loophole by cross-holding stocks and ballooning their stock prices, creating a precarious situation in the stock market. Furthermore, on transfer of land title, since the assessment of land value increment tax is based on the government-announced price, rather than the actual transaction price, the excessive gap between the two prices results in a substantial proportion of land capital gains not being taxed. The reported land capital gains, by definition, have been netted off the land value increment tax. Our empirical results, however, show that the ‘net’ land capital gains still

16 Jian-Shuan Wang, the former Minister of Finance, stated that according to the MOF’s blueprint, the stock transaction tax rate should be raised to 6‰, a doubling of the current rate, to compensate for the tax loss from tax-exemptions on stock capital gains (Chinese Tax Affair 2000, 8).
have a significant effect in terms of lowering corporate ETRs, lending support to the argument that currently, the land value increment tax system, based on the government-announced price, needs to be reformed in pursuit of a more equitable income tax system.\textsuperscript{17} The evidence from this study may, therefore, have implications for the government with regard to the regulating of stock and land markets, and planning of future tax reforms.

We have also found that, \textit{ceteris paribus}, affiliated companies have lower ETRs than their nonaffiliated counterparts, supporting the argument that affiliated companies have much greater advantages to reduce their tax burdens, and that corporate-affiliations may be tax-motivated. In order to better regulate affiliated enterprises, the government in Taiwan enacted Chapter VI-I of the Company Law, "Affiliated Enterprises", in May 1997, illustrating that the government does have the determination to counter the problems deriving from affiliated enterprises. However, our results suggest that the government should also take into account the adverse effects of an inequitable tax system that allows affiliated companies to avoid paying their fair share of taxes. In order to better regulate related-party transactions that are clearly tax-motivated, the government may require affiliated enterprises to file consolidated tax returns that have been implemented in the US and New Zealand. These findings suggest that in the pursuit of a more equitable income tax system, the existing capital gain exemptions and corporate-affiliating should both be taken into consideration by tax policy-makers.

The empirical results also show that, \textit{ceteris paribus}, large firms are more likely to have higher ETRs, supporting the political cost hypothesis. The results are consistent with the findings of Tsai (1993), using the 1981-1991 financial statement data on listed companies. However, our results are of higher external validity because our samples were expanded to include listed and OTC companies, and the sample period was extended to 1997. Furthermore, our results show that firms with greater leverage tend to have lower ETRs, while firms with greater profitability have higher ETRs, supporting both the debt tax shield effect and the income effect. Turning to the industry effect, we find that the electronics companies have the lowest ETRs, supporting the argument that the electronics industry in general, enjoys the most favorable tax incentives, and that the playing field is grossly uneven across the different industries. The overall empirical findings of this study illustrate the importance of controlling for the tax law and business environment in addressing the determinants of corporate ETRs in Taiwanese corporations.

The conclusions of this study are, nevertheless, subject to two non-trivial limitations. First of all, although the main purposes of this study were to address the adverse impacts of tax-exempt stock and land capital gains on corporate ETRs and tax equity, we are unable to determine whether the capital gains arise from the sale of stocks and land held over the long-term, or from speculative gains from ballooning stock and land values; the latter has drawn the most criticism. Secondly, in calculating the stock and land capital gains, we have not taken into account the costs of capital for companies using internal funds to buy stocks and land. This may result in higher nominal capital gains, and thus,

\textsuperscript{17} The objective of this paper is to discuss the impact of the tax-exempt land capital gains on the income tax system \textit{per se}. It may be inappropriate to extend the conclusions of this paper to evaluate the land tax system as a whole. We thank the referees for cautioning this limitation.
lower ETRs, especially for capital gains arising from stocks and land held over the
long-term.\footnote{We thank the referees for suggestions on these limitations.}

(Submitted October 1999; accepted October 2000)

REFERENCES


證券及土地交易所得免稅對我國公司
有效稅率之影響

陳明進
國立政治大學會計學系副教授
林世銘
國立台灣大學會計學系副教授
張天勳
安侯建業會計師事務所

摘要：我國所得稅制度長期對於證券及土地交易所得免稅的規定是兩項極不公平的租稅漏洞，不僅損害政府財政健全，也衍生出證券及土地市場管理的問題（例如關係企業交叉持股、拉抬股價，乃至利用土地交易利益輸送等）。雖然，這兩項免稅規定所衍生之問題經常招致批評，但這兩項規定對於我國公司有效稅率之影響，迄無相關之實證證據，本文的主要研究目的乃利用上市與上櫃公司之財務報表資料，實證研究證券及土地交易所得免稅規定對我國公司有效稅率之影響，以作為政府檢討當前所得稅制及未來租稅改革之參考。

再者，我國現行營利事業所得稅是以個別企業作為申報單位，並無集團企業須編製稅務合併報表或合併申報之規定。但事實上，集團性企業利用非營業常規之交易安排，以規避稅負的情事時有所聞。然而，有關集團性企業經營對我國公司有效稅率之影響，在文獻上亦缺乏實證之證據。故本文亦在實證模式中探討集團性企業之經營型態對我國公司有效稅率之影響，並檢討該影響在政府稅務行政管理之意義。

本文所建立的我國公司有效稅率之實證模式，除了參考國外及國內相關文獻所探討的決定因素，如企業規模、投資及理財政策、獲利能力及產業別等之外（詳英文版文獻探討），並著重於融入我國稅法及商業環境之特色，例如證券及土地交易所得免稅之規定，以及集團性企業經營背景等因素。本研究室建立有效稅率（ETR）的實證模式，解釋變數包括：SIZE（企業規模）、R&D（研究發展支出）、CAPINT（資本資產密集度）、DEBT（財務槓桿）、ROA（資本報酬率）、INVG（處分投資利得）、INVL（處分投資損失）、ASTG（處分資產利得）、ASTL（處分資產損失）、GROUP（集團性企業）、LISTED
（上市上櫃別）、$l_k$（產業別之虛擬變數），各變數之定義以及使用台灣經濟新報社（TEJ）資料庫之各有關會計科目的名稱與編碼，請參考英文版表一。

$INVG$ 與 $INVL$ 是衡量公司證券交易所得與損失之代理變數，而 $ASTG$ 與 $ASTL$ 是衡量公司出售土地利得與損失之代理變數。依據本文提出之假說，在其他條件不變的情況下，上市與上櫃公司列報愈高比率之免稅證券交易所得與出售土地所得，其有效稅率應愈低；相反地，如果是損失，則其有效稅率愈高。雖然公司財務報表所列報之處分投資與處分資產的利得與損失，可能包括除了證券及土地以外的處分其他資產的應課稅之損益，而造成衡量之雜訊，但若本文之推論正確，$INVG$ 與 $ASTG$ 係屬於免稅之證券及土地交易所得，則公司有效稅率會因分母增加 $INVG$ 與 $ASTG$ 而降低。反之，若本文之推論不正確，$INVG$ 與 $ASTG$ 屬於應課稅之處分所得，則公司有效稅率並不會因 $INVG$ 與 $ASTG$ 之增加而降低，不利於發現支持本文假說之結果。因此，如果實證結果支持本文假說，則上述衡量之雜訊應不會造成對實證結果解釋之混淆效果。有關其他各項解釋變數對有效稅率之影響的說明，請參見英文版，不再贅述。

本研究有關上市及上櫃公司之財務報表資料係取自台灣經濟新報社資料庫，樣本期間為民國 75 年至 86 年度，此樣本期間營利事業所得稅率均為 25%，且所得稅制度並無重大之變動。經過樣本篩選後，本研究之樣本資料共有 4,244 筆，樣本公司之產業別及年度別之分布參見英文版表二。英文版表五列示民國 75 年至 86 年間，依產業別計算之 $ETR'$（所得稅費用÷稅前淨利）。其中顯示全體樣本 $ETR'$ 平均值約為 14.2%，遠低於名目稅率 25%，顯示上市與上櫃公司享有充裕的租稅減免優惠。此外，$ETR'$ 在各產業別間之分配迥異。電子業由於係政府長期重點獎勵發展之產業，享有較其他產業更多的投資抵減與租稅優惠，故歷年來其有效稅率鮮有超過 13% 者。反觀其他傳統產業及服務業，如食品業及觀光業，其歷年來之有效稅率幾乎皆超過 15%，顯然較電子業之有效稅率為高。

英文版表六列示本文迴歸模式之實證結果。由於研究樣本共有 12 年度之資料，考量樣本資料或許會因時間過長而有結構性之影響，而對較近年度之推論反而不適用，故又另組民國 81 年至 86 年（共 6 年）之次樣本，進行迴歸分析，以使研究結果更能推論於最近年度。此外，民國 78 年曾恢復課徵證券交易所得，為控制該年度恢復課徵可能對本研究產生之干擾效果，故亦以排除民國 78 年之資料另組一次樣本（共 11 年），進行迴歸分析，以控制此雜訊之影響。表六顯示三組資料所獲得的迴歸結果，各種解釋變數的歸屬係數之符號及 $P$-value 並無重大差異，且調整後決定係數 $(adj-R^2)$ 各組皆在 20% 左右，可以顯示實證結果並不因取樣時間不同而異。
表六中，INVG 與 ASTG 之係數均為負值，INVL 與 ASTL 的係數均為正值，符號均與預期相符，且達 1% 之顯著水準，故支持本文之假說。此一結果說明我國上市與上櫃公司財務報表所列報的處分投資與資產損益中，包含重大比例的證券及土地交易損益，足以顯著地降低其有效稅率。因此，現行證券及土地交易所得免稅之規定，確實對我國上市與上櫃公司之稅負分配有顯著之影響。因此，基於租稅公平及保護投資人之立場，本文之實證證據應可提供政府作為未來管理證券與土地市場，以及改革所得稅制度之參考。

再者，表六中，SIZE 的係數為正值，且達 1% 顯著水準，故對我國上市與上櫃公司而言，企業規模與有效稅率之關係基本上符合政治成本假說，即企業規模愈大者，受到公眾及政治上之監督愈大，故節稅的空間反而受到限制，而須負擔較高的租稅之政治成本。此一結果與蔡素幸(民國 82 年)使用民國 70 至 80 年上市公司資料之研究發現相同，但本文之樣本包括上櫃公司在內，且資料延伸至民國 86 年，故應具有較高之外部效度。

表六中，R&D 與 CAPINT 的係數均未達傳統 5% 顯著水準，故本研究並無發現可以支持投資政策影響我國公司有效稅率之證據，或許是因為 R&D 及機器設備之投資抵減有上限之規定，即僅能抵減當年度應納所得稅額之 50%，其餘必須遞延於以後 4 年內抵減，因而減弱公司進行投資當年度所能獲得投資抵減的減稅效果，且逐年遞延之結果，亦可能使企業平均喪失投資抵減的利益。另一可能原因為 R&D 平均僅佔企業總資產之 0.2% (詳英文版表三)，故對企業之有效稅率無法產生重大之影響。但是 DEBT 的係數為負值，而 ROA 的係數為正值，符號均與預期一致，且均達 1% 之顯著水準，則顯示上市與上櫃公司財務槓桿的運用及獲利能力可以顯著地影響其有效稅率。

就產業別而言，本文迴歸模式中的設計係以電子業為對照組(excluded group)。表六之實證結果顯示，所有的產業別虛擬變數皆有正的係數，且除了造紙業之外(可能由於樣本數較少)，皆達到 1% 顯著水準，此一結果顯示，電子業確實是享有最多的租稅優惠而有最低的有效稅率。此外，LISTED 的係數為負值，且達 1% 顯著水準。此一結果顯示，上市公司與上櫃公司之有效稅率負擔並不相同，在其他條件相同下，上市公司之有效稅率低於上櫃公司之有效稅率。

表六中，GROUP 的係數為負值，符號與預期一致，且達 1% 之顯著水準，故支持本文之推論，即具集團性企業經營背景之上市與上櫃公司，因擁有較多租稅規避之交易安排空間，其有效稅率將較非集團性企業之上市與上櫃公司為低。英文版的表七進一步計算集團性與非集團性公司在各年度有效稅率之平均值，結果顯示除了 84 年度外，其餘 11 個年度，集團性企業之上市與
上稿公司有效稅率的平均值皆低於非集團性公司之平均值。因為本研究區分
樣本是否為集團性公司之時點為民國 87 年 6 月，本文另以民國 83 年至 86
年之四个較近年度資料，計算集團性與非集團性公司有效稅率之平均值，並
進行兩母體平均數相等之 t 檢定，結果顯示集團性企業之上市與上稿公司在
這四年間有效稅率之平均值為 10.43%，低於非集團性公司的 11.46%，且其
差異之 t 統計值等於 2.08(P-Value = .0373)，故在 5% 显著水準下，仍支持本
文之推論。基於規範集團性企業營運的重要性，我國公司法於民國 86 年 5
月增列關係企業專章，代表政府對集團性企業所衍生問題之重視。但本文實
證結果顯示，集團性企業之優勢亦包括租稅優勢在內，故政府似亦應注意集
團性企業之經營，未來若集團性企業濫用租稅規避之手段，而嚴重影響租稅
之中立與公平，則政府似可參酌美國、紐西蘭等之立法例，增訂關係企業必
須編製合併稅務報表之相關規定。綜合本文研究結果的發現，支持本文主要
的研究目的：建構一個切合我國租稅制度及商業環境的有效稅率實證模式，
對於未來之相關研究應具有參考價值。

本文有兩個主要之研究限制，必須加以說明。雖然本文之實證結果發現
我國證券交易所得免稅與土地交易按公告現值課稅之規定，對公司有效稅率
與租稅負擔之分配有重大之影響，但是限於資料不易取得，本文無法區分出
售股票或土地之公司，究竟係多年持有後才予以出售，或係最為一般詬病之
短線投資炒作者，此為本文的研究限制之一。此外，對於公司以自有資金而
長期持有之股票及土地的出售利益，本文並未扣除其自有資金之隱含成本，
可能造成其名目之有效稅率偏低，乃本文之另一研究限制。

關鍵字：公司有效稅率、證券交易所得、土地交易所得、集團企業、
政治成本假說
Factors Influencing Corporate Effective Tax Rates in Taiwan*

Chi-Chun Liu a, †
National Taiwan University
Suming Lin b
National Taiwan University
Der-Fen Huang c
National Dong Hwa University

ABSTRACT: Researchers often use corporate effective tax rates (ETR) as an instrument to evaluate the fairness of a tax system. While foreign literature (e.g., Wang 1991) has indicated that studies examining corporate ETR in a univariate setting may suffer from omitted variable bias, the extant literature in Taiwan typically uses firm size as the only determinant of corporate ETR. Based on recent literature and Taiwan’s specific tax environment, we investigate the relationships between corporate ETR and corporate characteristics including firm size, R&D expenditure, financial leverage, capital intensity, inventory concentration, percentage of shares owned by directors and supervisors, profitability, long-term equity investment, and the number of subsidiaries. The sample empirically tested is a longitudinal data (panel data) consisting of listed companies’ financial data from 1981 to 1996. Through the analyses with the fixed effects model and many others, the main findings of this paper are as follows. (1) Tax preferences of R&D expenditure, long-term equity investment, and the number of subsidiaries have significant impact on corporate ETR. (2) The implementation of value-added tax and the reduction of business income tax rate in 1986 resulted in a structural change of the relationships between corporate ETR and its determinants. For example, since the 1986 tax reform the ETR of listed companies has been higher than before. On the other hand, larger companies still enjoy lower ETR than smaller companies, as suggested by the political power hypothesis.

Key Words: Effective tax rate, Tax policy, Tax incentives, Panel data, Fixed effects model.

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† Corresponding author. Email: ccliu@mba.ntu.edu.tw; suming@mba.ntu.edu.tw; derfen@mail.ndhu.edu.tw
I. INTRODUCTION

The business income tax is the tax collected by the government from a business enterprise based on its annual taxable income and the statutory tax rate schedule. Theoretically, the business income tax rate is determined by the need of government expenditures, for example, a country providing its citizens with a better social welfare system would have a higher tax rate. However, in an attempt to encourage the development of certain industries or investment activities, the government often stipulates various laws of tax incentives, thus creating a difference between the nominal business income tax (the legal tax rate) and the effective tax rate of business enterprises. Furthermore, tax incentives also cause acute differences in the effective tax rate among companies from different industries or of/with different sizes, violating the principle of tax equity. The study of the Citizens for Tax Justice presented by McIntyre and Wilhelm (1985) loudly criticized large companies for having unreasonably low effective tax rates (see literature review for details). That study was generally regarded as the major catalyst that fostered the 1986 tax reform in the United States. Thereafter, many US scholars used the effective tax rate to evaluate the performance of the Tax Reform Act of 1986 on corporate tax burdens and tax fairness (e.g. Hagan and Larkins, 1992; Kern and Morris, 1992; Omer, Molloy and Ziebart, 1993; Gupta and Newberry, 1997). Hence, effective tax rate studies are important both in academics and in public policy debate; they are useful not only in the fairness surveillance of a nation’s taxation system and the need for reform, but also useful in evaluating the success of tax reforms.

Since there are numerous factors causing differences between the effective tax rate and the nominal tax rate, a number of finance and accounting scholars have attempted to discover the factors deciding the effective tax rate. Studies of this nature could further clarify the various factors leading to tax differences, as well as make a valuable reference for taxation policies. The studies on Taiwan's effective tax rate are still in the incipient stage. Domestic studies, such as Chou et al (1989) and Lin & Yang (1994), generally examined the relation of effective tax rate and company size in a univariate framework and overlooked the effects of corporate characteristics (e.g. financial structure, profitability, investment activity, etc.) on the effective tax rate. Hence, prior studies potentially created correlated omitted variables problems, leading to biased and inconsistent parameter estimations (Greene, 2000, p.334). This paper provides empirical evidence on the determinants of variability in effective tax rate in a multivariate framework.

Having considered the related foreign studies (e.g. Gupta and Newberry, 1997; Wang, 1991) and the special taxation environment of Taiwan, this study uses nine variables of corporate characteristics to analyze the determinants of corporate tax burden (surrogated by average effective tax rate, ETR). These factors include company size, financial leverage, capital intensity, inventory
concentration, research and development expenditure, percentage of shares owned by directors and supervisors, profitability, long-term equity investment, and number of subsidiaries. The first seven factors were obtained from existing studies; the last two variables were used in light of the Affiliated Company chapter added to the 1997 amended ROC Corporate Law.\(^1\) Since the establishment of a subsidiary company is an important corporate tax planning maneuver, we also explored the effects of long-term equity investment and the structure of the parent/subsidiary companies on the corporate tax burden.

The current Income Tax Law in Taiwan set the maximum rate of business income tax at 25%. However, with the view to encourage investment, foster industrial upgrade, and bolster economic development, the government has also promulgated various tax incentives such as five-year tax exemptions, investment tax credits and accelerated depreciation in the Statute for Upgrading Industries, the Statute for Establishing and Managing Science-based Industry Parks. These tax incentives create an inequity of tax burdens between beneficiary and non-beneficiary businesses. Immediately after the Legislative Yuan passed the third reading of the Amendment to the Income Tax Law on December 26, 1997, the integration of the Two Tax Systems (the imputation tax credit system) came into effect on January 1, 1998 after the announcement of the presidential order. Under the new system, the business income tax paid at the corporate level can be used to offset the shareholders’ individual income tax. In compensation for the tax losses resulting from the integrated income tax system, an additional 10% income tax was imposed on the undistributed earnings of business enterprises. However, aside from abolishing the double taxation, could the implementation of the integrated income tax system also mitigate the existing uneven tax burdens of businesses? The answer to this question forms an important indicator for the evaluation of the integrated taxation system.

This study aims to explore the differences of corporate income tax burdens and the determinants of corporate ETR in Taiwan from 1981 to 1996, a period prior to the adoption of the integrated income tax system. Our study can be used as a comparative basis for future studies exploring whether the integrated income tax system improves tax fairness and decreases (or increases) corporate tax burdens. In other words, this study could not only enhance our understanding of the tax burdens of businesses, but also provide a basis of comparison for future studies.\(^2\)

The paper is organized as follows. Section 1 explains the motivation. Section 2 reviews domestic and foreign studies. Literature review provides the framework of variable selection and the foundations of our study. Section 3 describes research design, which includes selection and measurement of variables and the

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\(^1\) Special rules concerning the mutual investments of affiliated companies were added to the ROC Corporate Law to prevent the affiliates from non-arm’s length operations.

\(^2\) The additional 10% tax the ROC integrated income tax system imposed on undistributed earnings started to affect the income tax expense of companies in 1999. Our study, which was completed in 2000, was unable to obtain enough information of the financial statement variables for years after 1999; hence this paper did not aim to explore the ETR determinants after the implementation of the integrated income tax system.
empirical test procedures. Section 4 explains the empirical findings. Section 5 presents conclusions and limitations of this study as well as suggestions of future research.

II. LITERATURE REVIEW

Prior foreign studies on the relation between corporate tax burdens and firm size concentrated on two opposing viewpoints. Under the political cost hypothesis (Watts and Zimmerman, 1986), large firms are subject to greater government scrutiny than smaller firms (e.g., higher regulatory examination frequency). Since taxes are one component of total political cost, the political cost hypothesis suggests that bigger companies have higher political costs (e.g., tax burdens). Alternatively, the political power hypothesis argues that large businesses have more resources to influence the political process in their favor and develop expertise in tax planning, thereby employ the optimal tax saving measures. Therefore, bigger companies with political clout have smaller tax burdens (Siegfried, 1972, 1974). Zimmerman (1983) used the effective tax rate to measure political cost and studied the correlation between the company size and the effective tax rate of US companies during the period from 1947 to 1981. He found that the effective tax rate of the top 50 corporations were significantly higher than the rest of the companies, but the results varied among industries. For instance, company size was positively associated with effective tax rate in the natural resource industry, supporting the political cost hypothesis; however, the empirical result in the trade industry was consistent with the political power hypothesis.

The Citizens for Tax Justice (CTJ) published a series of reports from 1984 to 1986. The reports criticized the income tax system for violating the principles of fairness and creating a serious distortion in the economic activity. McIntyre and Wilhelm (1985) showed that from 1981 to 1984, tax incentive measures allowed 250 top US corporations to enjoy very low tax burdens; and majority of these corporations did not have to pay taxes for at least a year; in fact, they even received federal tax refunds. The government and academics paid serious attention to the survey report; thus it was generally perceived that the CTJ report became a key factor that pushed the passing of the 1986 Tax Reform Act (Birnbaum and Murray, 1987). The Tax Reform Act abolished the investment tax credits but expanded the tax base and increased the alternative minimum tax collected from companies enjoying tax incentives. Siegfried (1972), Porcano (1986) as well as Singh, Wilder and Chan (1987) studied the tax burdens prior to the implementation of the Tax Reform Act; their findings showed a negative correlation between effective tax rate and company size, thus consistent with the CTJ survey findings. The foregoing findings were consistent with the political power hypothesis.

Hagan and Larkins (1992) as well as Kern and Morris (1992) delved into the effects of the 1986 Tax Reform Act and found that after 1986, the difference between the effective tax rate of small and big companies became insignificant. However, Shevlin and Porter (1992) observed no significant correlation between company size and effective tax rate before and after 1986. Omer, Molloy and
Ziebart (1993) conducted an analysis using five effective tax rate measures. Their findings showed that after the implementation of the Tax Reform Act, effective tax rate of big corporations were higher than in small companies, consistent with the political cost hypothesis. Their inferences were not affected by the choice of effective tax rate measure.

Relative to the contradicting foreign studies, a specific report of the Ministry of Finance Tax Reform Committee (Chou Tien-cheng et al, 1989) found that the service sector had the highest effective tax rate, followed by the industrial sector; the agricultural sector had the lowest rate. Not only did the industrial sector enjoy more tax incentives than the service sector, large companies and corporations also had more tax incentives. Based on the principle of tax neutrality, the report suggested that the government should evaluate carefully the different tax incentive measures of the taxation laws. Lin and Yang (1994) studied the correlation of the effective tax rate of listed corporations in Taiwan vis-à-vis company size, type of industry and change of tax system. Empirical data showed that corporations with larger company size had lower effective tax rate, consistent with the political power hypothesis and significant differences of tax burdens were noted among industries. There was a significant difference noted in the tax incentives of industries and political power, thus showing unfair tax burdens. However, when the 1986 tax reform implemented the value-added tax, the effective tax rate of large corporations was higher than before.

A majority of the foregoing domestic and foreign studies investigating the correlation between company size and political power or political cost used the univariable (company size) approach and overlooked the effects of corporate characteristics (e.g. financial structure, profitability, investment activity, etc.) on the effective tax rate. As for multi-variable studies, Stickney and McGee (1982) used the cluster analysis to understand the factors affecting the effective tax rate of US corporations in 1978 and 1980. Empirical findings showed that companies having high financial leverage and high capital intensity, as well as engaging in natural resource mining had lower effective tax rate. Extent of foreign operation and company size had no major effect on the effective tax rate. Wang (1991) also believed that past univariable studies overlooked other relevant variables, hence the presence of bias and inconsistency in the estimates of parameters. Including the net operating losses into the model, Wang(1991) found a significantly negative correlation between company size and net operating losses, a significant negative correlation between net operating losses and effective tax rate, as well as no correlation between size and effective tax rate. His study showed that the single variable analysis might both cause omitted variable bias and draw the wrong conclusion that company size has certain effects on effective tax rate.

Gupta and Newberry (1997) used the ordinary least squares, the fixed effects model, and the random effects model to analyze the factors affecting effective tax rate of companies before (1982 to 1985) and after (1987 to 1990) the implementation of the 1986 Tax Reform Act. Empirical findings showed that before the implementation of the Tax Reform Act, companies with bigger size had higher effective tax rate, a finding consistent with the political cost hypothesis.
However after implementation of the Tax Reform Act, condition became consistent with the political power hypothesis; thus showing the Tax Reform Act worsened the tax distortion. In terms of corporate characteristics, companies with high capital intensity had lower effective tax rate (ETR); companies with high return of assets had higher ETR; and although financial leverage had significant correlation with ETR, but effects would vary with the different ETR measures used. Moreover, after implementation of the tax system changes, ETR increased significantly, hence the tax structural changes also influence the correlation between characteristics variables and ETR.

In short, prior Taiwanese studies predominantly concentrated on understanding the correlation between size or industry and ETR, but did not make a full evaluation of the effects of company characteristics. Therefore, this paper, like foreign studies, used the multi-variable approaches to examine the effects of company characteristics on the ETR of listed companies; thereby providing empirical evidence for the fairness or unfairness of the tax burdens. It is hoped that these findings can serve as basis for future studies on the impact of integrated income tax reform.

III. RESEARCH DESIGN

Measurement of Variables

The ETR is often used to measure corporate tax burdens in the tax policymaking process. The ETR can be used to evaluate the distribution effect of the tax system in the economy, thus providing an indicator for determining the presence of capital allocation distortion. Therefore, ETR is a widely used parameter of tax policy makers and academic researchers.

If the taxable income of business enterprises is higher than NT$100,000, then the 25% maximum marginal tax rate applies. Since marginal tax rate differences are quite limited, the average tax rate is used to define the dependent variable, ETR. Definitions of the dependent variable ETR and each explanatory variable are shown as follows. Reasons for using those variables are also provided.

\[ ETR = \frac{\text{income tax expense}}{\text{income before taxes from continuing operations}}. \]

\[ \text{SIZE} = \text{company size} = \text{natural logarithms of total assets}. \]

\[ \text{R&D} = \text{research and development expense}/\text{total assets}. \]

\[ \text{DEBT} = \text{financial leverage} = \text{total liability}/\text{total assets}. \]

\[ \text{CAPITAL} = \text{capital intensity} = \text{fixed assets}/\text{total assets}. \]

\[ \text{INV} = \text{inventory concentration} = \text{ending inventory}/\text{total assets}. \]

\[ \text{SHARE} = \text{percentage of shares owned by directors and supervisors}. \]

\[ \text{ROA} = \text{return of asset} = \text{net profit before tax}/\text{total assets}. \]

\[ \text{LTEI} = \text{long-term equity investments}/\text{total assets}. \]

\[ \text{SUB} = \text{number of subsidiaries owned}. \]

\[ \text{TIME} = \text{dummy variable for tax reform}. 1 \text{ for year after 1985}; 0 \text{ otherwise}. \]

\[ I_k = \text{dummy variable for industry type}. \]

The income tax expense in the financial statement can be further classified into current income tax expense and deferred income tax expense. Current income
tax expense (benefit) refers to the actual payable (refundable) income tax of the company for the year. Deferred income tax expense (benefit) refers to the future payable (deductible) income tax liability (asset). The different timing of recognition in the financial and taxable income computations causes the deferred income tax. Therefore, in our measurement of the ETR, the income tax expense served as the numerator, and the income from continuing operations was used as the denominator. Moreover, to prevent extreme values from affecting the study, observations showing ETR greater than 100% or smaller than 0 were eliminated.

Variable selection is based on the domestic and foreign studies as well as the existing Taiwanese income tax laws. Researchers have long been concerned with the correlation between company size and tax burden. According to the political power hypothesis, in the political process, bigger companies have more political power and political resource to participate in the formation of finance and economic laws, so they could veer policies for their benefit, thereby reducing their tax liabilities. As a result, corporate ETR would be negatively correlated to the company size. Furthermore, large corporations have more resources for tax planning; hence the ETR is negatively correlated to company size. On the contrary, the political cost hypothesis advocates that large corporations would be subject to higher surveillance and that its political cost would be higher than small companies. Hence ETR should be positively correlated with company size. Furthermore, while prior studies found that company size could significantly affect ETR, unfortunately most of them omitted important variables of corporate characteristics, which were correlated to the company size (See Literature Review). Therefore, this paper does not predict the direction of the effects of company size on ETR.

As to the corporate characteristics, this study selected variables related to the investment policies and financing policies of the company as the explanatory variables. Stickney and McGee (1982) as well as Gupta and Newberry (1997) used capital intensity, inventory concentration, research and development (R&D) intensity as the proxies for asset portfolio to measure the effects of asset portfolio on ETR. Hence, based on prior studies and Taiwan’s “Statute for Upgrading Industries”, this study measured capital intensity using the percentage of fixed assets against total assets, inventory concentration using the percentage of inventory against total assets, and R&D intensity using percentage of R&D expense against total assets. With the other conditions remaining constant, this study predicts that companies with higher capital intensity would be able to enjoy more investment tax credits and accelerated depreciation, thus enjoying lower ETR. Companies with higher inventory concentration have no investment tax credits; hence their ETR would be higher. Companies with higher R&D expense could enjoy higher investment tax credits, thus their ETR would be lower.

As for companies having more long-term equity investment, their ETR would be lower because 80% of their dividend income is tax exempted before the

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3 The Statute for Upgrading Industries is the primary legal foundation of tax incentives in Taiwan. Investments in R&D, pollution prevention, energy saving, and product automation are entitled to tax preferential treatment under this statute.
implementation of the integrated tax system. Furthermore, companies with subsidiaries could use transfer pricing and income manipulation among the parent and the subsidiaries to reduce taxes; hence their ETR would be lower than other companies. Hence, with other conditions remaining constant, this study predicts that companies with more long-term equity investment would have lower ETR; and companies with more subsidiaries would have more chances of using the parent-subsidiary company relationship to effect tax deductions, thus lowering ETR.

Under a progressive tax rate system, leveraged interest expense may be used as a tax deduction, the so-called tax shield benefits of interest expense. Hence we predict that companies with higher leverage would have lower ETR. Even in the absence of progressive tax rate, the degree of leverage would still affect ETR. For instance, income of hypothetical company A is $20 billion, and $10 billion of which is exempted from tax; if the nominal tax rate (assuming no progressive tax rate) is 25%, then ETR of company A is \( \frac{100 \times 25%}{200} = 12.5\% \). Now if company A needs capital of $10 billion for an investment project that would yield a $2 billion income per annum (before interest or other capital costs are deducted), the following two calculations illustrate the tax liabilities of the company with loan financing and with equity financing.

If the interest rate of loan is 10%, then ETR under loan financing is

\[
\frac{100 \times 25% + (20 - 100 \times 10\%) \times 25\%}{100 + 20 - 100 \times 10\%} = \frac{25 + 2.5}{210} = \frac{27.5}{210} = 13.095\%
\]

If fund is solicited through issuing new equity, then ETR is

\[
\frac{100 \times 25% + 20 \times 25\%}{100 + 20} = \frac{25 + 5}{220} = \frac{30}{220} = 13.636\%
\]

Apparently, corporate tax liability with loan financing is lower than equity financing. In other words, although Taiwanese business income tax has no apparent progressive tax rate, the tax exemption income and other tax factors might cause leveraged companies to enjoy lower ETR. In other words, since some income from loans is used to pay interests, the income tax payments and taxable income basis are smaller than those under equity financing. Moreover, as it is a proper fraction, the ETR under loan financing would be lower than ETR under equity financing.

Since income tax expense is used to compute ETR, other conditions being equal, a company with higher profitability would have higher taxable income, thus higher ETR. Hence, when conducting an empirical test, one should control the effects of profitability on ETR; otherwise, an omitted variable bias may emerge. We used the return of asset before taxes to measure company profitability. The percentage of shares owned by directors and supervisors manifested the directors’ and supervisors’ (insiders’) future expectations towards the company. So if the percentage of shares owned by directors and supervisors is higher, it reveals that the insiders are optimistic about company profitability; and taxable income would increase as profitability grows. ETR would also rise as a result. Therefore, we used the percentage of shares owned by directors and supervisors as the proxy for
future profitability of the company.

Changes in the general tax environment also affect the tax liabilities of a company. In 1986, the business income tax rate was reduced from 30% to 25%, directly reducing the tax liability of companies. However the value-added tax system was implemented in the same year, expanding the tax base. Hence the study was not able to predict the impact of the tax changes in 1986 on the ETR. To investigate the effects of structural changes on tax burden, this study divided the samples into three sub-periods for conducting several statistical analyses; namely the 1981-1985 period, the 1986-1990 period and the 1991-1996 period. The Statute for Upgrading Industries replaced the Statute for Encouraging Investment on January 1, 1991; and it became the most widely used law of tax incentives in Taiwan.

Sections 8 and 8-1 of the Statute of Upgrading Industries concerning investment tax credit of stockholders and the five-year tax exemption benefit could only be applied to primary technology industries, primary investment projects, and venture capital enterprises. Since not every industry benefited from those incentives, it caused a distortion in the tax burdens among different industries. We believe that the ETR may vary across industries. Thus, our empirical tests will examine the effect of industry type on ETR by including industry dummies in regressions.

**Empirical Models**

We conducted the univariable tests and the multiple regression tests on the research hypotheses. The samples used in the study came from the sixteen-year (1981-1996) financial statements of the listed corporations in Taiwan. They consisted of a longitudinal data (panel data) set, including the cross-sectional and time series data. The longitudinal data have more years and observations, so it can increase the freedom of the test and reduce multicollinearity problems between variables, thus improving estimation efficiency. Another advantage of the longitudinal data is its ability to use the fixed effects model or random effects model to control the effects of sample unit (company) and time (e.g. year) on the dependent variable. It prevents statistical estimation bias resulting from the omission of the two factors. Therefore, the longitudinal model may be used to improve the efficiency of parameter estimation.

Each company has its own unique historical background, business philosophy and company culture that create heterogeneity across companies. The fixed effects model and random effects model assume that despite the differences among companies, characteristics of companies are time invariant within a short period of time (e.g. the sub-periods of the study). The fixed effects model assigns each company a specific intercept to control the effects of company characteristics on the dependent variable; likewise it assigns a specific intercept to each time period (year) to control the effects of the particular time period. The random effects

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4 Effective January 1, 2000, the Statute for Upgrading Industries was amended to limit stockholder investment tax credits and the five-year tax exemption incentives to the Executive Yuan approved pioneer developing important strategic industries.
model, on the other hand, regards the characteristics of each company and time period as two random errors to control the effects of these characteristics on the dependent variable. For details, please refer to Greene (2000, Chapter 14).

If further analysis is conducted with the ordinary least squares (OLS) model, then the regression equation is:

\[ ETR_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 R & D_{it} + \beta_3 DEBT_{it} + \beta_4 CAPITAL_{it} + \beta_5 INV_{it} \]

\[ + \beta_6 SHARE_{it} + \beta_7 ROA_{it} + \beta_8 LTEI_{it} + \beta_9 SUB_{it} + \beta_{10} TIME + \varepsilon_{it} \]  

(1)

where \( \beta_0 \) is the only intercept.

If the two-way fixed effects model controlling both company and time effects is used, then the regression equation is:

\[ ETR_{it} = \alpha_i + \delta_t + \beta_1 SIZE_{it} + \beta_2 R & D_{it} + \beta_3 DEBT_{it} + \beta_4 CAPITAL_{it} + \beta_5 INV_{it} \]

\[ + \beta_6 SHARE_{it} + \beta_7 ROA_{it} + \beta_8 LTEI_{it} + \beta_9 SUB_{it} + \varepsilon_{it} \]  

(2)

Where \( i = 1,2\ldots N \) for \( \alpha_i \); and \( \alpha_i \) is the specific constant of the \( i \) company in the sample representing the individual firm effects. In the \( t = 1,2\ldots T-1 \) for \( \delta_t \); and \( \delta_t \) is the specific constant representing the time effects of each particular year. To prevent multicollinearity problems, \( T-1 \) rather than \( T \) is used.

The study divided the 1981-1996 period into three sub-periods (1981-1985, 1986-1990, 1991-1996) in the comparative analysis of the two foregoing models. The F statistics test of the error sum of squares of the two models (Greene, 2000, pp. 562-566) showed that the null hypothesis claiming firm effects of each company \( \alpha_i (i=1,2\ldots N) \) are equivalent (could be substituted by a single intercept) should be rejected. At the same time, the null hypothesis that time effects of each time period \( \delta_t (t=1,2\ldots T-1) \) were equal to zero should also be rejected. In other words, the OLS model would suffer from omitted variable biases; hence this study will not explain the results of the OLS regressions in detail.

The random effects model regression equation is similar to equation (2). However \( \alpha_i \) and \( \delta_t \) were regarded as random errors instead of constant intercepts. Therefore, the model loses less degree of freedom. Greene (2000) indicates that the statistical inferences of fixed effects model are only applicable in the original sample; while the random effects model may be generalized to the larger population outside of the sample. Nevertheless, if the errors \( \alpha_i \) and \( \delta_t \) of the random effects model were correlated to the explanatory variables, then the model estimation would be biased. Through the Hausman test (Greene, 2000, pp. 576-577) comparing the random effects model and the fixed effects model, the fixed effects model out-performs the random effects model. Therefore, this study will use the fixed effects model as the primary statistical method.

Since this study aimed to understand whether different tax incentives could cause industries to have differential tax burdens, we also amended the foregoing models to control the industry (rather than firm) effects and time effects in the fixed effects model. In the following regression, we assume each industry has its own unique operating environment that has influence on its tax burdens.
\[ ETR_\mu = \gamma_k + \delta_{\mu} + \beta_1 SIZE_\mu + \beta_2 R & D_\mu + \beta_3 DEBT_\mu + \beta_4 CAPITAL_\mu + \beta_5 INV_\mu + \beta_6 SHARE_\mu + \beta_7 ROA_\mu + \beta_8 LTEI_\mu + \beta_9 SUB_\mu + \epsilon_\mu \]  

where \( k = 1, 2, \ldots, k \) stands for type of industry.

To explore the effects of heteroskedasticity and error autocorrelation on the parameter estimation and tests, this study also uses the statistical methods proposed by White (1980) and Newey and West (1987) for the sensitivity analysis.

**IV. EMPIRICAL RESULTS**

Table 1 demonstrates the descriptive statistics of the dependent variable and the explanatory ones, and Table 2 illustrates the average effective tax rate (ETR) of each industry year by year. As these two tables indicate, after deleting those outliers with ETR greater than 100% or less than zero, the average ETR of all the listed companies in Taiwan is about 14.1%. Table 2 also shows that the average ETR varies across industries, suggesting that there are differential tax preferences enjoyed by different industries. In the whole sample period, the Paper & Pulp industry and the Electronics industry have the lowest ETRs, less than 10%. This may reflect the facts that the profitability of Paper and Pulp industry decreased year by year, and that the government strategically provided tax-favored treatments to the Electronics industry. On the other hand, Glass and Ceramics, Wholesale and Retail, Cement, and Finance industries have the highest ETRs, from 18% to 20%. Most of these industries are traditional domestic-demand industries, with the characteristics of low R&D expenses and high labor intensity.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Min</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETR*</td>
<td>0.141</td>
<td>0</td>
<td>0.039</td>
<td>0.143</td>
<td>0.218</td>
<td>0.963</td>
</tr>
<tr>
<td>DEBT*</td>
<td>0.514</td>
<td>0</td>
<td>0.361</td>
<td>0.503</td>
<td>0.652</td>
<td>0.996</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>0.075</td>
<td>0</td>
<td>0.015</td>
<td>0.047</td>
<td>0.102</td>
<td>0.945</td>
</tr>
<tr>
<td>INV</td>
<td>0.184</td>
<td>0</td>
<td>0.081</td>
<td>0.147</td>
<td>0.227</td>
<td>0.961</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.005</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.003</td>
<td>0.345</td>
</tr>
<tr>
<td>SHARE*</td>
<td>28.513</td>
<td>0.660</td>
<td>14.910</td>
<td>25.205</td>
<td>39.105</td>
<td>91.490</td>
</tr>
<tr>
<td>ROA*</td>
<td>0.066</td>
<td>-0.631</td>
<td>0.020</td>
<td>0.056</td>
<td>0.100</td>
<td>0.647</td>
</tr>
<tr>
<td>SUB</td>
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<td>0</td>
<td>1</td>
<td>3</td>
<td>32</td>
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<tr>
<td>LTEI</td>
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<td>0.003</td>
<td>0.037</td>
<td>0.113</td>
<td>0.861</td>
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</table>

Notes:
1 Q1 = the first quartile, and Q3 = the third quartile.
2 *: outliers excluded.
3 ETR = income tax expense / income before taxes from continuing operations; SIZE = In (Total Assets); R&D = R&D Expense/Total Assets; DEBT = Total Liabilities/Total Assets; CAPITAL = Fixed Assets/Total Assets; INV = Inventory/Total Assets; SHARE = percentage of shares owned by directors and supervisors; ROA = Net Income before Tax/Total Assets; SUB = Number of subsidiaries owned; LTEI = Long-term Equity Investment/Total Assets.
Table 2: The Average Effective Tax Rate for Each Industry by Year
(To be continued)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Cement</th>
<th>Foods</th>
<th>Plastics</th>
<th>Textiles</th>
<th>Electric &amp; Machinery</th>
<th>Electric Appliance &amp; Cable</th>
<th>Chemicals</th>
<th>Glass &amp; Ceramics</th>
<th>Paper &amp; Pulp</th>
<th>Steel &amp; Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>0.210</td>
<td>0.213</td>
<td>0.180</td>
<td>0.144</td>
<td>0.258</td>
<td>0.265</td>
<td>0.185</td>
<td>0.290</td>
<td>0.197</td>
<td>Na</td>
</tr>
<tr>
<td>1982</td>
<td>0.158</td>
<td>0.152</td>
<td>0.157</td>
<td>0.099</td>
<td>0.125</td>
<td>0.204</td>
<td>0.146</td>
<td>0.290</td>
<td>0.102</td>
<td>0.121</td>
</tr>
<tr>
<td>1983</td>
<td>0.183</td>
<td>0.166</td>
<td>0.144</td>
<td>0.125</td>
<td>0.137</td>
<td>0.207</td>
<td>0.167</td>
<td>0.257</td>
<td>0.143</td>
<td>0.035</td>
</tr>
<tr>
<td>1984</td>
<td>0.170</td>
<td>0.144</td>
<td>0.103</td>
<td>0.132</td>
<td>0.170</td>
<td>0.150</td>
<td>0.127</td>
<td>0.249</td>
<td>0.085</td>
<td>0.173</td>
</tr>
<tr>
<td>1985</td>
<td>0.158</td>
<td>0.181</td>
<td>0.135</td>
<td>0.179</td>
<td>0.215</td>
<td>0.225</td>
<td>0.177</td>
<td>0.242</td>
<td>0.053</td>
<td>0.179</td>
</tr>
<tr>
<td>1986</td>
<td>0.160</td>
<td>0.183</td>
<td>0.172</td>
<td>0.176</td>
<td>0.152</td>
<td>0.162</td>
<td>0.154</td>
<td>0.179</td>
<td>0.124</td>
<td>0.222</td>
</tr>
<tr>
<td>1987</td>
<td>0.184</td>
<td>0.184</td>
<td>0.164</td>
<td>0.153</td>
<td>0.165</td>
<td>0.179</td>
<td>0.148</td>
<td>0.169</td>
<td>0.109</td>
<td>0.165</td>
</tr>
<tr>
<td>1988</td>
<td>0.183</td>
<td>0.134</td>
<td>0.132</td>
<td>0.117</td>
<td>0.171</td>
<td>0.143</td>
<td>0.122</td>
<td>0.152</td>
<td>0.045</td>
<td>0.157</td>
</tr>
<tr>
<td>1989</td>
<td>0.172</td>
<td>0.166</td>
<td>0.167</td>
<td>0.127</td>
<td>0.177</td>
<td>0.150</td>
<td>0.165</td>
<td>0.184</td>
<td>0.046</td>
<td>0.158</td>
</tr>
<tr>
<td>1990</td>
<td>0.196</td>
<td>0.140</td>
<td>0.156</td>
<td>0.096</td>
<td>0.180</td>
<td>0.176</td>
<td>0.109</td>
<td>0.210</td>
<td>0.070</td>
<td>0.121</td>
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<tr>
<td>1991</td>
<td>0.215</td>
<td>0.145</td>
<td>0.192</td>
<td>0.149</td>
<td>0.149</td>
<td>0.172</td>
<td>0.118</td>
<td>0.189</td>
<td>0.040</td>
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<tr>
<td>1992</td>
<td>0.187</td>
<td>0.139</td>
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<tr>
<td>1993</td>
<td>0.171</td>
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<td>0.149</td>
<td>0.085</td>
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<td>0.146</td>
<td>0.131</td>
<td>0.192</td>
<td>0.010</td>
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<tr>
<td>1994</td>
<td>0.164</td>
<td>0.090</td>
<td>0.125</td>
<td>0.105</td>
<td>0.153</td>
<td>0.110</td>
<td>0.109</td>
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<td>1995</td>
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<td>0.213</td>
<td>0.158</td>
<td>0.151</td>
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<td>0.180</td>
<td>0.208</td>
<td>0.081</td>
<td>0.165</td>
</tr>
<tr>
<td>1996</td>
<td>0.167</td>
<td>0.131</td>
<td>0.196</td>
<td>0.172</td>
<td>0.160</td>
<td>0.166</td>
<td>0.142</td>
<td>0.133</td>
<td>na</td>
<td>0.226</td>
</tr>
<tr>
<td>All</td>
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<td>0.145</td>
<td>0.154</td>
<td>0.133</td>
<td>0.164</td>
<td>0.167</td>
<td>0.138</td>
<td>0.193</td>
<td>0.077</td>
<td>0.159</td>
</tr>
</tbody>
</table>

Outliers excluded.

Table 2: The Average Effective Tax Rate for Each Industry by Year
(Page 2 for two pages)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Rubber</th>
<th>Automobile</th>
<th>Electronics</th>
<th>Construction</th>
<th>Transportation</th>
<th>Tourism</th>
<th>Finance</th>
<th>Wholesale Retail &amp; Conglomerate</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>0.063</td>
<td>na</td>
<td>0.073</td>
<td>0.353</td>
<td>0.125</td>
<td>0.150</td>
<td>0.211</td>
<td>0.324</td>
<td>0.250</td>
</tr>
<tr>
<td>1982</td>
<td>0.021</td>
<td>na</td>
<td>0.001</td>
<td>0.247</td>
<td>0.225</td>
<td>0.124</td>
<td>0.202</td>
<td>0.255</td>
<td>0.288</td>
</tr>
<tr>
<td>1983</td>
<td>0.078</td>
<td>na</td>
<td>0.086</td>
<td>0.225</td>
<td>0.134</td>
<td>0.126</td>
<td>0.197</td>
<td>0.334</td>
<td>na</td>
</tr>
<tr>
<td>1984</td>
<td>0.058</td>
<td>0.046</td>
<td>0.101</td>
<td>0.144</td>
<td>0.034</td>
<td>0.142</td>
<td>0.170</td>
<td>0.143</td>
<td>na</td>
</tr>
<tr>
<td>1985</td>
<td>0.106</td>
<td>0.191</td>
<td>0.110</td>
<td>0.191</td>
<td>0.084</td>
<td>0.065</td>
<td>0.213</td>
<td>0.165</td>
<td>na</td>
</tr>
<tr>
<td>1986</td>
<td>0.113</td>
<td>0.149</td>
<td>0.120</td>
<td>0.068</td>
<td>0.131</td>
<td>0.175</td>
<td>0.155</td>
<td>0.130</td>
<td>na</td>
</tr>
<tr>
<td>1987</td>
<td>0.143</td>
<td>0.162</td>
<td>0.092</td>
<td>0.061</td>
<td>0.114</td>
<td>0.175</td>
<td>0.164</td>
<td>0.187</td>
<td>0.039</td>
</tr>
<tr>
<td>1988</td>
<td>0.119</td>
<td>0.155</td>
<td>0.080</td>
<td>0.108</td>
<td>0.123</td>
<td>0.204</td>
<td>0.158</td>
<td>0.231</td>
<td>0.072</td>
</tr>
<tr>
<td>1989</td>
<td>0.123</td>
<td>0.126</td>
<td>0.106</td>
<td>0.135</td>
<td>0.117</td>
<td>0.188</td>
<td>0.178</td>
<td>0.167</td>
<td>0.160</td>
</tr>
<tr>
<td>1990</td>
<td>0.256</td>
<td>0.111</td>
<td>0.090</td>
<td>0.095</td>
<td>0.128</td>
<td>0.171</td>
<td>0.207</td>
<td>0.206</td>
<td>0.171</td>
</tr>
<tr>
<td>1991</td>
<td>0.169</td>
<td>0.143</td>
<td>0.066</td>
<td>0.092</td>
<td>0.110</td>
<td>0.252</td>
<td>0.193</td>
<td>0.200</td>
<td>0.176</td>
</tr>
<tr>
<td>1992</td>
<td>0.134</td>
<td>0.164</td>
<td>0.062</td>
<td>0.100</td>
<td>0.124</td>
<td>0.189</td>
<td>0.190</td>
<td>0.222</td>
<td>0.186</td>
</tr>
<tr>
<td>1993</td>
<td>0.108</td>
<td>0.117</td>
<td>0.074</td>
<td>0.092</td>
<td>0.110</td>
<td>0.166</td>
<td>0.194</td>
<td>0.136</td>
<td>0.195</td>
</tr>
<tr>
<td>1994</td>
<td>0.063</td>
<td>0.109</td>
<td>0.068</td>
<td>0.084</td>
<td>0.196</td>
<td>0.112</td>
<td>0.172</td>
<td>0.168</td>
<td>0.129</td>
</tr>
<tr>
<td>1995</td>
<td>0.072</td>
<td>0.174</td>
<td>0.121</td>
<td>0.133</td>
<td>0.158</td>
<td>0.144</td>
<td>0.176</td>
<td>0.153</td>
<td>0.069</td>
</tr>
<tr>
<td>1996</td>
<td>0.106</td>
<td>0.182</td>
<td>0.159</td>
<td>0.123</td>
<td>0.156</td>
<td>0.207</td>
<td>0.170</td>
<td>0.164</td>
<td>0.114</td>
</tr>
<tr>
<td>All</td>
<td>0.159</td>
<td>0.137</td>
<td>0.090</td>
<td>0.110</td>
<td>0.128</td>
<td>0.165</td>
<td>0.183</td>
<td>0.190</td>
<td>0.116</td>
</tr>
</tbody>
</table>

Outliers excluded.
Table 3 demonstrates the matrix of correlation coefficients, calculated with outliers excluded. It reveals that \( ETR \) is correlated to a company’s individual characteristics such as the variables \( \text{SHARE} \) (the percentage of shares owned by directors and supervisors) and \( \text{R&D} \) (R&D Expense/Total Assets), but uncorrelated to the company size (\( \text{SIZE} \)). However, Table 3 also indicates that \( \text{SIZE} \) is significantly correlated to most of the variables related with the company’s individual characteristics. Just as Wang (1991) pointed out, researches using univariate tests often neglect other relevant variables, and over-attribute the corporate tax burden to the political power hypothesis, which claims that the larger the company size, the larger the political lobby power, and hence the \( ETR \) is lower. Previous literature, using \( \text{SIZE} \) as the only explanatory variable to explore the relationship between tax burden and company size, may have omitted variable bias because the regression error term includes the effects of companies' individual characteristics, which are correlated to the explanatory variable \( \text{SIZE} \). However, to meet the basic assumptions of the traditional regression models, the error term should not be correlated to the explanatory variables.

Table 3: Matrix of Correlation Coefficients (outliers excluded)

<table>
<thead>
<tr>
<th></th>
<th>( ETR )</th>
<th>( \text{SIZE} )</th>
<th>( \text{DEBT} )</th>
<th>( \text{CAPITAL} )</th>
<th>( \text{INV} )</th>
<th>( \text{R&amp;D} )</th>
<th>( \text{SHARE} )</th>
<th>( \text{ROA} )</th>
<th>( \text{SUB} )</th>
<th>( \text{LTEI} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( ETR )</td>
<td>0.0126</td>
<td>-0.0207</td>
<td>0.0045</td>
<td>-0.0022</td>
<td>0.0520*</td>
<td>-0.0915*</td>
<td>0.1522*</td>
<td>0.1953*</td>
<td>-0.0885*</td>
<td>-0.0451*</td>
</tr>
<tr>
<td>( \text{SIZE} )</td>
<td>0.0237</td>
<td>0.2180*</td>
<td>-0.1916*</td>
<td>0.3418*</td>
<td>-0.2742*</td>
<td>0.0243</td>
<td>-0.4236*</td>
<td>-0.0475*</td>
<td>-0.2876*</td>
<td></td>
</tr>
<tr>
<td>( \text{DEBT} )</td>
<td>-0.0270*</td>
<td>-0.2549*</td>
<td>-0.0844*</td>
<td>-0.1706*</td>
<td>0.1401*</td>
<td>0.0461*</td>
<td>0.2731*</td>
<td>0.0059</td>
<td>-0.1075*</td>
<td></td>
</tr>
<tr>
<td>( \text{CAPITAL} )</td>
<td>-0.1420*</td>
<td>-0.0264*</td>
<td>-0.1617*</td>
<td>0.1199*</td>
<td>-0.0640</td>
<td>-0.0356</td>
<td>0.1855*</td>
<td>0.2371*</td>
<td>0.2055*</td>
<td></td>
</tr>
<tr>
<td>( \text{INV} )</td>
<td>-0.0294*</td>
<td>-0.0055</td>
<td>0.3595*</td>
<td>-0.2132*</td>
<td>0.0201</td>
<td>-0.0184</td>
<td>-0.0713*</td>
<td>-0.0098</td>
<td>-0.1799*</td>
<td></td>
</tr>
<tr>
<td>( \text{R&amp;D} )</td>
<td>0.1272*</td>
<td>0.0821*</td>
<td>0.0679*</td>
<td>0.0173</td>
<td>-0.0118</td>
<td>0.0571*</td>
<td>0.1874*</td>
<td>-0.1902*</td>
<td>-0.1873*</td>
<td></td>
</tr>
<tr>
<td>( \text{SHARE} )</td>
<td>0.1067*</td>
<td>-0.0977*</td>
<td>-0.3745*</td>
<td>0.1448*</td>
<td>-0.0917</td>
<td>0.0924*</td>
<td>0.1654*</td>
<td>0.0975*</td>
<td>0.0561*</td>
<td></td>
</tr>
<tr>
<td>( \text{ROA} )</td>
<td>-0.0662*</td>
<td>0.2577*</td>
<td>-0.0018</td>
<td>-0.0829*</td>
<td>-0.0546</td>
<td>0.0938*</td>
<td>-0.1802*</td>
<td>0.0494*</td>
<td>0.5182*</td>
<td></td>
</tr>
<tr>
<td>( \text{SUB} )</td>
<td>-0.0910*</td>
<td>0.1987*</td>
<td>-2.5556*</td>
<td>-0.1673*</td>
<td>-0.2130</td>
<td>0.0310*</td>
<td>-0.1843*</td>
<td>0.0196</td>
<td>0.3868*</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. For the meanings of the variables, see Note 3 of Table 1.
2. Numbers in the upper-right triangle are the Spearman rank-correlation coefficients, and in the lower-left triangle are the Pearson correlation coefficients.
3. *: \( P<10\% \).

By dividing the full sample into two groups, large and small, according to the median of each explanatory variable, Table 4 demonstrates the descriptive statistics of the \( ETR \) in each group, and the results of univariate tests for the equality of the two-groups’ average \( ETRs \). As the Table reveals, divided by the median of \( \text{SIZE} \), the average \( ETR \) of the large group is less than that of the small group, with \( p\text{-value}=7.99\% \), significant only at \( \alpha = 10\% \) level under the mean test; but with \( p\text{-value}=13.23\% \), which is not significant, under the non-parametric rank test. The \( ETRs \) of the two groups, divided according to the median of \( \text{DEBT} \) (Total Liabilities/Total Assets), are not significantly different from each
other. Besides, the group with large INV (Inventory/Total Assets) has higher ETR than the small group, but only marginally significant at \( \alpha = 10\% \); the ETR of the group with large R&D (R&D Expense/Total Assets) is significantly lower than that of the small group. In the meanwhile, groups with larger SHARE (the percentage of shares owned by directors and supervisors) or larger ROA (Net Income before Tax/Total Assets) tend to have lower ETR than the smaller groups. Finally, there is no significant difference in ETR between the large and small groups of CAPITAL (Fixed Assets/Total Assets) and of LTEI (Long-term Equity Investment/Total Assets)\(^5\).

Table 4: Descriptives of ETR in the Large and Small Groups and the Univariate Tests for the Equality of ETR

<table>
<thead>
<tr>
<th>Variables</th>
<th>Descriptives of ETR in Each Group</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>SIZE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.138</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.144</td>
<td>0</td>
</tr>
<tr>
<td>DEBT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.143</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.141</td>
<td>0</td>
</tr>
<tr>
<td>CAPITAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.142</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.140</td>
<td>0</td>
</tr>
<tr>
<td>INV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.144</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.138</td>
<td>0</td>
</tr>
<tr>
<td>R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.130</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.140</td>
<td>0</td>
</tr>
<tr>
<td>SHARE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.139</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.131</td>
<td>0</td>
</tr>
<tr>
<td>ROA</td>
<td></td>
<td></td>
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<tr>
<td>Large group</td>
<td>0.153</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.131</td>
<td>0</td>
</tr>
<tr>
<td>LTEI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large group</td>
<td>0.141</td>
<td>0</td>
</tr>
<tr>
<td>Small group</td>
<td>0.141</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:
1 *: outliers excluded.
2 For the meanings of the variables, see Note 3 of Table 1.

\(^5\) We also divided the sample into large and small groups according to the median of ETR, and conducted the univariate tests. The mean values of all variables except for SIZE are found to be significantly different in the large and small groups.
The multiple regression results are shown in Table 5 to Table 7. From the results in Table 5 of the two-way fixed effects models, which control for the effects of individual company and time period, we find no significant relationship between company size and tax burden, either in the whole sample period spanning from 1981 to 1996, or in any of the three subsamples. This finding is different from that of the univariate analysis in Lin and Yang (1994), whose empirical results support the political power hypothesis. We will return to discuss this issue in more detail with the results of Table 7. Other variables including R&D, DEBT, CAPITAL, ROA, and SUB have significant influence on ETR in the regression covering the whole period. However, the influence of part of these variables turns into insignificance in the tests for the three subsamples. This may be caused by the fact that the degrees of freedom are decreased in the subsamples. For example, in the whole sample period, R&D is significantly and negatively related to ETR, but in the first (1981-1985) and the second (1986-1990) subsamples, no significant relationship is found. CAPITAL, a proxy of capital intensity, has positive relationship with ETR in the full sample, but this relationship no longer exists in the first and second subsamples. ROA (returns on assets) is positively associated with ETR, but in the third subsample (1991-1996) the association is not significant.

### Table 5 Regression Results of the Fixed Effects Model: Company and Time Effects Controlled

<table>
<thead>
<tr>
<th>Period</th>
<th>70 — 85</th>
<th>70 — 74</th>
<th>75 — 79</th>
<th>80 — 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>Coeff.</td>
<td>t</td>
<td>Coeff.</td>
<td>t</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.0025</td>
<td>-0.79</td>
<td>0.0158</td>
<td>1.25</td>
</tr>
<tr>
<td>DEBT</td>
<td>-0.0556</td>
<td>-4.70</td>
<td>-0.2279</td>
<td>-3.86</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>0.0365</td>
<td>1.87</td>
<td>0.0409</td>
<td>0.67</td>
</tr>
<tr>
<td>INV</td>
<td>0.0267</td>
<td>1.58</td>
<td>0.0894</td>
<td>1.65</td>
</tr>
<tr>
<td>SHARE</td>
<td>0.0002</td>
<td>1.36</td>
<td>0.0006</td>
<td>0.90</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1104</td>
<td>4.56</td>
<td>0.4379</td>
<td>4.76</td>
</tr>
<tr>
<td>LTEI</td>
<td>-0.0049</td>
<td>-0.22</td>
<td>-0.0146</td>
<td>-0.15</td>
</tr>
<tr>
<td>SUB</td>
<td>-0.0022</td>
<td>-2.45</td>
<td>na</td>
<td>0.0009</td>
</tr>
<tr>
<td>Σ FIRM</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
</tr>
<tr>
<td>Σ YEAR</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
</tr>
</tbody>
</table>

| n       | 4419    | 691     | 1647    | 2081    |
| F-value | 5.64    | 5.07    | 3.56    | 4.16    |
| $R^2$(adj) | 0.306   | 0.567   | 0.386   | 0.384   |

Note: FIRM = dummy variable for each company, YEAR = dummy variable for each year. For the meanings of other variables, see Note 3 of Table 1.

Following previous literature, which explored the impact of the differential tax preferences across different “industries” on corporate tax burden, the fixed effects models in Table 6 control for the time effect and the “industry” effect, rather than the “company” effect as in Table 5. In other words, models in Table 6 assume that each industry has its own special business environment, which is a factor influencing ETR and should be controlled for. As it reveals in Table 6, company size is negatively associated with ETR,
supporting the political power hypothesis, in the full sample, the second and the third subsamples. However, the analysis for the first subsample supports the political cost hypothesis. We will come back to this opposite finding with a discussion of structural change in Table 7. In general, the resulting analyses in Table 6 also suggest: (1) both R&D expenses and investment in long-term equity (LTEI) can result in the lower ETR; (2) the percentage of shares owned by directors and supervisors (SHARE), the return of assets (ROA) and the inventory intensity (INV) are positively related with corporate ETR; and (3) financial leverage (DEBT), capital intensity (CAPITAL), and the number of subsidiaries owned (SUB) have no significant impact on ETR.

Table 6 Regression Results of the Fixed Effects Model: Industry and Time Effects Controlled

<table>
<thead>
<tr>
<th>Period</th>
<th>70 — 85</th>
<th>70 — 74</th>
<th>75 — 79</th>
<th>80 — 85</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>t</td>
<td>Coeff.</td>
<td>t</td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.0059</td>
<td>-3.73</td>
<td>0.0077</td>
<td>1.86</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.6995</td>
<td>-4.55</td>
<td>-1.3332</td>
<td>-1.09</td>
</tr>
<tr>
<td>DEBT</td>
<td>-0.0037</td>
<td>-0.37</td>
<td>0.0031</td>
<td>0.10</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>-0.0040</td>
<td>-0.20</td>
<td>-0.0065</td>
<td>-0.11</td>
</tr>
<tr>
<td>INV</td>
<td>0.0292</td>
<td>2.16</td>
<td>0.0815</td>
<td>2.13</td>
</tr>
<tr>
<td>SHARE</td>
<td>0.0001</td>
<td>0.90</td>
<td>0.0010</td>
<td>1.16</td>
</tr>
<tr>
<td>ROA</td>
<td>0.2100</td>
<td>9.16</td>
<td>0.5685</td>
<td>7.87</td>
</tr>
<tr>
<td>LTEI</td>
<td>-0.0989</td>
<td>-5.62</td>
<td>-0.0381</td>
<td>-0.60</td>
</tr>
<tr>
<td>SUB</td>
<td>-0.0008</td>
<td>-1.08</td>
<td>na</td>
<td>omitted</td>
</tr>
<tr>
<td>ΣI</td>
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<td>na</td>
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<td>na</td>
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<tr>
<td>ΣYEAR</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
<td>omitted</td>
</tr>
</tbody>
</table>

n  | 4419 | 691 | 1647 | 2081 |
F-value | 15.26 | 7.39 | 6.18 | 13.72 |
R²(adj) | 0.124 | 0.229 | 0.094 | 0.172 |

Note: I = dummy variable for each industry, YEAR = dummy variable for each year. For the meanings of other variables, see Note 3 of Table 1.

It is worth exploring why the relationship of SIZE and ETR found in Table 5 and Table 6 is totally different. The fixed effects model in Table 5 assigns an individual constant term to each “company” to control for its special characteristics, i.e., to control for the heterogeneity among companies. It is assumed through the “constant term” that the characteristics of each company are “constant” during the period covered in the sample. If the company size does not change critically during the sample period, then the impact of size on ETR may be captured by the constant term $\alpha_i$. This may be the reason why SIZE is found to have no significant impact on ETR in Table 5. On the other hand, the fixed effects model in Table 6 assumes that each “industry” has its own characteristics in business environment, and controls for this heterogeneity using a constant term for each industry. For companies in a specific industry, their differences in size are not captured by the industry constant term; accordingly, the effect of size on ETR can fully appear and become significant in Table 6.

For Table 6, we have tested the null hypothesis that there is no heterogeneity across
industries, i.e., \( \gamma_1 = \gamma_2 = \ldots = \gamma_k \) for equation (3) and hence all the industry specific constant terms can be replaced by a single constant term \( \beta_0 \). The results rejected the null hypothesis, and imply that industry heterogeneity exists and differential tax preferences may be enjoyed by different industries. The random effects model has also been used to compare with the fixed effects model. The results of the Hausman tests, however, indicate that the latter is superior to the former. Therefore, the empirical results discussed in this paper are primarily based on the analysis of the fixed effects model.

In Table 6, the impact of SIZE on ETR changes from positive in the first subsample to negative in the second and third subsamples, implying that there may be a structural change over periods. In 1986 Taiwan adopted the value-added tax, and lowered the business income tax rate from 30% to 25%. In order to test if these tax system changes caused a structural change, in Table 7 a dummy variable TIME is set to be 1 if a data belongs to a year after 1985, and 0 otherwise. As shown in Table 7, interaction terms of TIME and other explanatory variables are also included to proceed the one-way fixed effects model with company effect controlled and with industry effect controlled, respectively. Because there is no data on the number of subsidiaries owned before 1986, SUBxTIME is not used as an interaction term.

In Table 7 the coefficients of SIZExTIME are significantly negative in both models, regardless of controlling for company effect or industry effect. This implies the tax reform in 1986 reduced the tax burden of, and was more beneficial to, large companies. This is contradictory to the principle of tax equity, a goal that a tax reform should pursue. Likewise, the coefficients of INVxTIME, ROAxTIME, and LTEIxTIME are all significantly less than zero. Therefore, companies with more inventories, higher profitability, or more long-term equity investment have lower tax burden after the tax reform. This probably reflects the fact that these companies are beneficiaries of the implementation of value-added tax and the decline of business income tax rate. In addition, the coefficient of TIME is significantly greater than zero, suggesting that the overall tax burden of listed companies is increased after the tax reform. However, it is noteworthy that the impact of tax reform may also emerge through the interaction terms. For example, the coefficient of ROAxTIME is significantly negative, implying that profitable companies’ ETR is decreased after the tax reform.

Our research sample covers financial data of listed companies in Taiwan from 1981 to 1996, spanning a 16-year period before the adoption of the integrated income tax system (the imputation tax credit system) in 1998. While we explore the differences and the determinants of the corporate tax burden before the new system was effective, the research findings illustrated above can be used as a comparative basis for evaluating the impact of the new tax system. As a supplementary analysis, this paper has collected the data of 1998 (the year the integrated income tax system was effective in Taiwan) to preliminarily test the impact of the new tax system, although it is more suitable to use a data set covering more years. Because the fixed effects model cannot be used to control for the company effect or time effect when a data set covers only a single year, the test of the 1998 data just used dummy variables to control for the industry effect. The results of the random effects model are available from the authors upon request.
resulting analysis indicates that the regression coefficients’ positive/negative directions are similar to those in the 1991-1996 column of Table 6. However, most coefficients are not significantly different from zero, due to the smaller degrees of freedom in the single year data set. Of noticeable difference is the significantly negative coefficient of ROA, which is opposite to what was found for the period prior to the integrated income tax system. This phenomenon deserves future explorations with a data set covering more years.

Table 7 Regression Results of One-way Fixed Effects Model with Interaction Terms

<table>
<thead>
<tr>
<th>Models</th>
<th>Company Effect Controlled</th>
<th>Industry Effect Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Coeff.</td>
<td>t</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0044</td>
<td>1.29</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.7431</td>
<td>-1.99</td>
</tr>
<tr>
<td>DEBT</td>
<td>-0.0370</td>
<td>-1.92</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>0.0218</td>
<td>0.56</td>
</tr>
<tr>
<td>INV</td>
<td>0.1422</td>
<td>5.13</td>
</tr>
<tr>
<td>SHARE</td>
<td>0.0009</td>
<td>1.39</td>
</tr>
<tr>
<td>ROA</td>
<td>0.2584</td>
<td>5.46</td>
</tr>
<tr>
<td>LTEI</td>
<td>0.0572</td>
<td>1.11</td>
</tr>
<tr>
<td>SUB</td>
<td>-0.0015</td>
<td>-1.70</td>
</tr>
<tr>
<td>TIME</td>
<td>0.1738</td>
<td>4.13</td>
</tr>
<tr>
<td>SIZE×TIME</td>
<td>-0.0107</td>
<td>-3.59</td>
</tr>
<tr>
<td>R&amp;D×TIME</td>
<td>0.4799</td>
<td>1.21</td>
</tr>
<tr>
<td>DEBT×TIME</td>
<td>-0.0069</td>
<td>-0.33</td>
</tr>
<tr>
<td>CAPITAL×TIME</td>
<td>0.0061</td>
<td>0.14</td>
</tr>
<tr>
<td>INV×TIME</td>
<td>-0.1426</td>
<td>-5.06</td>
</tr>
<tr>
<td>SHARE×TIME</td>
<td>-0.0008</td>
<td>-1.23</td>
</tr>
<tr>
<td>ROA×TIME</td>
<td>-0.1675</td>
<td>-3.33</td>
</tr>
<tr>
<td>LTEI×TIME</td>
<td>-0.0919</td>
<td>-1.74</td>
</tr>
</tbody>
</table>

ΣI na omitted

n 4419 4419
F-value 9.06 5.45
R²(adj) 0.032 0.033

Note: I = dummy variable for each industry, TIME = dummy variable for tax reform. For the meanings of other variables, see Note 3 of Table 1.

The analysis using only one-year data may suffer from insufficient stability, so the regression results are not fully discussed. However, using the Newey and West (1987) model as an example, the regression results can be summarized as follows (the coefficients of industry effects are omitted):

<table>
<thead>
<tr>
<th>Variable</th>
<th>SIZE</th>
<th>R&amp;D</th>
<th>DEBT</th>
<th>CAPITAL</th>
<th>INV</th>
<th>SHARE</th>
<th>ROA</th>
<th>LTEI</th>
<th>SUB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>-0.033</td>
<td>-0.505</td>
<td>-0.068</td>
<td>0.026</td>
<td>0.337</td>
<td>0.001</td>
<td>-0.539</td>
<td>-0.240</td>
<td>0.003</td>
</tr>
<tr>
<td>t</td>
<td>-1.427</td>
<td>-0.811</td>
<td>-0.586</td>
<td>0.177</td>
<td>1.781</td>
<td>1.051</td>
<td>-3.458</td>
<td>-1.638</td>
<td>0.529</td>
</tr>
</tbody>
</table>

The reviewer’s opinion on this regression is highly appreciated.
V. CONCLUSIONS AND SUGGESTIONS

This study explored the differences and the determinants of the tax burden of listed companies in Taiwan with data spanning 16 years from 1981 to 1996. The empirical results were also used to explain how the corporate tax burden was impacted by both the reduction of income tax rate and the adoption of value-added tax in 1986. Our research findings provide relevant information for the government to evaluate previous tax policies and to formulate future tax reforms. In addition, tax researchers can extend our empirical findings as a comparative basis to evaluate the impact of the integrated income tax system, effective in 1998. To summarize, the empirical results are as follows:

1. From 1981 to 1996, the average ETR of all the listed companies is 14.1%, lower than the top statutory tax rate of 25%. The Paper & Pulp industry and the Electronics industry have the lowest ETR, less than 10%. On the other hand, the Glass and Ceramics, and the Wholesale and Retail industries have the highest ETR, close to 20%. These results indicate that tax incentives prior to the end of 1996 significantly affected companies’ tax burden. They also reveal that the tax preferential treatments across industries violated the tax neutrality principle, and hence might cause a distortion in the allocation of resources.

2. A company’s tax burden is associated with its individual characteristics. For example, a company with higher R&D expense has lower ETR, indicating that the tax policy of promoting R&D by allowing tax credits to R&D has successfully achieved its goal. On the other hand, since no tax preferences were provided to inventory, a company with more inventories tends to have higher tax burden. Moreover, a company with more long-term equity investment or owning more subsidiaries has lower ETR, reflecting that these companies may undertake intercompany tax planning to reduce its tax burden.

3. In general, larger companies have lower tax burden, consistent with the political power hypothesis.

4. There was a structural change for the determinants of tax burden caused by the adoption of value-added tax and the reduction of business income tax rate in 1986. After the 1986 tax reform, the tax burden of the listed companies generally increased, implying that the tax reform broadened the tax base. However, large companies still had lower tax burden than small ones, consistent to the political power hypothesis.

5. Various econometrics models used in this study generally produced similar statistics and test results\(^8\), indicating the robustness of the research findings.

---

\(^8\) The models proposed by White (1980) and Newey and West (1987) were also used to re-estimate Table 5 to Table 7. No significant difference was found. White’s estimator of the consistent covariance matrix is

\[
\left( \frac{1}{T} \sum_{t=1}^{T} x_t x_t' \right)^{-1} \left( \frac{1}{T} \sum_{t=1}^{T} e_t^2 x_t x_t' \right) \left( \frac{1}{T} \sum_{t=1}^{T} x_t x_t' \right)^{-1}.
\]

When there is heteroscedasticity but no autocorrelation in the dataset, the White’s method, known as weighted least squares (WLS), should be used. However, if there is both heteroscedasticity but no autocorrelation, the Newey and West’s method should be used. Their consistent covariance matrix is
Our research has the following limitations, which suggest opportunities for future study. (1) Article Three of the Income Tax Law stipulates that a company with its head office within the territory of Taiwan should pay income tax on its worldwide income; and the foreign tax paid may be deducted from the increased tax in consequence of the inclusion of the foreign income. Therefore, the percentages of domestic and foreign income to the worldwide income can significantly impact the level of ETR. However, due to the difficulty of obtaining relevant data, we did not explore how the components of worldwide income affect the ETR. (2) For the industry classification as in Table 2, we adopted the classification standard established by the Taiwan Stock Exchange. In fact, a great number of big companies diversify their business into various operation items. We did not take this diversification factor into consideration.

In addition, the following suggestions are expected to be of interest to future researchers. (1) The ETR calculated in this study is on a yearly basis. Future study may explore the long-term tax burdens by calculating three-year moving average or five-year moving average ETRs to eliminate cyclical fluctuations. (2) While our research sample includes listed companies only, future study can use samples made up of the OTC (Over-the-Counter) companies as well as the listed companies.

Since our research models and empirical results can be used as a comparative basis, this study has implications for tax policy researchers, who are of interest to investigate the effects of the integrated income tax system adopted in Taiwan since 1998. Under the new system, the business income tax paid at the corporate level can be used to offset the shareholders' individual income tax. Shareholders should include gross dividend income (including both the value of dividend distributed and the associated tax credit) in their assessable income. If an individual shareholder is at a marginal tax rate higher than the corporate income tax rate, he or she will then pay extra tax. On the other hand, if an individual shareholder is at a marginal tax rate lower than the corporate income tax rate, he or she will then get a tax refund. Hence, in the new system, the business income tax functions as a withholding vehicle for individual income tax, and the tax preferences enjoyed at the “corporate” level are of no substantive benefit to the shareholders. Therefore, we anticipate that the impact of R&D on ETR will mitigate after the implementation of the integrated income tax system, because the R&D tax credit is a tax preference at the “corporate” level. Analogously, we also predict that the association between SIZE and ETR will lessen because of the lower motivation to trim down taxes at the corporate level. If future studies provide empirical evidence that ETR and SIZE are not correlated after the new tax system, which is different from our findings, then the integrated income tax system does contribute to promoting tax equity, one of the reasons that the government claimed for that tax reform. Moreover, unlike the old tax system in which only 80% of the corporate dividend income was tax exempt, dividends going to corporate shareholders after 1997 are 100% exempt from the business income tax (the

\[
\frac{1}{T} \sum_{t=1}^{T} e_t^2 x_t x_t' + \frac{1}{T} \sum_{t=1}^{T} W_{m(t)}(\tau) \sum_{t-T+1}^{T} (t, e_t, x_t' e_x e_{t-\tau} + x_t e_x e_{t-\tau} x'_{t-\tau}) , \quad \text{where} \quad x_t = (x_{t1}, x_{t2}, \ldots, x_{tk})
\]

standing for the values of the explanatory variables for the \( t \)th observation, \( T \) is the sample size, \( e_t \) is the residuals obtained from OLS, and \( W_{m(t)} = 1 - \tau / m(t) \) is the weight (Andrews, 1991).
imputation tax credit will be passed to individual shareholders). Consequently, we also conjecture that the tax burden will be even lower for those companies with more long-term equity investment or with more subsidiaries. While providing our study as a comparative basis for upcoming studies, we look forward to empirical evidence to examine the above conjectures and clarify how the integrated income tax system influences the tax equity in Taiwan.

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REFERENCES
Omer, T. C., K. H. Molloy and D. A. Ziebart. 1993. An Investigation of the Firm


台灣上市公司有效稅率決定因素之研究

劉啟群
國立台灣大學會計系教授
林世銘
國立台灣大學會計系副教授
黃德芬
國立東華大學會計系助理教授

摘要：現有文獻經常藉由有效稅率之高低與分配情形，衡量租稅制度之良窳或作為評估租稅改革成效之指標。為鼓勵特定產業或投資活動，政府經常制定各項租稅優惠，導致營利事業所得稅之名目稅率(法定之最高稅率)與有效稅率(企業實質繳納之稅率)產生差異，進而導致不同產業之間與不同企業規模之間的有效稅率存有極大差異，造成租稅負擔不公平之現象。由於有效稅率與名目稅率發生差異之原因繁多，許多財經與會計學者試圖找出有效稅率之決定因素，此類型之研究可進一步釐清稅負差異之各種原因，對於政府之賦稅政策極具參考價值。

我國現行所得稅法規定營利事業所得稅之最高稅率為 25%，但歷年來為獎勵投資、促進產業升級、振興經濟發展等政策目的，通過促進產業升級條例與科學工業園區設置管理條例等法律，訂定五年免稅、稅額抵減等許多租稅減免措施，這些租稅優惠一向造成受獎勵企業與未受獎勵企業租稅負擔不均之不公平現象。民國 87 年實施兩稅合一制度後，未來營利事業所繳納之營利事業所得稅，將可由股東扣抵個人綜合所得稅；另外，為彌補實施兩稅合一後造成的稅收損失，因而規定對營利事業未分配盈餘加徵 10%營利事業所得稅。兩稅合一之實施，除了消除營利事業所得稅與個人綜合所得稅重複課稅之現象以外，是否能夠降低企業稅負不均的情況，而使各種產業、各種規模之企業較能在相同的立足點上公平競爭，也是吾人評估兩稅合一制度施行成果的重要指標。

我國探討有效稅率之研究尚屬萌芽階段，國內文獻大都採用單變量（企業規模）的分析方法，忽略了有效稅率亦受企業個體特徵（如財務結構、獲利能力、投資活動等）之影響，因此可能含有遺漏變數之誤差
而導致參數估計存在偏誤及不一致性。根據國外近期文獻及考量我國特殊之稅制環境後，本文採用公司規模、公司財務槓桿、資本密集度、存貨密集度、研究發展支出、董監事持股比例、獲利能力、長期股權投資、控制子公司之數目等九個解釋變數，作為分析企業租稅負擔的決定因素。其中，前七個因素係參考自現有文獻，而後兩個因素之採用則源於民國 86 年我國公私法增訂關係企業專章，基於關係企業亦是企業租稅規劃重要手段之一，故本文亦分析企業長期股權投資及母子公司結構對企業租稅負擔之影響。

本文旨在藉由實證分析探討兩稅合一實施前我國企業租稅負擔之差異情況及其決定因素，為將來評估兩稅合一是否具有促進稅制公平之效果預作準備。換言之，本文之研究議題具有持續性，不但有助於了解兩稅合一實施前之企業稅負情形，也可作為未來進一步研究之比較基礎。

國外早期文獻多數集中在兩個對立假說的檢驗。政治成本假說主張大型企業受監督管制的程度（例如被政府查帳之機會）高於小型企業，故公司規模愈大，所承受的政治成本（例如租稅負擔）愈高。另外，政治權力假說則主張大型企業有較多資源從事政治遊說，聘任專業人才從事租稅規劃，以最佳節稅方式從事營運，故公司規模愈大則稅負愈輕，亦即政治權力愈大。Zimmerman(1983)發現美國前 50 大公司之有效稅率顯著高於其他公司，但產業間則呈現迥異結果，天然資源產業符合政治成本假說；而貿易業則符合政治權力假說。


相對於眾說紛紜之國外文獻，我國財政部賦稅改革委員會專題報告（周添城等，民國 78 年）指出，服務業之有效稅率最高，工業次之，農
業最低。不但工業部門所獲之租稅優惠較高於服務業，大型企業及公司組織企業亦獲得較大的租稅優惠。基於租稅中立原則，該報告建議有關單位應審慎檢討稅法之各種租稅優惠措施。林世銘與楊朝旭（民國 83 年）研究台灣上市公司有效稅率與公司規模、產業別及稅制變化之關係，實證證據符合政治權力假說；而各產業之租稅負擔也顯著不同；但在民國 75 年稅制改革實施加值型營業稅後，大型企業之有效稅率已較先前為高。

在採用多變量的研究方面，Stickney and McGee(1982)發現高財務槓桿、高資本密集及從事天然資源開採之公司有較低之有效稅率；而國外營運比重及公司規模對公司規模對有效稅率無重大影響。Gupta and Newberry(1997)的實證結果顯示實施租稅革新法案之前，符合政治成本假說；而在法案實施之後，則符合政治權力假說，顯示租稅革新法案加重了租稅扭曲。在公司個體特徵方面，高資本密集公司的有效稅率較低；高資產報酬率公司的有效稅率較高；財務槓桿雖然有效稅率呈顯著關係，但影響方向隨有效稅率衡量方式之不同而異。另外，稅制改變後，公司有效稅率提高；且稅制結構變動也影響到公司個體特徵變數與有效稅率之關係。

我國營利事業只要課稅所得在十萬元以上，即適用 25%之最高邊際稅率，所以邊際稅率的差異極為有限，因而本文之有效稅率係採平均稅率的定義，即所得稅費用／繼續營業部門稅前財務所得。至於解釋變數的選取係根據國內外文獻及我國現行所得稅法及相關法規。其中，公司規模與租稅負擔之關係早為學者所關切，依據政治權力假說與政治成本假說，本研究並不預設公司規模對有效稅率的影響方向。在企業個體特徵方面，本文選用與公司之投資決策及融資決策攸關的變數作為解釋變數。因為公司各種投資標的所適用之稅法優惠措施互異，本研究援引以往文獻並參酌「促進產業升級條例」之相關規定，推論如下：其他條件不變下，資本密集度愈高之公司，愈能適用相關法令而享有愈多的投資抵減與加速折舊，故有效稅率愈低；而存貨密集度愈高之公司，享有的投資抵減較少，其有效稅率較高；研究發展費用比率愈高之公司，享有愈高的投資抵減，有效稅率愈低。就擁有較多長期股權投資之公司而言，由於實施兩稅合一之前，被投資公司所發放之股利可享有 80%免稅之優惠，故轉投資愈多之公司其實質租稅負擔愈低。此外，母子公司比較容易利用關係企業價格移轉、盈虧互抵等交易之安排遂行降低賦稅之目的，使其有效稅率較其他企業為低。至於融資決策方面，在累進稅率之所得税制度下，由於舉債之利息費用可以抵稅，因此舉債額度相對較高之公司其有效稅率可能較低，此即利息費用之稅盾利益。另外，即使無
累進稅率時，公司之財務槓桿程度仍會影響有效稅率。此乃因舉債融資所產生之所得必須先償付利息，故所得稅費用及課稅基礎皆小於股權融資的情況，由於真分數的性質，舉債融資下之有效稅率將低於股權融資下之有效稅率。由於所得稅費用為計算有效稅率之分子，當其他條件不變時，公司獲利能力愈高代表課稅所得愈高，從而有效稅率亦高，故進行實證測試時亦應控制獲利能力對有效稅率之影響。本文擬以稅前資產報酬率衡量公司之獲利能力；另外，董監事持股比率傳達了董監事（內部人）對公司經營前景之預期，持股比例愈高表示內部人對公司獲利前景樂觀，故文中亦以董監事持股比率作為公司未來獲利能力之代理變數。另外，總體租稅環境的變遷也影響公司之租稅負擔。民國 75 年營利事業所得稅率自 30% 降至 25%，直接降低公司的實質稅負；但該年同時實施加值型營業稅制使稅基擴大，故不預設該年租稅制改變對有效稅率之影響方向。但為檢視結構變遷對租稅負擔產生的影響，本文另將樣本區分割為三個子期間進行統計分析。再者，由於政府在國家經濟發展各階段重點扶植之產業不同，促進產業升級條例中有關股東投資稅額抵減與五年免稅之租稅優惠，並非一體適用於所有產業，從而形成產業間租稅負擔的人為扭曲。故有效稅率可能隨產業之不同而異。

本研究樣本為民國 70 年至 85 年上市公司連續 16 年之財務報表數據，構成所謂的棋盤式資料（longitudinal data 或 panel data）。利用固定效果模型（fixed effects model）或隨機效果模型（random effects model）來控制抽樣單位（公司）的異質性以及期間異質性（年度）對因變數的影響，可避免遺漏異質性造成統計模型之估計偏誤。文中分別以整個期間和三個子期間就上述兩種模型進行比較，經由誤差平方和的 F 統計量檢定，結果皆拒絕公司異質效果全為零的虛無假設，同時亦拒絕各期間效果全為零的虛無假設。換言之，OLS 模型將會產生遺漏變數偏誤。此外，利用 Hausman test 比較隨機效果模型與固定效果模型時，本文發現固定效果模型具一致性，因此本文捨去隨機效果模型的迴歸結果。另外，本文亦將上述包括公司效果與時間效果之二元固定效果模型，修正為控制產業效果與時間效果之固定效果模型，以探討產業效果。為顧及計量模型的周密性，本文研究亦採用 White (1980) 及 Newey and West (1987) 所提出的敏感性分析。經實證分析與討論後，結論如下：(1) 民國 70 年至 85 年間，全體上市公司歷史之平均有效稅率為 14.1%，低於法定最高稅率的 25%。其中以造紙業及電子業之租稅負擔最低；玻璃陶瓷業與百貨業之租稅負擔最高。顯見租稅優惠措施確實造成產業間資源配置的扭曲，違反租稅中立
原則；從另一個角度觀之，此現象亦表示租稅獎勵措施對企業租稅負擔
具有顯著之影響。(2)企業之租稅負擔與其規模有關。在控制產業效果之
後，大體而言，公司規模愈大，其有效稅率愈低，符合政治權力假設之
預期。(3)企業之租稅負擔與其個體特徵變數有關。研究發展費用愈高之
公司，其實質租稅負擔愈輕，顯示投資抵減具一定成效；而企業之融資
決策對稅負具有顯著之負向影響，顯示存在有利利息分數效果。其次，
就資產組合決策而言，存貨比例較高之公司，其有效稅率較高，原因在
於存貨並未享有特別之租稅優惠；再者，就長期股權投資而言，公司握
有越多的長期股權投資及轉投資子公司較多者，具有較高的節稅效果。
(4)民國 75 年實施的加值型營業稅以及調降營利事業所得稅稅率，使企
業租稅負擔之決定因素產生結構性之變化，亦即經過該年的稅制改革
後，上市公司的租稅負擔反而普遍較民國 75 年之提高，顯示加值型營
業稅制度確有擴大稅基之作用；但規模較大的上市公司之租稅負擔仍較
小型上市公司為低，符合政治權力假設之預期。(5)不同計量方法所獲之
參數估計值及檢定結果大致相同，顯示本研究之實證證據具有穩健性。

依本研究實證結果，企業之租稅負擔與企業個體特徵及所處之產業
有關。倘租稅改革以落實租稅中立及租稅公平為目標，則稅法應取消對
特定產業或產業之租稅優惠，例如，取消對重要科技事業之免稅優惠。
倘租稅改革除考慮公平因素外，尚須配合產業發展政策，則應全面檢討
配套措施，權衡「產業發展」及「租稅公平」之得失利弊，而本文之實
證結果或可作為擬定配套措施之參考。例如，本文發現 R&D 對有效稅率
存在有顯著負向影響，因此提高 R&D 之租稅優惠有達成鼓勵企業從事 R&D
之作用；但其配套措施則可將目前兩稅合一制度下公司對投資股利收入
100% 免稅之規定，酌予降低為 90% 或回到從前僅 80% 免稅之規定，以避免
企業間藉交叉持股規避租稅負或避免企業大量舉債購買股票而產生利息費
用以減少課稅所得，而股利收入卻又免稅之不公平現象。至於研究限制
則包括下列幾點：(1) 因資料取得困難，本研究並未考慮企業國外投資
行為對有效稅率之影響。(2)本研究係以台灣證券交易所的產業分類為
準。目前許多公司進行多角化經營，被分類為同產業的公司其營業範圍
可能不甚相同，本研究並未考慮將此種公司進行重分類，此為限制之二。

對於日後從事相關研究者，本文有下列幾點建議：(1) 本研究以一年
期有效稅率為分析對象，後續研究可考慮採用三年期或五年期之有效稅
率為分析對象，以克服所得稅時間差異之影響，探討企業長期實質租稅
負擔。(2) 本研究之研究對象僅及於上市公司，後續研究可採討影響上櫃
公司及其他公司租稅負擔之因素。(3) 兩稅合一實施後，未來研究者可利
用本文為基礎，繼續探討兩稅合一租稅改革之效果。基於「兩稅合一後
公司之租税減免利益不及於個人股東」，本文預期在兩稅合一之後解釋變數 R&D 對有效稅率之影響將會降低。同理，本文也預期兩稅合一之後，大公司不必再汲汲於利用政治影響力降低公司之租稅負，因此未來公司規模對有效稅率的負向影響可望降低。如果未來之實證結果顯示公司規模與有效稅率之高低無關，即為支持兩稅合一能促進租稅公平的重要證據。此外在實施兩稅合一之後，公司收到被投資公司所發放之股利，從舊稅制 80%免稅改變為可享有 100%之免稅優惠，可能鼓勵企業擴大舉債進行轉投資，而在股利所得免稅且舉債之利息費用又可以減少其他課稅所得的新稅制下，本文也預期兩稅合一之後，長期股權投資及子公司數目愈多的公司（轉投資愈多之公司），其租稅負擔將比兩稅合一之前更有降低。後續研究可以本文為基礎，探討兩稅合一之租稅改革是否有上述預期之影響。

關鍵詞：公司有效稅率、租稅政策、租稅優惠、棋盤式資料、固定效果模型
The Efficiency of Investors’ Use of Quarterly Earnings Information in the Taiwan Stock Exchange*

TsingZai C.Wu a, †
National Cheng Kung University
Ya Yi Chao b
Kun Shan University of Technology

Abstract: In this study, we used firms listed in the Taiwan Stock Exchange (TaiEx) from 1992 to 1998 to examine the extent to which investors used quarterly earnings information. Specifically, we investigated relationships between cumulative abnormal residuals (CAR) and current quarterly standardized unexpected earnings (SUE) along with their four lagged values. Evidence from this study showed that large-firm investors in the TaiEx used quarterly information that was reflected in the time-series properties of earnings (lagged SUEs by the 1st and 4th periods). Nevertheless, they under-estimated the influence of $SUE_{t-1}$ and over-estimated that of $SUR_{t-4}$. For the small-firm group, however, no significant evidence from the stock market illustrates that investors used seasonal earnings information. The efficiency in using quarterly information for small-firm investors could be improved. We also found that investors in the TaiEx used quarterly information more efficiently during the bull market period (1996-1998) than during the bear market (1994-1995). Investors of electronics-related (high-tech) firms showed better efficiency in using quarterly information. Our results also indicated that the quarterly earnings forecasting model used by investors in the TaiEx is likely to be the seasonal random walk model without trend.

Key Words: Quarterly Earnings, Time-Series Correlations, Naïve Model, Information Content

I. INTRODUCTION

Investors always pay attention to their investment returns. Among all the factors determining stock price, the future earning power of a firm might be the most important

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† Corresponding author. E-mail: tsingzai@mail.ncku.edu.tw
A firm’s future earning power can be estimated from historical accounting earnings through different forecast models (the **predictive value** of earnings). In addition, the historical accounting earnings can also provide information for investors to revise their expectations about the future earning power of the firm (the **feedback value** of earnings). And the current stock prices are affected accordingly. Therefore, the relationship between accounting earnings and stock prices has been one of the most important issues for accounting researchers. Many studies document that investors’ unexpected earnings affect stock prices.¹

If the stock market were efficient,² earnings information would be fully reflected in stock prices around its announcement date. However, many market-based studies (e.g. Bernard and Thomas 1989; Freeman and Tse 1989, among others) indicate that, in general, stock prices in the U.S. market did not immediately and completely respond to quarterly earnings information when it was announced. Most firms’ abnormal returns, after the earnings announcement dates, continued up until at least the next quarter. Namely, there exists the phenomenon of “**post earnings announcement drift**”. Following this line of reasoning, one could use current quarterly earnings to predict future abnormal returns, and therefore future stock prices. Such a phenomenon cannot be explained by the risk premium. Some researchers (e.g. Bernard and Thomas 1990; Ball and Bartov 1996, among others) argued that such a phenomenon meant investors could not completely understand the time-series characteristics of quarterly earnings. Therefore, studying how investors forecast earnings is critically important in explaining the information content of quarterly earnings.

Studies on quarterly earnings for firms listed in the Taiwan Stock Exchange (**TaiEx** hereafter) can be classified into two areas. The first area examines different time series models of quarterly earnings and compares the predictive ability of those models. Liao (1993) and Wang (1992) indicated that using different ARIMA models for respective firms, in general, forecasted quarterly earnings better than using simplified models.³ Thus far, no study in Taiwan has discussed how investors actually forecast quarterly earnings. Accounting and finance literature illustrates that quarterly earnings have information content, and that analysts forecast quarterly earnings better than time series models do. Since financial analysts in Taiwan make only annual earnings forecasts (and only for major firms), the exploration of time-series models for quarterly earnings has value for investors.

The second area of quarterly earnings research is to examine their information content. Using the seasonal random walk model (Lin 1996) and ARIMA models (Lin 1994) as the forecast models for quarterly earnings, both of them concluded that the quarterly earnings had information content. However, Chiao (1995) used the seasonal random walk model for quarterly earnings and found that quarterly earnings had no information content. The empirical results of information content for quarterly earnings

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² According to the definition of Fama (1970), all public information is fully reflected in stock price for a semi-strong efficient market. Fama proved that U.S. stock markets are at least semi-strongly efficient.

³ The three simplified models are Foster (1977) ARIMA(1,0,0)(0,1,0) model, Griffin-Watts (1977) ARIMA(0,1,1)(0,1,1) model and Brown-Rozeff (1979) ARIMA(1,0,0)(0,1,1) model respectively.
are thus controversial in Taiwan. Such controversy might be due to several methodology issues. First, when these researchers examined the information content of quarterly earnings, they assumed the types of investors’ forecasting models in advance and did not investigate how investors actually forecasted future quarterly earnings. Since the assumed models were different, their results could hardly be consistent with one another. Second, the controversy might also be due to omitting some different relevant variables in these studies. Third, these information content studies on quarterly earnings were all confined to relatively short windows. Their windows for accumulating abnormal returns did not last for more than one month after the earnings announcement dates. From these relatively short-window studies, it is obviously hard to determine whether quarterly earnings have information content or not.

So far, studies of quarterly earnings in the TaiEx have focused either on examining the earnings forecast models or on investigating the information content of quarterly earnings given the investors’ earnings forecast models. The purpose of this study is to examine investors’ earnings forecast models based on market reactions to quarterly earnings announcements without giving the forecast models ex ante. In addition, this study re-examines the controversial results of the information content of earnings for the TaiEx in prior studies and explores the possible reasons for this controversy.

Clarifying the above issues can help us to understand the extent to which investors use quarterly earnings information. If analyses on cumulative abnormal returns around quarterly earnings announcement dates show that investors completely understand the time-series characteristics of quarterly earnings, then the investors’ use of quarterly earnings information can be said to be efficient. On the other hand, if analyses show that investors were not fully aware of the time-series properties of quarterly earnings, we can infer that investors could not fully take advantage of quarterly earnings information.

Empirical results of this study show that the announcement of quarterly earnings has information content for large firms in the TaiEx. Large-firm investors use information contained in the time-series models of quarterly earnings. However, they under-estimate the influence of $\text{SUE}_{t-1}$ and over-estimate that of $\text{SUR}_{t-4}$. Small-firm investors, on the other hand, do not use current or lagged quarterly earnings information at all. In addition, the quarterly earnings forecasting model used by investors in the TaiEx is likely to be the seasonal random walk model without trend. Current quarterly earnings have been found to have information content for all industries, electronic or not. However, investors most fail to understand the time-series characteristics of quarterly earnings for the non-electronic industries. On the other hand, electronic-industry investors could partially identify the time-series property of quarterly earnings. Even in the most attractive electronic industry, investors could not use the time-series properties of quarterly earnings information efficiently. If we could help investors to understand the quarterly earnings information better so that they could use the earnings information more, the efficiency of the TaiEx could be improved.

The rest of the paper is organized as follows: In section 2, we review the literature of quarterly earnings studies. The time series behavior of quarterly earnings and the

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4 The longest window is in Lin (1994), which is formed 20 days before, and 30 days after, the quarterly earnings announcement dates.
development of hypothesis for investors’ forecast models of quarterly earnings are discussed in section 3. Research design and empirical results are shown in section 4 and 5. In section 6, we make some additional sensitive analyses. Section 7 contains the conclusions of this study.

II. LITERATURE REVIEW

Using the seasonal random walk model (the Naïve Model) as the forecast model of quarterly earnings, Freeman and Tse (1989) and Bernard and Thomas (1989) both found that stocks' cumulative abnormal returns after earnings were announced continued up to the next earnings announcement dates at least. That is, if there was a positive (negative) unexpected income in quarter $t$, a positive (negative) stock abnormal return would persist around the earnings announcement date for the quarter $t+1$. Namely, the current quarter's earnings can predict future stock prices. This phenomenon cannot be explained from the standpoint of risk premium.

The subsequent study of Bernard and Thomas (1990) argued that such a phenomenon was at least partially due to investors not fully recognizing the time-series behavior of quarterly earnings. Therefore, when current quarterly earnings were announced, such earnings information could not be fully reflected in the current stock price. This led to the stock price not reaching its real value. Since the unexpected quarterly earnings of the current quarter were highly correlated with those of the following quarters, the part of the unexpected earnings that could not be reflected in the price in the current quarter would be realized in the following quarters. This means investors could not use the information of current quarterly earnings to revise their earnings estimation for the next quarter because the time-series behavior of quarterly earnings were not fully understood.

Empirical results of Bernard and Thomas (1990) also indicated that stock prices in the U. S. market could not fully respond to the implications of current earnings for the future earnings (i.e., the time series characteristics of the quarterly earnings were not recognized). The price only reflected the earnings forecasted by the seasonal random walk model. Therefore, the investors' quarterly earnings forecast model is the naïve model. However, extending the research of Bernard and Thomas (1990), Ball and Bartov (1996) showed that investors in fact had recognized part of the time-series characteristics of quarterly earnings. The investors' quarterly earnings forecast model was not a naïve model. Investors just under-estimated the time-series characteristics of quarterly earnings. We outline the forecast models for quarterly earnings in the next section.

III. QUARTERLY EARNINGS SERIES AND EARNINGS EXPECTATION MODELLS

Time-Series Characteristics of Quarterly Earnings

It has been documented that the seasonal differences of different lags for quarterly earnings are significantly correlated. The pattern of such correlations can be classified

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5 Earnings of the same quarter in the last year are used as the expected earnings of the current quarter.
into two types: (1) Seasonal differences of earnings for the current quarter and those for the following three quarters are positively correlated. That is, a change in earnings for quarter \( t \) tends to be followed by progressively smaller changes in earnings, although in the same sign, for quarters \( t+1, t+2, \) and \( t+3 \). (2) Seasonal differences of earnings for the current quarter \( t \) and those for the quarter \( t+4 \) are negatively correlated. Therefore, a portion of the seasonal differences in quarter \( t \) is reversed in quarter \( t+4 \). Seasonal differences for more than five quarters are uncorrelated. Studies in the TaiEx also have documented that quarterly earnings series have autocorrelations between the current quarter and the following four quarters (Lin 1994; Liao 1994).

To depict the time-series behavior of quarterly earnings in the TaiEx, we illustrate the autocorrelations for seasonally differenced EPS from our sample firms in Table 1. Different methods of calculating quarterly seasonal difference variables (\( \Delta Q_t = Q_t - Q_{t-4} \)) were used. Notice that quarterly seasonal differences represent the forecast error for the quarter \( t \) from a seasonal random walk model without a trend or with a linear trend. The first variable (seasonal differences) in Table 1 shows that, consistent with prior studies, the autocorrelations in the first three lags are positive and declining. The sample means of autocorrelations are 0.6031, 0.2407, and 0.0424 for lag 1, 2, and 3 respectively. There is a negative autocorrelation at the fourth lag (mean = \(-0.20684\)). For comparison purposes, we employ two other variables, the standardized unexpected earnings (SUE) and the scaled decile of SUE, to calculate autocorrelations. The numerator of SUE is equal to the actual earnings of the current quarter minus earnings expectation based on seasonal random walk (i.e. earnings in the fourth quarter in the prior year). The denominator is the standard deviation of the numerator measure of unexpected earnings over the estimation period for each firm. To reduce the influence of outliers, SUE is transformed to its cross-sectional decile rank among sample firms. The decile ranks are then scaled to the range of \([0, 1]\) by using \((\text{decile} - 1) / 9\). The correlations of different lags for seasonal differences, SUE, and scaled SUE decile are shown in Table 1.

Table 1 shows that patterns of time-series autocorrelation for the seasonally-differenced earnings, the standardized unexpected earnings (SUE), and the scaled unexpected earnings decile (SUE decile) are very similar. This means the methods whereby quarterly earnings are differenced do not significantly affect the autocorrelation. In order to reduce the influence of outliers on autocorrelations, both Bernard and Thomas (1990) and Ball and Bartov (1996) used the SUE decile, instead of SUE itself, as the variable of seasonally differenced earnings. We also used the SUE decile in this paper for comparison purposes. Consistent with their papers, empirical evidence from the TaiEx in this study shows that: (1) the signs of autocorrelation for seasonally differenced earnings at the first four lags are (+, +, +, −); (2) the autocorrelations at the first three lags are positive but declining; (3) there is a negative autocorrelation at the fourth lag. However, the autocorrelation between current \( \Delta Q_t \) and \( \Delta Q_{t-4} \) is very weak compared to other lags.

---

6 Since \( \Delta Q_t = Q_t - Q_{t-4} \), and \( \Delta Q_{t-4} = Q_{t-4} - Q_{t-8} \). Therefore, \( \Delta Q_t = Q_t - \Delta Q_{t-4} - Q_{t-8} \). The above equation means seasonal difference of earnings for quarter \( t \) (\( \Delta Q_t \)) and that of quarter \( t-4 \) (\( \Delta Q_{t-4} \)) are negatively correlated.
Table 1 Autocorrelations in Seasonally Differenced Earnings, SUE and SUE Deciles

<table>
<thead>
<tr>
<th>Lag</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\Delta Q_t : \Delta Q_{t-1})</td>
<td>(\Delta Q_t : \Delta Q_{t-2})</td>
<td>(\Delta Q_t : \Delta Q_{t-3})</td>
<td>(\Delta Q_t : \Delta Q_{t-4})</td>
</tr>
<tr>
<td>Seasonally differenced earnings (a)</td>
<td>0.6031</td>
<td>0.2407</td>
<td>0.0424</td>
<td>-0.2069</td>
</tr>
<tr>
<td>SUE (b)</td>
<td>0.5999</td>
<td>0.2932</td>
<td>0.0302</td>
<td>-0.1935</td>
</tr>
<tr>
<td>SUE decile (c)</td>
<td>0.6258</td>
<td>0.3331</td>
<td>0.0587</td>
<td>-0.1795</td>
</tr>
</tbody>
</table>

\(\Delta Q_t\) = seasonally differenced earnings = current quarterly earnings – earnings relative to the equivalent quarter in the prior year

\(\text{SUE} = (\text{actual quarterly earnings} – \text{quarterly earnings expectation}) / \text{standard deviation. Quarterly earnings expectation is the earnings relative to the equivalent quarter in the prior year. Standard deviation for each firm is that of unexpected earnings during the research period.}\)

\(\text{The scaled unexpected earnings decile (SUE decile) is SUE transformed into its cross-sectional decile rank, then scaled to range over the interval [0, 1] by (decile – 1) / 9.}\)

Investors’ Expectation Models of Quarterly Earnings

Empirical results from NYSE-AMEX (Bernard and Thomas 1990; Ball and Bartov 1996, among others) and the TaiEx (Table 1 of this study) show that current quarter’s SUE is correlated with four lagged SUEs in the \((+, +, +, -)\) sign pattern respectively, as derived by Bernard and Thomas (1990). Therefore, current quarter’s \(SUE_t\) can be approximated as a linear function of the four lagged SUEs as following:

\[
SUE_t = b_1 + b_2 SUE_{t-1} + b_3 SUE_{t-2} + b_4 SUE_{t-3} + e_t
\]

where, \(b_1, b_2, b_3 > 0\) and \(b_4 < 0\). The \(e_t\) is white noise that is identically independently distributed in \(N(1,0)\). To investigate how investors use quarterly earnings information, we employ the following regression (with minor modification in notations) suggested by Ball and Bartov (1996):

\[
CAR_t = k + a_1 SUE_t + a_2 SUE_{t-1} + a_3 SUE_{t-2} + a_4 SUE_{t-3} + a_5 SUE_{t-4} + u_t
\]

It is well documented in accounting literature that unexpected quarterly earnings have information content. Therefore, the current \(SUE_t\) announced around the event window in which Cumulated Abnormal Return (\(CAR_t\)) was accumulated is included in Equation (2). To examine the extent to which investors use the prior four quarters’ earnings, regression (2) also includes four lagged SUEs. The estimated coefficients on the lagged SUEs in regression (2) allow us to infer the extent to which investors in the market incorporate the information in the prior four quarters’ earnings when forming earnings expectations for the current quarter. That is, through examining the magnitudes and significance of the coefficients \(a_1, a_2, a_3, a_4\) in equation (2) (whose theoretical values can be calculated from \(b_1, b_2, b_3, \) and \(b_4\) in equation (1)), one can infer the extent to which investors use quarterly information as if they were aware of the formation of current earnings in equation (1). In drawing these inferences, we follow the reasoning process developed by Ball and Bartov (1996), and previously Bernard and Thomas (1990), described below.

Three competing situations for investors’ expectations model of quarterly earnings
in the stock market can be hypothesized:

**Hypothesis I:** Investors completely understand the time-series model of quarterly earnings and fully use such information in the market.

The first hypothesis assumes that investors in the market fully are aware of the process generating current \( SUE_t \) and make full use of the past earnings information for the four lagged SUEs. That is, the market acts as if equation (1) best describes the time-series process of earnings. Since the current \( SUE_t \) can be estimated by the past four lagged SUEs, the price reaction (\( CAR_t \)) becomes a function of the earnings estimation errors (\( \varepsilon_t \)) alone:

\[
CAR_t = \alpha + \beta \varepsilon_t + \epsilon_t
\]  
(3)

where, \( \beta > 0 \) and \( \epsilon_t \) is white noise. Substituting \( \varepsilon_t \) in equation (1) into equation (3), we then get:

\[
CAR_t = \alpha^* + \beta SUE_t - b_1 \beta SUE_{t-1} - b_2 \beta SUE_{t-2} - b_3 \beta SUE_{t-3} - b_4 \beta SUE_{t-4} + \epsilon_t
\]  
(4)

where \( \alpha^* = \alpha - b_0 \beta \). If investors were fully aware that equation (1) is the best model describing the time-series process of earnings, they could then predict both the signs and the magnitudes of the coefficients of lagged SUEs in equation (2). Since the sign pattern of serial correlations between the current \( SUE_t \) and the four lagged SUEs in equation (1) is (+, +, +, −), the predicted signs of the coefficients for \( CAR_t \) on the four lagged SUEs in equation (4), controlling for the \( SUE_t \), will exhibit a (−, −, −, +) sign pattern. The predicted magnitudes of the coefficients on \( SUE_{t-1}, SUE_{t-2}, SUE_{t-3}, \) and \( SUE_{t-4} \) in equation (4) are \( -b_1 \beta, -b_2 \beta, -b_3 \beta, -b_4 \beta \) respectively. And \( \beta \) can be estimated as the coefficient (\( a_0 \)) of current \( SUE_t \) in equation (2). We can estimate \( b_1, b_2, b_3, \) and \( b_4 \) from the coefficients for \( SUE_t \) regressed on the four lagged SUEs in regression (1). Therefore, if the partial correlation coefficients between \( CAR_t \) and \( SUE_t \) through \( SUE_{t-3} \) are significantly positive and in decline, and the partial correlation between \( CAR_t \) and \( SUE_{t-4} \) is significantly negative, we can infer that investors fully recognize the time-series characteristics of quarterly earnings.

**Hypothesis II:** Investors use a naïve seasonal differenced random walk model to forecast seasonal earnings in the stock market. They are totally unaware of any serial correlations in SUEs.

The second hypothesis assumes that investors use a ‘naïve’ seasonal differenced random walk model, being totally unaware of the serial correlations in SUEs. (Note that seasonal differenced \( SUE_t \) represents the forecast error for a seasonal random-walk forecast model without or with a linear trend.) In this case, investors’ expectation model of quarterly earnings is:

\[
Q_t = Q_{t-4} + \text{error}_t
\]  
(5)

\[
(Q_t - Q_{t-4})/\sigma(Q_t - Q_{t-4}) = SUE_t = \epsilon_t
\]  
(6)
If one substitutes $\varepsilon_t$ in equation (6) into equation (3), then the price reaction ($CAR_t$) of the quarterly earnings announcement in quarter $t$ is:

$$CAR_t = \alpha + \beta SUE_t + \varepsilon_t \quad (7)$$

Therefore, if investors used the naïve seasonal random walk model to forecast quarterly earnings, then price would react only to current earnings changes and ignores the predictability of all past quarters’ earnings. In such a case, the predicted coefficients on lagged $SUE_{t-1}$, $SUE_{t-2}$, $SUE_{t-3}$, and $SUE_{t-4}$ in regression (2) would all be zero. This means, if the $CAR_t$ and all four lagged SUEs were independent, when controlling for the current $SUE_t$, one can infer that investors would be completely unaware of the time-series characteristics of quarterly earnings. They just use the naïve seasonal random walk model to forecast quarterly earnings.

**Hypothesis III:** Investors are not fully aware of the time-series characteristics of quarterly earnings and use the incomplete seasonal earnings forecast model when trading stocks.

The third hypothesis assumes that investors in the stock market use the incomplete earnings expectations model because of insufficient knowledge of the time-series characteristics of quarterly earnings. In this case, some partial correlations between $CAR_t$ and $SUE_{t-1}$ through $SUE_{t-4}$ in equation (2) will not be significant. In other words, if some partial correlations between $CAR_t$ and lagged $SUE_{t-1}$ through $SUE_{t-4}$, when controlling for the current $SUE_t$, were not all significant from zeros, we could infer that investors are not fully aware of the time-series characteristics of quarterly earnings. In addition, if investors systematically over (or under) estimated the magnitude of serial correlations in SUEs, then the predicted partial correlation coefficients between $CAR_t$ and the four lagged SUEs in Equation (2) would be larger (or smaller) in absolute value than those predicted in the fully-informed hypothesis in Equation (1).

It has been documented that the relationship between earnings and stock price is conditioned by firm size (see Atiase 1985; Freeman 1987, among others). The size effect should be controlled in order to obtain true relationships between variables of interest in information content studies. In order to examine the size effect on the price-earnings relationship, we further classify our full sample into large/small-firm sub-groups based on market values of firms at the beginning of the year in our analyses.

**IV. RESEARCH DESIGN**

**Sample Selection and Study Period**

The TaiEx experienced dramatic shifts from 1988 to 1991, but became more stable after the fourth quarter of 1991. Therefore, we collected data from the first quarter of 1992. Since independent variables of this study are seasonal differences of quarterly earnings up to the fourth lag, our testing period starts from the first quarter of 1994 and ends with the third quarter of 1998. Our sample includes 216 listed firms in the TaiEx with 3560 observations in total. Firms qualified for our sample are those:

(a) listed in the TaiEx on or before January 1, 1992; and
(b) with complete data of after-tax earnings per share and operation income per share for each quarter from the first quarter of 1992 to the third quarter of 1998; and
(c) with complete stock price data from the first quarter of 1992 to the third quarter of 1998; and
(d) have not been re-classified by the TaiEx as a registrant required to be traded in full margin during our study period; and
(e) not in financial or broking industries because of specialization in financial reporting in these industries.

Variable Definitions

1) Standardized unexpected EPS: \( SUER^R \)

\[
SUER^R_t = \frac{Q_t - Q_{t-4}}{\sigma(Q_t - Q_{t-4})}
\]

where, \( Q_t \) is after-tax earnings per share (EPS) adjusted for stock dividend and seasoned equity offerings.

\( SUER^R \) is the standardized seasonal difference of quarterly EPS. It is defined as the seasonal difference of quarterly EPS divided by the standard error of those seasonal differences during the study period (1Q1994 to 3Q1998) for each firm. We transform \( SUER^R \) into its cross-sectional ascending decile rank for all firms in the quarter \( t \), and then scale it into the range of [0.1] by the formula \( SUE = (SUER^R \text{ decile} - 1) / 9 \). As such \( SUE = 1 \) represents the portfolio which has the best news, and \( SUE = 0 \) represents the portfolio which has the worst news. This definition is consistent with Bernard and Thomas (1990) and Ball and Bartov (1996).

2) Standardized unexpected operating income per share: \( OSUE^R \)

\[
OSUE^R_t = \frac{OQ_t - OQ_{t-4}}{\sigma(OQ_t - OQ_{t-4})}
\]

To examine the effect of non-recurring income, we employ before-tax operating income per share adjusted for stock dividend and seasoned equity offerings (\( OQ_t \)) to construct standardized unexpected earnings.

\( OSUE^R \) is the standardized unexpected operating income per share. It is defined as the seasonal difference of quarterly operating income per share divided by the standard error of those seasonal differences during the study period (1Q1994 to 3Q1998) for each firm. We transform \( OSUE^R \) into its cross-sectional ascending decile rank for all firms in the quarter \( t \), and then scale it into the range of [0.1] by the formula \( OSUE = (OSUE^R \text{ decile} - 1) / 9 \). As such \( OSUE = 1 \) represents the portfolio which has the best news, and \( SUE = 0 \) represents the portfolio which has the worst news.

3) Abnormal return and cumulative abnormal return

We use the market model to compute the abnormal returns.\(^7\) The event day is the quarterly earnings announcement date. It is documented that abnormal returns around the

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\(^7\) We also constructed “size-adjusted” abnormal returns, where daily abnormal returns were the differences between daily returns of firm \( i \) and the returns for TaiEx firms of the same size decile based on market values of equity at the beginning of the year as used by Bernard and Thomas (1990) and Ball and Bartov (1996). Results (not reported here) were similar.
quarterly earnings announcement date in the TaiEx generally started from five days before to five days after the event date. Therefore, we take the window period of [-5,5] (eleven days in total) around the quarterly earnings announcement date to accumulate abnormal returns.

According to the market model, the return of each stock ($R_{it}$) is a linear function of the return of market portfolio ($R_{mt}$):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$$

where, $R_{it}$ is the actual return at date $t$ of firm $i$. $R_{mt}$ is the volume-weighted average index of the TaiEx. $\epsilon_{it} \sim N(0, \sigma^2)$. The abnormal return at date $t$ in the forecast period for firm $i$, $AR_{it}$, is estimated as follows:

$$AR_{it} = \hat{R}_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

where, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the estimated regression coefficients of firm $i$ according to the market model for the estimation period (100 days before the event window). The cumulated abnormal returns ($CAR_{it}$) for firm $i$ in the event window [-5, +5] is:

$$CAR_{it} = \sum_{t=-5}^{5} AR_{it}$$

Data Sources

All data needed in this paper, including after-tax EPS, operating income per share, market values of the firm, stock return, and the quarterly earnings announcement date, are available in the Taiwan Economic Journal (TEJ) database. The announcement date of quarterly earnings in the TEJ was taken from the earliest date the news appeared in the Economic Daily News, The Business Times and other professional newspapers in Taiwan.

V. EMPIRICAL RESULTS

Time-Series Characteristics of Quarterly Earnings

To find partial correlations between SUEs for firms in the TaiEx, we regress current $SUE_t$ on lagged SUEs from lag 1 through lag 4 as in Eq. (1). The regression coefficients represent partial serial correlations between the dependent variable ($SUE_t$) and independent variables (lagged SUEs). Empirical results reported in Table 2 indicate that the regression coefficients on SUEs lagged 1, 2, and 4 are in (+, +, -) sign pattern and are significantly different from zero (two-tail $t$ test). However, the regression coefficient of SUE lagged 3 is negative and not significantly differently from zero. The magnitudes of regression coefficients of SUEs from lag 1 to lag 4 are decreasing as expected. Regressions for large/small-firm subgroups show a similar (+, +, 0, -) pattern in the TaiEx. These results are partly inconsistent with the results of Bernard and Thomas (1990) and Ball and Bartov (1996) in NYSE-AMEX data. They found that the current SUE had significant partial correlations with all four lagged SUEs in the sign pattern of (+, +, +, -).

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8 See Lin (1994) and Lin (1996). During the event window [-5,5] for quarterly earnings announcements, our empirical results (not presented here) showed that abnormal returns were significant from zero on every day except day $t-4$ and day $t-1$. 

---
In order to investigate the effect of non-recurrent items in earnings, we conduct another regression based on operating income, the OSUEs, in Table 3. Table 3 reports empirical results of regressing current $OSUE_t$ on four lagged OSUEs from lag 1 through lag 4. Results in Table 3 are similar to those in Table 2. The insignificant partial serial correlation between current $SU_et$ and $SU_et-3$ is not due to the non-recurrent items in net income. Table 3 shows that partial serial correlations represented by regression coefficients between current $OSUE_t$ and OSUEs lagged 1, 2, and 4 are in (+, +, −) sign pattern and significant. The partial serial correlation between $OSUE_t$ and $OSUE_t-3$ is also positive and insignificant. Regression coefficients of OSUEs from lag 1 to lag 4 are decreasing as expected. Regressions on large/small-firm subgroups show a similar (+, +, 0, −) pattern in the TaiEx.

**Table 2 Serial Correlations between Current SUE and Lagged SUEs**

\[
SUE_t = b_0 + b_1 SUE_{t-1} + b_2 SUE_{t-2} + b_3 SUE_{t-3} + b_4 SUE_{t-4}\]

<table>
<thead>
<tr>
<th>Panel A: Full sample</th>
<th>$b_0$</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$b_3$</th>
<th>$b_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(p value)</td>
<td>0.27</td>
<td>0.66</td>
<td>0.03</td>
<td>−0.01</td>
<td>−0.22</td>
<td>0.49</td>
<td>841</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: By firm size</th>
<th>$b_0$</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$b_3$</th>
<th>$b_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large firms (p value)</td>
<td>0.27</td>
<td>0.66</td>
<td>0.03</td>
<td>0.01</td>
<td>−0.24</td>
<td>0.48</td>
<td>277</td>
</tr>
<tr>
<td>Small firms (p value)</td>
<td>0.29</td>
<td>0.64</td>
<td>0.07</td>
<td>−0.01</td>
<td>−0.24</td>
<td>0.50</td>
<td>287</td>
</tr>
</tbody>
</table>

a: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.
b: We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms within the bottom 1/3 of market values.

The partial serial correlation between current $SU_et$ and $SU_et-3$ is insignificant in the TaiEx. Such a result is inconsistent with that in NYSE-AMEX. This insignificance, however, is a natural consequence of a weak autocorrelation between $SU_et$ and $SU_et-3$ in the TaiEx as shown in Table 1. The special partial serial correlations between current $SU_et$ and lagged SUEs in the TaiEx, i.e., the (+, +, 0, −) pattern, will change the sign pattern for lagged SUEs in a regression of $CAR_t$ on current and lagged SUEs.

Being constructed with an after-tax earnings per share, the SUE figure contains all the earnings information of a firm. Therefore, current SUE can be better explained by the lag 1 through lag 4 SUE ($adj. R^2 = 0.49$). Nevertheless, lagged SUEs regression coefficients ($0.66, 0.03, −0.01, −0.22$) are less significant when compared with that of lagged OSUE, meaning weaker serial correlations for SUE. On the other hand, OSUE is constructed from the operation income per share. It only contains recurring operational information. So, lag 1 through lag 4 OSUEs explain current OSUE less ($adj. R^2 = 0.31 < 0.49$). Since non-operational information and non-recurrent items are excluded, the
pattern of the OSUE time series is more stable than that of the SUE time series. Therefore, regression coefficients of $OSUE_t$ on lagged OSUEs ($0.39, 0.15, 0.03, -0.35$) are more significant, indicating that OSUEs serial correlations are stronger than SUEs.

**Table 3 Serial Correlations between Current OSUE and Lagged OSUEs**

$$OSUE_t = b'_0 + b'_1 OSUE_{t-1} + b'_2 OSUE_{t-3} + b'_3 OSUE_{t-4}$$

<table>
<thead>
<tr>
<th></th>
<th>$b'_0$</th>
<th>$b'_1$</th>
<th>$b'_2$</th>
<th>$b'_3$</th>
<th>$b'_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.18)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>394</td>
</tr>
<tr>
<td>Panel B: By firm size$^b$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Large firms</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.20)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>134</td>
</tr>
<tr>
<td>Small firms$^b$</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.18)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>155</td>
</tr>
</tbody>
</table>

a: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

b: We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms with the bottom 1/3 of market values.

**Incorporating Lagged SUEs into Investors’ Expectation Models**

To investigate how efficiently investors in the TaiEx use quarterly information, we regress $CAR_t$ on current and lagged unexpected quarterly earnings. Table 4 shows the empirical results of cumulated abnormal returns over 11 days ($CAR_{[-5,5]}$) regressed on current SUE and four lagged SUEs. First, we examine the partial correlation between $CAR_t$ and current $SUE_t$. As indicated in Section I, empirical results are controversial concerning the role of current unexpected quarterly earnings on the stock prices in the TaiEx. Our results in Table 4 show that the regression coefficient ($a_0$) of current $SUE_t$ is significantly and positively correlated with $CAR_t$ for the full sample and the large-firm subgroup. This means, generally, that the current quarterly earnings announcements do have information content in the TaiEx. Such a conclusion is consistent with that of Lin (1994) and Lin (1996). For the small-firm subgroup, however, current quarterly earnings announcements are not fully reflected in stock prices. Investors do not use the quarterly earnings information for small firms. This result is the same as Chiao (1995). Therefore, the reason why empirical results about information content of quarterly earnings are controversial in the TaiEx may be due to the size effect.

Second, we examine the partial correlations (i.e. regression coefficients) between $CAR_t$ and lagged SUEs in Table 4. As indicated in Section III, if investors fully used the information for generating current $SUE_t$ through four lagged SUEs in Equation (1) and their serial correlations are in the $(+, +, +, -)$ sign pattern, then the regression coefficients of $CAR_t$ regressed on four lagged SUEs, controlling for the current $SUE_t$, would be in the $(-, -, -, +)$ pattern. In addition, the regression coefficients between current $SUE_t$ and lagged SUEs in Equation (1) can be used to estimate the partial
correlation coefficients between \( CAR \), and lagged SUEs in equation (4). For firms in the TaiEx, since the current \( SUE_t \) is correlated with four lagged SUEs in the pattern of \((+, +, 0, -)\) as indicated in Table 3, the regression coefficients of \( CAR_t \) on lagged SUEs, \textit{controlling for the current SUE}_t, shall be in the \((- , - , 0 , +)\) pattern if investors fully use quarterly earnings information.

Table 4 reports our empirical results in the TaiEx. For the full sample, it shows that the only lagged SUE having a significant partial correlation with \( CAR_t \) is the fourth lagged \( SUE_{t-4} \) after controlling for the current \( SUE_t \). Of course, the current \( SUE_t \) itself also has a significant and positive partial correlation with \( CAR_t \) as has been indicated previously. The regression coefficients for SUEs lagged 1 and lagged 2 are not significantly correlated with the current \( CAR_t \). The regression coefficients of \( CAR_t \) on lagged SUEs, \textit{controlling for the current SUE}_t, are in the \((0, 0, 0, +)\) sign pattern for the full sample. Empirical results in Table 4 enable us to conclude that investors in the TaiEx do not fully use past quarterly earnings information in predicting the current \( SUE_t \). For the full sample, investors in the TaiEx use only \( SUE_{t-4} \) to predict current \( SUE_t \). Our results support Hypothesis III that investors in the TaiEx use the incomplete seasonal earnings forecast model.

### Table 4: Relationships between CAR and SUEs around Quarterly Earnings Announcement Dates

\[
CAR_t = k + a_0 SUE_t + a_1 SUE_{t-1} + a_2 SUE_{t-2} + a_3 SUE_{t-3} + a_4 SUE_{t-4} \quad a
\]

<table>
<thead>
<tr>
<th>Expected sign</th>
<th>( k )</th>
<th>( a_0 )</th>
<th>( a_1 )</th>
<th>( a_2 )</th>
<th>( a_3 )</th>
<th>( a_4 )</th>
<th>adj. ( R^2 )</th>
<th>( F \text{ value} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>(-2.42)</td>
<td>1.44</td>
<td>(-0.69)</td>
<td>0.91</td>
<td>(-0.11)</td>
<td>1.49</td>
<td>0.91%</td>
<td>7.42</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.19)</td>
<td>(0.11)</td>
<td>(0.84)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Panel B: By firm size ( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
</tr>
<tr>
<td>Large firms ( b )</td>
<td>(-2.85)</td>
<td>2.28</td>
<td>(-1.16)</td>
<td>0.94</td>
<td>(-0.70)</td>
<td>2.71</td>
<td>3.33%</td>
<td>8.99</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.08)</td>
<td>(0.16)</td>
<td>(0.29)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Small firms ( b )</td>
<td>(-1.38)</td>
<td>0.51</td>
<td>(-1.24)</td>
<td>1.53</td>
<td>(-0.23)</td>
<td>(-0.01)</td>
<td>0.01%</td>
<td>0.56</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.01)</td>
<td>(0.58)</td>
<td>(0.24)</td>
<td>(0.15)</td>
<td>(0.83)</td>
<td>(0.99)</td>
<td>(0.72)</td>
<td></td>
</tr>
</tbody>
</table>

\( a \): In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

\( b \): We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms within the bottom 1/3 of market values.

In order to investigate the effect of size on our conclusion, we further divide the full sample into large/small-firm subgroups. For the large-firm subgroup, since the coefficients of lagged SUEs are in the \((+, 0, 0, -)\) pattern when regressing with current \( SUE_t \), the regression coefficients of \( CAR_t \) on lagged SUEs, \textit{controlling for the current SUE}_t, will be in the \((- , 0, 0 , +)\) sign pattern. Panel B of Table 4 shows that \( CAR_t \) is correlated positively with the current \( SUE_t \), negatively with \( SUE_{t-1} \) and positively with \( SUE_{t-3} \) and \( SUE_{t-4} \).
We then analyze the relationships between regression coefficients in Table 4 and those in Table 2. From panel B in Table 4, we can get $-a_1/a_0 = 0.51$, and $-a_4/a_0 = -1.18$. These should be the estimated serial correlations between current $SUE_t$, lagged $SUE_{t-1}$ and $SUE_{t-4}$. (See Section III). Referring to panel B in Table 2, however, the real serial correlation between current $SUE_t$, lagged $SUE_{t-1}$ and $SUE_{t-4}$ are 0.66 and $-0.24$. This means investors in the TaiEx recognize the serial correlation between current $SUE_t$, lagged $SUE_{t-1}$ and $SUE_{t-4}$ for large firms. However, they underestimate $SUE_{t-1}$ and over-estimate $SUE_{t-4}$ when using them to predict the current $SUE_t$. Investors in large firms in the TaiEx still use an incomplete seasonal earnings forecasting model, although they are much more efficient users of quarterly earnings information than those in the small-firm subgroup.

For the small-firm subgroup in the TaiEx, the information content of the current quarterly earnings announcement is not fully reflected in the stock price. This is shown in panel B of Table 4. Investors in small firms totally ignore the quarterly earnings information. This may be due to following reasons. First, since the relative value of a small firm in the market is not heavy, investors may not notice the quarterly earnings information for small firms. Second, big stockholders and directors of small firms generally own a substantial portion of the shares. As insiders, they are not sensitive to the quarterly earnings announcements. Finally, the variation in quarterly earnings for small firms is generally large and the quarterly earnings of small firms is seldom sustained over time. Thus, investors seldom use quarterly information. Therefore, quarterly earnings for small firms do not have information content. Empirical results shown in Table 4 indicate that the F-value is insignificant and the adjusted R² is extremely low for small firms in the TaiEx.

Our results show that investors in large firms in the TaiEx recognize the serial correlations of SUEs. Nevertheless, they over-estimate the fourth lagged $SUE_{t-4}$, and under-estimate the first lagged $SUE_{t-1}$. They use the incomplete expectation model of quarterly earnings, which is not a naïve model. However, there is no statistical evidence showing that investors of small firms in the TaiEx use the quarterly earnings information. Our empirical results in the TaiEx are not totally consistent with the results of Ball and Bartov (1996) in NYSE-AMEX. They regressed $\text{CAR} [-2, 0]$ on the current $SUE_t$ and four lagged SUEs. The regression coefficients of all four lagged SUEs are significant regardless of firm size. However, the serial correlations estimated by these regression coefficients of Equation (2) are not the same with those obtained from the real serial correlation of Equation (1). Serial correlations for SUEs lagged by 1, 2, (3), 4 periods are under- (over-) estimated. This indicates that investors in the U.S. stock market use the correct expectations model for quarterly earnings, but systematically over-(or under-) estimate the magnitude of serial correlations in SUEs. Compared with investors in the NYSE-AMEX, we found that small-firm investors in the TaiEx did not use quarterly earnings information as efficiently as investors in the U. S. stock market.

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9 Their event window is from two days before to the day of the quarterly earning announcement, being 3 days in total.
Incorporating Lagged OSUEs into Investors’ Expectation Models

In order to examine the effect of non-recurrent earnings on the stock prices around the quarterly earnings announcement dates, we re-run equation (2) which regresses $CAR_t$ on current and lagged unexpected quarterly operating income. Table 5 reports the empirical results of (CAR $[-5, 5]$) regressed on four lagged OSUEs after controlling for the current $OSUE_t$. Note that, after excluding non-recurrent earnings, OSUEs do not include all quarterly information. The results in Table 5 for the full sample show that none of the regression coefficients of OSUEs are significant. This means investors in the TaiEx do not generally use quarterly operating income information, even for the current quarterly operating income. Such results are embarrassing. However, after breaking down the full sample into large/small-firm subgroups, we can see that the regression coefficient ($a'_4$) of the current $OSUE_t$ is positively significant and that ($a'_4$) of $OSUE_{t-4}$ is negatively significant for large firms. The current operating income announcement does have information content for large firms in the TaiEx. However, no statistical evidence shows that current operating income information is reflected in the stock price for a small firm. Investors in small firms generally do not use the current operating income information. Shares of small firms in the TaiEx are substantially owned by big stockholders and directors. As insiders, they may not be sensitive to the current operating income information.

Table 5 Relationships between CAR and OSUEs around Quarterly Earnings Announcement Dates

<table>
<thead>
<tr>
<th>Expected sign</th>
<th>$k'$</th>
<th>$\alpha_0'$</th>
<th>$\alpha_1'$</th>
<th>$\alpha_2'$</th>
<th>$\alpha_3'$</th>
<th>$\alpha_4'$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>$-1.65$</td>
<td>$0.35$</td>
<td>$0.54$</td>
<td>$0.04$</td>
<td>$0.06$</td>
<td>$0.47$</td>
<td>$0.07%$</td>
<td>$1.46$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.00)$</td>
<td>$(0.37)$</td>
<td>$(0.19)$</td>
<td>$(0.91)$</td>
<td>$(0.87)$</td>
<td>$(0.24)$</td>
<td>$(0.20)$</td>
<td></td>
</tr>
<tr>
<td>Panel B: By firm size $^b$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large firms</td>
<td>$-1.64$</td>
<td>$1.18$</td>
<td>$0.42$</td>
<td>$0.27$</td>
<td>$-0.95$</td>
<td>$0.98$</td>
<td>$0.33%$</td>
<td>$1.89$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.00)$</td>
<td>$(0.05)$</td>
<td>$(0.50)$</td>
<td>$(0.67)$</td>
<td>$(0.14)$</td>
<td>$(0.07)$</td>
<td>$(0.09)$</td>
<td></td>
</tr>
<tr>
<td>Small firms $^b$</td>
<td>$-1.51$</td>
<td>$-0.29$</td>
<td>$1.32$</td>
<td>$-0.34$</td>
<td>$-0.10$</td>
<td>$0.23$</td>
<td>$0.00%$</td>
<td>$0.57$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.01)$</td>
<td>$(0.72)$</td>
<td>$(0.10)$</td>
<td>$(0.67)$</td>
<td>$(0.89)$</td>
<td>$(0.77)$</td>
<td>$(0.72)$</td>
<td></td>
</tr>
</tbody>
</table>

$^a$: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

$^b$: We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms within the bottom 1/3 of market values.

Do investors in the TaiEx use past quarterly operating income in predicting current operating income? Let us examine the regression coefficients of lagged OSUEs in Table 5. Since current $OSUE_t$ is correlated with the four lagged OSUEs in the sign pattern of $(+, +, 0, -)$ for firms in the TaiEx (Table 3), the regression coefficients of $CAR_t$ on these four
lagged OSUEs should be in the pattern of \((-, -, 0, +)\) after controlling for the current OSUEt. The empirical results in Table 5 show that the only significant coefficient of lagged OSUEs is that of OSUEt-4 for large firms and that it is positively significant as expected. Investors in large firms in the TaiEx do use OSUEt-4 to forecast current quarterly operating income. However, OSUEt-1 and OSUEt-2 are not used by investors. These results support Hypothesis III. Investors use the incomplete quarterly operating income forecast model for large firms in the TaiEx. As for small firms, our results show that the overall fitness of the regression model is lacking and that the F tests are not significant either. Investors in small firms do not generally use current or lagged quarterly operating income information. The quality of earnings for a small firm is generally a serious concern for investors.

VI. SENSITIVITY ANALYSES

Additional Tests for Different Periods

The condition of the stock market (bull market or bear market) affects investors’ price expectation, the quantity of information, and the transmission speed of information. The price/earnings ratio of a firm is higher in a bull market than in a bear market. Also, market risk cannot be diversified away by investors. The condition of the stock market materially influences stock prices, and may also affect tests of market-related relationships such as testing the investors’ use of earnings.

![Figure 1 Value-Weighted Stock Price Index of TaiEx (1990 to 1998)](image)

Based on the history of the TaiEx Index from 1990 to 1998 (Figure 1), we found that the stock market in Taiwan experienced a sharp slump during 1990 and weak ups and downs during 1991. As indicated in Section IV, the four quarters lag requires us to begin
the original earnings data from the first quarter of 1992, although the differenced data in regressions are available from 1994. We then divide our study period (1994 - 1998) into the bear market period (1994 - 1995) and the bull market period (1996 - 1998) to test if the investors’ use of quarterly earnings is different in these two sub-periods. Table 6 and Table 7 report our results.

Panel B in Table 6 shows the results of current $SUE_t$ regressed on past $SUE$’s in two different market periods. Apparently, current quarterly earnings can be better predicted with past earnings in the bull market. The regression coefficients of the four lagged $SUE$’s are in the $(+, +, 0, -)$ sign pattern for the bull market period (1996-1998), whereas they are in the $(+, 0, 0, -)$ pattern for the bear market period (1994-1995) in the TaiEx. $SUR_{t-2}$ does not have a predictive ability for the current $SUE_t$ in the bear market.

### Table 6 Serial Correlations between Current $SUE$ and Lagged $SUE$s: Different Periods

$$SUE_t = b_0 + b_1 SUE_{t-1} + b_2 SUE_{t-2} + b_3 SUE_{t-3} + b_4 SUE_{t-4}$$

<table>
<thead>
<tr>
<th>$b_0$</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$b_3$</th>
<th>$b_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>0.27</td>
<td>0.66</td>
<td>0.03</td>
<td>-0.01</td>
<td>-0.22</td>
<td>0.49</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.07)</td>
<td>(0.40)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Panel B: By period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994－1995</td>
<td>0.23</td>
<td>0.69</td>
<td>0.03</td>
<td>0.02</td>
<td>-0.20</td>
<td>0.51</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.34)</td>
<td>(0.48)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>1996－1998</td>
<td>0.31</td>
<td>0.61</td>
<td>0.05</td>
<td>-0.01</td>
<td>-0.24</td>
<td>0.44</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.03)</td>
<td>(0.11)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

$^a$: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

### Table 7 Relationships between CAR and $SUE$s around Quarterly Earnings Announcement Dates: Different Periods

$$CAR_t = k + a_0 SUE_t + a_1 SUE_{t-1} + a_2 SUE_{t-2} + a_3 SUE_{t-3} + a_4 SUE_{t-4}$$

<table>
<thead>
<tr>
<th>$k$</th>
<th>$a_0$</th>
<th>$a_1$</th>
<th>$a_2$</th>
<th>$a_3$</th>
<th>$a_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>-2.42</td>
<td>1.44</td>
<td>-0.69</td>
<td>0.91</td>
<td>-0.11</td>
<td>1.49</td>
<td>0.91%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.19)</td>
<td>(0.11)</td>
<td>(0.84)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Panel B: By period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994－1995</td>
<td>0.73</td>
<td>-0.94</td>
<td>-0.36</td>
<td>0.58</td>
<td>-0.94</td>
<td>0.14</td>
<td>0.19%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.07)</td>
<td>(0.18)</td>
<td>(0.65)</td>
<td>(0.46)</td>
<td>(0.21)</td>
<td>(0.82)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>1996－1998</td>
<td>-4.36</td>
<td>2.85</td>
<td>-0.57</td>
<td>0.93</td>
<td>0.26</td>
<td>2.45</td>
<td>2.92%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.39)</td>
<td>(0.17)</td>
<td>(0.71)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

$^a$: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.
Do investors use quarterly information more efficiently in the bull market? Table 7 reports empirical results that regressed $CAR_t$ on SUEs in the TaiEx. According to panel B of Table 7, we cannot find statistical evidence that investors use quarterly earnings information in the bear market. None of the regression coefficients for SUEs is significant in the bear market (1994-1995). The F test is not significant. The overall fitness of the regression model in the bear market is lacking too (Adjusted $R^2 = 0.19\%$). On the other hand, investors in the bull market use quarterly information more efficiently. During the period of 1996-1998 (bull market), the regression coefficient ($a_0$) of current SUEs is significantly positive. This means investors do use the quarterly earnings information. The controversial results concerning the information content of quarterly earnings announcements in the TaiEx may also be due to different market conditions (bull or bear).

If investors fully recognized the time series characteristics of quarterly earnings in the TaiEx, the regression coefficients for $CAR_t$ regressed on lagged SUEs would be in the pattern of $(-, -, 0, +)$. As expected, in the bull market, empirical results show that only the coefficient of the fourth lagged $SUE_{t-4}$ is significantly positive. All other lagged SUEs are insignificant. Investors only used the incomplete seasonal earnings forecast model during the period of 1996-1998 (bull market).

Speaking overall, during the bear market period of 1994-1995, no statistical evidence shows that investors used quarterly earnings information. However, the market became a bull market from 1996 on, when empirical results show that investors recognized time-series characteristic of $SUE_{t-4}$ and used it to forecast current quarterly earnings. Investors in the TaiEx use the incomplete quarterly earnings forecast model during the 1996-1998 (bull market). This may have been due to the sharp increase in the number of professional investment institutions from 1996 on. In addition, foreign investors (individual or institutional) were allowed to invest in the TaiEx from February 1996 and the investment limit was raised to 30%. Because institutional investors generally pay more attention to fundamental analyses in forming their investment strategy, they are better able to recognize the time series correlation characteristics of quarterly earnings and reflect this in stock prices. Nevertheless, the time-series correlation characteristics of quarterly earnings are not fully reflected in the stock prices. Thus, the efficiency of investors using quarterly information could be improved in the TaiEx.

**Additional Tests for Different Industries**

Due to the international industries division and government encouragement, electronics-related (high-tech) industries (including the electrical machinery industry, the electrical appliance and cable industry, and the electronic industry) in Taiwan have developed quickly since the nineties. The high growth and high profitability of electronics-related firms attracted investors’ attention. The trading volumes of electronics-related firms are about 50% - 70% of the TaiEx market. Do investors in the electronics-related firms use the quarterly earnings information more efficiently than those investing in non-electronic firms? That is, is the information content of quarterly earnings announcements different between industries? Do investors using the time-series characteristics of quarterly earnings differ between industries? To address this issue, we

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10 See the news reported on the Taiwan’s *China Times* (October 22, 1997).
re-tests models (1) and (2) by classifying our full sample into the electronics-related industries (47 firms) and the non-electronic industries. The empirical results are shown in Table 8 and Table 9.

Panel B of Table 8 reports results of current $SUE_t$ regressed on four lagged SUEs by industry. The empirical results show that the regression coefficients of lagged SUEs are in the $(+, +, 0, -)$ sign pattern for non-electronic industries. This means the current $SUE_t$ is significantly correlated with SUEs lagged by 1, 2, and 4 quarters for non-electronic industries. However, the regression coefficients of lagged SUE are in the $(+, 0, 0, -)$ sign pattern for the electronic-related industries. The regression coefficients of $SUE_{t-2}$ and $SUE_{t-3}$ are both negative and insignificant. The current $SUE_t$ is significantly correlated with SUE lagged by 1 and 4 quarters for electronics-related industries. The business cycles of electronics-related industries are generally shorter than those of non-electronics industries, so the correlations between quarterly earnings are weaker for electronics-related industries.

Table 8 Serial Correlations between Current SUE and Lagged SUEs: Different Industries

<table>
<thead>
<tr>
<th></th>
<th>$b_0$</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$b_3$</th>
<th>$b_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>0.27</td>
<td>0.66</td>
<td>0.03</td>
<td>-0.01</td>
<td>-0.22</td>
<td>0.49</td>
<td>841</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.07)</td>
<td>(0.40)</td>
<td>(0.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel B: By industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic industry</td>
<td>0.20</td>
<td>0.80</td>
<td>-0.05</td>
<td>-0.07</td>
<td>-0.11</td>
<td>0.54</td>
<td>236</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.20)</td>
<td>(0.12)</td>
<td>(0.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-electronic industry</td>
<td>0.29</td>
<td>0.60</td>
<td>0.05</td>
<td>-0.01</td>
<td>-0.25</td>
<td>0.45</td>
<td>595</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.57)</td>
<td>(0.00)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

b. We combine the electric machinery industry, electric appliances and electric cable industry, and electronic industry of the full sample into the electronics-related industry; others belong to the non-electronics industry.

To examine the efficiency of investors’ use of quarterly earnings, we regress current $CAR_t$ on SUEs by industry (Panel B of Table 9). Empirical results show that the regression coefficients ($a_0$) of current $SUE_t$ are significantly positive for both electronics-related and non-electronic industries. The current quarterly earnings announcements do have information content in the TaiEx for both electronics-related and non-electronic industries.

For non-electronic industries, the current $SUE_t$ is correlated with four lagged SUEs in the pattern of $(+, +, 0, -)$, as indicated in Table 8. The regression coefficients of $CAR_t$ on lagged SUEs will be in the pattern of $(-, - , 0, +)$ after controlling for the current $SUE_t$. However, empirical results show that only the coefficient of the fourth lagged $SUE_{t-4}$ is significantly positive as expected (and over-estimated by the coefficient
analysis). The regression coefficients of $SUE_{t-1}$ and $SUE_{t-2}$ are not significant. Investors only use the fourth-lagged quarterly earnings in predicting current earnings for non-electronic industries. They ignore the first and second lagged earnings serial correlations in trading stocks. This result supports Hypothesis III. Investors in the TaiEx use the incomplete seasonal earnings forecast model for the non-electronic industry.

Table 9 Relationships between CAR and SUEs around Quarterly Earnings Announcement Dates: Different Industries

\[ CAR_t = k + a_0 SUE_t + a_1 SUE_{t-1} + a_2 SUE_{t-2} + a_3 SUE_{t-3} + a_4 SUE_{t-4} \]

<table>
<thead>
<tr>
<th>Expected sign</th>
<th>$k$</th>
<th>$a_0$</th>
<th>$a_1$</th>
<th>$a_2$</th>
<th>$a_3$</th>
<th>$a_4$</th>
<th>adj. $R^2$</th>
<th>$F$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>$-2.42$</td>
<td>$1.44$</td>
<td>$-0.69$</td>
<td>$0.91$</td>
<td>$-0.11$</td>
<td>$1.49$</td>
<td>$0.91%$</td>
<td>$7.42$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.00)$</td>
<td>$(0.00)$</td>
<td>$(0.19)$</td>
<td>$(0.11)$</td>
<td>$(0.84)$</td>
<td>$(0.00)$</td>
<td>$(0.00)$</td>
<td></td>
</tr>
<tr>
<td>Panel B: By industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic industry</td>
<td>$-0.61$</td>
<td>$7.94$</td>
<td>$-4.31$</td>
<td>$2.43$</td>
<td>$-0.85$</td>
<td>$12.59$</td>
<td>$7.48%$</td>
<td>$12.59$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.00)$</td>
<td>$(0.00)$</td>
<td>$(0.00)$</td>
<td>$(0.10)$</td>
<td>$(0.57)$</td>
<td>$(0.03)$</td>
<td>$(0.00)$</td>
<td></td>
</tr>
<tr>
<td>Non-electronic industry</td>
<td>$-2.74$</td>
<td>$1.53$</td>
<td>$0.14$</td>
<td>$0.79$</td>
<td>$0.08$</td>
<td>$1.24$</td>
<td>$1.00%$</td>
<td>$7.09$</td>
</tr>
<tr>
<td>(p value)</td>
<td>$(0.00)$</td>
<td>$(0.00)$</td>
<td>$(0.81)$</td>
<td>$(0.20)$</td>
<td>$(0.89)$</td>
<td>$(0.02)$</td>
<td>$(0.00)$</td>
<td></td>
</tr>
</tbody>
</table>

a: In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

b. We combine the electric machinery industry, electric appliances and electric cable industry, and electronic industry of the full sample into the electronics-related industry; others belong to the non-electronic industry.

For the electronics-related industry, the current $SUE_t$ is correlated with four lagged SUEs in the pattern of $(+, 0, 0, -)$. Therefore, the regression coefficients of $CAR_t$ on four lagged SUEs will be in the pattern of $(-, 0, 0, +)$ after controlling for the current $SUE_t$. Our empirical results in panel B of Table 9 show that coefficients of the lagged $SUE_{t-1}$ and $SUE_{t-4}$ are significantly in the $(-, +)$ pattern as expected. Such results indicate that investors in electronics-related industries recognize the time-series characteristics of quarterly earnings and use the information to forecast quarterly earnings. We then examine whether investors over- (under-) estimate past earnings information. From Table 9(B), we can get $-a_1/a_0 = 0.54$, $-a_4/a_0 = -1.58$, which are the estimated serial correlations between current $SUE_t$, lagged $SUE_{t-1}$ and $SUE_{t-4}$. However, according to the Table 8(B), the real serial correlations between current $SUE_t$, lagged $SUE_{t-1}$ and $SUE_{t-4}$ are $0.80$ and $-0.11$. Although investors in electronics-related firms correctly recognize the serial correlations between current $SUE_t$ and lagged SUEs, they systematically under-estimate the effect of $SUE_{t-1}$ and over-estimate the effect of $SUE_{t-4}$. Our results support Hypothesis III. Investors in the TaiEx use the incomplete seasonal earnings forecast model, whether in electronics-related industries or not. Investors use quarterly earnings more efficiently in electronics-related industries than in non-electronic industries. Even in the electronics-related industries, investors do not completely use the quarterly earnings information (though their efficiency is better than that of non-electronic industries).
industries). The efficiency of using quarterly earnings in the TaiEx can generally be improved.

**Additional Tests for a Different Quarterly Earnings Forecast Model**

Some empirical studies use the seasonal differenced random walk *with trend* as the quarterly earnings forecast model. This might happen in a market where investors expected quarterly earnings growing (or shrinking) in a non-linear trend (Bernard and Thomas 1990: 312, note 4). In order to examine possible effects of using different forecast model on our conclusions, we make additional tests that employ the seasonal differenced random walk *with trend* model for firms announcing quarterly earnings in the TaiEx.

The method of computing the trend in this paper is same as that used by Bernard and Thomas (1990). We use the five years before our study period as the estimation period (1989-1993) for a firm to compute the average change in seasonal-differenced quarterly earnings. We then standardize this average change with the standard error of changes for that firm to form the trend of seasonal-differenced quarterly earnings. To calculate the new SUE, we subtract the trend from the seasonal-differenced quarterly earnings and transform it to its cross-sectional decile rank. We use this new SUE to re-test the hypotheses of this paper. Because such calculations need an additional five years’ quarterly earnings from 1989 in order to estimate the trend, our sample size is reduced by 101 firms. It now contains only 115 listed firms (with 19 quarters’ data each). The empirical results are as follows.

Compared to Table 2, the results in Table 10 show that serial correlations between current SUE and lagged SUEs, *without* or *with* trend, are similar. The explanation power of these two models is also similar (adjusted $R^2$ are 0.49 and 0.43 respectively). The difference is that the coefficients of the third lagged $SUE_{t-3}$ for the full sample and the small-firms sub-sample are significantly negative for SUEs *with* trend. They are insignificant for SUEs *without* trend. Such results might be due to the fact that small firms in the TaiEx generally have a higher operation risk. Therefore, for small firms, the reversion of earnings is a common occurrence.

In order to compare results for the inference on investors’ efficiency of using quarterly information by employing SUEs *with* and *without* trend, we re-run Equation (2) in Table 11. Comparing Table 4 with Table 11, we found that, for the full and small-firm samples, the use of SUEs *with* or *without* trend as independent variables on $CAR$, is very similar. There are significantly positive relationships between $CAR$, and the current $SUE_t$ and the fourth lagged $SUE_{t-4}$ for the full sample. However, no statistical evidence exists showing that small-firm investors use quarterly earnings information when trading stocks. For the large-firm subgroup, the results of Table 4 using SUEs *without* trend as independent variables for $CAR$, shows the pattern of $(-, 0, 0, +)$ for the four lagged SUEs. On the other hand, the results of Table 11 using new SUEs *with* trend show that the coefficients for the four lagged SUEs are in the $(0, 0, 0, +)$ pattern. The partial correlation between $CAR$, and $SUE_{t-2}$ is insignificant. The seasonal differenced $SUE_t$ represents forecast error for the quarter $i$ from a seasonal random walk *without* or *with* a linear trend. Our results imply that investors in the TaiEx use seasonal differenced random walk *without* trend, instead of *with* trend, as the quarterly earnings forecast model when trading
stocks. Non-linear earnings trend model is not supported by our empirical results.

Table 10 Serial Correlations between Current SUE and Lagged SUEs: Seasonal Random Walk with Trend Model.

\[
SUE_t = b_0 + b_1 SUE_{t-1} + b_2 SUE_{t-2} + b_3 SUE_{t-3} + b_4 SUE_{t-4} \]

<table>
<thead>
<tr>
<th>( b_0 )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_3 )</th>
<th>( b_4 )</th>
<th>( \text{Adj. } R^2 )</th>
<th>( F \text{ value} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>0.28</td>
<td>0.63</td>
<td>0.05</td>
<td>-0.04</td>
<td>-0.20</td>
<td>0.43</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.04)</td>
<td>(0.08)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Panel B: By firm size (^b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large firms</td>
<td>0.29</td>
<td>0.62</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.21</td>
<td>0.44</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.26)</td>
<td>(0.27)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Small firms (^b)</td>
<td>0.25</td>
<td>0.61</td>
<td>0.13</td>
<td>-0.08</td>
<td>-0.16</td>
<td>0.44</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.06)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

\(^a\): In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

\(^b\): We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms within the bottom 1/3 of market values.

Table 11 Relationships between CAR and SUEs around Quarterly Announcement Dates: A Seasonal Differenced Random Walk with Trend Model.

\[
CAR_i = k + a_0 SUE_t + a_1 SUE_{t-1} + a_2 SUE_{t-2} + a_3 SUE_{t-3} + a_4 SUE_{t-4} \]

<table>
<thead>
<tr>
<th>( k )</th>
<th>( a_0 )</th>
<th>( a_1 )</th>
<th>( a_2 )</th>
<th>( a_3 )</th>
<th>( a_4 )</th>
<th>( \text{Adj. } R^2 )</th>
<th>( F \text{ value} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Full sample</td>
<td>-2.81</td>
<td>1.91</td>
<td>-0.64</td>
<td>1.06</td>
<td>0.46</td>
<td>1.05</td>
<td>1.26%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.35)</td>
<td>(0.12)</td>
<td>(0.51)</td>
<td>(0.08)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Panel B: By firm size (^b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large firms</td>
<td>-2.77</td>
<td>2.76</td>
<td>-0.91</td>
<td>0.45</td>
<td>0.27</td>
<td>1.49</td>
<td>1.68%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.33)</td>
<td>(0.63)</td>
<td>(0.77)</td>
<td>(0.06)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Small firms (^b)</td>
<td>-2.63</td>
<td>0.62</td>
<td>-2.14</td>
<td>3.05</td>
<td>0.63</td>
<td>0.90</td>
<td>0.7%</td>
</tr>
<tr>
<td>(p value)</td>
<td>(0.01)</td>
<td>(0.58)</td>
<td>(0.24)</td>
<td>(0.15)</td>
<td>(0.83)</td>
<td>(0.99)</td>
<td>(0.10)</td>
</tr>
</tbody>
</table>

\(^a\): In order to avoid the effect of outliers in regression analyses, we drop observations with values more than three standard errors.

\(^b\): We divide all sample firms into three groups according to their market value at the beginning of the year. The large-firm group includes firms within the top 1/3 of market values; the small-firm group includes firms within the bottom 1/3 of market values.
VII. CONCLUSIONS

Our paper aims to examine the efficiency of investors’ use of quarterly earnings information in the TaiEx. We first investigate the serial correlations between the current SUE, and the four lagged SUEs to obtain their sign patterns. These sign patterns will be reversed in CAR, regressed on lagged SUEs after controlling for the current SUE. Examining the empirical sign patterns of lagged SUEs in the CAR regression will allow us to infer the extent to which investors use quarterly information. We also conduct several sensitivity analyses for our conclusions. Our empirical results are summarized in Table 12.

Speaking overall, the announcements of current quarterly earnings do have information content for large firms in the TaiEx. The quarterly earning forecast model for large firms includes past earnings lagged by periods 1 and 4. Investors use this information to trade stocks. Nevertheless, investors under-estimate the influence of $SUE_{t-1}$ and over-estimate that of $SUE_{t-4}$ when using them to predict the current SUE in trading stocks. On the other hand, though quarterly earnings for small firms in the TaiEx can be better predicted by past earnings lagged by periods 1, 2, and 4, no statistical evidence exists showing that small-firm investors use such information in trading stocks. The quarterly earnings announcements for small firms also do not have information content. The efficiency of small-firms investors in using quarterly earnings information can be much improved.

The above conclusions will not be altered by using a different quarterly earnings forecast model: the seasonal differenced random walk with trend. Our results indicate that the investors in the TaiEx use the seasonal differenced random walk without trend model to forecast quarterly earnings. The quarterly earnings growth (shrinkage) rate is not expected being non-linear in the eyes of investors.

We also found that investors in the TaiEx used quarterly information more efficiently during the bull market period (1996-1998). Many new professional investment institutions, such as mutual funds, have joined the TaiEx market since 1996. Foreign institutional investors have been allowed to invest in firms in the TaiEx by up to 30% since February 1996. Since these institutional investors generally pay more attention to fundamental analyses in forming their investment strategy, they are better able to recognize the time-series characteristics of quarterly earnings and reflect this in the on stock prices. Nevertheless, the serial correlations of quarterly earnings are not fully reflected in the stock prices, even in the bull market. Thus, the efficiency of investors’ use of quarterly information can still be improved.

Investors in electronics-related (high-tech) firms show better efficiency in using quarterly information. However, investors in non-electronic industries only use the fourth-lagged quarterly earnings in predicting current earnings. They ignore the first and second lagged earnings serial correlations in trading stocks. Their efficiency in using quarterly information can be improved. If investors can better recognize the time series characteristics of quarterly earnings and use this information more efficiently, the efficiency of the stock market can also be improved.
### Table 12 Summary of Empirical Results of This Study

<table>
<thead>
<tr>
<th>Lagged quarterly earnings or operating income</th>
<th>Inferences of empirical results</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_{UE_{t-1}}$ or $OS_{UE_{t-1}}$</td>
<td>The current $S_{UE_t}$ are significantly correlated with the lagged $S_{UE}$s by periods 1, 2, and 4 in the pattern of $(+, +, -)$ for large (and small) firms subgroups.</td>
</tr>
<tr>
<td>$S_{UE_{t-2}}$ or $OS_{UE_{t-2}}$</td>
<td></td>
</tr>
<tr>
<td>$S_{UE_{t-3}}$ or $OS_{UE_{t-3}}$</td>
<td></td>
</tr>
<tr>
<td>$S_{UE_{t-4}}$ or $OS_{UE_{t-4}}$</td>
<td></td>
</tr>
<tr>
<td>Time series of quarterly earnings ($S_{UE}$) [Eq. (1)]</td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>$+*<strong>$ b $+</strong>$</td>
</tr>
<tr>
<td>Large firms</td>
<td>$+<em><strong>$ $+$ $+$ $+</strong></em>$</td>
</tr>
<tr>
<td>Small firms</td>
<td>$+<em><strong>$ $+</strong>$ $-$ $+</em>**$</td>
</tr>
<tr>
<td>Time series of operating income ($OS_{UE}$) [Eq. (1)]</td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>$+<em><strong>$ $+</strong></em>$ $+$ $+***$</td>
</tr>
<tr>
<td>Large firms</td>
<td>$+<em><strong>$ $+</strong></em>$ $+$ $+***$</td>
</tr>
<tr>
<td>Small firms</td>
<td>$+<em><strong>$ $+</strong></em>$ $+$ $+***$</td>
</tr>
<tr>
<td>Correlations between $CAR_t$, current $S_{UE_t}$ and lagged $S_{UE}$s [Eq. (2)]</td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>$-(-)$ $+(-)$ $-(n.a.)$ $+***(+)$</td>
</tr>
<tr>
<td>Large firms</td>
<td>$-(-)$ $+(n.a.)$ $-(n.a.)$ $+***(+)$</td>
</tr>
<tr>
<td>Small firms</td>
<td>$-(-)$ $+(n.a.)$ $-(n.a.)$ $+(+)$</td>
</tr>
<tr>
<td>Correlations between $CAR_t$, current $OS_{UE_t}$ and lagged $OS_{UE}$s [Eq. (2)]</td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>$+(+)$ $-(+)$ $-(n.a.)$ $+(+)$</td>
</tr>
<tr>
<td>Large firms</td>
<td>$+(+)$ $-(n.a.)$ $+(+)$</td>
</tr>
<tr>
<td>Small firms</td>
<td>$+(+)$ $-(n.a.)$ $+(+)$</td>
</tr>
</tbody>
</table>

a: This table only shows signs and significances of regression coefficients (two-tail $t$ test).
b: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.1$
c: Sign in parentheses represents the theoretical inference for Eq. (2) from the time series model of quarterly earnings (operational gain or loss) in Eq. (1).
REFERENCE


投資人使用季盈餘資訊之效率：台灣上市公司之實證研究

吳清在
國立成功大學會計系副教授
趙雅儀
崑山科技大學會計系講師

摘要：對股票投資大眾而言，其所關心者莫過於購買股票所能賺取之投資報酬。在諸多影響股價之因素中，企業獲利能力通常最為投資人所重視，而此資訊可由財務報表中之會計盈餘獲得。經由會計盈餘資訊，引導投資人修正未來獲利能力之預期，使目前股票價格發生變動。故盈餘資訊之公佈與股價間之關連性向來是會計學者研究重點之一。國內外許多文獻皆發現在季盈餘宣告時，若實際季盈餘與投資人之預期盈餘有異，此種未預期盈餘（Unexpected Earnings）會影響股價，而使股票產生顯著之異常報酬。


國內目前在季盈餘之研究分為二方面。一方面為檢測季盈餘之時間數列模型及比較各種預測模式之優劣。如廖雲清(民82)及王麗君(民81)之研究，皆得到個別公司之ARIMA季盈餘預測模式優於精簡模式之實證結果。但對於投資人實際所使用之季盈餘時間數列預測模式之研究則付之闕如。由於季盈餘之宣告具資訊內涵，是故對投資人而言，現學界之資訊顯示分析師預測優於時間數列模式，但因國內目前僅有“年”盈餘之分析師預測(且非對所有公司皆作預測)，尚無“季”盈餘之分析師預測，故季盈餘時間數列預測模型探討之研究有其必要性。
另一方面之研究，則為直接檢測季盈餘宣告之資訊內涵。如林坤霖(民85)以季節性隨機漫步模式為盈餘預測模式，林惠美(民83)以 ARIMA 為盈餘預測模式，皆分別得到季盈餘之宣告有資訊內涵之結論。但喬慧雯(民84)同樣以季節性隨機漫步模式為盈餘預測模式，卻得出季盈餘之宣告無資訊內含之結論，因此國內關於季盈餘資訊內涵之實證結果並不一致。這種情形有可能是因為這些研究在檢測季盈餘之宣告之資訊內涵時，皆是事先假設投資人之盈餘預測模式，而無檢驗投資人實際所使用之季盈餘預測模式，假設不同，所得到之結果亦不盡一致，但亦有可能是遺漏其他重要變數所致。另外，前述有關季盈餘宣告資訊內涵之國內研究皆屬短天期之研究，其衡量累積異常報酬之期間皆不超過盈餘宣告後一個月，故在國內之文獻中，當季盈餘預測未來各季股價異常報酬之能力無從得知。

合併觀之，國內目前關於季盈餘之研究，皆只在單獨探討季盈餘之時間數列預測模式，或當季季盈餘宣告之資訊內涵。倘能結合季盈餘時間數列模式與盈餘宣告之資訊內涵兩方面之研究，則對於當季季盈餘預測未來各季盈餘宣告時股價異常報酬之能力，以及投資者所真正使用之季盈餘時間數列預測模式等課題將會有更進一步之了解，此為本文主要研究目的之一。另外，因為國內研究關於季盈餘資訊內涵有無之實證結果並不一致，故本研究再次驗證此一課題，並探討差異之可能原因，此為本文另一研究目的。

若能釐清此等課題，當能了解季盈餘此一重要會計資訊之投資者使用之狀況。若由季盈餘宣告時之累積異常報酬分析顯示投資人完全了解季盈餘之時間數列形態，表示市場對季盈餘此會計資訊之使用極有效率。反之，若季盈餘宣告時之累積異常報酬顯示投資人不完全了解季盈餘之時間數列形態，則表示季盈餘此資訊未為投資人所充分利用，因此須進一步引導投資人更加深入了解季盈餘資訊，以便有效善用該資訊。

是故，本研究結合季盈餘時間數列模式與盈餘宣告之資訊內涵此二類研究，利用經過分組之當季及落後四季之季盈餘季節性差分(亦即天真預期模式下之未預期盈餘，SUE = [實際季盈餘 − 預期季盈餘]/標準差)，以及季盈餘宣告日前五天至宣告日後五天共十一天之市場調整累積異常報酬(CAR)，驗證季盈餘之時間數列型態，以及投資者所使用之季盈餘時間數列預測模式等命題。本研究之樣本係取自民國八十三(1994)年第一季至八十七(1998)年第三季，共計九十九季(五年)之臺灣證券交易所第一類及第二類股票上市公司之，符合條件之216家上市公司，共計3560個觀察值。

根據 Ball and Bartov (1996)及 Bernard and Thomas (1990)之理論，可以推導出投資人使用季盈餘資訊之三個競爭假說如下：
假說一：投資人完全知悉季盈餘時間序列之特性。市場完全知悉 SUE 時間數列之產生程序及其係數之大小，且完全使用前期之盈餘資訊來預測後期之盈餘。若第 \( t \) 季盈餘宣告日股價之累積超額報酬，與第 \( t-1, t-2, t-3 \) 季之標準化盈餘季節性差分十分位(SUE)呈遞減之偏負相關，而與第 \( t-4 \) 季之標準化盈餘季節性差分呈偏正相關，則可推論投資人係完全知悉季盈餘時間序列特性。

假說二：投資人完全不知道季盈餘之時間序列模式，而僅使用天真季節隨機漫步模式預測季盈餘。若第 \( t \) 季盈餘宣告日股價之累積超額報酬，與第 \( t-1, t-2, t-3, t-4 \) 季之標準化盈餘季節性差分十分位(SUE)無關，則可推論投資人係不完全使用季盈餘之時間序列模式，而僅使用天真季節隨機漫步模式預測季盈餘。

假說三：市場投資人使用不完全之季盈餘預測模式。市場投資人可能使用不完全之季盈餘預測模式，亦即投資人未完全使用後期四期之 SUE 來預測當期之 SUE，或系統性地高估或低估 SUE 序列相關之大小。是故，若第 \( t \) 季盈餘宣告日股價之累積超額報酬，無法與第 \( t-1, t-2, t-3, t-4 \) 季之每一個標準化盈餘季節性差分十分位(SUE)呈顯著之偏相關，則可推論市場投資人係使用不完全之季盈餘預測模式。

實證結果顯示，在臺灣股市中，大公司因占市場權值較重，其當季盈餘之宣告時較能引起投資人之注意，故季盈餘資訊之宣告存在正向之資訊內涵。在盈餘預測模式上，投資人對大公司已使用盈餘時間數列相關性，但系統性地低估落後一季之季盈餘資訊而高估落後四季之季盈餘資訊。在小公司方面，則不論當期或落後之季盈餘(季營業損益)資訊皆未為投資人使用，不若美國股市之投資人般有效率地利用盈餘之時間數列型態以預測盈餘。這可能因為小公司佔市場權值不重，其盈餘宣告資訊較不為投資人注意所致，也可能是這些公司的股票多數集中在大股東、董事手中，因此其對盈餘宣告資訊較不敏感。是故在探討季盈餘宣告之資訊內涵時應考慮規模效果。

此外，以上結果並不會受到市場季盈餘預測模式係有無帶趨勢之隨機漫步模式而有著不同，實證結果亦顯示台灣股市投資對季盈餘之預測模式可能較接近無趨勢之隨機漫步模式。本研究之實證亦同時顯示自從民國八十五年開始，臺灣股市加入許多如共同基金等專業投資機構，再加上自民國八十五年二月底起，政府逐步開放外國人投資我國股市，使得在引入國內外之專業投資機構後，因其投資策略較著重基本面之分析，故較能認知季盈餘之時間數列相關特性，且部份反應在股價上，表示臺灣股市已逐漸回歸基本面而趨於理性。
在產業效果方面，當季盈餘宣告之顯著正向資訊效果不因電子業與否而有不同。但投資人對非電子產業公司季盈餘之時間數列型態之認知非常少，在電子產業公司方面，投資人雖認知到其季盈餘時間數列特性，且其對季盈餘時間數列相關資訊使用程度明顯優於非電子業，但亦僅使用不完全之季盈餘預測模式。此結果表示即使是市場中最令人感興趣之電子股，投資人對其相關資訊－季盈餘之時間數列型態之認知雖已較非電子業佳，但應用上仍有低估落後一季之季盈餘資訊而高估落後四季度盈餘資訊之現象。

整體而言，倘若能進一步引導投資人更加深入解讀季盈餘資訊及其時間數列型態，並有效率地善用該資訊，相信必能增進臺灣股市之效率性。

關鍵字：季盈餘、時間數列、天真模式、資訊內涵
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