The Effects of Capital Structure on the Corporate Performance of Taiwan-listed Photovoltaic Companies: A Moderator of Corporate Innovation Activities

Yung-Chieh, Chien, Department of Recreation Sports Management, Kao-Yuan University, Kao-Hsiung City, Taiwan

ABSTRACT

This study is primarily intended to verify the effects of capital structure on the corporate performance of Taiwan-listed photovoltaic companies, with corporate innovation activities being the extraneous variable. Interviews were conducted on the managerial staff of financial, human resources, production and marketing departments besides general production-department workers at the afore-mentioned companies, selected by way of Simple Random Sampling. This study's author tested the goodness-of-fit effects of the overall model, structural model, and measurement model using Structural Equation Modeling (SEM) and identified a significantly positive extraneous or interactive effect of corporate innovation activities on the relationship between capital structure and corporate performance of Taiwan-listed photovoltaic companies. In other words, corporate innovation activities noticeably accelerate the effects of capital structure on a Taiwan-listed photovoltaic company's corporate performance.

Keywords: Capital structure, Corporate performance, Corporate innovation activities

INTRODUCTION

Given the frequent media coverage of global warming as the cause of sea-level rise, and Japan’s Fukushima nuclear power plant meltdown triggered by the 2011 Tohoku earthquake, people worldwide are feeling the urge to step up environmental protection efforts while considering alternative energy plans, hence the good prospects of green energy industry. Among others, the photovoltaic companies that make solar panels to harness photovoltaic/solar energies are believed to create tremendous revenues. More than just an energy converter relying on buildings, the solar panel will evolve into something that beautifies the environment with eco-friendly, visually pleasant architectural designs.

Meanwhile, a photovoltaic company must focus on corporate innovation activities (i.e., technological, knowledge and managerial innovations) in order to deliver popularized products that meet the general public’s needs. Photovoltaic manufacturing is an emerging industry in Taiwan; it has a promising future especially in the sector that makes high-tech products, including solar panels. A sound capital structure combined with wisely applied technological innovations, therefore, will mostly likely have much positive effect on the corporate performance of photovoltaic companies listed on the Taiwan Stock Exchange. Photovoltaic manufacturing is going to be an integral part of Taiwan’s economy, as evident in the recently impressive output of Taiwan-listed photovoltaic companies, which are a major driving force behind the effort to create and enhance national economic prowess. Threatened by intensifying competition as the greater economic context has worsened in recent years, the management of Taiwanese photovoltaic companies must eagerly create new values, explore growth opportunities, and at the same time engage themselves in corporate innovation activities for bolstered corporate performance.
Not only does strategic integration become more and more important in terms of management accounting, it is also shifting from the one-dimensional principle of performance assessment toward a multi-dimensional one that involves an organization’s key success factors at every level (Kaplan, 1984; Johnson, 1990; Hall, 1990). In addition to the financial, or conventional, perspective of corporate performance, the Balance Scorecard (BSC) system consists of indicators in three non-financial perspectives, namely the “customer”, “internal-business-process” and “innovation and learning” perspectives. By connecting an organization’s vision/strategies, the BSC presents a new measurement system constructed on the basis of objectives and measures, with the organization’s future competitiveness driven largely by the four perspectives mentioned above. The value of BSC, according to Chow and Haddad (1997), lies in the fact that it is an integration of strategies, frameworks and vision that transforms a corporate organization’s long-term strategies and goals (e.g., the creation of customer value) into tangible actions, internally or externally (Liu, 2002).

BSC, a measure of the driving forces behind a company’s future performance, not only remedies the inadequate measures for financial performance, but also is a strategic management tool integrated with corporate strategies/vision. Meanwhile, corporate innovation activities ensure a company’s high Enterprise Value (EV) and an edge over rivals, which eventually becomes the core competitiveness essential to survival (Chiang, 2006).

As a result, this study’s author scrutinized Taiwan-listed photovoltaic companies in a research model built on previous literature to verify its goodness-of-fit effects. The specific purposes of this study are listed as follows:

1. To verify and understand whether capital structure has a significantly positive effect on the corporate performance of Taiwan-listed photovoltaic companies;
2. To verify and understand whether corporate innovation activities have a significantly positive effect on the corporate performance of Taiwan-listed photovoltaic companies;
3. To verify and understand whether the capital structure and corporate innovation activities exert a significant and positive interactive effect on the corporate performance of Taiwan-listed photovoltaic companies.

LITERATURE REVIEW

In this section, previous research results pertaining to this study’s topics are reviewed to establish hypotheses and a research framework. The relevant theories and studies are stated as follows:

Capital structure
Nieh and Lou (2005) conceptually defined capital structure as “the sum of stockholders’ equity and long-term liabilities of a company, or a company’s financial structure minus the current liabilities.”

In a study conducted between 1972 and 1982, Titman and Wessels (1988) examined determinants of the capital structures of U.S.-based manufacturers within an SEM framework. They identified the significant explanatory power of profitability and company size with regard to a company’s capital structure.

Crutchley and Hansen (1989) adopted the Ordinary Least Squares (OLS) method to test the financial qualities of 603 companies from 1981 through 1985, in an attempt to identify how the companies’ capital structures were affected by financial factors. Their empirical findings suggested that the percentage of R&D costs and company size both affect a company’s capital structure significantly.
In a comparative study of high-tech and traditional industries, Wang (2002) examined the potential effects of industrial factors on the relationships among a company’s ownership structure, board composition and capital structure, with long-term debt-to-equity ratio (D/E) and overall D/E being the two variables of capital structure. Wang’s empirical findings indicated interactive effects among the ownership structure, board composition and capital structure, as well as the possibility that a company improves its overall performance by skillfully arranging various corporate governance mechanisms.

By scrutinizing the connections among ownership structure, capital structure and corporate performance, Shi (2006) provided future researchers with the best approach to studying the optimal ownership structure, capital structure and financial decisions. His analysis was based on such variables as D/E, corporate risks, company size and fixed assets.

Huang and Song (2006) discussed the determinants of mainland Chinese companies’ capital structures in an analysis based on 7 variables, namely the profitability, company size, asset tangibility, tax payments, non-debt tax shields, growth prospects and the degree of fluctuation.

Kao (2008) examined how the capital structure, human capital and R&D efforts affect the corporate performance of Taiwanese semiconductor firms, with overall D/E being the variable for capital structure.

Given the literature reviewed above, this study’s author conceptually defined capital structure as “the sum of stockholders’ equity and long-term liabilities of a company” while using D/E (i.e., long-term and the overall D/E) as the indicator, or measurement perspective, to evaluate the soundness of capital structure, as suggested by Wang (2002).

**Corporate performance**

Corporate performance is measurable using various financial indicators (e.g., ROE, ROA, EPS, P/E) and BSC, which takes into consideration both financial and non-financial measures.

Using financial performance as the sole indicator in corporate performance assessments sometimes leads to measurement biases in financial performance, due to window dressing in the financial reports. To solve that dilemma, Kaplan and Norton (1996) suggested a BSC system comprising four perspectives: (1) the financial perspective; (2) the customer perspective; (3) the internal-business-process perspective; and (4) the learning-and-growth perspective.

In their study Chow and Haddad (1997) noted the value of BSC lies in the fact that it connects organizational strategies, frameworks and vision to create a set of corporate performance indicators for both traditional and modern companies. Meanwhile, the BSC method transforms a company’s long-term strategies/goals (e.g., the creation of customer value) into actual organizational actions, internally or externally.

Wu (1999) believed that BSC, as a matter of fact, involves all functions of an organization. For example, the financial perspective of BSC is relevant to corporate finance and accounting; the customer perspective, marketing; the internal-business-process perspective, the overall value chain; the learning-and-growth perspective for employees, human resources.

From the viewpoint of BSC, Lu (2000) studied the connection between capital structure and operating performance at Taiwan-listed IT & electronics firms from the year 1958 to 1999, with the financial-perspective indicators including the Cash Flow Adequacy Ratio, sales growth, operating profit margin and Return on Equity (ROE); the customer-perspective indicators including market share and product return rate; the internal-business-process perspective, research and development (R&D) benefit, average cash-turnover period, and percentage of maintenance costs; and the learning-and-growth perspective, revenue per employee and wage per unit.
Yeh (2001) conducted a case study of the connection between organizational learning models and performance at product development departments of Taiwan-base electronics technology firms, with the performance evaluated in three non-financial BSC perspectives, namely the customer, internal-business-process and learning-and-growth perspectives.

The literature above shows that all companies, regardless of industry, take into consideration indicators from both the financial and non-financial perspectives when measuring their corporate performance, which in the present study is conceptually defined as a performance measurement indicator consisting of four perspectives, namely the financial, customer, internal-business-process and learning-and-growth perspectives. As recommended by Kaplan and Norton (1996), this study’s author measured in these four perspectives how capital structure affects the corporate performance of Taiwan-listed photovoltaic companies.

Corporate Innovation Activities

Despite the large quantity of literature concerning innovations, opinions vary over the definition and viewpoint of innovations. Most researchers in this area focused on technical improvements/breakthroughs or product refinements/development (Souder, 1987; Chandy and Tellis, 2000).

Phillips (1997) divided innovations into technological and non-technological ones. As a technological innovation involves either a product or a manufacturing process, a creative company is one that has introduced within the past three years at least one product or manufacturing process that is new or an improvement. A non-technological innovation, he said, occurs in such areas as marketing strategy, management techniques, or organizational structures. A business that initiated a reform in any of the afore-mentioned areas is considered a non-technological innovation company (Chen, 2008).

Lai, Wang and Huang (1997) incorporated the notions of management capabilities and learning organization into their study of technical performance measures, and expanded it to include an organization’s creativity. Tsai, Huang and Kao (2001) defined creativity from a multi-indicator viewpoint. These studies took the discussions of innovation from the technical level to a managerial one. Clark and Guy (1998) contended that innovation is a process where knowledge is transformed into a useful product, with emphasis placed on how the persons, resources and company departments involved in that process interact with one another, and how information is fed back. Since innovation is the primary source of newly created and/or diffused knowledge, it provides an important means to bolstering competitiveness for a country or a business.

In “The influences on innovative activity, intellectual capital towards corporate development: evidence and insights from Taiwan-publicly listed IT corporations” Hung (2008) addressed corporate innovation activities into three sub-perspectives: (1) managerial innovations; (2) research and development; (3) knowledge innovation.

In summary, this study’s author was inspired by Hung (2008) and defined corporate innovation activities in three sub-perspectives: Firstly, a managerial innovation is resulted from an organization’s creative process, where a new idea is identified and carried out for the construction of, and assistance for, the planning/execution of corporate innovation activities, so the organization could make plans with bolstered competencies in a wider range of operations, and also with the management ability of identifying strategic goals. Secondly, technological innovations are achieved by applying innovative thinking/methods to R&D-oriented transformation efforts and technological advancements, with continuously added elements of knowledge. Thirdly, knowledge innovations is an attempt of individuals/groups in the organization (or the organization as a whole) to improve on, or enhance, the existing knowledge using various methods, or to develop brand-new knowledge valuable to the organization, in addition to acquiring the needed knowledge from external sources.
The effects of capital structure on corporate performance

Researchers worldwide have published a large number of studies on the relations between D/E (i.e., the overall D/E and long-term D/E) and a company’s operating performance, despite the disagreement over whether such relations are positive or negative. Those who believe D/E and corporate operating performance are positively related include: (1) Ross (1977), who examined the asymmetric information between a company’s internal staff and investors, and concluded that a company with an internal staff optimistic about its prospects is likely to not only have a higher D/E ratio, but also convey information about good investment policies to external investors. As the investors perceive those investments policies as favorable information, the company will enjoy improved corporate performance; (2) Berger and Patti (2002), who contended that, under the same conditions, companies with good operating performance tend to choose a higher D/E ratio because they have already made future financial crises less probable: the better a company’s operating performance, the higher the D/E. Researchers who insist on the negative correlation between D/E and corporate operating performance include Myers (1984), who put forth a “pecking order theory” to explain the fact that, for fear that issuing shares to raise funding would result in asymmetric information and underestimated share prices, the financing approach most common among corporate entities is internal funding, followed by loans from outside creditors, and then the issuance of common stocks. The asymmetric information sparks concerns over certain company policies as it makes investors believe that the management of a company has greater access to internal information. Perceiving the issuance of equity securities as a sign of dampened corporate performance, investors would deliberately suppress the price of such securities, forcing the under-funded company to issue them at discount prices, hence the declining corporate performance. Another argument that supports the negative correlation between D/E and corporate operating performance was presented by Brander and Spencer (1987), who said that, in the case of a rising D/E ratio that drives up the probability of bankruptcy, a company’s internal staff will make less efforts on their work/job and consequently hurt the corporate operating performance (Chen, 2011).

To a certain extent, the studies mentioned above displayed similar viewpoints even if they do not discuss companies from the same industry or of the same size. Photovoltaic manufacturing is an emerging industry of promising future, especially in the green-energy sector that makes high-tech solar panels. A sound capital structure and wisely used technological innovations will surely have a tremendously positive effect on the corporate performance of Taiwan-listed photovoltaic companies. This study’s author, therefore, proposed the following hypothesis:

\[ H1: \text{A sound capital structure affects the corporate performance in a significantly positive way.} \]

The effects of corporate innovation activities on corporate performance

Yeh (2011) considered technological innovations a key factor to a company’s product portfolio development and also a crucial weapon that enhances market competitiveness. Meanwhile, a company will not be able to fully display the operating performance until it meets customers’ needs by commoditizing innovative technologies.

According to Wang (2008), only by devising an appropriate strategy for technological innovations will a company be able to create impressive operating performance.

Tai (2011) noted that an excessive output of innovations would lead to dampened corporate operating performance, although the improved quality of innovation output helps improve the operating performance. Companies engaged in corporate innovation activities, he noted, must enhance EV by creating and securing value for innovations. With expanded capabilities of organizational learning and
innovation, a company is able to improve the operating performance by slightly increasing its innovation output (or R&D investments).

Since photovoltaic companies are much reliant on corporate innovations (i.e., technological, knowledge and managerial innovations), as mentioned above, corporate innovation activities are supposed to directly or indirectly affect their efforts to improve corporate performance. This study’s author, therefore, proposed the following hypothesis:

**H2:** Corporate innovation activities affect the corporate performance in a significantly positive way.

The effects of capital structure and corporate innovation activities on the corporate performance

Literature review indicates that whether capital structure and corporate innovation activities simultaneously exert a multiplying effect or synergy on corporate performance is a topic worth verifying. This study’s author, therefore, proposed a third hypothesis:

**H3:** Capital structure and corporate innovation activities exert an interactive effect on the corporate performance in a significantly positive way.

**RESEARCH METHOD**

Figure 1 illustrates how motivations, research objectives and literature review cited in the previous passages led to this study’s hypotheses and conceptual research framework (Baron and Kenny, 1986):

**Research Framework**

![Research Framework Diagram]

**Figure 1: Research Framework**

**Designing the Questionnaire and CMV Test**

1. **Designing the Questionnaire**

   The questionnaire in this study was compiled on the basis of Multi-Dimension Measurement and the afore-mentioned observable perspectives. On a 7-point Likert Scale, the answers were measured with 7 denoting Strongly Agree and 1 denoting Strongly Disagree: the score grows along with the degree of agreement. The sample data collected was then “centralized” so the sum of scores given to all
questionnaire items is zero after deducting the average. Centralization erases multicollinearity between the independent and extraneous variables, in order that their interactions are tested more accurately, as shown in the mathematical equation below (Chang and Lee, 2012):

$$\Sigma(Y_i - \bar{y}) = \Sigma X_i = 0$$

The 4-item questionnaire for capital structure is based on the capital structure measures proposed by Wang (2002), namely the long-term and overall D/E.

The 12-item questionnaire for corporate innovation activities (i.e., managerial, technological and knowledge innovations) was inspired by the viewpoint of Hung (2008) and compiled with additional adjustments.

As for the 16-item questionnaire for corporate performance, it features corporate performance measures based on the argument of Kaplan and Norton (1996) that BSC should be discussed in four perspectives: the financial, customer, internal-business-process, and learning-and-growth perspectives.

2. CMV Test

The questionnaire tested common method variance (CMV) problems by CFA comparison method, and the results show that it has no CMV problems as illustrated in Table1 (Lee and Huang, 2012).

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>DF</th>
<th>$\Delta \chi^2$</th>
<th>$\Delta$DF</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Factor</td>
<td>1357.631</td>
<td>207</td>
<td>831.32</td>
<td>28</td>
<td>0.001</td>
</tr>
<tr>
<td>Multi-Factor</td>
<td>526.311</td>
<td>179</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sampling Method

While the respondents of questionnaire survey (i.e., the managerial staff of financial, human resources, production and marketing departments besides general production-department workers at Taiwan-listed photovoltaic companies) were selected by simple random sampling, 30 copies of questionnaire were given out to experts in a pilot-test. After revising or removing unsuitable items as per the exerts’ advice, the study’s author sent out 500 copies of questionnaire in an official post-test and received 201 validly completed copies for a 40.2% response rate.

The Data Obtained from Questionnaire and Measurement Model

This study’s author adopted Linear SEM in a Confirmatory Factor Analysis (CFA) of the research framework, and based the questionnaire design on three latent variables (i.e., capital structure, corporate innovation activities and corporate performance), each of which was divided into observable/explicit sub-variables containing several questions, as shown in the table below. After processing the collected data, the author created a primary file that preceded the design of questionnaire, using Multi-Dimension Measurement for the construction of this study’s measurement system. However, Duel Measurement was adopted to ensure the computer software efficiently handled and/or measured all data (Chen, 2010). Table 2 shows the number of questions under each implicit or explicit variable, as well as the referential sources (Lee³, 2012).
Table 2: Number of Questionnaire Items under each ‘Implicit Variable’ and ‘Observable Variable’

<table>
<thead>
<tr>
<th>Implicit Variables</th>
<th>Explicit Variables</th>
<th>Total Number of Questionnaire Items</th>
<th>Referential Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall D/E</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Corporate innovation activities (Mo)</td>
<td>Managerial innovations</td>
<td>4</td>
<td>Feng-chu Hung (2008)</td>
</tr>
<tr>
<td></td>
<td>Technological innovations</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge innovations</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer perspective</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal-business-process perspective</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning-and-growth perspective</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

RESULTS AND ANALYSIS

Linear Structure Model Analysis

This study includes a CFA, an analytical method contrary to the Exploratory Factor Analysis (EFA), on the three unobservable/latent variables of capital structure, corporate innovation activities and corporate performance. SEM is made up of structural and measurement models to efficiently tackle the cause-effect relations among implicit/latent variables. The three parts of model-testing in this study are: (1) goodness-of-fit of the measurement model; (2) goodness-of-fit of the structural model; (3) the overall model’s conformity with goodness-of-fit indicators. In other words, goodness-of-fit indicators were applied to a test of the overall goodness-of-fit effect of SEM (Diamantopoulos & Siguaw, 2000; Lee⁹, 2012).

Analyzing Fit of the Measurement Model

To a large extent, factor loading is intended to measure the intensity of linear correlation between each latent/implicit variable and a manifest/explicit one. The closer the factor loading is to 1, the better an observable variable is in measuring latent variables. Since this study’s reliability is supported by the fact that factor loadings for all observable variables range between 0.8 and 0.9, all observable/explicit variables in the measurement model appropriately gauged the latent/implicit ones. The Average Variance Extracted (AVE), on the other hand, gauges an unobservable/implicit variable’s explanatory power of variance with regard to an observable one, with the VE value growing in proportion to the reliability and convergent validity of that particular implicit/latent variable. As a rule, AVE must be larger than 0.5 for an observable variable’s explainable variance to exceed the measurement error (Fornell and Larcker, 1981). As Table 3 and Figure 2 show that all AVEs in this study exceed 0.5, the explicit variables have excellent reliability and convergent validity (Lee and Huang, 2012).

Table 3: Judgment Indicators for the Measurement Model

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>Observable Variables: Centralized Dual Measurement</th>
<th>Factor loading</th>
<th>Composite Reliability, C. R.</th>
<th>Cronbach’s α</th>
<th>Average Variance Extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital structure (X)</td>
<td>X1C</td>
<td>0.821</td>
<td>.824</td>
<td>.821</td>
<td>0.643</td>
</tr>
<tr>
<td></td>
<td>X2C</td>
<td>0.831</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate innovation activities (Mo)</td>
<td>M1C</td>
<td>0.852</td>
<td>.843</td>
<td>.822</td>
<td>0.762</td>
</tr>
<tr>
<td></td>
<td>M2C</td>
<td>0.833</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X*Mo</td>
<td>X1M1C</td>
<td>0.871</td>
<td>.864</td>
<td>.851</td>
<td>0.771</td>
</tr>
<tr>
<td></td>
<td>X2M2C</td>
<td>0.861</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate performance (Y)</td>
<td>Y1C</td>
<td>0.861</td>
<td>.863</td>
<td>.851</td>
<td>0.764</td>
</tr>
<tr>
<td></td>
<td>Y2C</td>
<td>0.852</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analyzing Fit of Structure Model

1. Path Analysis Results of Structure Model

This study’s author made sure that the overall model passed the goodness-of-fit test before calculating the parameter estimates; Standard Errors (S.E.) and Critical Ratio (C.R.) among latent variables (see Table 4). According to the results, the interaction between a sound capital structure and corporate innovation activities (X*Mo) affects corporate performance (Y) significantly (c=0.813). That is, a company that factors corporate innovation activities into the effects of a sound capital structure on its corporate performance tends to accomplish multiplying synergy.

Table 4: Path Analysis Results of the Structural Model

<table>
<thead>
<tr>
<th>Path Coefficients between Implicit Variables</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital structure (X) → Corporate performance (Y)</td>
<td>1.023</td>
<td>.056</td>
<td>18.268</td>
<td>***</td>
<td>a</td>
</tr>
<tr>
<td>Corporate innovation activities (Mo) → Corporate performance (Y)</td>
<td>.924</td>
<td>.041</td>
<td>22.537</td>
<td>***</td>
<td>b</td>
</tr>
<tr>
<td>X*Mo → Corporate performance (Y)</td>
<td>1.133</td>
<td>.043</td>
<td>26.349</td>
<td>***</td>
<td>c</td>
</tr>
<tr>
<td>X → X1C</td>
<td>.863</td>
<td>.032</td>
<td>26.969</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X → X2C</td>
<td>.872</td>
<td>.038</td>
<td>22.947</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Mo → M1C</td>
<td>.843</td>
<td>.037</td>
<td>22.784</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Mo → M2C</td>
<td>.822</td>
<td>.038</td>
<td>21.631</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X*Mo → X1M1C</td>
<td>1.034</td>
<td>.042</td>
<td>24.619</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>X*Mo → X2M2C</td>
<td>1.021</td>
<td>.071</td>
<td>14.380</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Y → Y1C</td>
<td>.832</td>
<td>.036</td>
<td>23.111</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Y → Y2C</td>
<td>.841</td>
<td>.038</td>
<td>22.132</td>
<td>***</td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001

Table 5: Standard Regression Weights: (Group number 1–Default model)

| Estimate |
|------------------|--------|
| Capital structure (X) → Corporate performance (Y) | .741   |
| Corporate innovation activities (Mo) → Corporate performance (Y) | .762   |
| X*Mo → Corporate performance (Y) | .813   |

Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001

2. Coefficient of Determination

The Coefficient of Determination, also known as Squared Multiple Correlation (SMC), indicates the explanatory power of an implicit independent variable with regard to an implicit dependent one. That is, the R\textsuperscript{2} values shown in Table 6 (including Table 6.1 &6.2) indicate that the implicit independent variables have adequate explaining power on the implicit dependent variables, respectively.

Table 6: Path Coefficient of Determination

Table 6.1: Coefficients\textsuperscript{a} 【Hierarchical Regression】

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.877\textsuperscript{a}</td>
<td>.769</td>
<td>.773</td>
<td>.317</td>
<td>.004</td>
<td>14.218</td>
<td>2</td>
<td>97</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>.885\textsuperscript{b}</td>
<td>.783</td>
<td>.785</td>
<td>.512</td>
<td>.002</td>
<td>7.024</td>
<td>1</td>
<td>96</td>
<td>0.003</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Predictors: (Constant), Mo and X
\textsuperscript{b} Predictors: (Constant), Mo, X and Mo*X

Table 6.2: Coefficients\textsuperscript{a}

<table>
<thead>
<tr>
<th>Coefficients of Determination</th>
<th>R\textsuperscript{2}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital structure (X), corporate innovation activities (Mo) versus corporate performance (Y)</td>
<td>0.726</td>
</tr>
<tr>
<td>Capital structure (X), corporate innovation activities (Mo) and X*Mo versus corporate performance (Y)</td>
<td>0.731</td>
</tr>
</tbody>
</table>
3. Indices of Fit of the Overall Model

This study’s author adopted SEM for modeling in order to explore how unobservable variables connect to one another in the Structural Model, whether the measurement model has measurement reliability, and how the overall model’s goodness-of-fit effect is. While $\chi^2$, d.f., GFI, AGFI, NFI, CFI, RMR and RMSEA are the goodness-of-fit indicators for the overall model, it is usually required that $\chi^2$/d.f. <5, GFI>0.9, NFI>0.9, (Schumacker and Lomax, 2004), CFI>0.9, RMR<0.05 and RMSEA<0.05 (Bagozzi & Yi, 1988). In this study, the overall model has a satisfactory goodness-of-fit effect because $\chi^2$/d.f. <5 and the values of GFI, AGFI and NFI all exceed 0.90, with a below-0.05 RMR, as shown as in Table 7 (Chang and Lee, 2012).

![Table 7: Assessment of Fit of the Overall Model](image)

<table>
<thead>
<tr>
<th>Determination index</th>
<th>$\chi^2$</th>
<th>DF</th>
<th>GFI</th>
<th>AGFI</th>
<th>NFI</th>
<th>CFI</th>
<th>RMR</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit value</td>
<td>12.705</td>
<td>14</td>
<td>0.923</td>
<td>0.911</td>
<td>0.918</td>
<td>0.906</td>
<td>0.037</td>
<td>0.031</td>
</tr>
</tbody>
</table>

4. Standardized Results of SEM Analysis

The model’s overall framework was resulted from computer-aided standardization, as shown in Fig. 2 (Lee, 2011).

![Figure 2: Standardized results of SEM analysis](image)
Analytical Testing of Path Effects for the Structural Model

To test the extraneous variable, this study’s author performed a hierarchical regression analysis, followed by centralized regression analyses and *t-tests* of Y versus X, Mo and X*Mo in order to examine whether the hypothesis about a significant regression coefficient *c* is substantiated (i.e. whether *c* is zero or not). The test results are shown in Table 8.

| Model | Unstandardized Coefficients | Standardized Coefficients | t  | Sig.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td></td>
<td>.362</td>
<td>4.921</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>.712</td>
<td>.481</td>
<td>11.931</td>
</tr>
<tr>
<td></td>
<td>Mo</td>
<td>.884</td>
<td>.412</td>
<td>13.334</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td></td>
<td>.453</td>
<td>5.812</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>.841</td>
<td>.433</td>
<td>11.743</td>
</tr>
<tr>
<td></td>
<td>Mo</td>
<td>.984</td>
<td>.234</td>
<td>14.242</td>
</tr>
<tr>
<td></td>
<td>X*Mo</td>
<td>.512</td>
<td>.533</td>
<td>24.971</td>
</tr>
</tbody>
</table>

*a. Dependent Variable: Organizational Effectiveness (Y)*

As shown in Table 8, the 0.683 Path Coefficient of Mo*X versus Y suggests an extraneous effect of Mo*X on Y.

The following results were derived from analyses mentioned above:

1. A sound capital structure affects corporate performance in a significantly positive way, with a 0.741 standardized path coefficient that supports H₁ (Hypothesis substantiated);
2. Corporate innovation activities affect corporate performance in a significantly positive way, with a 0.762 standardized path coefficient that supports H₂ (Hypothesis substantiated);
3. A sound capital structure and corporate innovation activities exert an interactive effect on corporate performance in a significantly positive way, with a 0.813 standardized path coefficient that supports H₃ (Hypothesis substantiated).

**CONCLUSIONS AND SUGGESTIONS**

Conclusions

This study’s conclusions were derived from the afore-mentioned data analyses and results as detailed in the following passages:

1. Regarding the verification of SEM, this study has a good model fit as its author constructed a SEM with satisfactory goodness-of-fit in the measurement, structural and the overall models.
2. Conclusions regarding the verification of business practices at Taiwan-listed photovoltaic companies:

   The interaction between a sound capital structure and corporate innovation activities affects the corporate performance of Taiwan-listed photovoltaic companies in a significantly positive way. In other words, the “corporate innovation activities” variable in this study displays a positive extraneous effect. According to Chen (2010), if an extraneous and an independent variable both exert a significant interactive effect on a dependent variable, neither the independent nor the extraneous variable will have a significant effect on the dependent one. Moreover, when the variable of “corporate innovation activities” exerts an extraneous effect, the capital structure (i.e., independent variable) and corporate innovation activities (i.e., extraneous variable) will be irrelevant/independent variables (as shown in Figure 4.1).
Contributions of the Present Study

1. Innovative Applications of Research Method

Exploratory research enabled by the multi-regression analysis accounts for a majority of the literature, leaving the implicit variables’ extraneous effect in a CFA-based research framework rarely considered. Since the present study’s main perspectives are implicit variables, CFA and linear SEM appear to be suitable measurement tool and model framework, respectively. That explains why this study is relatively innovative in terms of research method (Lee, 2011; Chang and Lee, 2012).

2. A Topic that Meets the Actual Needs of Taiwan-listed IT Firms

Unlike the previous studies, which were largely based on EFA, this study’s author performed modeling in accordance with the summarized literature review and then verified the model for goodness-of-fit effects. The present study, consequently, is a CFA-based one addressing topics that are both important and innovative in terms of business practices, with the research results serving as a reference for further studies in relevant fields, and also for decision-makers at Taiwan-listed photovoltaic companies seeking management insights.

Limitations and Suggestions

1. This study is focused solely on the CFA of Taiwan-listed photovoltaic companies, and future researchers are advised to compare the goodness-of-fit effects of the same model applied to companies in different industries or business groups.

2. Regarding modeling for a CFA-based study like the present one, it is advisable that a simple verification model be built to avoid excessive complexity, and the subsequently poor goodness-of-fit (Chen, 2010). This study’s author, therefore, decided to focus solely on how capital structure affects the corporate performance, with corporate innovation activities being the extraneous variable.

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