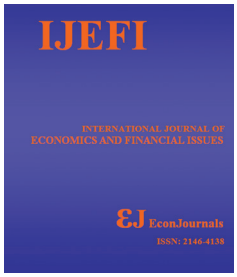

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Does Accounting Conservatism Reduce Default Risk? Evidence from Taiwan

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ABSTRACT

Differing from existing research focusing on the relations between default risk and equity returns, corporate governance, tax allowance, this paper investigates whether accounting conservatism (accounting conservative reporting) reduces default risk. We adopt Taiwanese high-tech and traditional industries as samples and find that for two industries, a firm that increases more accounting conservatism reduces default risk. This negative effect of accounting conservatism on default risk holds through increasing efficient investments, implying that investments serve as a channel through which conservatism has negative effects on default risk. Efficient investments more strengthen the negative effects in high-tech firms than traditional firms. For risk management practice, a manager can increase conservative accounting reporting to reduce default risk, and thereby improve a firm's performance, attracting more investors and increasing market capitalization. A suggestion for investors is to invest a firm adopting more accounting conservatism because default risk may be lower.

Keywords: Default Risk, Accounting Conservatism, Efficient Investments
JEL Classification: C21, C23, D21, G33

1. INTRODUCTION

In Taiwan, agency problems induce some firms to suffer financial distress because managers are more engage in risky and inefficient investments than their counterparts (Chen, 2008)[1]. Taiwanese firms adopt a governance mechanism - increasing managerial ownership to reduce inefficient investment, decrease conflicts between managers and owners, and lower default risk[2] (Chiang et al., 2015). Chiang et al. (2015) indicate the need for future research into whether other governance mechanisms are related to default risk. We observe that accounting conservative reporting (hereafter named as accounting conservatism) is a corporate governance mechanism that decreases managerial incentives to make inefficient investments (Watts, 2003a; Ball and Shivakumar, 2005). Existing studies focuses on the relation between default risk and equity returns, corporate governance, and corporate tax allowance[3] that are the field of accounting information. Little studies discuss a relation between default risk and accounting conservative reporting.

A firm defaults when it fails to service debt obligations (Vassalou and Xing, 2004). A conservative accounting allows a firm to decrease the amount attributed to debt holders and save more cash (Kirschenheiter and Ramakrishnan, 2009); preserved cash flow improves a firm's ability to repay with debt holders, reducing default risk (Uhrig-Homburg, 2005; Kim et al., 1993). Conservative firms are more likely to violate covenants (Zhang, 2008), enhancing debt holders' monitoring power, alleviating under-investment, improving cash flows, and reducing default

1 Taiwan companies involved in accounting scandals and insolvencies include Procomp, Ya-Hsin and Rebar (Chiang et al., 2015), IFODISC, SUMMIT, PEWC, XEPEX. Agency problems include conflicts between managers and shareholders, managers' self-serving behavior, and negative NPV investment projects.

2 Tsai et al. (2009) demonstrate that self-entrenched managers of large family firms in Taiwan protect their wealth and decrease their exposure to default risk.

3 The studies include the relation between default risk and equity returns (Vassalou and Xing, 2004; Campbell et al., 2008; Florakis et al., 2017), and corporate governance (Chiang et al., 2015), and corporate tax allowance (Panteghini and Vergalli, 2016; Rendleman, 1978).

risk (Nikolaev, 2010; Tan, 2013). We link above studies and find that accounting conservatism may reduce default risk. However, little studies explore direct relation between default risk and accounting conservatism reporting. Motivated by this gap, this paper studies the first question: Does a firm adopting more accounting conservatism reduce default risk? Based on above research, we expect that accounting conservatism has negative effects on default risk, and develop the first hypothesis H1 that a firm with more accounting conservatism reduces default risk.

Accounting conservatism improves efficient investments, and thus increases cash flows (Francis and Martin, 2010, Lara et al., 2016)[4]; holding cash flows reduces default risk (Berkovitch and Isracl, 1998; Campbell et al., 2008; Anderson and Carverhill, 2012). In previous studies, we observe that accounting conservatism seems to reduce default risk through efficient investments. However, there is little direct evidence on the subject. Therefore, we propose the second question: Is the negative effect of accounting conservatism on default risk generated through efficient investments? To obtain the answer, we study two relations between efficient investments and accounting conservatism as well as default risk and efficient investments. Regarding the former relation, accounting conservatism resolves both under- and over- investment and improves investment efficiency (Lara et al., 2016). We thus expect that a firm with more accounting conservatism increases efficient investments and develop the hypothesis H2a. Regarding relation between default risk and efficient investments, existing studies suggest that efficient investments attributable to conservatism generate tax benefits (Rendleman, 1978; Panteghini and Vergalli, 2016) and enhance debt contracting efficiency, thereby decreasing default risk (Ball and Shivakumar, 2005; Galai and Masulis, 1976). Accordingly, we expect that a firm with more efficient investments reduces default risk and develop the hypothesis H2b. If H2a and H2b are supported by empirical results, linking two hypotheses suggests that a more conservative firm can increase efficient investments, which reduces default risk; efficient investments serves as a channel through which conservatism has negative effects on default risk.

This paper selects a firm-year panel dataset including Taiwan high-tech and traditional industries, which are composed of the firms listed on the Taiwan Stock Exchange (TWSE). In Taiwan, high-tech and traditional firms may adopt different degrees of conservatism to resolve different inefficient investments, which lead to different degree of negative effects of efficient investments on default risk. Therefore, we aim to compare two industries and study whether their findings differ in the negative effects of conservatism on default risk. Based on three hypotheses, we model three multiple regressions to examine three samples-full sample, high-tech and traditional industry. Our empirical findings are presented as follows.

First, a firm that increases more accounting conservatism reduces default risk for three samples supporting hypothesis H1, and the negative effect is stronger in traditional firms than high-tech firms. For full sample and high-tech firms, negative effect of conditional conservatism on default risk is stronger than that of unconditional conservatism, consistent with Carrizonsa and Ryan's (2013) analyses. Second, a firm that increases more accounting conservatism increases efficient investments supporting hypothesis H2a, a firm that increases more efficient investments reduces default risk supporting hypothesis H2b, implying that a more conservative firm reduces default risk through increasing more efficient investments which serve as a channel between conservatism and default risk. This is because that conservative reporting may alleviate agency problems (e.g., debt holder- shareholder conflict, negative NPV projects) and promote efficient investments, reducing default risk because of tax savings, cash holdings and debt value proposed in prior studies. Third, for our first findings, the negative effects of conservatism on default risk in traditional firms are stronger than those in high-tech firms. When we add a variable-efficient investments, the positive effects of conservatism on investments and negative effects of investments on default risk in high-tech firms are stronger than those in traditional firms. Namely, the negative effect of conservatism on default risk through increasing efficient investment in high-tech industries becomes stronger than traditional ones, implying that efficient investments more strengthen negative effect in high-tech firms than traditional firms. Robustness test results confirm above-mentioned findings in favor of three hypotheses.

For practical implications, our findings provide a suggestion for investors that it is worthy to invest a firm that adopts accounting conservatism because its default risk may be lower. For risk management, a manager may increase conservative accounting reporting to reduce default risk, and thereby improve a firm's performance, attracting more investors and increasing market capitalization. A suggestion for policymakers is to enact accounting regulatory policy to encourage conservative reporting, which helps a firm reduce default risk.

In response to above motivations, this paper contributes to the literature as follows. First, unlike previous research studying relation between default risk and equity returns, corporate tax, this paper studies the relation between default risk and accounting conservatism, which is a corporate governance mechanism, extending Chiang et al.'s (2015) advice for future research. Second, we find that a firm with more conservatism reduces default risk by increasing efficient investments, a channel linking conservatism and default risk, which complements Biddle et al.'s (2016) two channels (cash holdings, earnings management). Third, we find that the negative effect of conservatism on default risk by increasing efficient investments becomes stronger for high-tech firms than traditional firms, which complements Chiang et al.'s (2015) evidence that negative effects of corporate governance on default risk are far greater for high-tech firms than conventional firms.

This paper differs from existing studies in some ways. First, we apply the Merton's (1974) model to calculate a default risk measure (EDF), different from Chiang et al. (2015) applying KMV model

4 Biddle et al. (2016) proxy for bankruptcy risk by using expected default frequency (EDF) in Merton (1974) and Campbell et al. (2008). Both unconditional and conditional conservatism reduce default risk by enhancing cash holdings (Biddle et al., 2016).

to estimate EDF[5]. Second, regarding endogeneity problem that leads to bias and inefficiency in coefficients, this paper estimates ordinary least squares (OLS) regressions and conducts test results suggesting that no presence of endogeneity is recognized in the OLS regressions, unlike Chiang et al.'s (2015) generalized method of moments. Our samples select Taiwan listed firms as Chiang et al. (2015), but our sample period 15 years (1998–2012) is longer than their 12 years (1998–2009). Third, unlike Lara et al.'s (2016) using four proxies, this paper uses eight proxies including unconditional and conditional conservatism as explanatory variables to enhance explanatory power of variables in the regressions. Fourth, our robustness test show that negative effects of conservatism on default risk are not influenced by various degrees of default risk, unlike Vassalou and Xing's (2004) findings that stock returns are influenced by high and low degrees of default risk.

The remainder of this paper is organized as follows. Section 2 reviews studies related to default risk and develops the hypotheses. Section 3 describes data selection and model design. Section 4 reports summary statistics and empirical results. Section 5 concludes our findings.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1. Studies on Default Risk

Prior subjects on default risk focus on relationship between default risk and equity returns, corporate governance, and tax benefits. Vassalou and Xing (2004) propose positive effect of default risk on equity returns, indicating that high default risk firms earn higher returns than low default risk firms. Campbell et al. (2008) conclude that high financial distress stocks deliver anomalously low returns compared to stocks with low distress risk. Florakis et al. (2017) offer a significantly positive default risk premium in international markets. Chiang et al. (2015) find that certain characteristics of corporate governance have explanatory power on default probability[6]. Certain scholars confirm tax savings for reducing default risk. Panteghini and Vergalli (2016) demonstrate that tax depreciation allowances lead to a decrease in leverage and a reduction in default risk. Rendleman (1978) finds that when tax deductibility of interest on debt is considered, default risk of debt is significantly reduced.

2.2. Default Risk and Accounting Conservatism

Two types of accounting conservatism could decrease bankruptcy and default risk. Unconditional conservatism (ex ante or news-independent conservatism) understates net assets and earnings, and induces a firm to accumulate savings and cushions, which *ex ante* insulates a firm from risk realizations (Biddle et al., 2016). Relative to a cushioning role that unconditional conservatism plays, conditional conservatism (ex post or news-dependent conservatism) plays an informational role that more quickly reports loss upon receiving bad news than reporting gains to good news by recognizing downside risk ex post (Ryan, 2006). A prudent decision maker prefers a more conservative accounting system to save more cash and fungible assets as future earnings become riskier (Kirschenheiter and Ramakrishnan, 2009). Preserved cash flow improves a firm's ability to repay and renegotiate with debt holders, thereby decreasing bankruptcy risk (Uhrig-Homburg, 2005; Kim et al., 1993)[7]. This effect of conservatism on default risk enhances liquidation values and supports debtholders' liquidation rights, which deter managers from filing for bankruptcy (Biddle et al., 2016). Accounting conservatism increases recovery rates of debt covenants, decreasing default rates by preserving cash and fungible assets. Evidences that conditional conservatism generates are stronger than unconditional conservatism (Carrizonsa and Ryan, 2013).

More conservative borrowers are more likely to violate covenants after a negative price shock (Zhang, 2008)[8]. Covenant violations induced by conservatism transfer control rights from borrowers to debt holders[9] and enhance their monitoring power, thus alleviating under-investment and improving cash flows (Nikolaev, 2010; Tan, 2013), and improving a firm's ability to renegotiate with debt holders and reduce default risk (Uhrig-Homburg, 2005; Kim et al., 1993). Conditional conservatism (timely loss recognition) reduces information asymmetry (Wittenberg-Moerman, 2008). Conservative reporting reduces information asymmetry between debt holders and managers, and mitigates bondholder-shareholder conflicts, reducing debt costs and default probability (Ahmed et al., 2002). The lower information asymmetry attributable to conservatism enhances the frequency and scope of debt renegotiation (Nikolaev, 2013) and increases firms' ability to negotiate debt and avoid bankruptcy filings (Biddle et al., 2016). Based on above studies, we expect that accounting conservatism negatively influences default probability, and propose the first hypothesis:

H_1: A firm that increases accounting conservatism reduces default risk.

2.3. Efficient Investments and Accounting Conservatism

Accounting reports quality improves investment efficiency (Biddle et al., 2009). Two types of accounting reports (unconditional and conditional conservatism) improve investment efficiency (Francis

5 We follow Vassalou and Xing (2004) and Biddle et al. (2016) calculate a default risk measure. Our approach differs from KMV model adopted by Chiang et al. (2015) in two ways. First, we do not use their method to assess the asset volatility, which incorporates Bayesian adjustments for the country, industry, and size of the firm. Second, they allow for convertibles and preferred stocks in the capital structure of the firm, whereas we allow only equity, as well as short and long-term debt (Vassalou and Xing, 2004).

6 Real default is a part of financial distress stage in bankruptcy timelines (Biddle et al., 2016). The financial distress has been widely investigated in existing studies. Similar to Chiang et al. (2015) using Taiwanese data, Lee and Yeh (2004) demonstrate that weak corporate governance increases the probability of financial distress and supports the wealth expropriation hypothesis.

7 Uhrig-Homburg (2005) develops a model that captures cash-flow shortage as a reason to declare bankruptcy. Kim et al. (1993) suggest the importance of cash flow shortages in causing bankruptcy.

8 The firm's financial reporting become more conservative after covenant violations (Tan, 2013).

9 Watts and Zimmerman (1986) and Watts (2003a; 2003b) indicate that whether the reallocation may or may not cause actual defaults depends on the extent to which debt holders can induce borrowers to take remedial actions and/or are willing to renegotiate terms.

and Martin, 2010; Lara et al., 2016). Conservatism improves investment efficiency and mitigates debt-equity conflict, facilitating debt financing, limiting under- investment, and reducing over-investment (Lara et al., 2016). Timely loss recognition (conditional conservatism) decreases managerial incentives to invest in negative NPV projects (Ball and Shivakumar, 2005). More conservative accounting managers make less-risky investments (Kravet, 2014). Conservatism encourages managers to engage in low-risk behavior and smore prudent investments (Roychowdhury et al., 2010; Bushman et al., 2011). According to above research, we predict that conservative reporting has positive impacts on efficient investments, which leads to the second hypothesis:

H2a: A firm that increases accounting conservatism increases efficient investments.

2.4. Default Risk and Efficient Investments

Efficient investments reduce default risk through increasing cash savings. Accounting conservatism improves investment efficiency and increases cash flows (Francis and Martin, 2010; Lara et al., 2016). Holding cash flows reduces distress risk on the prediction horizons (Cambpell et al., 2008). Cash holdings enhance debt holders' belief in a firm's ability to pay debts and renegotiate contracts to avoid bankruptcy (Berkovitch and Isracl, 1998). Cash holdings that prevent real default serve stockholders' interests (Anderson and Carverhill, 2012). Moreover, efficient investments reduce default risk through debt financing. Ball and Shivakumar (2005) conclude that conditional conservatism curbs negative NPV projects and increases positive NPV projects to do efficient investments, which increase debt covenants and debt contracting efficiency and reduce default risk. Galai and Masulis (1976) propose that a new investment project that alleviates operating risk would reduce default probability and increase debt value. Further, tax benefits from investments would reduce default risk. Rendleman (1978) finds that tax deductibility of interest from debt financing that supports an investment reduces default probability of the debt. Accelerated tax depreciation stimulates a firm's investment that is expected to reduce default risk. Panteghini and Vergalli (2016) conclude that tax depreciation allowances lead to a decrease in the leverage and reduce default risk. Above research induces us to expect that a firm's efficient investments have negative effects on default probability. Thus, we propose the following hypothesis as:

H2b: A firm that increases efficient investments reduces default risk.

3. METHODOLOGY

3.1. Data

Our sample is a firm-year panel dataset including Taiwanese firms listed on the TWSE and extracted from Taiwan economic journal database. We use some methods to filter the initial sample. First, we delete firm-year observations with missing data and with negative assets and book values of equity. Second, following Khan and Watts (2009), we delete observations with prices per share that are <$1 and book values per share that are less than $10. Third, firms with a fiscal year ending in December are selected in the dataset. Finally, the firms in financial service industries are not selected in the dataset. We use filtering methods to obtain a final sample of 11,340 firm-year observations that contain 756 firms from 1998 to 2012. Our sample contains two subsamples: High-technology and traditional industry. The former contains 363 firms from eight industries[10]. The traditional industry consists of 393 firms from nineteen industries[11].

3.2. Variables

3.2.1. Measures of expected default frequency

In this paper, variable definitions are presented in the Appendix. Default risk is measured as expected default frequency (EDF) by applying Merton's (1974) model, which suggests that a firm's equity is regarded as a call option on the firm's assets, as indicated by Vassalou and Xing (2004). The estimation procedure is specified as follows. The market value of a firm's assets follows a geometric Brownian motion of the form presented as:

$$dV_A = \mu V_A dt + \sigma_A V_A dW \tag{1}$$

Merton's (1974) model indicates that market value of equity is viewed as a call option on the assets V_A with maturity T. Following the Black-Scholes (1973) model, a call option pricing model is specified as:

$$V_E = V_A N(d_1) - Xe^{-rT} N(d_2) \tag{2}$$

$$d_1 = \frac{\ln(V_A / X) + (r + \frac{1}{2}\sigma_A^2)\ T}{\sigma_A \sqrt{T}}, d_2 = d_1 - \sigma_A \sqrt{T} \tag{3}$$

Following the derivative procedure in Vassalou and Xing (2004), default probability is given as

$$P_{def,t} = \Pr ob\left(- \frac{\ln\left(\frac{V_{A,t}}{X_t}\right) + \left(\mu - \frac{\sigma_A^2}{2}\right)\ T}{\sigma_A \sqrt{T}} \geq \varepsilon_{t+T} \right) \tag{4}$$

Under the assumption that the normal distribution is implied in Merton's (1974) model, the theoretical default probability is specified as

$$P_{def} = N\left(- \frac{\ln\left(\frac{V_{A,t}}{X_t}\right) + \left(\mu - \frac{\sigma_A^2}{2}\right)\ T}{\sigma_A \sqrt{T}} \right) \tag{5}$$

10 For example, semiconductor, computer and peripheral equipment, optoelectronic, communications, Internet, electronic parts and components, electronic products distribution, information services, and other electronics.

11 For example, cement, food, plastic, textiles, electric machinery, electrical and cable, glass and ceramic, paper and pulp, iron and steel, rubber, automobiles, building material and construction, shipping and transportation, tourism, trading and consumer goods, chemicals, biotechnology and medical care, oil, gas and electricity, and miscellaneous.

Where, V_E is market value of equity. V_A denotes market value of a firm's assets with instantaneous volatility of assets is σ_A. Volatility of equity returns. σ_E An instantaneous drift μ is calculated by computing the mean of the change in ln V_A. W stands for a standard Wiener process, r is risk-free rate, and N $(\cdot)$ is cumulative density function of standard normal distribution. X_t denotes strike price of call option that is equal to book value of a firm's debts at time t. T denotes the time to the expiration of debt.

3.2.2. Measures of accounting conservatism

Following Beaver and Ryan (2005), this paper adopts two types of conservatism: Conditional and unconditional conservatism. The variable definitions are shown in appendix. Conditional conservatism means that economic losses are recognized in a timelier fashion (Basu, 1997; Watt, 2003; Ryan, 2006; LaFond and Watt, 2008). We adopt two proxies to measure conditional conservatism. The first proxy C_Score is used by several studies (Lara et al., 2016; Ettredge et al., 2012; Tan, 2013; Khan and Watts, 2009; Biddle et al., 2016). We calculate C_Score by a two-stage procedure that shows in supplemental material, following Khan and Watts (2009), who suggest that firms with longer investment cycles have higher conservatism and higher C_Score because of higher uncertainty and information asymmetry.

Following Callen et al. (2010), we use the second measure CR ratio that is calculated as the proportion of unexpected current earnings to total earnings news, measuring the extent to which unexpected current earnings is incorporated into total earnings shock. If a negative shock occurs, the firm with higher CR implies that it has higher conservatism because more of total negative shock is recognized in current and future cash flows (Callen et al., 2010)[12]. When calculating CR ratio, we use 1-year Taiwan Bank deposit interest rate as risk-free rate and set ρ to be 0.967, as suggested by Callen et al. (2010). CR is used by recent studies (Lara et al., 2016; Biddle et al., 2016).

Regarding unconditional conservatism, the first measure is market-to-book ratio (M/B), calculated as the ratio of market value of equity to book value of equity at the end of the year, which is used by prior studies (Khan and Watts, 2009; Ettredge et al., 2012; Tan, 2013). The larger the M/B, the more conservative system a firm employs (Callen et al., 2010)[13]. Following prior studies (Kim et al., 2013; Cheng, 2005), the second measure is research and development expenditures (R&D) scaled by sales.

We employ a third measure: Non-operating accruals (NOACC) scaled by lagged assets. This measure is calculated as total accruals (net income+depreciation−cash flow from operations) minus operating accruals, which are calculated as non-cash current assets (Δ accounts receivable+ Δ inventories+ Δ prepaid expenses) minus change in current liability excluding short-term debt (Δ accounts payable+ Δ tax payable). NOACC is widely used in the studies (Givoly and Hayn, 2000; Lara et al., 2016; Biddle et al., 2016).

Following Penman and Zhang (2002), the fourth measure is the reserve (RES), RES is calculated as the sum of capitalized research and development (R&D), capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liabilities (Penman and Zhang, 2002). The remaining two measures are the relative skewness (SKEW) and variability of earnings (VAR) relative to cash flows, which have been used in previous studies (Lara et al., 2016; Sohn, 2012; Chen et al., 2014). SKW (VAR) is calculated as the difference between earnings skewness (variability) and cash-flow skewness (variability). The greater SKEW and VAR means the higher unconditional conservatism that a firm adopts. Overall, the greater numbers of six measures means that a firm employs more conservative accounting reporting.

3.2.3. Measure of efficient investments

Following variable definition of Lara et al. (2016), we measure efficient investments as the sum of R&D, capital expenditure and acquisition expenditure less cash receipts from the sale of property, plants, and equipment; the sum is multiplied by 100 and scaled by lagged sales.

3.3. Empirical Models

To examine Hypothesis H1 that accounting conservatism reduces default risk, this paper estimates an empirical model below:

$$EDF_{Iit} = \alpha_1 + \beta_1 UNCON_{i,t-1} + \beta_2 CONCON_{i,t-1} + \gamma Controls_{i,t} + \varepsilon_{i,t} \quad (6)$$

Where EDF denotes expected default frequency. UNCON and CONCON represent unconditional and conditional conservatism, respectively. UNCON contains six variables: M/B, NOACC, R&D, RES, SKW, and VAR. CONCON includes two variables: C_SCORE and CR. Based on Hypothesis H1, we predict that the sign of UNCON and CONCON is negative: $\beta_1 < 0, \beta_2 < 0$ in Eq. (6).

Controls represents control variables that affect default risk used by previous research (Anderson and Carverhill, 2012; Campbell et al., 2008; Eberhart et al., 2008) as follows. Firm size (ln MV) is calculated by the natural logarithm of market capitalization at the fiscal year end. Leverage ratio (LEV) equals short-term plus long-term debt scaled by total asset. Return on total assets (ROA) is the ratio of earnings over total assets. Return volatility (Std_Ret) is standard deviation of 5 years of stock return. The risk-free rate (rate) is measured by 1-year Taiwan Bank deposit interest rate. R&D investment intensity (Inten_RD) is the ratio of R&D expenses to total assets.

To further examine hypotheses H2a and H2b, we study the effect of accounting conservatism on efficient investments and the effect of efficient investments on default risk, and specify two empirical models as follows:

$$INV_{i,t} = \alpha_2 + \beta_3 UNCON_{i,t-1} + \beta_4 CONCON_{i,t-1} + \gamma_1 Controls_{i,t} + \varepsilon_{i,t} \quad (7)$$

12 Calculation procedures are presented in Appendix and the supplemental material.

13 When accounting reporting is more conservative, book value is understated more relative to market value (Ashton and Wang, 2013).

$$EDF_{i,t} = \alpha_3 + \theta_1 INV_{i,t} + \gamma_2 Controlsi_{i,t} + \varepsilon_t \quad (8)$$

Following Baron and Kenney (1986), the two models test the mediating effect of a channel, INV. Where, INV denotes efficient investments, which is calculated as the sum of R&D, capital expenditure and acquisition expenditure less cash receipts from the sale of property, plants, and equipment. The sum is multiplied by 100 and scaled by lagged sales (Lara et al., 2016). UNCON and CONCON are the variables that measure unconditional and conditional conservatism. Based on Hypothesis H2a and H2b, we expect the sign of UNCON and CONCON to be positive: $\beta_3 > 0, \beta_4 > 0$ in Eq. (7). The sign of INV is expected to be negative, $\theta_1 < 0$ in Eq. (8). Moreover, following Lara et al. (2016), we include control variables that affect efficient investments, including size, LEV, StdCFO, StdSales, StdInvestment, proportion of tangible assets (tangibility), CFOSale, dividend payout (Dividend), OperCycle, InvCycle, and financial slack (Slack).

4. EMPIRICAL RESULTS

4.1. Preliminary Analysis

4.1.1. Descriptive statistics

Table 1 presents descriptive statistics for full sample and two subsamples. We find that average EDF 0.15 for full sample is <0.01 of Taiwanese firms reported by Chiang et al. (2015). The average investment 24.09% is close to the ratio of investment of 25.29% in Lara et al. (2016), suggesting that on average, Taiwanese firms invest 24 NT dollars when they have sales of 100 NT dollars. Conservatism variables NOACC, RES, VAR, and C_SCORE display larger variations because of a larger standard deviation, suggesting that for each of these variables, there is significant variance among Taiwanese sample firms. Average CR ratio 0.14 is smaller than that (0.51) in Callen et al. (2010), implying that the degree of conservative reporting in Taiwanese firms is lower than that in the U.S. firms studied by Callen et al. (2010).

Wilcoxon test results are shown in final column of Table 1, the ($P < 0.01$) suggests significant differences between the two types of firms for all variables except NOACC, RES, and SKW. For example, the means of EDF and C_SCORE for high-tech firms are significantly lower than those of traditional firms. High-tech firms have significantly higher means for INV and conservatism variables (M/B, R&D, VAR, CR) than traditional firms.

4.1.2. Model diagnostics

To examine whether our estimation results are influenced by multicollinearity, we conduct a multicollinearity test for regression models. Table 2 shows that individual variance inflation factors (VIF) for full sample and two subsamples range from 1.0 t0 9.3, lower than 10, which is the threshold value at which multicollinearity may influence the regression estimates (Belsley et al., 1980)[14]. Test findings suggest that multicollinearity did not bias our estimation results. In addition, Durbin-Watson statistics in Eq. (6)-Eq. (8) for full sample and two subsamples are between 1.8 and 2.5, suggesting that no autocorrelation of error terms exists in the estimated models.

We further examine three statistical characteristics (heteroskedasticity, endogeneity, and persistency) that may be sources of bias and inefficiency in estimated coefficients of regression models. Following Westerlund and Narayan's (2015) work, we conduct three tests based on data-generating process[15]. Table 2 reports test results. Residual heteroskedasticity test shows that for three groups of samples, null of no heteroskedasticity is not rejected for three regressions at 10%, 5%, 1% significance levels. Similarly, the F value of three regressions does not reject the null significantly.

To test the endogeneity of regressors, we estimate Eq. (1) and Eq. (2) of Westerlund and Narayan (2015) and obtain two error terms, $\varepsilon_{y,t}$, $\varepsilon_{x,t}$. We use two error terms to estimate Eq. (3) and obtain the estimator $\hat{\gamma}$ of, which indicates the coefficient in the regression of $\varepsilon_{y,t}$ onto $\varepsilon_{x,t}$. Table 2 shows that $\hat{\gamma}$ is not significantly different from zero, suggesting that the null of no endogeneity ($\gamma=0$) is not rejected for all regressors in three regressions for three samples, implying that no endogeneity exists in all regressors.

To confirm that spurious regressions proposed by Granger and Newbold (1974) did not occur in our regressions, we conduct augmented Dickey-Fuller (ADF) panel unit root tests to examine whether independent variables are stationary. Test results in Table 2 suggest that for three sets of samples, independent variables in each model are stationary because ADF value rejects null hypothesis of a unit root at the 1%, 5%, and 10% significance levels, implying that no persistence exists in the regressors of three models.

4.2. Results for Full Sample

The effects of accounting conservatism on default risk are reported in Table 3. For full sample, UNCON (M/B, NOACC, RES, and VAR) and CONCON variables (C_SCORE) have negative effects on EDF at the 1% significance level. Both types of conservatism variables support Hypothesis H1, confirming that a firm with more accounting conservatism reduces default risk because it has more reserves to improve firm performance, thus reducing default probability. The coefficients of unconditional conservatism range from 0.005 to −0.009, larger than the UC_PCA coefficient −0.0443 in Biddle et al. (2016). However, coefficients of conditional conservatism, −8.496 for CR and −0.083 for C_SCORE, are smaller than the CC_PCA coefficient of −0.0083 in Biddle et al. (2016)[16].

Table 4 shows that for full sample, accounting conservatism has positive effects on efficient investments; for example, M/B, NOACC, R&D, RES, CR and C_SCORE have a positive impact

14 In multicollinearity tests, an exceptional case is found. The MV for high-tech subsamples showing that the VIF value is larger than 10 has been dropped from Eq. (2).

15 Westerlund and Narayan's (2015) data generating-processes are given as $y_t = \theta + \beta x_{t-1} + \varepsilon_{y,t}$ (1), $x_t = \mu(1-\rho) + \rho x_{t-1} + \varepsilon_{x,t}$ (2), ε $\gamma\varepsilon$ ε (3). We use Eviews software to conduct these tests for three statistical characteristics (e.g., heteroskedasticity, endogeneity, and persistency).

16 In Biddle et al. (2016), UC_PCA and CC_PCA are the variables that proxy for unconditional conservatism and conditional conservatism, respectively.

Table 1: Descriptive statistics

Variable	Full sample				High-tech firms				Traditional firms				P
	Mean±SD	Median	Maximum	Minimum	Mean±SD	Median	Maximum	Minimum	Mean±SD	Median	Maximum	Minimum	
EDF	0.15±0.16	0.06	0.96	0.029	0.01±0.03	0.005	0.96	0.00	0.29±0.11	0.33	0.39	0.00	0.000
INV	426.46±1986.86	161.52	65915.82	−19870.85	579.96±1907.18	302.58	43927.15	−2233.18	284.67±2047.68	70.24	65915.82	−19870.85	0.000
M/B	1.79±1.67	1.34	28.69	0.00	2.23±1.96	1.74	26.38	0.00	1.33±1.13	1.07	28.69	0.04	0.000
NOACC	−4000.25±3579139	−66026	44291398	−79812301	−24748.52±3635656	−72285	44291398	−79812301	15190.32±3526294	−58331	44291398	−79812301	0.786
R and D	3.97±14.31	1.63	628.74	−144.46	4.65±8.56	2.04	412.83	−21.47	3.34±18.03	0.7	628.74	−144.46	0.000
RES	1250.12±37821.14	214.48	1820251	−1436261	1660.71±43186.69	209.21	1820251	−395399.3	870.91±32077.86	215.96	1377258	−1436261	0.119
SKW	−6.95±207.21	8.49	6.22	−6470.57	−15.71±298.82	0.44	6.22	−6470.57	0.56±1.54	0.56	4.89	−5.15	0.649
VAR	127007±988219	43207	17177778	−5848800	230620±1284862	55305	17177778	−3461082	31303±578665	33600	3509293	−5848800	0.000
CR	0.14±25.54	−0.04	1579.3	−761.78	0.21±26.31	0.03	761.78	−756.49	−0.27±27.59	0.16	321.7	−1579.3	0.000
C_score	24789876±121509218	3430670	3165514281	−376492	5121469±22659682	551672	477410825	−376492	44185237±165094655	11664418	3165514281	136420	0.000
Controls variable													
LMV	15.32±1.39	15.21	21.65	10.61	15.53±1.39	15.33	21.64	11.35	15.14±1.37	15.06	20.66	10.61	0.000
LEV	0.71±1.59	0.35	39.88	0.00	0.46±0.79	0.27	30.22	0.00	0.93±2.05	0.46	39.88	0.00	0.000
ROA	1.75±3.71	1.81	41.87	−42.88	2.44±4.02	2.51	39.06	−42.88	1.05±3.21	1.23	41.87	−32.5	0.000
Std_Ret	51.08±31.77	49.21	303.84	0.00	61.72±19.93	59.66	112.42	21.77	41.25±37.03	35.25	303.84	0.00	0.000
RATE	2.11±1.31	1.59	5.67	0.55	2.11±1.33	1.58	5.66	0.55	2.12±1.31	1.59	5.67	0.55	0.995
Inten_RD	2.54±7.26	0.61	412.83	−21.47	4.81±9.83	2.25	412.83	−21.47	0.45±1.46	0.11	44.41	−9.98	0.000
StdCFO	411172±1464258	114293	61772942	0.00	533549±1981375	116748	61772942	162.5	298157±687279	112393	11092583	0.00	0.000
StdSales	2773693±16173188	470496	708205999	0.00	4142683±22336677	534677	708205999	0.00	1510598±6268934	431514	188102647	869	0.000
StdInv	161.76±984.61	41.42	27989	0.00	170.11±483.31	74.46	15680	0.44	154.05±1284	17.19	27989	0.00	0.000
Tangibility	0.25±0.019	0.21	3.22	0.00	0.20±0.18	0.14	3.22	1.15	0.28±0.19	0.26	0.94	0.00	0.000
CFOsale	0.02±2.69	0.03	84.63	−263.07	0.05±0.17	0.04	9.78	−5.89	−0.007±3.74	0.03	84.63	−263.07	0.000
Dividend	627512±3405007	72987	77748668	0.00	683406±4016687	37776	77748668	0.00	466650±2684917	26000	61963844	0	0.000
OperCycle	652.79±15321	76.43	1102494	−3370	81.85±204.77	62108	7196	−3370	1105.6±20504	91.00	1102494	−1583	0.000
InvCycle	4.85±7.54	1.01	164	0.00	0.025±0.03	0.01	0.33	0.00	8.27±8.25	6.00	164	0.00	0.000
Slack	10.10±606.15	0.11	60415	0.00	0.13±0.12	0.09	0.77	0.031	17.16±792.32	0.14	60415	0.00	0.000

This statistics are reported for Taiwan listed firms on the TWSE. Our full sample includes two sub-samples: High-technology and traditional industry. The 756 firms in full sample are constituted by 363 high-tech firms and 393 traditional firms. This table reports summary statistics for each of the variables as follows. EDF: The expected default frequency measured as default risk, INV: Investment is calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure, less cash receipts from the sale of property, plant, and equipment, multiplied by 100 and scaled by lagged sales, M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R and D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability), SKW (the relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_score is calculated by using a two-stage procedure following Khan and Watts (2009), Control variables: Controls include the following variables, LMV: Firm size is calculated by natural logarithm of market capitalization at the fiscal year end, LEV: Leverage ratio equals short-term plus long-term debt scaled by total asset, ROA: Return on total assets is the ratio of earnings over total assets, Std_Ret: Return volatility is standard deviation of 5 years of stock return, RATE: Risk-free rate is measured by the 1-year Taiwan Bank deposit interest rate, Inten_RD: R and D investment intensity is the ratio of R and D expenses to total assets, StdCFO: Volatility of cash flow from operations, StdSales: Volatility of sales), StdInv: Volatility of investment, Tangibility: Proportion of tangible assets, CFOsale: Opetating cash flow to sales, Dividend: Dividend payout ratio, OperCycle: Length of the operating cycle, InvCycle: Length of the investment cycle, Slack (financial slack). The P value of the Wilcoxon nonparametric two sample test examines whether there is a significant difference between the high-tech and traditional firms, SD: Standard deviation. ***, **, *Significance at the 1%, 5%, and 10% level, respectively

Table 2: Model diagnostics

Panel A

Model 1: $EDF_t=\alpha_1+\beta 1UNCON_{t-1}+\beta 2CONCON_{t-1}+\gamma Controlst+\varepsilon_t$

Variable	Full sample						High-tech firms						traditionalFirms					
	Heteroskedasticity		Endogeneity		ADF	VIF	Heteroskedasticity		Endogeneity		ADF	VIF	Heteroskedasticity		Endogeneity		ADF	VIF
	Stastistics	P	$\hat{\gamma}$	P			Stastistics	P	$\hat{\gamma}$	P			Stastistics	P	$\hat{\gamma}$	P		
Dependent variable: EDF																		
UNCON																		
M/B	8.64	0.02	0.03	0.28	−31.98***	1.67	2.87	0.09	0.001	0.83	−25.52***	1.68	0.05	0.82	0.08	0.07	−25.42***	1.72
NOACC	4.41	0.11	−0.05	0.44	−23.7***	1.21	1.39	0.24	−0.008	0.21	−6.83***	1.02	2.13	0.12	−0.065	0.38	−2.58***	1.68
R and D	8.07	0.02	−0.18	0.11	−17.95***	1.49	0.92	0.39	−0.04	0.34	−16.68***	1.95	1.52	0.22	−0.176	0.05	−8.91***	1.09
RES	1.06	0.31	−0.02	0.65	−22.88***	1.36	0.77	0.46	−0.009	0.32	−16.87***	1.06	0.08	0.77	0.285	0.02	−15.01***	1.26
SKW	7.33	0.23	0.06	0.56	−21.67***	1.02	0.06	0.81	−0.001	0.84	−14.87**	1.07	0.18	0.67	−0.673	0.05	−6.98***	1.02
VAR	3.86	0.15	−0.35	0.67	−39.75***	1.04	0.45	0.63	0.057	0.84	−27.82***	1.01	2.01	0.13	−0.376	0.05	−14.62***	1.04
CONCON	0						1											
CR	0.51	0.62	−0.03	0.64	−74.61***	1.01	1.83	0.18	0.001	0.75	−5.19***	1.19	0.23	0.63	0.003	0.81	−38.17***	1.17
C_SCORE	0.002	0.96	−0.05	0.34	−10.88***	2.15	1.91	0.15	0.002	0.85	−11.18***	9.31	1.49	0.22	0.055	0.18	−4.73***	2.53

This table reports the results of model diagnostics for the regression of default frequency on accounting conservatism. To save the space, we show the results of independent variables, and control variables are not reported here, but they are available upon the readers' requests. ***, **, *Significance at the 1%, 5%, and 10% level, respectively. The individual VIF of the dependent variables for full sample and two subsamples range from 1.0 to 9.3 smaller than 10, indicating that multillinearity would not bias our estimation results. The statistic values of three samples do not reject the null of no heteroskedasticity for 1% significantly level. $\hat{\gamma}$ is not significantly different from zero, suggesting that the null of no endogeneity (γ =0) is not rejected and no endogeneity exists in all regressors for three samples. ADF statistic value rejects null hypothesis of a unit root at 1%, 5%, and 10% significant level, suggesing that no persistency exists in dependent variables and they are stationary. VIF: Variance inflation factor. M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R and D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability), SKW (the relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_score is calculated by using a two-stage procedure following Khan and Watts (2009)s is the ratio of earnings over total assets, Std_Ret: Return volatility is standard deviation of 5 years of stock return, RATE: Risk-free rate is measured by the 1-year Taiwan Bank deposit interest rate

Panel B

Mode 2: $INV_t=\alpha_2+\beta_3UNCON_{t-1}+\beta_4CONCON_{t-1}+\gamma_1+Controls_t+\varepsilon_t$

Variable	Full sample						High-tech firms						Traditional firms					
	Heteroskedasticity		Endogeneity		ADF	VIF	Heteroskedasticity		Endogeneity		ADF	VIF	Heteroskedasticity		Endogeneity		ADF	VIF
	Stastistics	P-value	$\hat{\gamma}$	P			Stastistics	P-value	$\hat{\gamma}$	P-value			Stastistics	P-value	$\hat{\gamma}$	P-value		
Dependent variable: INV																		
UNCON																		
M/B	1.35	0.25	−0.06	0.71	−35.63***	1.62	1.91	0.16	−10.1	0.89	−17.78***	2.14	0.28	0.75	−0.18	0.24	−24.89***	1.73
NOACC	0.34	0.55	7.68	0.08	−22.76***	1.25	1.58	0.45	25.5	0.95	−13.39***	1.14	5.07	0.03	0.51	0.08	−1.472*	1.79
R&D	6.87	0.99	−0.05	0.87	−17.95***	1.48	1.71	0.19	−106	0.83	−17.45***	2.64	0.03	0.97	−0.11	0.08	−2.09***	1.37
RES	2.23	0.08	0.15	0.45	−25.85***	1.38	1.15	0.28	859.5	0.18	−6.46***	1.52	0.69	0.71	0.15	0.72	−15.01***	1.12
SKW	2.44	0.09	0.06	0.56	−40.19***	1.02	0.62	0.54	228.3	0.77	−3.16***	1.06	1.39	0.51	−0.42	0.03	−29.39***	1.02
VAR	4.06	0.02	−0.35	0.67	−39.75***	1.06	0.17	0.84	229.4	0.78	−12.28***	1.35	0.75	0.47	−0.89	0.36	−28.71***	1.03
CONCON																		
CR	0.05	0.95	0.02	0.65	−74.61***	1.24	2.14	0.12	25.2	0.39	−8.71***	1.17	0.80	0.45	0.01	0.91	−38.17***	1.13
C_SCORE	1.89		0.17		−9.59	2.41	−10.88***						−15.1	0.91	4.97	1.61	0.19	0.07

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Panel C

Model 3: $EDF_t=\alpha_3+\theta_1 INV_t+\gamma_2 Controls_t+\varepsilon_t$

Variable	Full sample					High-tech firms					Traditional firms				
	Heteroskedasticity	Endogeneity		ADF	VIF	Heteroskedasticity	Endogeneity		ADF	VIF	Heteroskedasticity	Endogeneity		ADF	VIF
	Stastistics	P	$\hat{\gamma}$	P		Stastistics	P	$\hat{\gamma}$	P		Stastistics	P	$\hat{\gamma}$	P	
Dependent variable: EDF															
INV	1.95	0.16	0.15	0.19	−13.66*** 1.19	0.61	0.54	−0.07	0.97	−4.52*** 1.29	0.66	0.51	−1.09	0.21	−12.64*** 1.05

This table reports the results of model diagnostics for the regression of investment on accounting conservatism (Panel B) and default frequency on investment (Panel C). To save the space, we show the results of independent variables, and control variables are not reported here, but they are available upon the readers' requests. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. The individual variance inflation factor (VIF) of the dependent variables for full sample and two subsamples range from 1.0–4.9 smaller than 10, indicating that multilinearity would not bias our estimation results. The statistic values of three samples do not reject the null of no heteroskedasticity at 1% significantly level. $\hat{\gamma}$ is not significantly different from zero, suggesting that the null of no endogeneity (γ =0) is not rejected and no endogeneity exists in all regressors for three samples. ADF statistic value rejects null hypothesis of a unit root at 1%, 5%, and 10% significant level, suggesing that no persistency exists in dependent variables and they are stationary

on investment at the 1%, 5%, and 10% significance levels. Two types of conservatism variables have positive explanatory power on investment, supporting Hypothesis H2a. The economic significance of coefficient β_3 (or β_4) means that a one percentile change in CONCON (or UNCON) leads to an increase in INV. The C_SCORE coefficient (0.154) is smaller than the coefficient (1.338) in Lara et al. (2016) because our measurement method is different from that in Lara et al. (2016)[17]. Table 5 reports that the negative effect of INV on EDF is significant. The θ_1 coefficient is significantly negative (−0.002, t-stat= −1.702, *p*-value=0.088) supporting Hypothesis H2b.

Control variables generally provide results consistent with expectations. Regarding Table 3, LMV, RATE, and Inten_RD have negative effects on EDF at 1% significance level. In Table 4, LMV, StdInv, OperCycle significantly have positive effects on EDF. In Table 5, LMV, RATE, and Inten_RD have negative effects on EDF at 1% and 5% significance level.

4.3. Results for High-tech Firms

The findings for high-technology firms in Table 3 show that the effects of RES and C_SCORE on EDF are significantly negative at the 5% and 1% significance level. Both types of conservatism variables support Hypothesis H1 that a more conservative firm reduces default risk. RES coefficient −0.001 is larger than that (−0.0443) of Biddle et al. (2016). The C_SCORE coefficient −0.004 is larger than −0.0083 of Biddle et al. (2016). In the columns of high-tech firms in Table 4, unconditional conservatism variables (M/B, NOACC, R&D) have a positive effect on INV at the 1% significance level supporting Hypothesis 2a; whereas conditional conservatism variables do not. Table 5 show that θ_1 coefficient (−0.045, t-stat= −1.815, *p*-value=0.069) is significantly negative, suggesting that the effect of INV on EDF is negative at the 10% significance level in favor of Hypothesis 2b. Control variables mostly present results in accordance with expectations. In Table 3, the impacts of RATE and Inten_RD on EDF are negative at the 1% and 5% significant levels, respectively. Regarding Table 4, StdInv has significantly positive effect on INV, and LEV, StdCFO, StdSales has significantly negative effect on INV. In Table 5, LMV, ROA, RATE present a significantly negative effect on EDF while others do not.

4.4. Results for Traditional Firms

Traditional firms in Table 3 report that the effect of M/B, NOACC, R&D, SKW on EDF is significantly negative at the 1% level. CR and C_SCORE do not have significant effects on EDF. Only unconditional conservatism variables support Hypothesis H1. Table 4 show that the impacts of UNCON-M/B, NOACC, R&D, RES on INV are positive at 1% and 10% significant levels. CONCON-CR, C_SCORE are positively associated with INV at the 1% significance level. Both types of conservatism variables have positive effects on investment, supporting Hypothesis 2a. The C_SCORE coefficient 0.213 is smaller than the coefficient 1.338 in Lara et al. (2016). Traditional firms findings in Table 5 show a significant and

17 The conservatism variable (CON) in Garcia Lara et al. (2016) is defined as three-year average of the G-Score plus the C-Score.

Table 3: The regression results of default risk on accounting conservatism

Model 1: $EDF_t=\alpha_1+\beta_1 UNCON_{t-1}+\beta_2 CONCON_{t-1}+\gamma Controls_t+\varepsilon_t$

Variables	Sign	Full sample			High-tech firms			Traditional firms		
		Coefficients	t-statistics	P	Coefficients	t-statistics	P	Coefficients	t-statistics	P
Intercept								1.834	1.642	0.101
UNCON										
M/B	–	−0.009	−3.639	0.000***	0.002	0.613	0.543	−0.082	−2.154	0.031**
NOACC	–	−0.002	−2.626	0.008***	−0.006	−0.879	0.382	−0.016	−3.366	0.000***
R and D	–	−0.007	−1.019	0.308	0.009	0.486	0.627	−0.016	−1.866	0.063*
RES	–	−0.009	−2.774	0.005***	−0.001	−1.905	0.058**	−0.002	0.444	0.657
SKW	–	0.005	0.590	0.555	0.010	1.505	0.134	−0.057	−1.658	0.098*
VAR	–	−0.001	−1.951	0.051**	1.889	0.254	0.799	0.008	0.984	0.325
CONCON	–									
CR	–	−8.496	−0.247	0.805	−0.002	−0.737	0.462	0.007	1.815	0.070*
C_SCORE	–	−0.083	80.212	0.000***	−0.004	−4.055	0.000*	−0.001	−0.021	0.983
Controls										
LMV	–	−0.090	−55.30	0.000***	−0.005	−1.387	0.167	0.128	2.288	0.022**
LEV	+	+0.002	−3.681	0.000***	−0.003	−0.098	0.921	−0.085	−0.022	0.982
ROA	–	−0.003	−0.819	0.412	−3.256	−0.020	0.984	−0.021	−13.534	0.000***
Std_Ret	+	−0.002	−1.346	0.178	−3.565	−0.984	0.326	0.012	0.856	0.392
RATE	–	−0.015	−9.217	0.000***	−0.005	−4.127	0.000***	−0.038	−1.779	0.076*
Inten_RD	–	−0.004	−2.534	0.011***	−0.006	−2.118	0.035**	−0.051	−3.562	0.000***
R2		0.750			0.722			0.685		
N.obs.		11340			5445			5895		

Dependent variable is the expected default frequency of firms, and the independent variables are reported as follows. M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R&D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability, SKW the relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_Score is calculated by using a two-stage procedure following Khan and Watts (2009), Control variables: Controls include the following variables. LMV: Firm size is calculated by natural logarithm of market capitalization at the fiscal year end, LEV: Leverage ratio equals short-term plus long-term debt scaled by total asset, ROA: Return on total assets is the ratio of earnings over total assets, Std_Ret: Return volatility is standard deviation of 5 years of stock return, RATE: Risk-free rate is measured by the 1-year Taiwan Bank deposit interest rate, Inten_RD: R and D investment intensity is the ratio of R and D expenses to total assets). ***,**,* indicate significance at the 1%, 5%, and 10% level, respectively

Table 4: The regression results of investment on accounting conservatism

Model 2: $INV_t=\alpha_2+\beta_3 UNCON_{t-1}+\beta_4 CONCON_{t-1}+\gamma_1 Controls_t+\varepsilon_t$

Variables	Sign	Full sample			High-techfirms			Traditionalfirms		
		Coefficients	t-statistics	P	Coefficients	t-statistics	P	Coefficients	t-statistics	P
Intercept										
UNCON										
M/B	+	0.153	3.634	0.000***	0.334	2.552	0.011***	0.245	4.301	0.000***
NOACC	+	0.017	2.181	0.029**	0.122	2.315	0.021***	0.016	1.626	0.104*
R and D	+	0.182	14.437	0.000***	0.465	6.547	0.000***	0.004	2.914	0.003***
RES	+	0.003	1.636	0.101*	0.002	0.034	0.972	0.029	2.713	0.006***
SKW	+	−0.058	−1.298	0.194	0.061	1.096	0.274	0.035	0.447	0.654
VAR	+	0.002	0.054	0.956	−0.007	−0.012	0.989	−0.020	−0.327	0.743
CONCON										
CR	+	0.004	2.110	0.034**	0.025	0.922	0.357	0.018	2.663	0.007***
C_SCORE	+	0.154	5.692	0.000***	0.038	0.649	0.517	0.213	4.044	0.000***
Controls										
LMV	–	0.269	5.705	0.000***	−0.353	−2.207	0.028**	2.861	0.402	0.687
LEV	–	−0.004	−0.050	0.961	−0.497	−2.336	0.020**	0.004	0.423	0.672
StdCFO	–	−2.698	−2.379	0.017**	−0.161	−2.141	0.033**	−8.968	−2.143	0.032**
StdSales	–	−3.809	−2.050	0.043**	−0.318	−3.899	0.000***	−6.989	−0.862	0.388
StdInv	+	0.002	10.336	0.000***	0.443	0.181	0.000***	0.002	8.017	0.000***
Tangibility	+	−0.852	−4.967	0.000***	0.812	0.863	0.388	−1.184	−5.824	0.000***
CFOsale	–	−0.007	−2.619	0.008***	−0.685	−1.249	0.212	−0.011	−3.012	0.002***
Dividend	–	−8.159	−1.534	0.124	0.028	0.501	0.616	−4.809	−0.663	0.507
OperCycle	+	3.196	5.726	0.000***	−0.037	−0.615	0.539	2.436	3.976	0.000***
InvCycle	–	0.005	1.666	0.095*	−4.567	−1.164	0.245	−0.010	2.922	0.003***
Slack	+	1.635	1.007	0.314	−0.631	−1.331	0.184	1.665	1.287	0.198
R2		0.830			0.843			0.801		
N.obs.		11340			5445			5895		

Dependent variable is the expected default frequency of firms, and the independent variables are reported as follows. M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R and D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability, SKW: The relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_Score is calculated by using a two-stage procedure following Khan and Watts (2009), Control variables: Controls include the following variables, StdCFO: Volatility of cash flow from operations, StdSales: Volatility of sales, StdInv: Volatility of investment, Tangibility: Proportion of tangible assets, CFOsale: Opetating cash flow to sales, Dividend: Dividend payout ratio, OperCycle: Length of the operating cycle, InvCycle: Length of the investment cycle, Slack: Financial slack. ***, **, *Significance at the 1%, 5%, and 10% level, respectively

Table 5: The regression results of default risk on investment

Model 3: $EDF_t=\alpha_3+\theta_1 INV_t+\gamma_2 Controls_t+\varepsilon_t$										
Variables	**Sign**	**Full sample**			**High-tech firms**			**Traditional firms**		
		Coefficients	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**
Intercept								0.642	0.662	0.508
INV	–	−0.002	−1.702	0.088*	−0.045	−1.815	0.069*	−0.009	−1.713	0.087*
Controls										
LMV	–	−0.010	−5.292	0.000***	−9.471	−2.871	0.004***	−0.074	−4.909	0.000***
LEV	+	−0.002	−3.002	0.002***	−0.096	+5.329	0.000***	−0.001	−0.225	0.822
ROA	–	0.002	0.804	0.421	−0.012	−3.070	0.002***	−0.018	−12.160	0.000***
Std_Ret	+				−0.003	+4.337	0.000***	−0.011	−0.818	0.413
RATE	–	−0.017	−14.547	0.000***	−0.498	−23.683	0.000***	0.150	0.722	0.471
Inten_RD	–	−0.002	−1.932	0.053**	0.005	0.288	0.773	0.002	0.029	0.976
R2	+	0.757			0.980			0.631		
N.obs.		11340			5445			5895		

Dependent variable is the expected default frequency of firms, and the independent variables are reported as follows. INV is efficient investment calculated as the sum of research and development expenditure, capital expenditure, and acquisition expenditure, less cash receipts from the sale of property, plant, and equipment; multiplied by 100; and scaled by lagged sales. Control variables: Controls include the following variables. LMV: Firm size is calculated by natural logarithm of market capitalization at the fiscal year end, LEV: Leverage ratio equals short-term plus long-term debt scaled by total asset, ROA: Return on total assets is the ratio of earnings over total assets, Std_Ret: Return volatility is standard deviation of 5 years of stock return), RATE: Risk-free rate is measured by the 1-year Taiwan Bank deposit interest rate, Inten_RD: R and D investment intensity is the ratio of R and D expenses to total assets. ***, **, *Significance at the 1%, 5%, and 10% level, respectively

negative coefficient θ_1 (−0.011, t-statistic = −1.624, $P = 0.104$), which suggests that INV has negative explanatory power on EDF at the 10% significance level, supporting Hypothesis 2b. We combine the results of supporting Hypotheses H2a and H2b, suggesting that a firm with more accounting conservatism increases more efficient investments, which reduce default risk. Control variables generally display results in accordance with expectations. In Table 3, ROA, RATE, and Inten_RD are negatively associated with EDF. Table 4 shows that StdInv and OperCycle are positively and significantly associated with INV. In Table 5, ROA and LMV present a negative and significant relation with EDF, as expected.

4.5. Robustness Tests

Vassalou and Xing (2004) indicate that high default-risk firms earn higher returns than low default-risk firms, suggesting that stock returns are associated with the high and low degrees of default risk. Their evidences induce us to study whether our above findings are influenced by the degree of default risk and conservatism. To test whether the effect of conservatism on default risk varies with the degrees of default risk and conservatism, we use the following procedure to sort the data and examine each sorted subsample. First, we sort each variable from small to large values and construct the distribution. Based on the distribution, we divide the data into four groups. From the lower to the upper quartile, four groups are named the first quartile subsample (0~25%), the second quartile subsample (26~50%), the third quartile subsample (51~75%), and the fourth quartile subsample (76~100%). Secondly, we use the data of each subsample to re-estimate three regression models Eq.(1) ~ Eq. (3), and report the results in Tables 6-8.

The robustness test results confirm our findings in sections 4.2 to 4.4. For full sample and two industrial firms, four quartile subsamples display the evidence in favor of three hypotheses, H1, H2a, and H2b, suggesting that the effect of conservatism on default risk does not vary with the degrees of default probability and conservatism. These findings are not similar to Vassalou and Xing (2004), who indicate that stock returns are associated with the degrees of default risk.

5. DISCUSSION

5.1. Test of Hypothesis 1

The findings in Table 3 support Hypothesis H1, indicating that both types of conservatism have significant negative impacts on default risk in full samples and in high-tech firms except for traditional firms, which only have evidences on unconditional conservatism, not conditional conservatism. The results can be explained for two reasons. First, traditional firms composed by nine industries have various industry characteristics. In some industries, using conditional conservatism (reporting of timelier loss recognition) in response to bad news enhances debt holders' monitoring power and improves cash flows sufficiently to pay debt, thereby reducing default probability; however, other industries do not. Second, because of divergent characteristics, traditional firms are apt to be influenced by the fluctuations in market factors (interest rates, exchange rates, stock price). When they adopt conditional conservatism, some reduce default risk while others do not, leading to various operating performance. Compared to traditional industries,[18], high-tech firms have consistent electronic industrial characteristics; thereby when they adopt more conditional conservatism, it could reduce default risk consistently.

We observe that negative effects of unconditional conservatism on default probability in traditional firms are stronger than those in high-tech firms. For example, a negative and significant variable M/B (−0.082) in traditional firms has a larger absolute coefficient than RES (−0.001) in high-tech firms. Additionally, our evidence of full samples and high-tech firms comports with Carrizonsa and Ryan (2013), indicating that negative effect of conditional conservatism on default probability is stronger than that of unconditional conservatism. For example, in high-tech firms, the

18 Based on the definitions provided by the Taiwanese Council for Economic Planning and Development, the high-tech industry in Taiwan includes the information, telecommunications, consumer electronics, precision machinery and automation, medical and health care, high-level materials, semiconductors, pollution prevention, aeronautics and astronautics, rare chemicals, and pharmaceuticals industries (Chiang et al., 2015. p. 58).

Table 6: Robustness test 1- regression of default risk on accounting conservatism

Model 1: $EDF_t=\alpha_1+\beta_1 UNCON_{t-1}+\beta_2 CONCON_{t-1}+\gamma Controls_t+\varepsilon_t$									
Variables	**Sign**	**Full sample**			**High-tech firms**			**Traditional firms**	
		Coefficients	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**
Subsample of the fourth quartile (76–100%)									
M/B	–	0.068	10.85	0.00***	0.055	8.12	0.00***	−0.001	−0.31	0.76
NOACC	–	−0.091	−25.63	0.00***	−0.066	−9.01	0.00***	−0.035	0.41	0.68
R&D	–	0.018	6.86	0.00***	−0.012	−5.99	0.00***	−0.017	−1.55	0.12
RES	–	−0.035	−38.57	0.00***	0.026	13.95	0.00***	−3.415	−0.32	0.75
SKW	–	0.093	34.39	0.00***	4.696	11.97	0.00***	0.001	2.81	0.00***
VAR	–	0.007	4.01	0.00***	0.051	0.57	0.56	6.746	0.08	0.93
CR	–	−0.003	−18.54	0.00***	0.014	7.49	0.00***	−1.485	−0.14	0.88
C_SCORE	–	−0.034	−12.02	0.00***	0.038	7.33	0.00***	−0.012	−1.07	0.28
Controls included		Yes			Yes			Yes		
R2		0.99			0.94			0.97		
N.obs.		2824			1356			1468		
Subsample of the third quartile (51–75%)									
M/B	–	0.003	0.39	0.69	−3.48	−0.49	0.62	−0.002	−1.85	0.06*
NOACC	–	−0.009	−1.75	0.07**	−3.05	−0.08	0.92	0.415	1.97	0.04**
R and D	–	−0.005	−0.66	0.51	0.001	2.82	0.00***	0.002	2.56	0.01***
RES	–	−0.014	−2.24	0.02**	2.84	0.83	0.41	0.002	1.62	0.10*
SKW	–	−0.014	−2.48	0.01**	−5.56	−1.67	0.09*	0.003	1.52	0.12
VAR	–	−0.006	−0.74	0.45	−1.67	−0.23	0.81	0.005	0.95	0.34
CR	–	−0.017	−2.13	0.03**				−0.001	−1.67	0.09*
C_SCORE	–	0.001	0.04	0.97	−1.56	−0.93	0.35	0.006	2.51	0.01***
Controls included		Yes			yes			Yes		
R2		0.99			0.95			0.96		
N.obs.		2833			1359			1474		
Subsample of the second quartile (26–50%)									
M/B	–	0.001	1.23	0.22	−7.876	−0.67	0.50	−0.023	−2.32	0.02**
NOACC	–	0.001	0.37	0.71	0.003	1.31	0.19	0.004	0.16	0.87
R and D	–	−0.007	2.15	0.03**	0.001	1.14	0.27	0.005	2.43	0.01***
RES	–	0.003	1.03	0.34	−0.004	2.46	0.01***	−0.001	−0.51	0.61
SKW	–	0.002	0.86	0.39	−0.008	−3.09	0.00***	0.002	1.44	0.15
VAR	–	−0.002	−0.68	0.49	2.529	−0.88	0.37	−0.003	−0.88	0.37
CR	–	−0.009	−1.76	0.07*	−0.004	−1.79	0.08*	0.005	0.48	0.62
C_SCORE	–	−9.33	−0.78	0.43	6.776	1.51	0.13	0.009	3.53	0.00***
Controls included		Yes			Yes			Yes		
R2		0.99			0.92			0.95		
N.obs.		2836			1410			1426		
Subsample of the first quartile (0–25%)									
M/B	–	1.431	0.84	0.42	6.049	0.12	0.90	0.013	0.73	0.46
NOACC	–	4.762	1.72	0.08*				−0.044	−0.05	0.96
R and D	–	4.143	0.71	0.47	6.629	0.39	0.69	−0.009	−8.22	0.00***
RES	–	1.635	2.49	0.01***	−4.479	−0.45	0.65	−0.004	−0.65	0.51
SKW	–	−4.247	−0.78	0.43	1.238	0.55	0.58	−0.011	−3.58	0.00***
VAR	–	−4.599	−1.88	0.06*	−3.516	−0.07	0.93	0.007	1.69	0.09*
CR	–	−1.421	−0.47	0.63	−1.249	−0.02	0.95	−0.007	−1.71	0.08*
C_SCORE	–	−5.341	−1.65	0.09*				0.031	1.94	0.05*
Controls included		Yes			Yes			Yes		
R2		0.99			0.97			0.92		
N.obs.		2847			1367			1480		

This table reports robustness results of four subsamples (first quartile, second quartile, third quartile, fourth quartile) for full sample, high-tech firms and traditional firms. These regressions of expected default frequency on independent variables reported as follows. M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R and D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability, SKW: The relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_Score is calculated by using a two-stage procedure following Khan and Watts (2009). Control variables: Controls include LMV, LEV, ROA, Std_Ret, RATE, Inten_RD. ***,**,*Significance at the 1%, 5%, and 10% level, respectively

C_SCORE coefficient (−0.004) is larger than RES (−0.001). In full samples, the C_SCORE has a larger coefficient (−0.083) than M/B (−0.009), NOACC (−0.002), RES (−0.009), and VAR (−0.001). Our evidences are consistent with Nikolaev (2010) and Tan (2013) suggesting that accounting conservatism enhances debt holders' monitoring power and increase cash flow and negotiating ability,

Table 7: Robust test 2 - regression results of investment on accounting conservatism

Model 2: $INV_t=\alpha_2+\beta_3 UNCON_{t-1}+\beta_4 CONCON_{t-1}+\gamma_1 Controls_t+\varepsilon_t$

Variables	Sign	Full sample			High-tech firms			Traditional firms		
		Coefficients	t-statistics	P	Coefficients	t-statistics	P	Coefficients	t-statistics	P
Subsample of the fourth quartile (76~100%)										
M/B	+	0.683	23.07	0.00***	0.194	1.93	0.41	0.242	8.98	0.00***
NOACC	+	0.001	0.23	0.82	0.001	0.82	0.05**	0.001	0.62	0.53
R and D	+	−0.058	−2.11	0.03**	0.446	11.61	0.00	0.002	3.75	0.00***
RES	+	−0.079	−7.29	0.00***	0.278	7.56	0.00	0.087	9.89	0.00***
SKW	+	0.358	14.58	0.00***	0.058	6.25	0.00			
VAR	+	0.078	2.85	0.00***	0.003	2.06	0.04**	−0.044	−3.67	0.00***
CR	+	0.006	9.71	0.00***	0.054	3.06	0.00***	0.058	−4.07	0.00***
C_SCORE	+	0.001	3.55	0.00***	−0.017	−0.52	0.61	−0.062	−5.37	0.00***
Controls included		Yes			Yes			Yes		
R2		0.98			0.91			0.96		
N.obs.		2824			1356			1468		
Subsample of the third quartile (51–75%)										
M/B	+	0.77	3.26	0.00***	−0.02	0.45	0.64	0.010	2.02	0.04
NOACC	+	0.081	8.43	0.00***	0.001	−0.65	0.51	0.015	0.84	0.39
R and D	+	0.112	7.24	0.00***	−0.004	−0.27	0.78	0.026	2.19	0.03**
RES	+	0.107	7.14	0.00***	0.003	0.54	0.58	0.012	0.19	0.84
SKW	+	0.069	5.15	0.00***	0.064	2.12	0.03**	0.018	0.23	0.82
VAR	+	0.221	11.64	0.00***	−0.002	−0.05	0.95	−0.027	−0.06	0.95
CR	+	0.047	2.22	0.021**				−0.079	−0.21	0.83
C_SCORE	+	0.023	3.54	0.00***	0.007	0.69	0.48	0.019	1.95	0.05**
Controls included		Yes			Yes			Yes		
R2		0.95			0.97			0.93		
N.obs.		2833			1359			1474		
Subsample of the second quartile (26–50%)										
M/B	+	−0.003	−0.68	0.49	0.008	1.45		0.025	0.25	0.84
NOACC	+	−0.001	−0.44	0.65	0.001	0.12		0.011	1.28	0.19
R and D	+	0.001	0.55	0.58	−0.026	−3.89		0.003	0.22	0.83
RES	+	0.004	2.77	0.01***	−0.009	−0.37		−0.002	−0.04	0.96
SKW	+	0.005	2.85	0.00***	0.016	3.01		−0.001	0.01	0.98
VAR	+	−0.002	−0.59	0.55	−0.009	1.88		0.096	1.88	0.06*
CR	+	0.001	0.25	0.84	−0.004	−3.27		−0.011	−1.48	0.13
C_SCORE	+	0.007	2.95	0.00***	−0.047	−2.62		0.092	2.14	0.03**
Controlsi included		Yes			Yes			Yes		
R2		0.95			0.91			0.97		
N.obs.		2836			1410			1426		
Subsample of the first quartile (0–25%)										
M/B	+	−0.228	−7.29	0.00***	0.032	0.27		0.142	2.34	0.02**
NOACC	+	0.89	4.60	0.00***	0.626	7.44		0.491	7.67	0.00***
R and D	+	−0.027	−9.39	0.00***	0.088	4.74		0.031	2.29	0.02***
RES	+	0.008	1.64	0.10*	0.119	1.43		0.072	3.88	0.00***
SKW	+	1.025	3.58	0.00***	−0.973	−4.81		0.066	0.85	0.39
VAR	+	0.019	0.86	0.38	0.407	8.05		0.015	2.86	0.00***
CR	+	−0.071	−20.04	0.00***	0.731	11.23		−0.007	−1.87	0.38
C_SCORE	+	0.071	8.41	0.00***				−0.207	−0.87	0.06*
Controls included		Yes			Yes			Yes		
R2		0.99			0.99			0.99		
N.obs.		2847			1367			1480		

This table reports robustness results of four subsamples (first quartile, second quartile, third quartile, fourth quartile) for full sample, high-tech firms and traditional firms. These regressions of efficient investment on independent variables reported as follows. M/B: Market-to-book ratio is calculated as the ratio of market of equity value to book value of equity at the end of year, NOACC: Nonoperating accruals scaled by lagged assets, R and D: Research and development is calculated as the sum of research and development expenditures, scaled by sales, RES: Reserve is calculated as the sum of capitalized R and D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which is measured as operating assets minus operating liability, SKW: The relative skewness of earnings relative to cash flows is calculated as the difference between earnings skewness and cash-flow skewness, VAR: Relative variability of earnings relative to cash flows is calculated as the difference between earnings variability and cash-flow variability, CR: Unexpected current earnings to total earnings news, measuring how much of total earnings shock is incorporated into unexpected current earnings, C_SCORE: C_Score is calculated by using a two-stage procedure following Khan and Watts (2009). Control variables: Controls include StdCFO, StdSales, StdInv, Tangibility, CFOsale, Dividend, OperCycle, InvCycle, Slack. ***,**,*Significance at the 1%, 5%, and 10% level, respectively

thus reducing default risk. Therefore, Taiwanese firms could strengthen accounting conservatism because such a management decision would produce the desired effects, as described by Ahmed et al. (2002); for example, conservatism reduces information asymmetry between debt holders and managers, reducing debt costs, further enhancing a firm's ability to negotiate with debt holders, avoiding bankruptcy filings. As documented by Uhrig-Homburg (2005) and Kim et al. (1993), when adopting conservatism, Taiwanese firms could save more cash and improve an ability to negotiate, thereby reducing default risk.

Table 8: Robust test 3 - regression results of default risk on investment

Model 3: $EDF_t=\alpha_3+\theta_1 INV_t+\gamma_2 Controls_t+\varepsilon_t$										
Variables	**Sign**	**Full sample**			**High-tech firms**			**Traditional firms**		
		Coefficients	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**	**Coefficients**	**t-statistics**	**P**
Subsample of the fourth quartile (76–100%)										
INV	–	−1.105	−1.94	0.05**	−1.646	−1.88	0.059*	−0.03	−6.46	0.00***
Controls included		Yes			Yes			Yes		
R2		0.99			0.99			0.99		
N.obs.		2824			1356			1468		
Subsample of the third quartile (51–75%)										
INV	–	0.003	2.316	0.02**	−0.153	2.44	0.01***	−0.02	−1.98	0.04**
Controls included		Yes			Yes			Yes		
R2		0.99			0.99			0.99		
N.obs.		2833			1359			1474		
Subsample of the second quartile (26–50%)										
INV	–	−0.016	−2.839	0.00***	−0.009	1.75	0.08*	−0.01	−3.92	0.00***
Controls included		Yes			Yes			Yes		
R2		0.99			0.99			0.99		
N.obs.		2836			1410			1426		
Subsample of the first quartile (0–25%)										
INV	–	−0.008	−5.79	0.00***	−0.049	−4.604	0.00***	−8.05	−1.87	0.06*
Controls included		Yes			Yes			Yes		
R2		0.99			0.91			0.99		
N.obs.		2847			1367			1480		

This table reports robustness results of four subsamples (first quartile, second quartile, third quartile, fourth quartile) for full sample, high-tech firms and traditional firms. These regressions of expected default frequency on investment and control variables including LMV, LEV, ROA, Std_Ret, RATE, Inten_RD. ***,**,* indicate significance at the 1%, 5%, and 10% level, respectively

5.2. Test of Hypothesis 2a

In Table 4, the findings of three samples support Hypothesis H2a suggesting that a firm with more accounting conservatism increases efficient investments, consistent with existing research showing that the reporting of unconditional and conditional conservatism contributes to investment efficiency (Francis and Martin, 2010; Lara et al., 2016).

Unlike full samples and traditional firms showing that both types of conservatism have significant and positive impacts on investment, high-tech firms do not have significant effects of conditional conservatism variables. This is because that compared to traditional firms, high-tech firms have more factors that influence efficient investment, including agency problems (e.g. managers' self-serving behavior, conflict between managers and debt holders, and information asymmetry). Influenced by these factors, although a firm adopts conditional conservatism and increases debt holders' monitoring power, it does not solve agency problems and do efficient investments (decreasing negative NPV and increasing positive NPV projects). Namely, conditional conservatism does not increase efficient investments significantly in high-tech industries, unlike Ball and Shivakumar's (2005) conclusion.

The significant and positive effects of unconditional conservatism on investments in high-tech firms are stronger than those in traditional firms. For example, the coefficients of M/B (0.334), NOACC (0.122), and R/D (0.465) in high-tech industries are larger than those variables (0.245, 0.016, 0.004) in traditional firms. This is because that compared to traditional firms, high-tech firms have more agency problems abovementioned; when it adopts more unconditional conservatism, this decision behavior can reduce managers' self- interest behavior[19]and produce more efficient investments, supporting Ball and Shivakumar's (2005) analysis.

5.3. Test of Hypothesis 2b

Table 5 reports a significant and negative effect of investment on default risk at the 10% level for full sample and two industries, supporting Hypothesis 2b indicating that a firm that have more efficient investments reduces default probability. Further, the significant and negative effect of investments on default probability in high-tech firms is stronger than that in traditional firms; for example, the absolute value of INV coefficient (−0.045) in high-tech firms is higher than that (−0.009) in traditional firms. This is because that compared to traditional industries, high-tech industries have stronger effects of unconditional conservatism on investments, as shown in Section 5.2. The efficient investments induced by conservatism generate more debt interest deductibility and accelerated tax depreciation allowances (Panteghini and Vergalli, 2016), leading to more cash-flow holdings that reduce default probability.

When we link two findings supporting H2a and H2b, combined evidences imply that a firm that adopts more accounting

19 Taiwanese high-tech firms with agency problems that cause financial distress risk are listed in the second footnote.

conservatism can reduce default probability through increasing efficient investments, which serves as a channel between accounting conservatism and default risk and exerts an intermediate effect.

6. CONCLUSION

Differing from existing studies focusing on the relation between default risk and equity returns, corporate governance, and tax allowance, this paper studies whether accounting conservatism reduces default risk, extending Chiang et al.'s (2015) effects of corporate governance on default risk. We find that first, a firm that increases more accounting conservatism reduces default risk. This negative effect of conservatism on default risk holds through increasing efficient investments, implying that investments serve as a channel through which conservatism has negative effects on default risk. Secondly, the negative effect of conservatism on default risk through increasing efficient investment in high-tech industries becomes stronger than traditional ones, implying that the investments more strengthen the negative effect in high-tech firms than traditional firms.

This paper studies a small country in Asia. Other economies may have an accounting regulatory system different from Taiwanese one, which makes firms adopt a different accounting conservatism reporting that will change the reduction degree of default probability. Future researchers are advised to collect more data of large economies in Europe and America, and provide more evidences of accounting conservatism and default risk.

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APPENDIX

Definitions of variables	
Variable	**Definition**
EDF	Default risk is measured as expected default frequency (EDF) by applying Merton's (1974) model. The calculation procedure are documented in section 3.2
Investment (INV)	Investment is calculated as the sum of R&D expenditure, capital expenditure, and acquisition expenditure, less cash receipts from the sale of property, plants, and equipment; multiplied by 100; and scaled by lagged sales
Unconditional conservatism	
M/B	Market-to-book ratio (M/B) is calculated as the end-of-year ratio of market value of equity to book value of equity
R&D	R&D is calculated as the sum of research and development expenditures, scaled by sales
NOACC	This is non-operating accruals (NOACC) scaled by lagged assets. NOACC is calculated as total accruals (net income+depreciation−cash flow from operations) minus operating accruals, which is calculated as the change in non-cash current assets (Δaccounts receivable+Δinventories+Δprepaid expenses) minus the change in current liabilities, excluding short-term debt (Δaccounts payable−Δtax payable)
RES	Reserve (RES) is calculated as the sum of capitalized R&D, capitalized advertising expense, and the LIFO reserve scaled by net operating assets, which are measured as operating assets minus operating liabilities
SKEW	SKW means the relative skewness of earnings relative to cash flows. It is calculated as the difference between earnings skewness and cash-flow skewness
VAR	VAR means the relative variability of earnings relative to cash flows. It is calculated as the difference between earnings variability and cash-flow variability
Conditional conservatism	
C_Score	Following Khan and Watts (2009), C_Score is calculated by using a two-stage procedure. Calculation procedure is presented in supplementary material.
CR ratio	We follow Callen et al. (2010) to calculate $CR_t = \eta_{2,t} / Ne_t$, whereis earnings news (shocks) computed as $Ne_t = \Delta E_t \sum_{j=0}^{\infty} \rho^j (roe_{t+j} - i_{t+j})$ $Ne_t = \Delta E_t \sum_{j=0}^{\infty} \rho^j (roe_{t+j} - i_{t+j})$. H_{2t} is the earnings surprise from the VAR system. Following Callen et al. (2010), CR ratio is calculated by the proportion of unexpected current earnings to total earnings news, measuring how much of a total earnings shock is incorporated into unexpected current earnings