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Volatilities of Book Income and Taxable Income and Their Risk Relevance

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Abstract: This study investigates the volatility of book income and taxable income, and their relevance to stock returns variability. Book income is recognized under the financial accounting principle whereas taxable income is determined on the basis of legal right. Thus, the two types of earnings can provide different sets of information to investors. Particularly related to the role of earnings as a risk measure, this study shows that book income is more volatile than taxable income, which indicates that taxable income is relatively more consistent and predictable. Further, the volatility of book income is strongly positively related to stock return variability while the taxable income volatility is insignificantly associated with the stock returns volatility. Additional analysis shows that the earnings volatility is more closely linked to the systematic risk of stock prices than the idiosyncratic risk. In conclusion, this study suggests that book income and taxable income is mutually different in terms of earnings variability and its relevance to firm risk. The findings also indicate that those two sets of earnings information are complementary to each other and provides investors with useful information to assess underlying firm risk.

Keywords: earnings volatility; book income; taxable income; stock returns; firm risk

1. Introduction

Many accounting researchers have studied the informational role of accounting earnings and the relation between earnings and stock prices including Ball and Brown (1968) and the subsequent relevant studies. Recent studies have paid growing attention to specific components of earnings and their informational value from various perspectives. An important application in this avenue is the investigation of the value relevance of tax accounting differentiated from that of financial accounting (Hanlon et al. 2005; Mayberry et al. 2015). Specifically, book income is normally defined as earnings before tax recorded in the income statement under the generally accepted accounting principles (GAAP). Meanwhile, taxable income is computed using the earnings recognition rules as designated by corporate tax laws, which can be reasonably estimated in the financial statements by adjusting book income with the book-tax difference items or the deferred tax accounts.

Researchers argue that taxable income has property and quality differentiated from book income and thus can provide investors with additional information that book income alone might not fully convey. The prior literature in this respect presents coherent findings that taxable income is incrementally relevant to stock prices in addition to book income (Lev and Nissim 2004; Hanlon et al. 2005; Chen et al. 2012).

Nevertheless, the research on the role of different sets of earnings in terms of risk measures is limited. In particular, earnings volatility reflects the market or economic shock to firm's business activities to a considerable extent, and accordingly can be regarded as an important indicator of firm risk that should ultimately affect the stock return variability. Given that taxable income is a reliable information source differentiated from book income (Hanlon et al. 2005; Ayers et al. 2009), a natural conjecture is that the volatility of taxable income can also show a different aspect of firm risk other

than that of book income. Unfortunately, the prior literature is silent on the properties of earnings volatility for taxable income and book income. This study fills the void in the literature and provides empirical test results for the variability of both types of earnings and their association with stock returns volatility.

The first research question in this study relates to the comparison of earnings volatility between book income and taxable income. Book income is known to include a substantial portion of fair value and accruals estimation while recognition of taxable income is rather strictly made on the basis of legal right (Lev and Nissim 2004; Mills and Newberry 2001). As the fair value estimation and accruals are subject to arbitrary presumption or market fluctuation and thus likely to be more volatile than the realized earnings, book income is also expected to be more volatile than taxable income.

The empirical test results support this conjecture. Using the ample size of samples from 2001 to 2015 for Korean listed firms, this study conducts firstly the univariate test to compare the mean and median values of the volatilities of the book income and taxable income. The test results show that the volatility of book income significantly exceeds that of taxable income in terms of the mean and medial value as well. In support of the first hypothesis, these results indicate that the book income including various estimations tend to be more volatile than the taxable income.

The second research question is about the association between earnings volatility and stock returns variability for book income and taxable income. Although taxable income is viewed as a more predictable and persistent portion of earnings than book income, the downside of taxable income is that it may understate the underlying firm risks since it does not reflect the change in values of corporate resources in a timely manner. Whereas book income can reflect the changes in the business environment and the corresponding asset value changes more promptly and, accordingly, the volatility of book income is likely to be more closely linked to the stock returns variability than the volatility of taxable income.

The empirical tests in this study show that the volatility of book income is significantly positively related to the stock returns variability, whereas the association between the return variability and the taxable income volatility is statistically insignificant. The direct comparison between the regression coefficients on the volatility measures for the two earnings components also show that the book income volatility is far more highly associated with the stock returns variability than the taxable income volatility. Overall, this test result indicates that book income is more risk relevant to stock prices than taxable income, which is consistent with the second hypothesis.

Further, this study performs an additional analysis on the breakdown of the risk relevance of earnings into the systematic risk and the idiosyncratic risk. In detail, the market beta obtained from the capital asset pricing model represents the systematic, undiversifiable risk while the residual from the market model indicates the unsystematic, diversifiable risk. The additional test results show that the volatility of book income is strongly positively related to the idiosyncratic risk but it is negatively associated with the market beta. This indicates that the book income volatility mostly reflects the unsystematic and idiosyncratic firm risk rather than the systematic risk. A similar result is observed for the taxable income, but its significance is much weaker than that of the book income.

This study contributes to the literature in various aspects. First, this study provides new evidence on the volatility of financial accounting earnings and tax accounting earnings. The finding in support of less volatility of taxable income than book income suggests that taxable income can be used as a reliable source of estimating future cash flows, which complements the more volatile book income for investors' decision making. Second, this study highlights the role of earnings as risk measures and provides new empirical evidence that book income is more risk relevant to stock return variability than taxable income. Particularly, this finding suggests that there exists a trade-off relation between the reliability and the risk sensitivity of both types of earnings. In other words, taxable income can serve as additional information to reliably predict future cash flow, but its volatility is less informative to assess the firm risks than book income. Accordingly, my findings suggest that investors should pay attention to this trade-off relation and apply the different sets of earnings information with caution to assess the

stock value properly. Finally, this study provides insight on corporate disclosure policy regarding the details of earnings information. Specifically, the usefulness of taxable income, as well as book income in terms of future cash flow estimation and risk measures, highlights the necessity of expanding corporate disclosure on specific accounts of earnings rather than one-line, aggregated earnings.

The rest of this paper proceeds as follows: Section 2 provides the literature review and the research hypotheses. Section 3 explains the research design and the sample composition. Section 4 presents the main empirical test results, and Section 5 shows the additional analysis. Finally, Section 6 provides the conclusion.

2. Literature Review and Research Hypotheses

2.1. The Volatility of Book and Taxable Income

It is well known that accounting earnings are important information to assess firms' future profitability and cash flows that should ultimately affect its stock price. Dechow (1994) suggests that accounting earnings are useful in estimating firms' business performance and empirically supports that earnings are more strongly correlated to stock returns than realized cash flows. In addition to the usefulness of accounting information in terms of the measure of corporate performance, the financial information can serve as a risk measure of corporate business activities. Beaver et al. (1970) provide that investors can use accounting data to assess the riskiness of securities. For example, they show that investors use earnings variability as a risk measure in their investment decisions. In this connection, Ball and Sadka (2015) argue that accounting earnings are affected by various shocks from demand and the cost side and therefore reflect the underlying firm risk.

Despite the usefulness of accounting earnings as a measure of firm risk, the literature on the variability of diverse types of accounting earnings is sparse. Khan and Bradbury (2014) provide empirical evidence that comprehensive income is significantly more volatile than net income and the comprehensive income is also closely associated with stock return volatility. Their findings imply that different levels of earnings information can provide incremental insight into a firm's riskiness beyond the single bottom-line earnings.

In this regard, it is widely accepted that a firm's taxable income has incremental informational value in addition to book income. For example, Hanlon et al. (2005) provide that taxable income also has greater information content than cash flows. Ayers et al. (2009) also present similar results and further show the relationship between the quality of taxable income and its information content. The underlying conjecture on the incremental informational value of taxable income is that the tax regulations on income recognition are based on the principle of legal right confirmation which does not usually coincide with accounting accruals and therefore restricts arbitrary earnings bookings. However, the previous studies are silent about the usefulness of taxable income as a risk measure and especially the volatility of taxable income. Thus, it is an empirical question whether taxable income can provide differentiated information beyond book income regarding corporate business risks as reflected in earnings volatility.

In relation to earnings volatility, book income includes various types of accruals and fair value estimations. Barth et al. (1995) examined the effect of fair value accounting on earnings volatility using a sample of 137 financial institutions and found that earnings based on fair value are more volatile than the historical cost-based earnings. Hodder et al. (2006), using the sample of 202 commercial banks, report that the volatility of earnings based on the full fair value method considerably exceeds the volatilities of comprehensive income and net income. With regard to the effect of accruals on earnings volatility, Dechow and Dichev (2002) state that accruals are largely dependent on estimation of future cash flows, and thus are subject to a fairly large amount of estimation errors. They also argue that a volatile business environment can make the estimation error problem even worse and increase the earnings volatility which will eventually lead to lower earnings predictability. In this context,

Dichev and Tang (2009) find empirical evidence that the volatility of earnings increases with the level of accruals.

In contrast, earnings under tax rules are recognized on the basis of legal right and revenue realization. Thus, revenues and the corresponding expenses are recognized for taxable income purposes when those items become actually realizable, not merely when the underlying economic event is accrued. Under the realization principle for earnings recognition, tax accounting is remote from fair value estimation but rather rely on historical cost accounting in a wide range of revenue and expense recognition. Accordingly, theoretical conjecture is that earnings under corporate tax rules are based on historical cost accounting and limited application of accruals and/or fair value estimation, and therefore are likely to be less volatile than book income under financial accounting rules. Direct empirical evidence in this avenue, however, is not found, but circumstantial evidence supports the possibility of less volatile earnings for tax accounting. For instance, Sloan (1996) reports that the temporary book-tax differences composed of accruals are less persistent in future earnings. Hanlon (2005) presents that earnings for firms with higher book-tax differences are less persistent than the other earnings components. Further, Blaylock et al. (2011) report a similar result to Hanlon (2005), which indirectly suggests the possibility that taxable income itself, excluding the book-tax differences, should be more persistent and less volatile than the other book income portion.

Taking the aforementioned theoretical and empirical grounds altogether, the first research hypothesis in this study regarding the comparison of earnings volatility between book income and taxable income takes an alternative form as follows:

Hypothesis 1. *Book income is more volatile than taxable income.*

2.2. Risk Relevance of Book and Taxable Income to Stock Return Volatility

It is a fundamental financial theory that stock prices reflect the future cash flows discounted by the expected rate of returns (Ohlson 1995). Therefore, two components of stock valuation can largely play out an important role in determining the stock prices. One is the expected cash flows and the other is the discount rates. In relation to the former, accounting earnings can affect investors' estimation of future cash flows, and more predictable and less volatile accounting earnings can have a greater impact on stock prices (Dichev and Tang 2009). In this respect, the quality of taxable income that is less subject to managerial discretion (Mills and Newberry 2001; Lev and Nissim 2004) and is expected to be less volatile as in the above Hypothesis 1. Accordingly, taxable income can be relevant to stock prices additionally beyond book income, and the prior literature generally supports this notion.

Relevant prior studies have investigated the stock value relevance of taxable income. Hanlon et al. (2005) show that the revision in taxable income is incrementally relevant to stock returns beyond the book income change. Ayers et al. (2009) report that the association between taxable income and stock returns is lower for firms that conduct tax planning more intensively. Further, Mayberry et al. (2015) find that managerial discretion to smooth taxable income deteriorates the relevance of taxable income to stock returns.

In comparison to the ample evidence on the earnings-return association, the relationship between earnings and discount rate is not well understood. From the theoretical perspective, firms' revenues are subject to demand fluctuations and other external economic shocks, and other cost and expenses can be also affected by market circumstances and business cycles. Accordingly, those business risk factors should be reflected by accounting earnings and closely represented by earnings volatility. That is, earnings volatility can serve as an indicator of the riskiness of corporate businesses and therefore the variability of stock returns. Ryan (1997) suggests the results of a comprehensive survey of previous studies and concludes that earnings volatility is strongly connected to equity risk.

Despite the generally accepted idea on the relevance of earnings volatility to stock return risks, empirical evidence on the specific component of earnings and its risk relevance is rare. Fundamentally, book income includes a substantial portion of accruals and fair value estimation, which are known

to be more effective market-based risk measures than other historical accounting-based methods (Hodder et al. 2006). Considering that stock returns reflect all the available information in the market and can widely fluctuate depending on the change in market participants' estimation on the fair value of firm's resources, book income as a result of applying accruals and fair value accounting is likely to better reflect the firm's riskiness than historical cost accounting. On the other hand, taxable income adopts the strict rule-based earnings recognition and historical cost accounting and, therefore, is expected to be relatively less sensitive to the economic risks that affect firm value. In sum, I propose the next hypothesis regarding the risk relevance of book income and taxable income in an alternative form as follows:

Hypothesis 2. *The volatility of book income is more strongly associated with stock returns variability than the volatility of taxable income.*

3. Research Design and Sample Selection

3.1. Empirical Models

3.1.1. Test Variables

As a first step for the empirical model design, I construct the main variables indicative of the volatility of book income and taxable income as follows. First, book income is defined as profit before tax scaled by the lagged market value of equity. To estimate the taxable income, I first calculate the current tax expense which is the same as total tax expense deducting deferred tax expense. Then, taxable income equals the current tax expense divided by the statutory tax rate (Shevlin 2001).

Next, $EVOL\_BI$ denotes the volatility of book income and is calculated as the standard deviation of the annual book income for the previous 5 years. The same method is applied to compute the volatility of taxable income, denoted as $EVOL\_TI$. To formally test which of the two volatility measures exceed the other one regarding Hypothesis 1, I conduct a univariate test to compare the mean and median value of $EVOL\_BI$ and $EVOL\_TI$.

In relation to stock returns variability, I construct $RETVOL$ which is computed as the standard deviation of daily stock returns for the previous 12-month period. The other variables to be used in the relevant regression tests as controls for the potential firm characteristics to affect the earnings and stock return volatilities are defined as follows: $SIZE$ is a log-transformed value of the total assets as of the year end. LEV indicates the debt-to-total asset ratio at the year-end. MTB represents the market-to-book ratio which equals the market value of equity divided by the book value of net equity. ROA and $Sales$ represents the return-on-assets ratio and the sales-to-assets ratio, respectively. T_Asset denotes the tangible assets deflated by total assets. $R\&D$ refers to the expenses related to research and development activities, which are scaled by the lagged market value of equity.

3.1.2. Regression Models

To formally test Hypothesis 2 regarding the risk relevance of book income and taxable income, the following analysis models are adopted regressing the stock returns variability, $RETVOL$, on $EVOL\_BI$ and $EVOL\_TI$, individually and collectively[1].

[1] The main regression variables including the stock returns variability and the control variables are identified on a yearly basis. However, the variables for accounting income volatility is measured on a 5 year rolling basis, since the measurement of income volatility inevitably requires multiple time series of yearly data. Nevertheless, it is reasonably assumed that the income volatility pattern for a firm does not change extremely for a short time period, and thus the volatility for the recent 5 years may well serve as a proxy for potential income volatility during the subject test year.

$$RETVOL_{it} = \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \quad (1)$$

$$RETVOL_{it} = \beta_0 + \beta_1 EVOL_{TI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \quad (2)$$

$$RETVOL_{it} = \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 EVOL_{TI_{it}} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 MTB_{it} + \beta_6 ROA_{it} + \beta_7 Sales_{it} + \beta_8 T_{Asset_{it}} + \beta_9 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \quad (3)$$

Equations (1) and (2) above adopt the main explanatory variables, *EVOL_BI* and *EVOL_TI* individually. Equation (3) directly compares the regression coefficients on *EVOL_BI* and *EVOL_TI*, and the coefficient β_1 on *EVOL_BI* is expected to be greater than β_2 on *EVOL_TI*, following Hypothesis 2.

In all the above and subsequent regression models in this study, the year and industry dummy variables are added to control for time-series and cross-sectional fixed effects. In addition, all the continuous variables are winsorized at the 1% and 99% levels to minimize the potential bias from extreme outliers. Further, the standard errors in the regression models are firm-clustered to mitigate the autocorrelation problem among the regression error terms (Petersen 2009).

3.2. Samples and Data

The initial sample consists of firms listed in the Korean stock markets including KOSPI (Korea Composite Stock Price Index) or the KOSDAQ (Korea Securities Dealers Association Automated Quotation). The test period starts from 2001 to 2015. The sample rejects financial companies and firms with non-December year end, in order to keep the consistency in type and timing of financial reporting throughout the sample.

The accounting data and the stock market data were collected from Korea Listed Companies Association's Total Solution 2000 (TS-2000) and Dataguide Pro of FNGuide, respectively. Further, the observations with missing values for the regression variables are eliminated. Finally, I rejected the firms of which the total assets are smaller than the total liabilities, in order to mitigate the effect of abnormal financial status. Consequently, the final sample comprises 15,424 firm-years in total.

4. Empirical Results

4.1. Descriptive Statistics and Correlations

Table 1 presents the descriptive statistics of the main test variables. With respect to the earnings volatility variables, the mean (median) value of *EVOL_BI* is 0.253 (0.118) while the mean (median) value of *EVOL_TI* is 0.137 (0.077). It appears that the volatility of book income is higher than that of taxable income. The stock returns volatility, *RETVOL* is apparently well distributed as its mean value of 0.034 is close to the median value of 0.032.

Among the control variables, the financial leverage ratio (*LEV*) is 0.417 on average which implies that the debt burden of the sample firms is generally moderate. The distribution of *MTB* is slightly right-skewed as shown in the mean value of 1.482 greater than its median value of 1.002. This indicates that a small number of firms have a significantly higher market value of equity over its book value. In contrast, the distribution of *ROA* is left-skewed including a small group of firms with a large amount of losses as shown in the value of the 5% tier (−0.212). The distribution of *Sales* and *T_Asset* is generally stable with only a slight difference between their mean and median values. The research and development expenditure (*R&D*) has the mean (median) value of 0.020 (0.003), which implies that a small number of large companies lead the entire research activities in the industry.

Table 2 shows the Pearson/Spearman correlations among the main variables. First, the Pearson (Spearman) correlation between *EVOL_BI* and *EVOL_TI* is 0.192 (0.287), which indicates that those two types of earnings are fairly well correlated since they share a substantial portion of earnings subcomponents. In relation to the correlation with stock returns variability, *RETVOL*, *EVOL_BI* has a significantly high correlation as shown its Pearson (Spearman) coefficient of 0.265 (0.315). On the contrary, the Pearson correlation between *EVOL_TI* and *RETVOL* is insignificant and the Spearman correlation is even negative (−0.093).

With regard to the control variables, *SIZE* has statistically significant correlations with all the other variables, which implies that the total asset size of the company is a critical firm characteristic to affect corporate businesses and its behaviors. Similarly, *LEV*, *MTB*, and *ROA* have also strong correlations with the other variables, which accordingly shows that the financial structure and firm profitability is an important factor to influence earnings and stock returns volatility as well.

Table 1. The descriptive statistics.

Variable	N	Mean	Std.	5%	25%	Median	75%	95%
EVOL_BI	15,424	0.253	0.510	0.024	0.061	0.118	0.231	0.830
EVOL_TI	15,424	0.137	0.181	0.000	0.033	0.077	0.168	0.473
RETVOL	15,424	0.034	0.013	0.016	0.024	0.032	0.041	0.058
SIZE	15,424	18.881	1.420	17.035	17.906	18.600	19.565	21.817
LEV	15,424	0.417	0.201	0.102	0.257	0.418	0.566	0.750
MTB	15,424	1.482	1.502	0.313	0.610	1.002	1.731	4.339
ROA	15,424	0.009	0.115	−0.212	−0.003	0.029	0.065	0.136
Sales	15,424	0.921	0.536	0.200	0.569	0.837	1.157	1.953
T_Asset	15,424	0.291	0.188	0.012	0.145	0.274	0.417	0.635
R&D	15,424	0.020	0.038	0.000	0.000	0.003	0.021	0.096

Variable definitions. *EVOL_BI*: The standard deviation of the earnings before tax deflated by the lagged market value of the equity for the previous 5 years; *EVOL_TI*: The standard deviation of the taxable income deflated by the lagged market value of the equity for the previous 5 years; *RETVOL*: The standard deviation of daily stock returns for the previous 12-month period; *SIZE*: The log-transformed value of the total assets as of the year-end. *LEV*: The debt-to-total asset ratio at the year-end; *MTB*: The market-to-book ratio which equals the market value of equity divided by the book value of net equity; *ROA*: The ratio of the net income to total assets as of the end of year; *Sales*: The ratio of sales revenue to the total assets as of the end of year; *T_Assets*: The amount of tangible assets deflated by total assets. *R&D*: The expenses related to research and development activities, which is scaled by the lagged market value of equity.

Table 2. The Pearson/Spearman Correlations among the variables.

	EVOL_BI	*EVOL_TI*	*RETVOL*	*SIZE*	*LEV*	*MTB*	*ROA*	*Sales*	*T_Asset*	*R&D*
EVOL_BI		**0.192**	**0.265**	−0.010	**0.240**	0.009	**−0.113**	**0.028**	**0.073**	**−0.077**
EVOL_TI	**0.287**		−0.006	**0.142**	**0.154**	**−0.197**	**0.057**	**0.027**	**0.162**	**−0.181**
RETVOL	**0.315**	**−0.093**		**−0.363**	**0.177**	**0.164**	**−0.271**	**−0.020**	**−0.051**	**0.080**
SIZE	**−0.108**	**0.259**	**−0.407**		**0.183**	**−0.108**	**0.236**	**−0.022**	**0.156**	**−0.179**
LEV	**0.326**	**0.151**	**0.176**	**0.177**		**0.101**	**−0.257**	**0.249**	**0.262**	**−0.056**
MTB	**−0.185**	**−0.369**	**0.163**	**−0.142**	**0.046**		**−0.154**	**−0.018**	**−0.139**	**0.248**
ROA	**−0.222**	**0.078**	**−0.215**	**0.179**	**−0.322**	**0.083**		**0.169**	**0.030**	**−0.128**
Sales	**0.073**	**0.118**	**−0.019**	0.000	**0.257**	−0.007	**0.231**		−0.009	**−0.085**
T_Asset	**0.043**	**0.146**	**−0.067**	**0.155**	**0.252**	**−0.181**	**−0.037**	**0.054**		**−0.128**
R&D	**−0.131**	**−0.248**	**0.101**	**−0.148**	0.009	**0.270**	**−0.049**	**−0.021**	**−0.044**	

(1) Please refer to Table 1 for variable definitions; (2) This table shows Pearson (Spearman) correlations. Coefficients marked in bold font are significant at the statistical level of $p < 0.05$ (two-tailed test).

4.2. Main Hypotheses Test Results

4.2.1. The Results for Hypothesis 1

Table 3 shows the result of univariate test for comparing the volatility between book income and taxable income with respect to Hypothesis 1. First, I compute the ratio of *EVOL_BI* to *EVOL_TI* at each firm level. As shown in Panel A of Table 3, the values of *EVOL_BI*/*EVOL_TI* are distributed from the lower 5% of 0.264 to the higher 95% of 39.390, while its mean (median) value is 1.554 (1.253).

This shows that apparently the value of *EVOL_BI* is overall higher than that of *EVOL_TI* at the firm level.

Panel B of Table 3 presents the formal statistical test for the mean and median values of *EVOL_BI* and *EVOL_TI* at the firm level. The t-test result for the paired mean difference shows that the mean of *EVOL_BI* is significantly greater than that of *EVOL_TI* at a 1% significance level (*p*-value: <0.001). Further, the Wilcoxon signed rank test for median difference also shows that the median values of the two variables are statistically significantly different (*p*-value: <0.001). Given the above, the volatility of book income is much higher than that of taxable income, which supports Hypothesis 1. In other words, book income includes a higher portion of arbitrary estimation or fair value accounting than taxable income and, thus, is relatively prone to the fluctuation of the economic environment and business cycles. In that sense, taxable income can be used as a useful index to estimate future cash flows more reliably.

Table 3. The difference in the earnings volatilities between the book and taxable income.

Panel A: Distribution of the Ratio of Book Income Volatility to Taxable Income Volatility							
Variable	**Mean**	**Std**	**5%**	**25%**	**Median**	**75%**	**95%**
EVOL_BI/EVOL_TI	1.554	3.189	0.264	0.751	1.253	2.695	39.390
Panel B: Statistical Test for the Mean and Median Differences in Earnings Volatility							
Differences			*EVOL_BI–EVOL_TI*			*p*-value	
Mean (*t*-test)			0.116			<0.001	
Median (Wilcoxon's signed-rank test)			0.020			<0.001	

Please refer to Table 1 for variable definitions.

4.2.2. The Results for Hypothesis 2

Table 4 summarizes the results of testing for Hypothesis 2 regarding the risk relevance of book income and taxable income[2]. Panel A of Table 4 shows the result of regressing the stock returns variability, *RETVOL*, on each of *EVOL_BI* and *EVOL_TI*. In the first column, the coefficient estimate on *EVOL_BI* is positive (coef. = 0.004) and statistically significant at the 1% level. On the contrary, the second column shows that the coefficient on *EVOL_TI* is not statistically different from zero. This indicates obviously that it is the volatility of book income, not taxable income that is meaningfully correlated to stock returns variability.

Panel B of Table 4 provides a formal test result on directly comparing the regression coefficient on *EVOL_BI* and *EVOL_TI*. In the regression including both the earnings variables simultaneously, the coefficient on *EVOL_BI* is 0.004 which is statistically significant at the 1% level, whereas that on *EVOL_TI* is very close to zero (coef. = −0.001). The *F*-test on the difference between the two coefficient estimates shows that the difference is statistically significant (*p*-value: <0.001).

Taken together, the test result supports Hypothesis 2. That is, the finding shows that book income, which is more volatile than taxable income, is more risk relevant to stock prices. It is also consistent with the notion that accruals and fair value estimation included in book income better reflect the firm's risk profile than taxable income based on the strict tax rules. Accordingly, book income can be useful to assess the degree of risks underlying a firm's business activities and ultimately the variability of stock prices.

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[2] Untabulated, a diagnostic test for autocorrelation of error terms using the Durbin–Watson statistic indicates that only a moderate level of positive autocorrelation exists for the subject tests (e.g., Durbin–Watson values around 1.3). Meanwhile, clustering standard errors is well known to be robust to autocorrelation and heteroscedasticity of error terms (Petersen 2009). To minimize the potential bias from autocorrelation and heteroscedasticity, this study uses clustered standard errors for all the regression tests.

Table 4. The relevance of earnings volatilities to stock return variability.

Panel A: The Separate Test for the Book Income and Taxable Income Volatilities						
Variables	**(1) *RETVOL***			**(2) *RETVOL***		
	Coefficient	***t*-Value**		**Coefficient**	***t*-Value**	
Intercept	0.101	43.83	***	0.103	43.47	***
EVOL_BI	0.004	15.13	***			
EVOL_TI				0.000	0.56	
SIZE	−0.003	−25.17	***	−0.003	−24.71	***
LEV	0.010	13.10	***	0.012	15.34	***
MTB	0.001	13.95	***	0.001	14.10	***
ROA	−0.012	−10.86	***	−0.012	−11.29	***
Sales	−0.002	−7.12	***	−0.002	−7.49	***
T_Asset	−0.005	−5.81	***	−0.005	−5.56	***
R&D	0.000	0.14		−0.002	−0.77	
Fixed Effects		Year, Industry			Year, Industry	
Adjusted R^2		0.456			0.436	
Observations		15,424			15,424	
Panel B: The Collective Test for the Book Income and Taxable Income Volatilies						
Variables	***RETVOL***					
	Coefficient			***t*-Value**		
Intercept	0.101			44.02		***
EVOL_BI	0.004			15.28		***
EVOL_TI	−0.001			−2.02		**
SIZE	−0.003			−25.19		***
LEV	0.010			13.24		***
MTB	0.001			13.70		***
ROA	−0.011			−10.75		***
Sales	−0.002			−7.16		***
T_Asset	−0.005			−5.69		***
R&D	0.000			−0.03		
EVOL_BI = EVOL_TI	*F*-stat (*p*-value): 54.80 (<0.001)					
Fixed Effects	Year, Industry					
Adjusted R^2	0.456					
Observations	15,424					

(1) Please refer to Table 1 for variable definitions; (2) ** and *** indicate statistical significance at the 5 percent and 1 percent levels, respectively.

5. Additional Tests

The main test results above show that the volatility of the two different sets of earnings components is related to stock return variability as a whole. Further, the firm risks as represented by stock returns volatility can be broken down into two subcomponents. One is the systematic risk that is correlated with the entire market returns and thus undiversifiable. The other is the idiosyncratic risk ascribed to the firm itself and therefore can be reduced by constructing well-diversified portfolios. Liu et al. (2018) state that idiosyncratic return volatility and the market beta have fundamentally different nature from each other, but those two indices often show a positive correlation which leads to the so-called beta anomaly. Therefore, investigating the relationship between the accounting income variability and the subcomponents of stock return volatility in detail could be additionally helpful to better understand the risk relevance of accounting income. In this context, it is still an empirical question whether the risk relevance of the earnings components is mainly attributed to the systematic risk portion or the idiosyncratic risks.

To test for the above question, this additional analysis bifurcates the entire stock returns volatility into the market beta, a proxy for the systematic risk, and the diversifiable residual risk. The systematic risk as denoted as *Beta* is calculated by applying the capital asset pricing model (CAPM). That is,

I regress the individual daily stock returns on market returns for the previous 1-year period using the following regression model[3]:

$$R_{js} = \alpha_j + \beta_j R_{Ms} + \varepsilon_{js} \tag{4}$$

where R_{js} and R_{Ms} represent the daily stock returns for firm j and the daily market index return, respectively. The systematic risk variable, *Beta* is accordingly equal to the coefficient estimate β_j in Equation (4). Similarly, the variable for idiosyncratic risk, *Idio*, is computed from the square of the residual error term, ε_j in the Equation (4).

Then I regress *Beta* and *Idio*, respectively, on the income volatility measures and other controls as in the following Equations (5)–(10).

$$\begin{aligned} Beta_{it} = \quad & \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} \\ & + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{5}$$

$$\begin{aligned} Beta_{it} = \quad & \beta_0 + \beta_1 EVOL_{TI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} \\ & + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{6}$$

$$\begin{aligned} Beta_{it} = \quad & \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 EVOL_{TI_{it}} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 MTB_{it} \\ & + \beta_6 ROA_{it} + \beta_7 Sales_{it} + \beta_8 T_{Asset_{it}} + \beta_9 R\&D_{it} \\ & + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{7}$$

$$\begin{aligned} Idio_{it} = \quad & \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} \\ & + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{8}$$

$$\begin{aligned} Idio_{it} = \quad & \beta_0 + \beta_1 EVOL_{TI_{it}} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 MTB_{it} + \beta_5 ROA_{it} \\ & + \beta_6 Sales_{it} + \beta_7 T\_Asset_{it} + \beta_8 R\&D_{it} + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{9}$$

$$\begin{aligned} Idio_{it} = \quad & \beta_0 + \beta_1 EVOL_{BI_{it}} + \beta_2 EVOL_{TI_{it}} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 MTB_{it} \\ & + \beta_6 ROA_{it} + \beta_7 Sales_{it} + \beta_8 T_{Asset_{it}} + \beta_9 R\&D_{it} \\ & + \sum \beta_m YEAR + \sum \beta_n IND + \varepsilon \end{aligned} \tag{10}$$

The additional analysis results are summarized in Tables 5 and 6. Panel A of Table 5 refers to the test of regressing the systematic risk, *Beta* on *EVOL_BI* and *EVOL_TI*, individually. The first column shows that the coefficient estimate on *EVOL_BI* is −0.055 and statistically significant, while the coefficient estimate on *EVOL_TI* is −0.176 as in the second column. In Panel B of Table 5 including both *EVOL_BI* and *EVOL_TI* in the same regression, the coefficient on *EVOL_BI* (coef. = −0.046) is significantly greater than that on *EVOL_TI* (coef. = −0.157).

Overall, the test results as summarized in Table 5 indicate that both book income and taxable income do not sufficiently reflect the firm's systematic risk. Particularly, the strongly negative coefficient on *EVOL_BI* implies that book income is not adequate to assess the degree of the systematic risk embedded in the stock prices that is not diversifiable by constructing a well-distributed portfolio.

In contrast, the results as shown in Table 6 suggest that the volatilities of the earnings components are closely related to the idiosyncratic risk. In detail, Panel A of Table 6 for the test using *EVOL_BI* and *EVOL_TI* separately provides that the coefficient estimate on *EVOL_BI* is highly positive (coef. = 0.037) and statistically significant at the 1% level. Meanwhile, the coefficient on *EVOL_TI* is also positive but its statistical significance is somewhat weak. Panel B of Table 6 further shows the direct comparison of regression coefficients on the two earnings volatility variables. The result is that the coefficient estimate on *EVOL_BI* (coef. = 0.037) is higher than that on *EVOL_TI* (coef. = −0.006), between which the difference in coefficients is statistically significant (p-value: <0.001).

[3] The market beta is calculated using daily stock returns in line with the long standing practice in the prior literature (Campbell et al. 2018; Reinganum 1981), and the test results are robust where the interval for the market model varies from 200 to 800 business days, not limited to the 1 year period.

Taken altogether, the earnings volatility variables reflect the firm's idiosyncratic risk rather than the systematic market beta of stock returns. Moreover, it is the volatility of book income that is strongly related to the diversifiable risk on stock returns. The findings imply that the nature of riskiness that is reflected by earnings volatility is different across the type of risks and the details of earnings components. Accordingly, investors need to pay close attention to interpreting the extent of firm risk that is represented by earnings volatility.

Table 5. The relevance of earnings volatilities to the market beta of stock returns.

Panel A: The Separate Test for the Book Income and Taxable Income Volatilities						
Variables	**(1)** ***Beta***			**(2)** ***Beta***		
	Coefficient	***t*-Value**		**Coefficient**	***t*-Value**	
Intercept	−0.214	−2.18	**	−0.233	−2.39	**
EVOL_BI	−0.055	−7.03	***			
EVOL_TI				−0.176	−7.84	***
SIZE	0.044	8.65	***	0.046	9.02	***
LEV	0.085	2.59	***	0.078	2.43	**
MTB	0.025	6.80	***	0.022	5.91	***
ROA	−0.201	−5.01	***	−0.177	−4.37	***
Sales	−0.006	−0.54		−0.005	−0.46	
T_Asset	−0.219	−6.36	***	−0.204	−5.95	***
R&D	1.477	9.60	***	1.442	9.41	***
Fixed Effects	Year, Industry			Year, Industry		
Adjusted R^2	0.151			0.152		
Observations	15,424			15,424		
Panel B: The Collective Test for the Book Income and Taxable Income Volatilities						
Variables	***Beta***					
	Coefficient			***t*-Value**		
Intercept	−0.204			−2.08	**	
EVOL_BI	−0.046			−5.85	***	
EVOL_TI	−0.157			−7.01	***	
SIZE	0.045			8.85	***	
LEV	0.099			3.04	***	
MTB	0.023			6.15	***	
ROA	−0.188			−4.73	***	
Sales	−0.007			−0.65		
T_Asset	−0.206			−5.99	***	
R&D	1.416			9.28	***	
EVOL_BI = EVOL_TI	*F*-stat (*p*-value): 20.10 (<0.001)					
Fixed Effects	Year, Industry					
Adjusted R^2	0.156					
Observations	15,424					

(1) Please refer to Table 1 for variable definitions; (2) ** and *** indicate statistical significance at the 5 percent and 1 percent levels, respectively.

Table 6. The relevance of earnings volatilities to the idiosyncratic risk of stock returns.

Panel A: The Separate Test for the Book Income and Taxable Income Volatilities						
Variables	**(1) *Idio***			**(2) *Idio***		
	Coefficient	***t*-Value**		**Coefficient**	***t*-Value**	
Intercept	0.621	37.86	***	0.644	37.40	***
EVOL_BI	0.037	17.50	***			
EVOL_TI				0.009	1.76	*
SIZE	−0.022	−28.96	***	−0.023	−28.10	***
LEV	0.058	10.74	***	0.075	13.42	***
MTB	0.008	13.23	***	0.009	13.50	***
ROA	−0.091	−10.51	***	−0.100	−10.93	***
Sales	−0.013	−7.22	***	−0.015	−7.61	***
T_Asset	−0.022	−3.94	***	−0.023	−3.76	***
R&D	−0.095	−4.94	***	−0.118	−5.74	***
Fixed Effects	Year, Industry			Year, Industry		
Adjusted R^2	0.403			0.366		
Observations	15,424			15,424		

Panel B: The Collective Test for the Book Income and Taxable Income Volatilities			
Variables	***Idio***		
	Coefficient	***t*-Value**	
Intercept	0.621	37.99	***
EVOL_BI	0.037	17.60	***
EVOL_TI	−0.006	−1.26	
SIZE	−0.022	−28.98	***
LEV	0.058	10.78	***
MTB	0.008	12.98	***
ROA	−0.090	−10.46	***
Sales	−0.013	−7.24	***
T_Asset	−0.021	−3.84	***
R&D	−0.098	−5.04	***
EVOL_BI = EVOL_TI	*F*-stat (*p*-value): 63.85 (<0.001)		
Fixed Effects	Year, Industry		
Adjusted R^2	0.403		
Observations	15,424		

(1) Please refer to Table 1 for variable definitions; (2) * and *** indicate statistical significance at the 10 percent and 1 percent levels, respectively.

6. Conclusions

The accounting literature on earnings has traditionally focused on its usefulness to estimate future cash flows or its relevance to stock prices. However, earnings can also provide important information on the firm risk underlying the corporate business activities since earnings vary widely depending on the fluctuation of business cycles and the change in business environments. Despite the potential usefulness of earnings as a risk measure, the prior research in this avenue is limited. This study fills the gap in the literature and conducts an empirical analysis of the volatility of earnings and its relevance to stock price variability. Moreover, this study provides insight on the role of taxable income as well as book income. Taxable income is differentiated from book income since the former is determined on the basis of legal right confirmation, not an accrual basis. Therefore, the volatility of taxable income can provide different types of information on the firm risk.

The primary test result shows that the volatility of book income is significantly greater than that of taxable income. This finding is consistent with the notion that most parts of taxable income is based on historical cost accounting, exclusive of fair value estimation or accruals, and thus less volatile than book income. Next, the test for the association between the earnings volatility and the stock return variability leads to the result that the book income volatility is strongly positively correlated with the

stock returns volatility. Whereas the taxable income volatility is not significantly related to the stock returns variability. This indicates that book income is superior to taxable income in terms of the degree of reflecting the firm's underlying business risk.

This study contributes to the literature by providing new empirical evidence on the volatility of book income and taxable income. Further, this study highlights the differentiated role of the book and taxable income as a firm risk measure and their relevance to stock returns variability. Accordingly, the findings in this study encourage expanding corporate disclosure on details of earnings components including those to estimate taxable income.

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