The Association between Firm Value and Productivity under US GAAP and IFRS

Abdullah Hiz

College of Business and Management, Northeastern Illinois University, United States
*Corresponding Author: ahiz@neiu.edu

Abstract The purpose of this study is to investigate the association between productivity and market value of firms. This study relies on the data that is derived from COMPUSTAT for the time period of 2002-2012 to address the differences of productivity and firm value associations in firms that comply with US GAAP and firms that comply with IFRS. The findings of this study reveal that the productivity is meaningful for associating with the firm's market value in US GAAP adopter firms and there is a strong correlation between productivity and firm value in US GAAP adopter firms. Meanwhile, the association of productivity and firm market value is not significant in IFRS adopter firms. This is consistent with Best [1] study, which finds that the increase in productivity may cause corporate profitability to be zero even negative.

Keywords Productivity, Net-value Added, US GAAP, IFRS

1. Introduction

Productivity has been an important gauge for companies to assess their performance with the companies that make same or similar products. In terms of comprehensive firm evaluation, productivity sets forth better results. Stock prices and other accounting measures show the value created for only investors of the firms. Meanwhile, productivity assesses the firm's overall economic contribution.

Productivity shows the efficiency in which inputs are converted to useful outputs. In other words, productivity shows the total economic value created by the capital and labor employed. Thus, improved productivity leads to additional value and economic wealth that eventually benefit not only shareholders but also employees and customers. Productivity can be measured in three different ways: labor productivity, capital productivity, and multi-factor productivity. Labor productivity is the easiest productivity measure to determine. It is the ratio of output per unit of labor input. However, it is not appropriate to use it in every industry. Especially, industries with high capital volume

show very small labor expense. Capital productivity is the ratio of output per unit of the capital input. Even though it is easier to compute labor productivity, most of researchers tend to use capital productivity because companies do not provide sufficient information about their energy and raw material used. Multi-factor productivity measures the changes in output net of the changes in all inputs that is combination of labor and capital productivity[2]. Despite its usefulness and accuracy, productivity has been rarely used in the assessments of the firms' performance because accountants' main focus is the profit rather than productivity.

It is always challenging to examine the association between earnings and nonearning information. This research uses productivity as nonearning information. Productivity can be determined by very few methods and this study applies net-value added method. In this study, two different samples are used to have comparison of productivity between US GAAP adopter firms and IFRS adopter firms. Lastly, Ohlson's security valuation model [3] is utilized to explain how productivity affects firm value. The model can be used to explain cross-sectional differences in market value on the basis of accounting numbers. This research study is motivated by the Riahi-Belkaoui study [4] on productivity, profitability, and firm value. The author examines the association between productivity and firm value. His findings are that productivity explains cross-sectional differences in market value incremental to that explained by book value.

International Accounting Standards Committee (IASC) promulgated a set of accounting standards (International Financial Reporting Standards) to be complied by firms since 2005. Before it was emerged, US GAAP had been mere set of standards in the world and now IFRS is considered US GAAP's main competitor. For the global competition, it is very crucial to have business strategies that are supported by widely accepted international systems such as accounting information system. Accounting is the only gauge that managers use to measure how successful they are. Thus, they expect the accounting information to consist with other firms, domestic or international, to compare the results and be competitive in the global scope. All this factors encourage firms to have consistent accounting standards. However, so

many non-US firms encounter with difficulties when they operate in US stock markets due to reconciliations and other differences. That causes them to have lower financial value than US firms. This research provides an explanatory result on the comparison of both accounting standards[5].

2. Literature Review

Due to the extensive purpose of this study, two broad areas of the literature are separately reviewed. Firstly, this study reviews the literature on productivity; its association with firm value, and determination methods of productivity applied by researchers to investigate the association between productivity and firm value. Secondly, this study reviews the literature on the gap between IFRS and U.S. GAAP; differences in the application.

3. Productivity

There is a substantial amount of research on the association of productivity and firm value. Relevant to this paper is the previous work studying the relationship of productivity, profitability, and firm value by Riahi-Belkaoui, [4]. In this existing study, the researcher explains the change in the firm value with a nonearning variable. He uses productivity as a nonearning variable and analyzes the cross sectional difference in firm value. He finds that the productivity is a useful measure in the prediction of firm value and the productivity explains the change in the firm value better than short-term earnings.

Bloom et al. [6] study finds a strong relation between human resource management (HRM) and firm's performance in terms of productivity and profitability. This relationship suggests human resource practices on reward and performance improve firm productivity. Further, the correlation between productivity and HRM policies leads to raising job satisfaction. Another study by Edmans [7] uses job satisfaction engendering from HRM activities to address the association between firm market value and productivity. The results reveal that high level of job satisfaction generates high long-run stock returns and stronger corporate productivity.

Taiwo et al. [8] study analyses the impact of international financial reporting standards (IFRS) on the performance of the firms in Nigeria. The researchers interview with 171 professionals about the anticipated benefits to be gained through the adaptation of IFRS in terms of efficiency of Nigerian firms. This study suggests that there is a strong positive correlation between the compliance of IFRS and financial performance of the firms. Also, IFRS compliant firms improve business efficiency and productivity of the operations. Another study by Morris [9] examines whether corporate market performance can be explained as a future outcome of firm productivity in South Africa subsequently the compliance of IFRS, which lead to increasing divergence

between the market value and book value of companies. The researcher uses human capital efficiency (which refers to an employee's ability to create value-added for his employer) for measuring productivity. This study empirically proves that productivity is associated with higher profitability in the most industries. Based on these outcomes from different countries and accounting standards, it is expected to find that the association between productivity and the firm market value changes when firms have different accounting standards to adopt.

Chen et al. [10] study analyzes the relation between the productivity, firm's market value and financial performance among Taiwanese firms. The researchers use Value Added Intellectual Coefficient (VAIC), which is sum of three measures, capital employed efficiency, human capital efficiency, and the structural capital efficiency. VAIC is used to measure the level of productivity created. The study provides empirical evidence that investors place higher value on firms with higher productivity and productive firms yield greater profitability and revenue growth.

Jasour et al. [11] measures the productivity in terms of intellectual capital, which comprise of human, structural, and customer factors. The data is derived from the quality of intellectual capital in 22 pharmaceutical companies. The results reveal that there is a positive association between productivity of intellectual capital and equity of sample firms. That indicates companies' efficient use of intellectual resources improves their profitability. This supports the hypotheses that capital structure efficiency has an impact on the financial performance of the firms. Lastly, the study finds that there is no relationship between market value and the productivity, which explains that pharmaceutical industry is more sensitive to material capital than intellectual capital.

In the determination of productivity, this research's model is motivated with Chen et al. [10]. In this existing study, the researcher uses the net-value added model to compute the value creation efficiency and examine its association with market valuation. This model's results indicate the benefits and the efforts of firms that are shared between employees, providers of capital, the government, and reinvestment. Mandal et al. [12] highlights the usefulness of value added statements as a supplementary financial statement.

It states that the value added can be used to design incentive schemes to the employees and providers of capital because value added recognizes the value created by every party in the firm. Also, productivity of operations can be measured in terms of value added. On the other hand, this study proves that value added statements have failed to score enough in its favor to replace with traditional statements due to the management discretions. Therefore, it is recommended to enhance the concept by using net value added. In this research, I also use the net-value added in order to avoid such management manipulations on the financial statements and strengthen the concept for calculation of productivity.

This study is expected to reveal the similar results with the Riahi-Belkaoui's study [4] by the implementation of the model developed by Ohlson [3]. This residual income

valuation model provides a theoretical framework for security valuation. It uses the book value of equities and actual historical earnings for estimating the firma value. This study contributes the existing model by including productivity component under the comparison of US GAAP and IFRS.

4. Research on IFRS and US GAAP

The US stock markets had allowed non-US firms to report under IFRS as long as they fulfilled the requirement of the reconciliations for earnings and shareholders equity. However, the SEC eliminated this requirement in 2007. The reason is that these reconciliations led the value of earnings to differ from their original value in their local stock markets. In the study by Gray et al. [13], the researchers examine the income and equity of IFRS and US GAAP companies, which are converged under these reconciliations. They find that there is a significant gap between IFRS and US GAAP companies in terms of measures of income and the reconciliations lead IFRS complied companies to have higher income than others.

McEnroe et al. [14] study analyzes the IFRS compliant firms' financial statements subsequently to the elimination of the reconciliations in order to determine whether there could be converge between two accounting systems. This study examines the some of individual reconciling items based on frequency of occurrence and size of the items such as taxes, deferred taxes, pensions, and other financial instruments. The results reveal that some prominent differences still exist and they can have very substantial effect on income statement items. Lastly, the researchers do not support the SEC's decision on the elimination of the US GAAP - IFRS reconciliations.

Barth et al. [15] study analyzes the comparability of IFRS and US GAAP compliant firms' financial results. They compute accounting system comparability by looking at the stock price and stock returns of firms to measure if an economic outcome (e.g., stock price) estimated based on the mapping from earnings to that economic outcome of one system is the same as the estimated economic outcome based on the other system. They find that comparability is usually greater for firms that adopt IFRS. Also, earnings smoothing and accrual quality are the potential sources of the increase in comparability after firms adopt IFRS. Further, the study suggests that IFRS requirements increase compliant firms' ability of reporting comparability with US firms.

In Europe, so many firms adopted IFRS voluntarily between 2005-2007. Andre et al. [5] study examines the determinants of voluntary compliance of IFRS. The findings lead them to determine the costs and benefits of complying with IFRS. Also, they find that the internationality, leverage, firm size, and auditor's reputation affect English firms' decision on selecting IFRS. However, they don't relate productivity and profitability with this voluntary decision and the researchers assume that it is due to the first time high costs of adaptation in small firms.

The accounting quality and its economic consequences have been a long discussion in the accounting literature. The quality of accounting information increases with the comparable accounting standards around the world. IFRS compliant' financial statements have shown that they have better accounting information quality with using IFRS. Also, firms have shown dramatic increase in their market liquidity and value after IFRS became mandatory[14].

Beke [17] study analyzes the benefits of complying with IFRS and its impacts on management decision, efficiency of firms, and to investigate whether IFRS reduces the level of earnings management and business profit with a sample from Budapest Stock Exchange in Hungary. The results of this study prove that IFRS has the most efficient tools to measure and evaluate the internal performance of firms because IFRS requirements are transparent and not flexibly changeable.

Overall, these studies illustrate that the financial items (i.e. earnings) from both accounting principles reveal different results. It either changes the value of financial items that leads firms seem less valuable than their US competitors or it changes the items features, which misleads the investors in the US. This research study is a comprehensive way to compare US GAAP and non-US GAAP adopter firms' value with a nonearning measure, which is productivity. Thus, it is expected that this research eliminate the impact of accounting principles and reconciliations for international firms by using productivity.

5. Hypotheses

Given the existing literature, this study focuses on the association between productivity and firm value. It further addresses the comparison of this association between US GAAP adopter and IFRS adopter firms. Based on the findings of prior studies from Riahi-Belkaoui [4] and Bao et al. [18], which suggest that productivity and market value have strong association, it is hypothesized in this study that if the productivity of a firm increases, then the market value of firm increases.

Also, Amir et al. [19] study's results reveal that US GAAP adopter firms have better earning quality than non-US firms in US stock market. Based on these findings, in this study it is hypothesized if the association of productivity and firm market value is high in US GAAP adopter firms compare to IFRS adopter firms, then US GAAP requires firms to report their financial statements in a better quality not to mislead their investors.

6. Sample Selection

To test the above hypotheses, this study selects a sample of IFRS adopter firms from Global Vantage $1 Financial Active. It is a financial data source in COMPUSTAT with the largest non-US firms that are total financial operation of

more than billion. Since it is difficult to get data from Global Vantage for smaller firms and this study focuses on the publicly traded firms, this limitation should not lead any important bias. Instead of using non-US firms that operate in US stock markets, this study uses non-US firms that do not operate in the US stock market. Thus, it avoids the disadvantages of reconciliations in the analysis. For US GAAP adopter firms, all US firms are also selected from COMPUSTAT.

The sample consists of 9000 companies date from 2002 through 2012. Several firms are dropped because their financial components do not fully exist in Global Vantage or COMPUSTAT to determine their productivity such as labor expense. Also, top and bottom 1% of the observations are removed in order to robust the test. The final sample consists of 1350 firm-year observations of US firms and 995 firm-year observations of non-US firms.

7. Model Specification

To examine the change in the association of productivity and firm value, between US GAAP adopters and IFRS adopters firm, this study defines firm value in terms of productivity attributes. This research focuses on four firm value attributes, which are productivity, profitability, firm size, and growth. It explains the differences of IFRS and US GAAP associations in the models' R^2s. In order to determine, if the differences between R2 are significant or not, this study tests the regression models with the attributes mentioned above.

Productivity: As mentioned above, productivity is the ratio of output produced to inputs consumed. The inputs represent the number of employee and labor hours. The outputs are called value-added. Using value-added is insightful. It shows the efforts of a firm are shared among employees, providers of capital, the government, and reinvestment. Also, value-added is one possible measurement of productivity. It can be obtained from disclosed accounting information. Net-value added shows how wealthy firms are. After dividing it with total asset, it indicates productivity of firms.

$$S-B=W+I+DP+DD+T+R \qquad (1)$$

$$S-B-DP=W+I+DD+T+R \qquad (2)$$

In formula, S = sales revenue, B = purchases of material and services, W = wages, I = interest, DD =dividends, T = taxes and DP = depreciation. First formula is called gross-value added and second one is net-value added. The difference between two equations is the consideration of depreciation. Researches with gross-value added avoid the management's judgments on the financial statements because gross-value added does not consist of depreciation expenses. However, most of research studies use net-value added due to availability of data. There are problems in the application of value added for international comparisons because the definition of value added varies from country to country. Another issue is the evaluation of certain expenses for instance rent, heat, and light expenses.

In the determination of productivity, this research model is motivated with Bao et al. [18]. The research also uses the net-value added model to compute productivity and examines the association between productivity and firm value. It is useful because it shows the way the benefits and the efforts of a firm are shared between employees, providers of capital, the government, and reinvestment. Bao et al. [18] emphasizes the advantages and disadvantages of the net-value added model. The main advantages of the net–value added are that it is designed to measure the efficiency and motivate the employees, its data can be derived from income statement and easily interpreted. The main disadvantage of the net-value added is the unknown decision between gross and net-value added. The findings of this study prove the association between productivity and firm value is even stronger than the association between earnings and firm value. Also, this study indicates that productivity affects the firms' security prices. This research also uses net-value added in order to avoid any management manipulation on the financial statements. Under the same method, it is expected to have consistent results with Bao et al. [18] to explain the association between productivity and firm value.

Profitability: Consistent with the prior researches, this study tests profitability attribute by Return on Asset (ROA) which is Net income / Total Assets

Firm Size: This study uses total asset in order to determine the association between firm size and market value. This attribute also helps this research study to reveal whether IFRS adopter firms have better explanatory power of firm value with firm size than US GAAP adopter firms.

Growth: This study measures growth of firms with the ratio of price and earnings.

8. Results

Panel A of table 1 shows the means and standard deviations of variables for US GAAP adopter firms. Among the variables, productivity scale reflects an average of standard scores. Therefore, its mean is so close to zero. Also, it is relatively small compared to other variables. Panel B of Table 1 shows the means and standard deviations of variables for IFRS adopter firms. In this sample, the mean of productivity and return on assets are very close to zero. Thus, they represent average of standards score. Also, the difference between upper and lower quartiles is relatively high here comparing to US GAAP adopter firms.

Table 1.   Descriptive statistics for US GAAP Adopter Firms for the years 2002 -2012

Panel A

Descriptive statistics for US GAAP Adopter Firms for the years 2002 -2012				2012a
Variableb	Mean	Standard deviation	Lower quartile	Upper quartile
Market Value	7621.687	13487.025	63.986	108901.08
Productivity	0.206	0.264	-0.242	2.502
Return on Asset	3.922	6.234	-24.446	27.217
Price/Earnings	14.648	22.361	-157.692	165.462
Total Asset	24017.702	52963.583	140.861	527715

a The number of firm-year observations with necessary data on Compustat is 1350 after deleting the observations in the top or bottom one percent ranked on market value, productivity, return on asset, price/earnings, and total asset.

b Market value(MV) is determined by price of a firm at the end of month and common shares outstanding. Productivity is the ratio of net-value of firms to total asset. Return on asset (ROA) is the ratio of net income to total assets of firm i. for year t. The Price/Earnings is the ratio of firm i for year t. Total Asset is consistent with current year historical data.

Panel B

Descriptive statistics for IFRS adopter firms for the years 2002-2012a				
Variable	Mean	Standard deviation	Lower quartile	Upper quartile
Market Value (MV)	254457.05	1289555.6	26.86	14870348.9
Productivity (P)	-0.17273	5.2475854	-60.07	36.91543946
Return on Asset	0.77	1.11	-6.23	3.637
Price/Earnings	202.66	943.92	-656.25	10460.42003
Total Asset (TA)	386645.32	984776.01	151.58	9755132

a The number of firm-year observations with necessary data on Compustat is 995 after deleting the observations in the top or bottom one percent ranked on market value, productivity, return on asset, price/earnings, and total asset.

b Market value(MV) is determined by price of a firm at the end of month and common shares outstanding. Productivity is the ratio of net-value of firms to total asset. Return on asset (ROA) is the ratio of net income to total assets of firm i. for year t. The Price/Earnings is the ratio of firm i for year t. Total Asset is consistent with current year historical data.

Table 2.   Correlation among independent and dependent variablesa

Panel A

Variablesb	Market Value (MV)	Productivity (P)	Return on Asset (ROA)	Price/Earnings (P/E)	Total Asset (TA)
Market Value (MV)	1	0.058	0.064	0.206	0.702
Productivity (P)	0.022	1	-0.008	0.132	-0.384
Return on Asset (ROA)	-0.017	-0.033	1	0.024	-0.012
Price/Earnings (P/E)	0.042	0.069	0	1	-0.108
Total Asset (TA)	0.579	-0.375	-0.014	-0.069	1

Panel A of Table 2 represents the Pearson and Spearman Correlation analysis. Pearson correlations are in the bottom-left cells and Spearman correlations are in the upper-right cells. Productivity and market value have positive correlation, which is consistent with the prior study by Riahi-Belkaoui [4] in the prediction of market value by productivity. Also, productivity and return on asset have a negative correlation since profitability may decrease the profitability of some firms in order to increase their productivity. Panel B of Table 2 shows the Pearson correlations in the bottom-left cells and Spearman correlations in the upper-right cells. The findings suggest that there is not any significant relationship between productivity and market value of firm. Also, return on asset and total asset have better explanatory power of market value.

a The number of firm-year observations is 1350. Pearson correlations are in the bottom-left cells and Spearman correlations are in the upper-right cells. All correlations are significant at the 0.01 level.

b Market value (MV) is determined by price of a firm at the end of month and common shares outstanding. Productivity is the ratio of net-value of firms to total asset. Return on asset (ROA) is the ratio of net income to total assets of firm i. for year t. The Price/Earnings is the ratio of firm i for year t. Total Asset is consistent with current year historical data.

Panel B

Correlation among independent and dependent variablesa

Variables[b]	Market Value (MV)	Productivity (P)	Return on Asset (ROA)	Price/Earnings (P/E)	Total Asset (TOA)
Market Value (MV)	1	0.048	0.188	0.165	0.629
Productivity (P)	-0.037	1	-0.055	-0.089	0.047
Return on Asset (ROA)	0.065	0.023	1	0.037	-0.116
Price/Earnings (P/E)	0.445	-0.063	0.057	1	0.038
Total Asset (TA)	0.06	0.033	-0.05	0.015	1

a The number of firm-year observations is 995. Pearson correlations are in the bottom-left cells and Spearman correlations are in the upper-right cells. All correlations are significant at the 0.01 level.

b Market value (MV) is determined by price of a firm at the end of month and common shares outstanding. Productivity is the ratio of net-value of firms to total asset. Return on asset (ROA) is the ratio of net income to total assets of firm i. for year t. The Price/Earnings is the ratio of firm i for year t. Total Asset is consistent with current year historical data.

Table 3.   Average of yearly cross-sectional regression of market value on productivity, return on asset, price/earnings, and total asset

Panel A

Models:

(1) $MV_{it} = a_{0t} + a_{1t}P_{it} + e_{it}$
(2) $MV_{it} = b_{0t} + b_{1t}P_{it} + b_{2t}ROA_{it} + e_{it}$
(3) $MV_{it} = c_{0t} + c_{1t}P_{it} + c_{2t}ROA_{it} + c_{3}P/E_{it} + e_{it}$
(4) $MV_{it} = d_{0t} + d_{1t}P_{it} + d_{2t}ROA_{it} + d_{3t}P/E_{it} + d_{4t}TA_{it} + e_{it}$

	Model 1	Model 2	Model 3	Model 4
Constant	7387.22	7527.34	7200.64	-45821
t	(15.856)	(14.35)	(12.66)	(-25.34)
Productivity	1136.55	1109.99	967.58	14062.4
t	(0.82)	(0.79)	(0.69)	(12.13)
ROA		-34.33	-34.56	4.79
t		(-0.582)	(-587)	(0.11)
P/E			24.37	42.18
t			(1.48)	(3.32)
Total Asset				5646.09
t				(30.3)
ADJ R2	0	-0.001	0	0.41

Note: Coefficient estimates are based on ordinary least-squares estimation. The tables report the average of the coefficient estimates and t-statistics from the yearly cross-sectional regressions. T statistics are in the parentheses.

Panel B

Models:
(1) $MV_{it} = a_{0t} + a_{1t}P_{it} + e_{it}$
(2) $MV_{it} = b_{0t} + b_{1t}P_{it} + b_{2t}ROA_{it} + e_{it}$

(3) $MV_{it} = c_{0t} + c_{1t}P_{it} + c_{2t}ROA_{it} + c_{3}P/E_{it} + e_{it}$
(4) $MV_{it} = d_{0t} + d_{1t}P_{it} + d_{2t}ROA_{it} + d_{3t}P/E_{it} + d_{4t}TA_{it} + e_{it}$

	Model 1	Model 2	Model 3	Model 4
Constant	252884.96	194043.7	95902.4	-246004.1
t	6.18	3.91	2.13	-1.374
Productivity	-9101.5	-9479.74	-2540.27	-3026
t	-1.168	-1.218	-0.363	-0.433
ROA		76552.6	46656.9	50074.81
t		2.08	1.41	1.51
P/E			603.43	601.857
t			15.48	15.46
Total Asset				31485.64
t				1.97
ADJ R2	0	0.004	0.197	0.199

Note: Coefficient estimates are based on ordinary least-squares estimation. The tables report the average of the coefficient estimates and t-statistics from the yearly cross-sectional regressions. T statistics are in the parentheses.

Panel A of Table 3 shows the yearly cross-sectional regressions of the variables for US GAAP adopter firms. Adjusted R^2 shows that productivity, ROA, total asset, P/E together explains .405 of the cross-sectional changes in the market value. Also, the result of t test is significantly high that is 12.134. Therefore, there is a significant relationship between productivity and the market value in US adopter firms. However, incremental explanatory power of each variable except total asset does not have significant impact on the market value. In the Panel B of Table 3, the adjusted R^2 shows that productivity, return on asset, price/earnings, and total assets explain approximately 19% of the market value together. Also, the same table suggests that productivity does not have impact on the market value by itself and the t statistic of productivity is so low which is 1.703. That also proves that there is no significant association between productivity and market value in IFRS adopter firms.

9. Conclusions

This study examines the association between productivity and market value with a sample, which consists of US GAAP and IFRS adopter firms in order to illustrate the difference

between two accounting standards. First of all, this study finds that productivity is an important component by assessing the market value in US GAAP adopter firms compare to IFRS adopter firms. Also, there is a strong relationship between productivity and market value. Meanwhile, this study shows that the same relationship is not significant for IFRS adopter firms. Several arguments can be formulated here about the quality of accounting standards, which causes different results between US GAAP and IFRS in this study. Overall, this study suggests that the US GAAP requirements on firms reporting and other regulations imposed by the Securities and Exchange Commission such as Sarbanes Oxley Act 2002 lead firms to give better results in evaluating their performance.

This study uses the net-value added method to measure productivity. However, so many firms do not disclose to necessary information to determine firm level productivity. Therefore, this study emphasizes the importance of disclosing necessary information for better evaluation of firms. The limitation of this study is the sample used for IFRS adopter firms, which is derived from Global Vantage under $ 1 financial active. These firms' earning returns and total assets are much greater than US GAAP adopter firms in this research. For this reason, these findings cannot be generalized to the smaller IFRS adopter firms based on this study alone.

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