

# **Continental and National Differences in the Financial Ratios of Investment Banking Companies: An Application of the Altman Z Model**

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*This research compares the financial ratios of investment banks across nations and continents. Ratios chosen were those in the Altman's Z model used to predict bankruptcy. The investment banking industry was chosen because of its interest to a broad range of individuals. We found a significant continental and national variation in most of the ratios studied. Presentation of ratios in a classroom, analysis by investors, or consideration of firm financial health using financial ratios should include consideration of these differences.*

## **INTRODUCTION**

The world is definitely moving toward an economic globalization and a borderless market. With this globalization, demand for quality advice and strategic financial solutions across the world is growing. For example, six different investment banks: Morgan Stanley, JP Morgan and Goldman Sachs (American-based multinational), Credit Suisse (Switzerland-based multinational), Deutsche Bank (German-based multinational) and Citigroup Inc.'s London division (England-based multinational) led the initial public offering (IPO) of Alibaba (a Chinese e-commerce company) on the New York Stock Exchange (a U.S. Stocks exchange). Alibaba's IPO, which is the largest IPO ever (Chen, Mac, & Solomon, 2014), is just one prominent example of the globalization the world is experiencing. Investment banks from different countries participate to the same operations, sometimes in a different geographical area from their origins and headquarters.

As the frequency of these cross-border activities increases, one may wonder how to evaluate performances and health of investment banks that are located in different geographical areas. Financial ratios are frequently used to do this evaluation. However financial ratios alone are meaningless without a performance benchmark. Therefore, a firm's financial ratios are usually compared to the norms of the industry to which the firm belongs. In fact, researches have shown that company financial managers' target are industry ratios (Lev, 1969). Moreover, financial ratio averages tends to differ across industry as every industry has its specific set of policies and practices regarding the conduct of business (Ronald & Manak, 1972; Filbeck & Krueger, 2005).

Of course, a multitude of financial ratios could be computed; each providing additional insight to firm financial health. In this research, the financial ratios used to compute the Altman Z score serve as framework to evaluate national differences in financial behavior. Beyond computing the Altman Z score

of the investment banks in our empirical sample to ascertain the existence of any national pattern regarding the Altman Z score itself, we will document national differences in component financial ratios.

Among the most likely reasons for differences in financial ratios across nations is accounting standard variation. International Financial Reporting Standards (IFRS) were developed by the International Accounting Standards Committee, which was subsequently named the International Accounting Standards Board. U.S. GAAP has been characterized as more “rules based,” while IFRS has been viewed as more “principles based.” However, the “P” in GAAP is the abbreviation of the term “principles.”

As of this writing, it is over seven years since the Securities and Exchange Commission announced a roadmap for a complete change in U.S. accounting standards, adopting IFRS in 2014. The delay has been attributed to the weakness of international reporting standards, which give managers more potential leeway to manipulate earnings. It is likely that this change will cause confusion for investors relying on financial statement analysis. This paper looks at the difference in a set of key ratios within a specific industry.

### Statement of the Problem

There are many reasons why financial ratios may be different for identical firms across national borders. Some of these are given in the following chart.

**TABLE 1**  
**VARIABLES CAUSING DIFFERENCES IN FIRM RATIOS FOR IDENTICAL FIRMS**

Macroeconomic Factors: Fiscal	Inflation	Reduced investment in cash accounts
	Interest rates	Higher retained earnings
	Balance of payments	Reduce investment in assets denominated in weak currencies
	Domestic economy size	Demand and revenues
Macroeconomic Factors: Societal	Financial system development	Competition and revenues
	Culture	Varying level of risk aversion
Macroeconomic Factors: Governmental	Banking regulations	Varying reserve requirement
	Accounting principles	Varying asset measurement

A few of these variables will be described in greater detail. Within the “culture” dimension, Nestor Gandelman and Ruben Hernandez-Murillo (2014) revealed the risk aversion varies among countries. These St. Louis Federal Reserve Bank researchers found that citizens in Taiwan being the most risk tolerant. The three-factor model presented by Fama and French (1992, 1993) documents the return in excess of the capital asset pricing model earned by smaller firms and those with a higher book value to market value.

Perhaps the most significant difference across political boundaries is the accounting system that is being employed. Bringinshaw (2008) identifies inventory valuation as being the most frequently discussed difference between IFRS and GAAP. GAAP allows the LIFO assumption, which expenses the most recently purchased inventory as a cost of goods sold. The higher costs, reduces taxes. Under IFRS, LIFO is not allowed at all.

IFRS however is more generous in the area of asset valuation. For instance, IFRS allows development costs, and not just basic research costs, to be included in the company's assets (and therefore not expensed against income). U.S. GAAP insists that all but a limited number of research and development costs get expensed. IFRS allows an asset that was written down due to the perceived permanent loss of value to get written back up again if there is a change in economic or industry conditions. GAAP does not.

IFRS is less conservative than U.S.GAAP, which has been found to increase income while holding cash flows constant. Until recently, European companies listed on U.S. exchanges had to report in both U.S. GAAP and IFRS, making it a natural laboratory for comparison. Jetuah (2007) reports that 82 percent of firms reported a higher income under GAAP, while Ciesielski (2008) reports that mean net income rises by 11 percent.

Just as financial ratios standards differ from one industry to another, it is plausible to expect differences in financial ratios from a country to another or from a continent to another. However, the specific occurrence of these differences is not readily obvious. Furthermore, if such differences exist, what are their implications for investors?

## Methodology

To conduct the research, the first step will be to select investment banks from different parts of the world. The initial goal was to find twelve public investments banks with strong financial records and high revenue from three continents: Asia, Europe, and North America. To minimize the effect of events in one specific nation, the twelve investment banks will come from a minimum of two countries per continent. Two countries only had five publically traded investment banks. Therefore, our sample consists of thirty four firms from six different countries.

Next, data for the computation of the financial ratios were collected. The principal sources used are the 10 k of the selected company and the Capital IQ database.

The third step consisted of computation of the same financial ratios of these investment banks. As mentioned earlier, the ratios computed are the ratios used in the Altman Z analysis. Firm ratios were computed and averaged within nations and continents. The ratios are:

- R1: Working Capital/Total Assets
- R2: Retained Earnings/Total Assets
- R3: Earnings Before Interest & Tax/Total Assets
- R4: Market Value of Equity/Total Liabilities
- R5: Sales/Total Assets

The formula to compute the Z-score is: **Z- score = 1.2R1 + 1.4 R2 + 3.3R3 + 0.6R4 + R5**

The fourth step will be the computation of Altman's Z-score by companies, which is averaged within each nation and continent. The final step will be the interpretation of the results and identification of patterns in these results. Moreover, if there is any patterns the interpretation will focus on finding the implication of these patterns for the investors

## Hypotheses

*Ho1: In the investment banking industry, the financial ratios used in computation of Altman's Z-score are the same across continents.*

*Ha1: In the investment banking industry, the financial ratios used in computation of Altman's Z-score vary across continents.*

*Ho2: In the investment banking industry, the financial ratios used in computation of Altman's Z-score are the same across national boundaries.*

*Ha3: In the investment banking industry, the financial ratios used in computation of Altman's Z-score vary across national boundaries.*

*Ho3: In the investment banking industry, Altman's Z-scores are the same across national boundaries.*

*Ha3: In the investment banking industry, there is a national difference in Altman's Z-scores of firms.*

## **Review of Literature**

The Altman Z-score is a widely recognized and accepted measure of companies' financial distress. In 1968, professor Altman conducted a research to assess the pertinence of ratio analysis, especially in bankruptcy prediction. He came up with a "discriminant-ratio model", the Z model, with an accuracy of 94 percent (Altman, 1968). The model has been used to conduct research in several countries of different continents.

### *Altman's Z Analyses*

In the United States, Charles Moyer has studied the accuracy of the Altman's Z model in predicting companies' financial distress (Moyer, 1977). When computing the Altman's Z score with data the year before the companies' failure, Moyer had a 88 percent rate of success in predicting the failure. When the period prior to the failure is extended, the success rate drops. As a matter of fact, the success rate is 83percent for data of 2 years prior the failure and 71 percent for data of 3 years priors the company's failure.

Although, the original Altman's Z score was computed with data of non-financial institutions, several researchers have assessed Altman's Z model in the financial industry. As a matter of fact, Vaziri, Bhuyan and Manuel (2012) conducted research that compared five failure predictions models: the Moody's model, the S&P's Model, the Vaziri's Model, the Logit model and Altman's Z model. Using data of hundred banks, the researchers concluded that the Altman's Z model was the most accurate, predicting 80 percent of failed banks.

Altman's Z model has also been used beyond the United States to conduct studies related to the financial health of financial institutions. For example, Jasmine Chieng studied the accuracy of the Altman Z model in the prediction of bank failures in the Eurozone (Chieng, 2013). She concluded that the Altman's Z model was an incredibly reliable predictor of the bank failures in the Eurozone as "it has predicted 100 percent of banking failures from five years to the year of their demise". Furthermore, Altman's Z model was also used in the analysis of the Indian banking industry (Pradhan, 2014). Roli Pradhan used Altman's Z scores to identify the most solvent Indian banks from 2008 to 2013. He then used this data to produce a ranking of India's banks in term of solvency from 2014 to 2020 and suggested the order in which the Reserve Bank of India should loan money to India commercial banks.

### *Applying Altman's Z to an International Comparison*

Very few researchers have used the Altman's Z score in a study involving financial institutions of different countries. The value of doing so is denoted by the effort of Altman et.al. (2014), who studied the accuracy of the Altman's Z model in an international context. To do so, they analyzed firms from 32 Europeans countries and three non-Europeans countries. However, this study only concerned private industrial (non-financial) companies.

## **Scope and Limitations**

The financial industry is a very wide and broad industry where companies simultaneously operate in different sectors (i.e., commercial finance and personal finance) and fields (i.e., banking, insurance, and real estate) at the same time. Therefore, this study focuses on firms in the investment banking industry. Even in this seemingly narrow construct, there is a variety of banking entities with different levels of focus on the investment banking process, making it difficult to classify companies as investment banks. To solve this problem, we used the classification provided by [finance.yahoo.com](http://finance.yahoo.com). Consequently, we used only firms that were listed in the “investment brokerage” category of Yahoo Finance.

Furthermore, to be selected into the data sample, a firm had to meet several criteria. First of all, we selected the two biggest stock exchanges of each continent. If the first two biggest stock exchanges came from the same country, like in America and Asia, we picked the next biggest stock exchange coming from a different country. Secondly, we chose the banks the biggest market capitalization; to ensure that the firms selected were major actors of their domestic market.

One of the main limitations of the study lies in the formula used to compute the Altman-z score. In fact, market capitalization varies from day to day and therefore can slightly change the Z-score from one day to another. Another limitation is the fact that, only 6 companies are selected in a given country. A larger sample size would increase the accuracy of this analysis, but may result in the inclusion of financial institutions that are not active participants in the investment banking arena.

## **Significance of the Study**

With the world going towards a globalized economy, individuals and financial institutions seek to take advantage of any arbitrage and opportunity whether these opportunities come from a domestic or foreign market. Financial ratios are one of many tools used by investors in the selection of these opportunities. According to Whittington (1980), one of the two principal use of financial ratios is “is to compare a ratio with some standard to say whether it is high or low”. The purpose of this paper is not only to investigate the robustness of such standards across the investment banking industry and provide some insight regarding how these standards vary across continents and nations.

## **EMPIRICAL RESULTS**

The will to conduct this study came from a simple observation. Considering the fact that financial standards and financial ratio benchmarks vary from one industry to another, it became interesting to investigate if such differences exist from one country to another or from one continent to another. However the most important question is not whether or not these differences exist but whether their existence impacts investment analysis. Table 2 presents the investments banks that constitute the sample. Investment banks in Hong Kong and Taiwan were chosen to represent Asia. Japanese investment banks were not used because it was impossible to locate financial institutions that were solely in the investment banking industry on the Tokyo Stock Exchange, as reported by [finance.yahoo.com](http://finance.yahoo.com). British and German investment banks represent European investment banks, because they are the largest European stock exchanges in 2011 according to [World-Stock-Exchanges.net](http://World-Stock-Exchanges.net). In North America, the Canadian Stock Exchange dwarfs the Mexican Stock Exchange by a factor 5 according to Forbes [www.forbes.com/pictures/eddk45igh](http://www.forbes.com/pictures/eddk45igh)) and Banco of Mexico ([www.bankxico.org.mx](http://www.bankxico.org.mx))

**TABLE 2**  
**INVESTMENT BANKS IN SAMPLE**

Continent	Country	Investment Bank
Asia	Hong Kong	Haitong International
		Guotai Junan
		Reorient Group Limited
		Freeman Financial
		VXL Capital Ltd
		Bright Smart Securities
	Taiwan	Waterland Financial Holdings
		Miura Co Ltd
		President Securities Corp
		China Bills Finance Corp
Europe	England	Masterlink Securities
		Cenkos Securities PLC
		IG Group Holdings PLC
		Charles Stanley Group
		ICAP PLC
		Plus 500 Ltd
	Germany	Tulett Prebon
		OVB Holding AG
		Baader Bank
		Fintech Group AG
		MWB
		Lang & Schwarz
North America	Canada	Valora Effekten
		Canaccord Genuity Group Inc
		Currency Exchange
		GMP Capital Inc
		Ladenburg Thalmann Financial S
		Pinetree Capital Ltd
	USA	Sunwah International Ltd
		Goldman Sachs Group Inc
		Morgan Stanley
		TD Ameritrade Holding Corp
		The Charles Schwab Corporation
		JP Morgan Chase and Co
Leucadia National Corporation		

**Continent-Based Findings**

Table 3 exhibits the continental averages for each of the Alman's z model's ratios and results of pairwise tests of significance. Each ratio is discussed independently below.

**TABLE 3**  
**CONTINENTAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF**  
**INVESTMENT BANKS**

Average ratio values for all countries in a continent P-values of t-tests for difference in means						
Equations	Asia	Europe	Asia	North America	Europe	North America
<u>Working Capital</u>	0.25	0.47	0.25	0.19	0.47	0.19
Total Assets	0.065*		0.22		0.01***	
<u>Retained Earnings</u>	0.15	0.19	0.15	-0.28	0.19	-0.28
Total Assets	0.33		0.12		0.1*	
<u>EBIT</u>	0.08	0.14	0.08	-0.03	0.14	-0.03
Total Assets	0.31		0.06*		0.07*	
<u>Equity Value</u>	3.21	5.68	3.21	3.15	5.68	3.15
Total Liabilities	0.22		0.44		0.22	
<u>Sales</u>	-0.06	0.74	-0.06	0.08	0.74	0.08
Total Assets	0.01***		0.30		0.00***	
<u>Altman's Z</u>	2.75	5.43	2.75	1.61	5.43	1.61
	0.11		0.31		0.08*	

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

- **Working capital to total asset ratio:** Average continental working capital ratios were 0.25, 0.47, and 0.19 in Asia, Europe, and North American, respectively. P-values for Student t statistics tests are given for each pair of ratios. The difference between the average working capital ratio in Europe and North America is significant at the 0.01 level, rejecting the null hypothesis. Though less significant, the difference between Europe and Asia is significant at the 0.10 level. It is not surprising that the differences between Asia and North America is insignificant, given the difference between the means of 0.06 (0.25 – 0.19).
- **Retained earnings to total assets:** Retained earnings range from 19 cents per dollar of total assets in Europe to a loss of 28 cents per dollar of total earnings in North American. (This loss primarily arises from negative net income in the face of diminished assets at one Canadian investment bank.) This continental difference is significant at the 0.10 level. No other differences in this ratio were significant.
- **Earnings Before Interest & Tax to Total Assets:** Asian and European investment banks have virtually the same level of operating income per dollar of total assets. Both are significantly different from the North American investment banks at the 0.10 level. Much of this difference arises from the poor performance of Canadian investment banks, which will be described in the next section of this paper.
- **Market Value of Equity/Total Liabilities:** There is no significant difference in this ratio across continents.
- **Sales to Total assets:** Investment bank revenue per dollar of total assets ranges from negative \$0.06 in Asia to \$0.74 in Europe. North American investment banks earn only \$0.08 cents per dollar of assets. While the difference between Asia and North America is not significant, Europe's difference with the other two continents is significant at the 0.01 level.
- **Altman's Z scores:** Altman's Z-score ranges from 1.61 in North America to 5.43 in Europe. Only the North American investment banks posted an Altman's Z score which is below the 1.8 value

considered indicative of a company heading into bankruptcy. The difference between Altman Z scores in Europe and North America is significant at the 0.10 level.

### Country-Based Findings

Separate tables are used to exhibit country-based information regarding each ratio. The first data column presents the average value of the investment banks within a country on a given ratio. The remaining data columns present the p-values from pairwise tests of mean differences.

#### *Working Capital to Total Asset Ratio*

**TABLE 4**  
**NATIONAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF INVESTMENT BANKS RATIO (WORKING CAPITAL/ ASSETS) VALUES FOR ALL COUNTRIES IN A CONTINENT**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	0.36					
Taiwan	0.14	.11				
England	0.34	.44	0.15			
Germany	0.60	.10	0.01***	0.09*		
Canada	0.08	.34	0.21	0.41	0.06**	
USA	0.29	.04**	0.32	0.06**	0.00***	0.09*

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Out of fifteen possible combinations, significant differences were found seven times. Approximately half the time the null hypothesis is rejected. Specifically,

- ✓ The null hypothesis is rejected at a 1 percent level for the following comparison: Taiwan vs England and Germany vs USA.
- ✓ The null hypothesis is rejected at a 5 percent level for the following comparison: Hong Kong vs USA, England vs USA and Germany vs Canada.
- ✓ The null hypothesis is rejected at a 10 percent level for the following comparison: England vs Germany and Canada vs USA.

*Retained Earnings to Total Asset Ratio*

**TABLE 5**  
**NATIONAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF INVESTMENT BANKS**  
**RATIO (RETAINED EARNINGS/TOTAL ASSETS) VALUES FOR ALL**  
**COUNTRIES IN A CONTINENT**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	0.12					
Taiwan	0.19	0.32				
England	0.31	0.07*	0.22			
Germany	0.06	0.24	0.19	0.03**		
Canada	0.09	0.16	0.14	0.11	0.17	
USA	-0.65	0.35	0.23	0.04**	0.25	0.17

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Table 5 reports that the null hypothesis is rejected at the 10 percent level when investments banks of Hong Kong are compared to investments banks of England. Moreover, the null hypothesis is rejected at the 5 percent level when institutions from England are compared to institutions from Germany and USA. There does not appear to be a lot of nation-based variation in retained earnings as a function of the amount of total assets.

*Earnings Before Interest and Taxes to Total Asset Ratio*

**TABLE 6**  
**NATIONAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF INVESTMENT BANKS**  
**RATIO (EBIT/TOTAL ASSETS) VALUES FOR ALL COUNTRIES IN A CONTINENT**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	0.13					
Taiwan	0.03	0.14				
England	0.29	0.21	0.09*			
Germany	-0.01	0.08*	0.15	0.06**		
Canada	0.02	0.10*	0.22	0.05	0.33	
USA	-0.07	0.13	0.28	0.08*	0.20	0.24

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Out of fifteen possible combinations, significant differences were found five times. One third of the time the null hypothesis is rejected. Specifically,

- ✓ The null hypothesis is rejected at a 5 percent level for the following comparison: Hong Kong vs Germany and Canada, England vs Taiwan and USA.
- ✓ The null hypothesis is rejected at a 10 percent level for England vs Germany.

*Market Value of Equity to Total Liabilities*

**TABLE 7**  
**NATIONAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF INVESTMENT BANKS**  
**RATIO (MARKET VALUE OF EQUITY/TOTAL LIABILITIES) VALUES FOR ALL**  
**COUNTRIES IN A CONTINENT**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	5.14					
Taiwan	1.28	0.12				
England	7.84	0.31	0.10*			
Germany	3.51	0.31	0.15	0.20		
Canada	0.28	0.44	0.22	0.40	0.34	
USA	6.03	0.07*	0.20	0.08*	0.06**	0.18

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Out of fifteen possible combinations, significant differences were found four times. Approximately one fourth of the time the null hypothesis is rejected. Specifically,

- ✓ The null hypothesis is rejected at a 5 percent level for the comparison between Germany vs USA.
- ✓ The null hypothesis is rejected at a 10 percent level for the following comparison: USA vs England and Hong Kong, Taiwan vs England.

*Sales to Total Assets*

**TABLE 8**  
**NATIONAL DIFFERENCES IN KEY FINANCIAL STATEMENTS OF INVESTMENT BANKS**  
**RATIO (SALES/TOTAL ASSETS) VALUES FOR ALL COUNTRIES IN A CONTINENT**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	-0.3					
Taiwan	0.17	0.19				
England	0.76	0.06**	0.07*			
Germany	0.72	0.06**	0.06**	0.47		
Canada	0.09	0.26	0.34	0.06**	0.05**	
USA	0.07	0.24	0.28	0.05**	0.04**	0.46

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Out of fifteen possible combinations, significant differences were found eight times. Slightly over half the time the null hypothesis is rejected. In fact, this ratio showed the most variation across countries. Specifically,

- ✓ The null hypothesis is rejected at a 5 percent level for the following comparison: Hong Kong vs England and Germany, England vs Canada and USA, Germany vs Canada and USA, Taiwan vs Germany.
- ✓ The null hypothesis is rejected at a 10 percent level for the comparison between England vs Taiwan.

Z-score

**TABLE 9**  
**NATIONAL DIFFERENCES IN ALTMAN Z SCORE OF INVESTMENT BANKS**

Averages and P-values of t-tests for difference in means						
	Within Country Average	Pair-wise t-test p values				
		Hong Kong	Taiwan	England	Germany	Canada
Hong Kong	3.82					
Taiwan	1.47	0.17				
England	7.26	0.21	0.08*			
Germany	3.60	0.46	0.09*	0.18		
Canada	2.88	0.43	0.38	0.23	0.44	
USA	0.55	0.09*	0.22	0.06**	0.01***	0.31

\*, \*\*, and \*\*\* indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

Out of fifteen possible combinations, significant differences were found five times. One third of the time the null hypothesis is rejected. Specifically,

- ✓ The null hypothesis is rejected at a 1 percent level for the comparison between Germany and USA.
- ✓ The null hypothesis is rejected at a 5 percent level for the comparison between England and USA.
- ✓ The null hypothesis is rejected at a 10 percent level for the following comparison: Hong Kong vs USA, Taiwan vs England and Germany.

## SUMMARY

Globalization of the world has increased the number of cross border transactions and investments, increasing the importance of standardized measure of firms' success. The use of financial ratios is one of the most established tools to evaluate the strength of a company. However, to be meaningful, financial ratios need to be compared to industry standards. The assumption that a single industry value is an appropriate benchmark is heroic when an industry consists of firms located in multiple geographic regions and nations. Macroeconomic variables (i.e, inflation, interest rates), societal variables (i.e., culture, financial market development), and government variables (i.e., taxation and accounting principles) are just some of the reason that financial ratios could vary for essentially identical firms. As these standards vary from one sector of the economy to another, this paper investigated the existence of such variations

across continents and countries in the investment banking industry. The study was conducted based on three hypothesis:

*Ho1: In the investment banking industry, the financial ratios used in computation of Altman's Z-score are the same across continents.*

*Ho2: In the investment banking industry, the financial ratios used in computation of Altman's Z-score are the same across national boundaries.*

*Ho3: In the investment banking industry, Altman's Z-scores are the same across national boundaries.*

Thirty four investment banks, from six countries of three continents, were selected to constitute our sample. The financial ratios computed are the financial ratios used to calculate the Altman Z score. The table below shows how the differences in financial ratios are consistent among countries.

**TABLE 10**  
**SUMMARY OF THE DIFFERENCES IN RATIOS BETWEEN COUNTRIES**

	Hong Kong	Taiwan	England	Germany	Canada
Hong Kong					
Taiwan					
England	R <sub>2</sub> <sup>*</sup> , R <sub>5</sub> <sup>**</sup>	R <sub>3</sub> <sup>*</sup> , R <sub>4</sub> <sup>*</sup> , R <sub>5</sub> <sup>*</sup> , Z <sup>*</sup>			
Germany	R <sub>3</sub> <sup>*</sup> , R <sub>5</sub> <sup>**</sup>	R <sub>1</sub> <sup>**</sup> , R <sub>5</sub> <sup>**</sup> , Z <sup>*</sup>	R <sub>1</sub> <sup>*</sup> , R <sub>2</sub> <sup>*</sup> , R <sub>3</sub> <sup>*</sup>		
Canada	R <sub>3</sub> <sup>*</sup>		R <sub>5</sub> <sup>*</sup>	R <sub>1</sub> <sup>**</sup> , R <sub>5</sub> <sup>**</sup>	
USA	R <sub>1</sub> <sup>**</sup> , R <sub>4</sub> <sup>*</sup> , Z <sup>**</sup>		R <sub>1</sub> <sup>**</sup> , R <sub>2</sub> <sup>**</sup> , R <sub>3</sub> <sup>*</sup> , R <sub>4</sub> <sup>*</sup> , R <sub>5</sub> <sup>**</sup> , Z <sup>**</sup>	R <sub>1</sub> <sup>***</sup> , R <sub>4</sub> <sup>**</sup> , R <sub>5</sub> <sup>**</sup> , Z <sup>**</sup>	R <sub>1</sub> <sup>*</sup>

<sup>\*</sup>, <sup>\*\*</sup>, and <sup>\*\*\*</sup> indicate ratios which are significantly different at the 0.10, 0.05, and 0.01 levels of significance, respectively.

The most persistent difference can be observed between England and USA that exhibit strong level of differences for all five ratios including the Z-score. The pairs Taiwan Vs England and Germany Vs USA also exhibit strong differences in three financial ratios and in the Z-score.

It appears that there is a nation-based systemic difference in financial ratios across continents and countries. Therefore, when analyzing firms, investors need to take into consideration the firms' geographical location, especially where there are differences in the accounting system used, the culture of the country, and banking regulations in effect. Future research can assess the robustness of this finding across industries by examining national difference in these ratios within other industries. Analysis of financial ratios in additional countries and continents might also lead to fresh insights regarding the proper application of financial statement analysis.

## REFERENCES

- Altman, E. (1968, September). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, 23(4): 589-609.
- Briginshaw, J. (2008). What will the international financial reporting standards (IFRS) mean to businesses and investors? *Graziadio Business Review*, 11(4): 1-6.

- Chen, L., Mac, R., & Solomon, B. (2014, September 22). *Alibaba Claims Title For Largest Global IPO Ever With Extra Share Sales*. Retrieved 2015, from Forbes:  
<http://www.forbes.com/sites/ryanmac/2014/09/22/alibaba-claims-title-for-largest-global-ipo-ever-with-extra-share-sales/>
- Chieng, J. R. (2013). *Verifying the Validity of Altman's Z Score as a Predictor of Bank Failures in the Case of the Eurozone*, National College of Ireland. Downloaded at [trap.ncirl.ie/865/](http://trap.ncirl.ie/865/).
- Ciesielski, J. (2008). IFRS & GAAP: The urge to converge. *The Analyst Accounting Observer*, 17(4): 1..
- Fama, E. and French, K.R. (1992). The cross-section of expected stock returns, *Journal of Finance*, 47(2): 425-465.
- Fama, E. and French, K.R. (1993). Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics*, 33: 3-56.
- Filbeck, G. & Krueger, T.M. (2005). An analysis of working capital management results across industries. *American Journal of Business*, 20(2),11-20.  
<http://dx.doi.org/10.1108/19355181200500007>
- Jetuah, D. (2007). Citigroup Lays out IFRS-US GAAP gulf, *Accountancy Age*, August 30, 2007. Found at:  
<http://www.accountancyage.com/aa/analysis/1782115/citigroup-lays-ifrs-us-gaap-gulf>.
- Moyer, C. (1977). Forecasting Financial Failure: Re-examination. *Financial Management*, pp. 11-17. Retrieved from The Leader in 3D Laser Scanning Technology: <http://3dforensicscans.com/>
- Pradhan, R. (2014, December). Z score estimation for Indian banking sector. *International Journal of Trade, Economics and Finance*, 5(6), 516-520.
- Vaziri, M., Bhuyan, R., & Manuel, P. A. (2012). Comparative predictability of failure of financial institutions using multiple models. *Investment Management and Financial Innovations*, , 9(2): . 120-117.