Excel Assignment Report

FIN60003: BUSINESS ANALYSIS AND MODELLING

THI KHANH HOA NGUYEN- 102227966

Tutorial class: Tuesday 11:30am

Tutor Name: Dr Amir Moradi

Executive Summary

This report aims to show the relationship of Fama and French three factor model to the World Market Index and Country Index. The analysis has been conducted to show the distribution of each variables by using histogram and the summary statistics of each variable also is shown in the tables. Following that, the confident interval and hypothesis testing is conducted to analyse the relationship between three factors of Fama and French model. The analysis shows that there is no relationship among these factors. The last part discusses about the regression and correlation to find the relationship between the MSCI index with the Country indexes. The results point out that there are moderate positive linear relationships between those variables.

Table of Contents

Thi Khanh Hoa Nguyen-102227966

Thi Khanh Hoa Nguyen-102227966

Introduction

In this report, the seven variables namely MSCI World Index, four variables from Fama and French Model (RF, RM-RF, SMB, HML, RER) (Bundoo 2008), Equity market Index and RER will be analyzed by using the descriptive statistics and inferential statistics in excel. The report contains 4 sections: Descriptive Statistics, Confidence Interval, hypothesis Testing and Correlation and Regression.

Descriptive Statistics

In the report, we are analyzing 7 variables including MSCI World index, Four variables in Farma and French Model (RF, RM-RF, SMB, HML, RER), Equity Market Index and RER.

a. **The MSCI World index**: is a broad global equity index that represents the net return of large and mid-capitalization stocks across 23 developed market. The histogram shows the frequency distribution of MSCI World index from 2014 to 2018 and the summary statistics is shown in the table
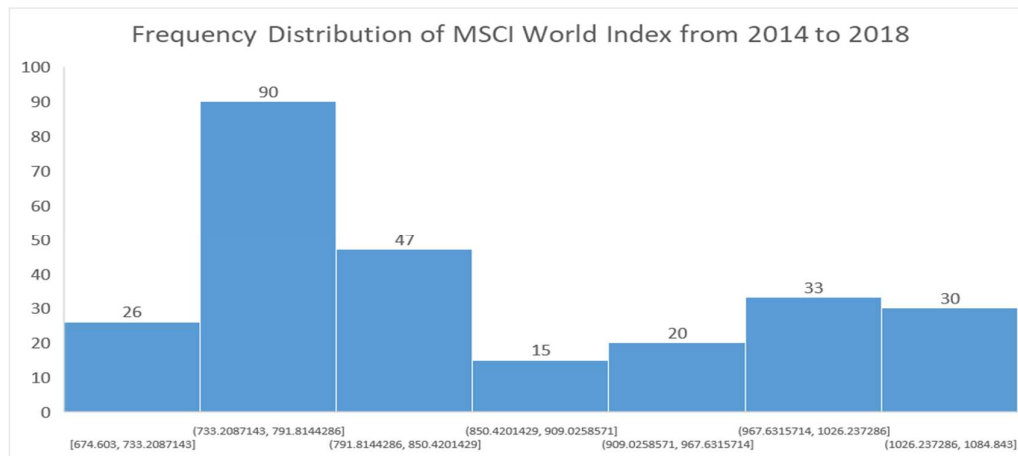
MSCI World Index	
Mean	849.4777969
Standard Error	6.926261818
Median	800.077
Standard Deviation	111.8971842
Range	410.24
Minimum	674.603
Maximum	1084.843

b. **Rf:** Risk free rate return at time t. The histogram shows the frequency distribution of RF from 2014 to 2018 and the summary statistics is shown in the table.

Frequency Distribution of RF from 2014 to 2018
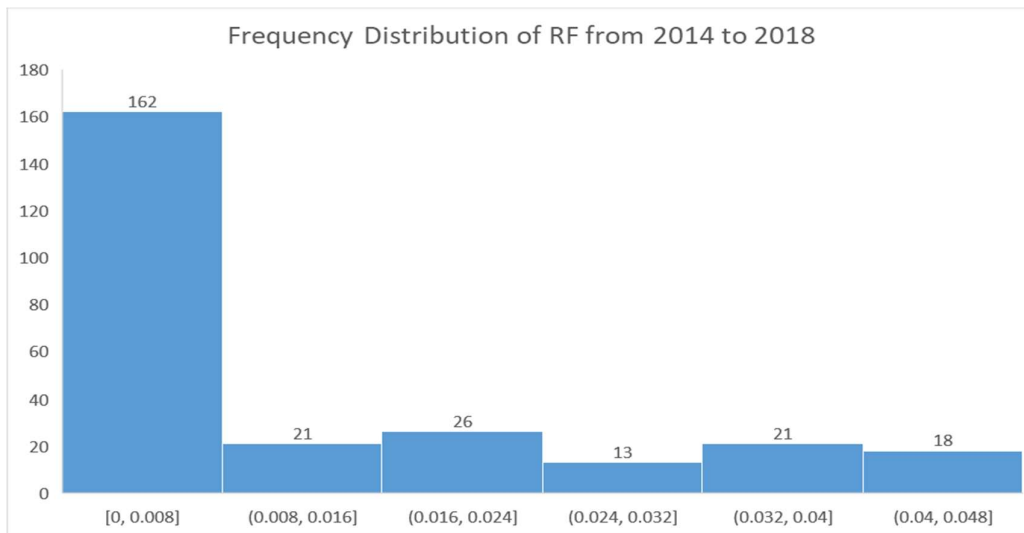
Rf	
Mean	0.011750958
Standard Error	0.000904412
Median	0.005
Mode	0
Standard Deviation	0.01461122
Range	0.048
Minimum	0
Maximum	0.048

c. **Rm-Rf**: is the excess return on the market portfolio (index)**.** The histogram shows the frequency distribution of RM-RF from 2014 to 2018 and the summary statistics is shown in the table.

Frequency Distribution of RM-RF from 2014 to 2018

RM - Rf	
Mean	0.145747126
Standard Error	0.112945818
Median	0.3
Mode	1.38
Standard Deviation	1.824695527
Range	12.1
Minimum	-7.32
Maximum	4.78

d. **SMB**: historic excess returns of small-cap companies over large-cap companies. The histogram shows the frequency distribution of SMB from 2014 to 2018 and the summary statistics is shown in the table.
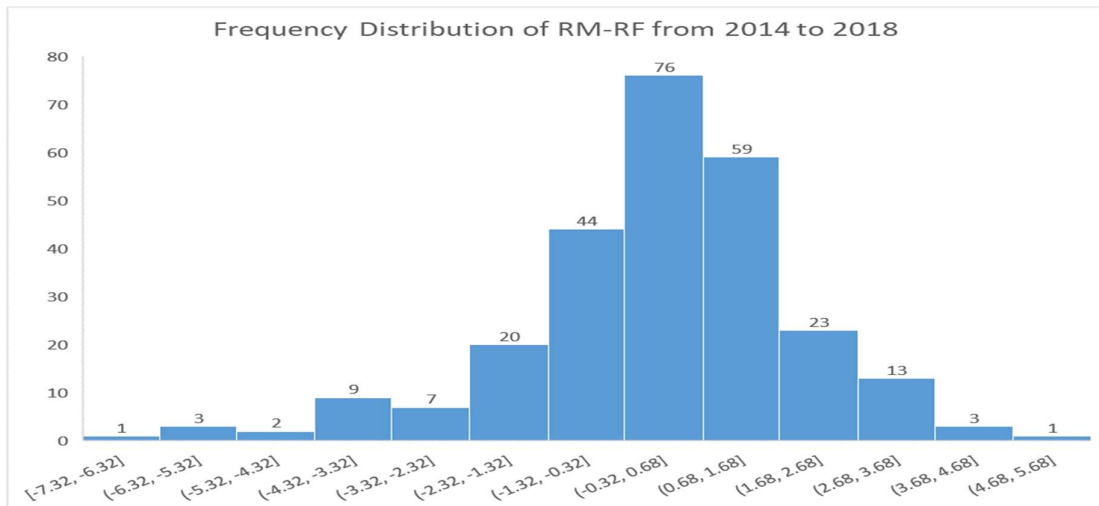

Frequency Distribution of SMB from 2014 to 2018

Thi Khanh Hoa Nguyen-102227966

SMB	
Mean	0.049233716
Standard Error	0.07075762
Median	0.02
Mode	-0.55
Standard Deviation	1.14312434
Range	9.21
Minimum	-3.16
Maximum	6.05

e. **HML**: Historic excess returns of value stocks over the growth stocks. The histogram shows the frequency distribution of HML from 2014 to 2018 and the summary statistics is shown in the table.

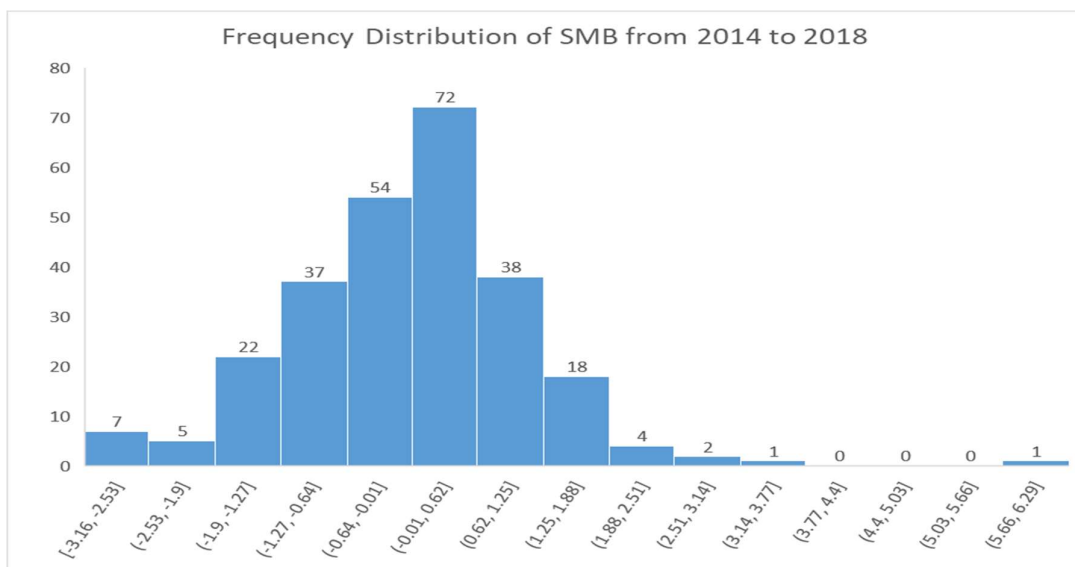Frequency Distribution of HML from 2014 to 2018
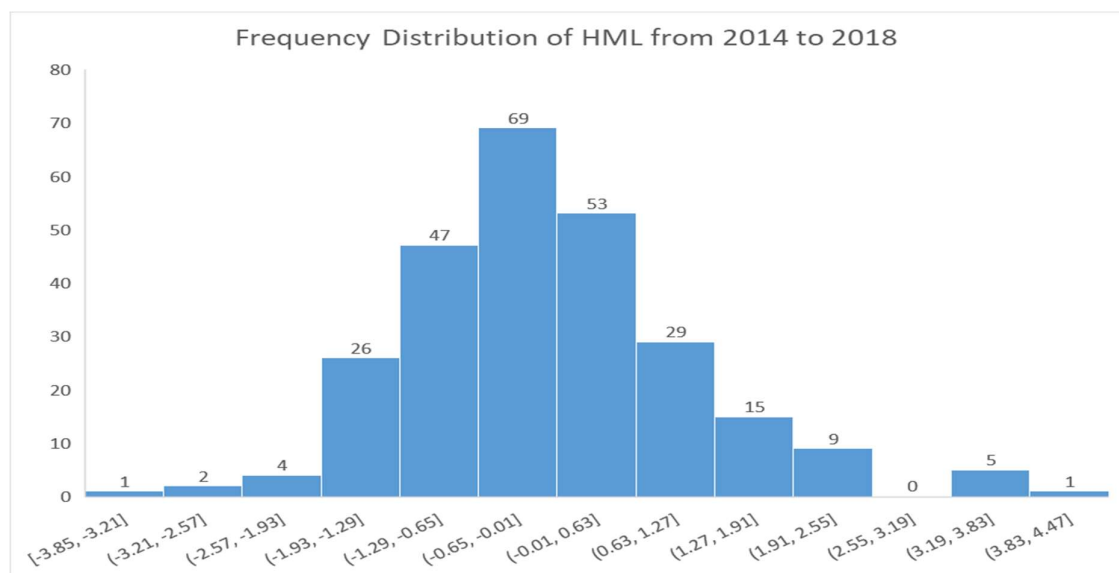
HML	
Mean	-0.04908046
Standard Error	0.071839989
Median	-0.14
Mode	-0.08
Standard Deviation	1.160610548
Range	7.76
Minimum	-3.85
Maximum	3.91

f. **Equity Market Index**: captures the net return of large and mid-capitalization stocks in a specific country. The histogram shows the frequency distribution of Equity Market Index from 2014 to 2018 and the summary statistics is shown in the table.

Thi Khanh Hoa Nguyen-102227966

Frequency Distribution of Equity market index from 2014 to 2018
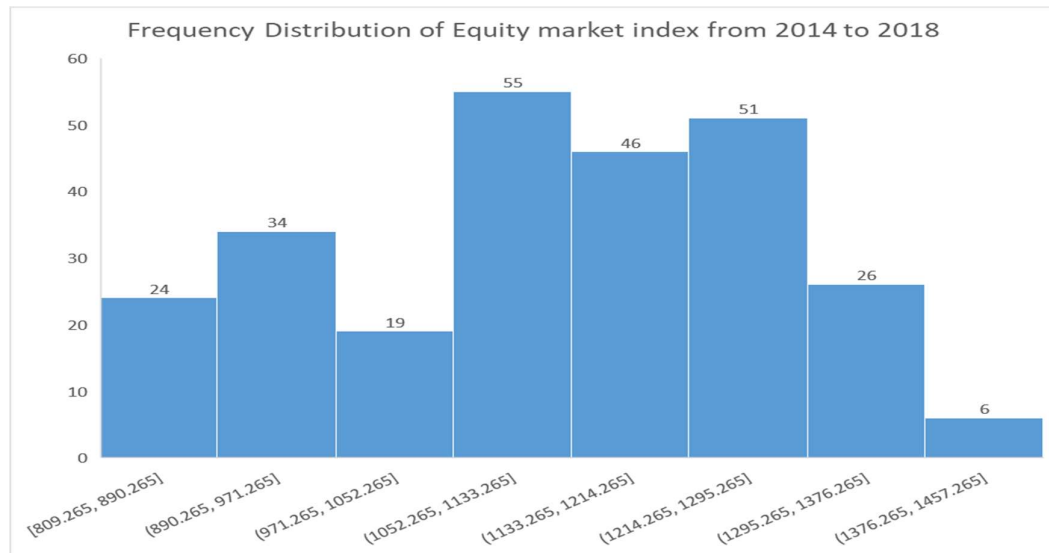
Equity Market Index	
Mean	1120.268805
Standard Error	9.164346547
Median	1133.055
Mode	1263.327
Standard Deviation	148.0545495
Range	602.896
Minimum	809.265
Maximum	1412.161

g. **RER**: Real Exchange Rate: measures the prices of one country's goods and services related to those of another country. The histogram shows the frequency distribution of RER from 2014 to 2018 and the summary statistics is shown in the table.

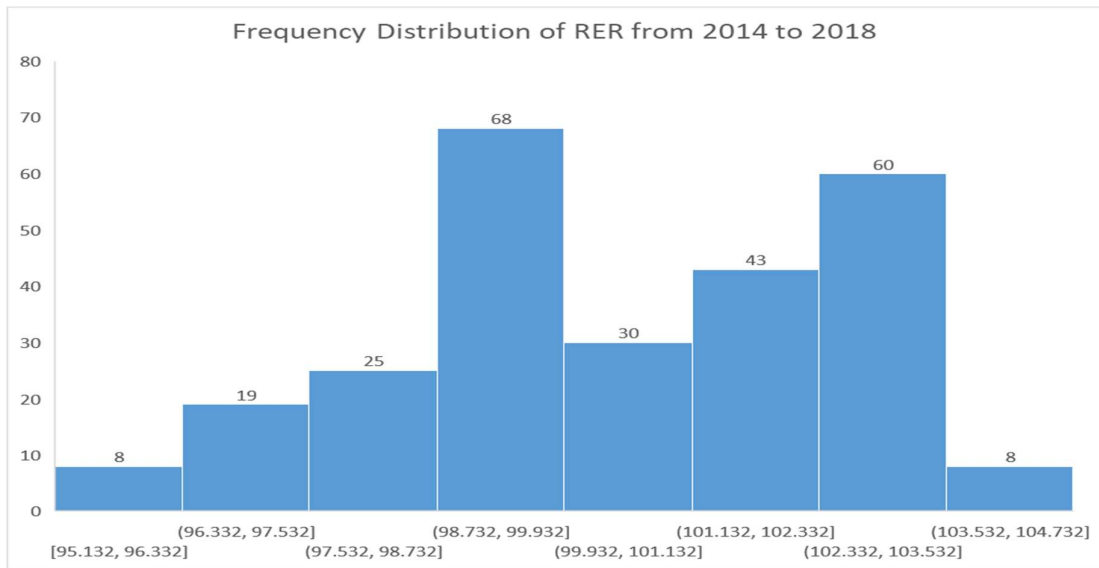Frequency Distribution of RER from 2014 to 2018

RER	
Mean	100.4808889
Standard Error	0.132328406
Median	100.184
Mode	102.238
Standard Deviation	2.137830822
Range	9.36
Minimum	95.132
Maximum	104.492

Confidence Interval

a. Confidence interval for Rf:

Our confidence interval has a limit of 0.00997 and 0.01352. We are 95% confident that the true mean will lie within the interval. We are about 5% sure that the population mean will not lie in this interval. (Please refer to appendix 1a for detail)

b. Confidence Interval for RER:

Our confidence interval has a limit of 100.741 and 100.2203. We are 95% confident that the true mean will lie within the interval. We are about 5% sure that the population mean will not lie in this interval (Please refer to appendix 1b for detail)

Thi Khanh Hoa Nguyen-102227966

Hypothesis Testing

a. Hypothesis testing was performed to test the argue that the average excess return of the market portfolio (Rm-Rf) is higher than the average of Risk free rate of Return (Rf). It is one tailed test (upper tail), independent samples.

df	520
t Stat	-1.18634
P(T<=t) one-tail	0.118015
t Critical one-tail	1.647789

As the t-statistic is less than the t-critical one-tail (--1.18634<1.647789), we accept that the average excess return of the market portfolio (Rm-Rf) is not higher than the average of Risk free rate of Return (Rf) (Please refer to appendix 2a for detail.)

b. Hypothesis testing was performed to test the different between the value premium (HML) and the size premium (SMB) factor. It is two-tailed test, independent samples.

df	520
t Stat	-0.00152
P(T<=t) two-tail	0.998788
t Critical two-tail	1.964537

As the t-statistic is in between two value of t-critical two-tail (-1.964537<-0.0152<1.964537), we accept that there is no different between the value premium (HML) and the size premium (SMB) factor (Please refer to appendix 2b for detail).

c. Hypothesis testing was performed to test the different between the excess return on the market portfolio (Rm-Rf) and the size premium (SMB) factor. It is two-tailed test, independent samples. The detail of the hypothesis testing is shown as follow:

| df	520
t Stat	1.462948
P(T<=t) two-tail	0.144086
t Critical two-tail	1.964537

As the t-statistic is in between two value of t-critical two-tail (-1.964537<1.462948<1.964537), we accept that there is no different between the excess return on the market portfolio (Rm-Rf) and the size premium (SMB) factor (Please refer to appendix 2c for detail)

Thi Khanh Hoa Nguyen-102227966

Correlation and Regression

a. The regression between the MSCI World Index and the country Equity market Index. (Please refer to appendix 3a for detail)

Independent variable: Equity market Index

Dependent variable: MSCI World Index
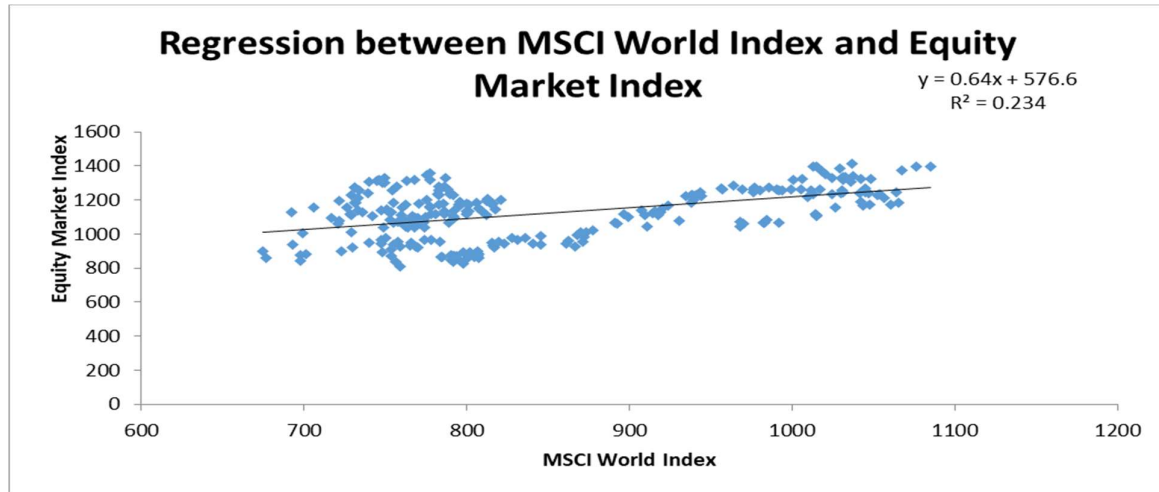
Equation: **Equity Market Index = 576.6+ 0.64 × MSCI World Index**

576.6: is the estimated average value of Equity market Index when the value of MSCI World Index is zero.

0.64: is the estimated change in the average value of Equity Market Index as a result of a one-unit change in the MSCI World Index.

Multiple R = 0.4837. It shows that there is a moderate positive linear relationship between he MSCI World Index and the Equity market index.

Coefficient of determination (R^2) = 0.234. This means that 23.4% of the variation in the Equity Market Index for this sample can be explained by the linear relationship between MSCI and Equity market index. This leaves 76.6% of variations in Equity market index unexplained.

b. The regression between the MSCI World Index and the country Real Exchange Rate (RER) (Please refer to appendix 3b for detail)

Dependent variable: RER

Independent Variable: MSCI World Index

Thi Khanh Hoa Nguyen-102227966

Regression between MSCI World Index and RER

$y = 0.0109x + 91.246$
$R^2 = 0.3238$

Equation: **RER = 91.246+ 0.0109 × MSCI World Index**

91.246: is the estimated average value of RER when the value of MSCI World Index is zero

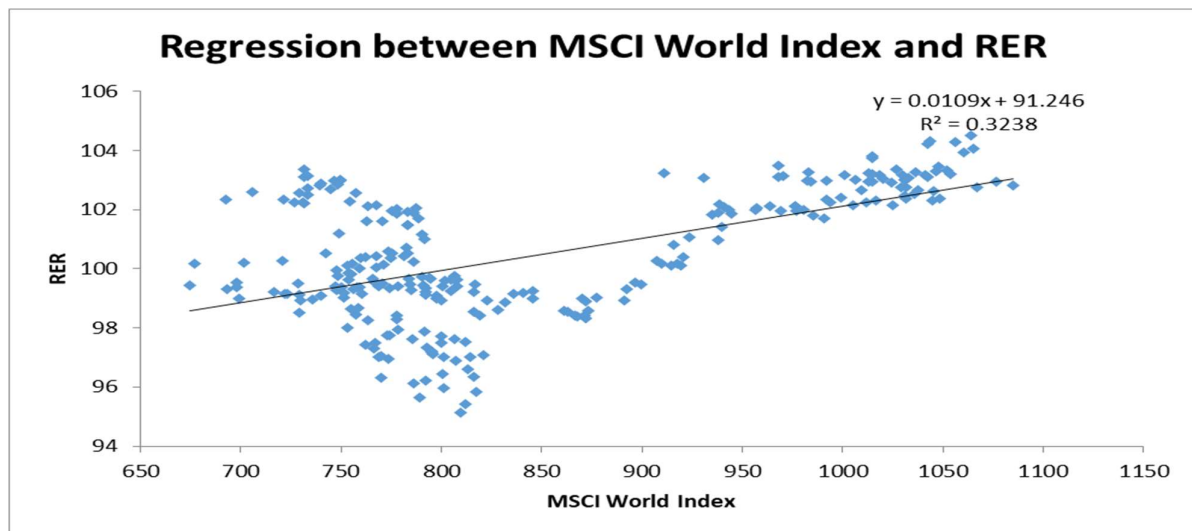**0.0109**: is the estimated change in the average value of RER as a result of a one-unit change in the MSCI World Index

Multiple R = 0.569. It shows that there is a moderate positive linear relationship between the MSCI World Index and the RER.

Coefficient of determination (R^2) = 0.3238. This means that 32.38% of the variation in the RER for this sample can be explained by the linear relationship between MSCI and RER. This leaves 67.62 % of variations in RER unexplained.

   c. Significant test for the Correlation

   - T test for Correlation between Equity Market Index and MSCI

t-statistic = 8.894, d.f = 259, t-critical= 2.2545

As the t-statistic is greater than t-critical, there is evidence of a linear association at the 5% level of significance between Equity Market Index and MSCI ((Please refer to appendix 3c for detail)

   - T test for Correlation between RER and MSCI

t-statistic = 11.13, d.f = 259, t-critical= 2.2545

As the t-statistic is greater than t-critical, there is evidence of a linear association at the 5% level of significance between RER and MSCI (Please refer to appendix 3d for detail)

Thi Khanh Hoa Nguyen-102227966

Conclusion

After analyzing the seven variables by using descriptive and inferential statistics, it can be concluded that there are some relationships between MSCI and Country Indexes. On the other hand, there is no evidence for the relationship between three factors in Fama and Frech model. As we are using the descriptive and inferential statistics in this report, there are some limit that can be listed. Firstly, the descriptive statistics is used for making summation about a particular variable, hence, it can not be used to generalize other variables. Secondly, we are testing the hypothesis tests and regression and correlation based on sample that is collected from five consecutive years form the population, hence, there is come uncertainty about the correctness of the results. To ensure the ethics in statistics, it is required the high accurate in data collection and data interpretation. The personal biases to the data collection and interpretation cold lead to the misrepresentation of the data.

References

Bundoo, SK 2008, 'An augmented Fama and French three-factor model: new evidence from an emerging stock market', *Applied Economics Letters*, vol. 15, no. 15, pp. 1213–1218.

Groebner, D. F., Shannon, P. W., & Fry, P. C. (2018). *Business statistics: a decision-making approach*

Thi Khanh Hoa Nguyen-102227966

Appendix

Appendix 1a: Confidence interval for Rf

Rf	
Confidence Level (95.0%)	0.001780904
Mean	0.011750958
Upper limit	0.013531862
Lower limit	0.009970053

Appendix 1b: Confidence interval for RER

RER	
Confidence Level (95.0%)	0.260571834
Mean	100.4808889
Upper limit	100.7414607
Lower limit	100.2203171

Appendix 2a: Hypothesis testing to test the argue that the average excess return of the market portfolio (Rm-Rf) is higher than the average of Risk-free rate of Return (Rf).

t-Test: Two-Sample Assuming Equal Variances		
	Rf	RM - Rf
Mean	0.011751	0.145747
Variance	0.000213	3.329514
Observations	261	261
Pooled Variance	1.664864	
Hypothesized Mean Difference	0	
df	520	
t Stat	-1.18634	
P(T<=t) one-tail	0.118015	
t Critical one-tail	1.647789	
P(T<=t) two-tail	0.236031	
t Critical two-tail	1.964537	

Appendix 2b: Hypothesis testing to test the different between the value premium (HML) and the size premium (SMB) factor

t-Test: Two-Sample Assuming Equal Variances		
	SMB	HML
Mean	-0.04923	-0.04908
Variance	1.306733	1.347017
Observations	261	261
Pooled Variance	1.326875	
Hypothesized Mean Difference	0	
df	520	
t Stat	-0.00152	

Thi Khanh Hoa Nguyen-102227966

P(T<=t) one-tail	0.499394	
t Critical one-tail	1.647789	
P(T<=t) two-tail	0.998788	
t Critical two-tail	1.964537	

Appendix 2c: Hypothesis testing to test the different between the excess return on the market portfolio (Rm-Rf) and the size premium (SMB) factor.

t-Test: Two-Sample Assuming Equal Variances		
	RM - Rf	SMB
Mean	0.145747	-0.04923
Variance	3.329514	1.306733
Observations	261	261
Pooled Variance	2.318124	
Hypothesized Mean Difference	0	
df	520	
t Stat	1.462948	
P(T<=t) one-tail	0.072043	
t Critical one-tail	1.647789	
P(T<=t) two-tail	0.144086	
t Critical two-tail	1.964537	

Appendix 3a: The regression between the MSCI World Index and the country Equity market Index

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.483705914							
R Square	0.233971412							
Adjusted R Square	0.231013772							
Standard Error	129.831788							
Observations	261							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	1333458.972	1333458.972	79.10749	1.03449E-16			
Residual	259	4365779.932	16856.29318					
Total	260	5699238.904						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	576.5979784	61.65219441	9.352432365	4.22E-18	455.1946007	698.0014	455.1946	698.0014
MSCI World Index	0.640005929	0.071957357	8.894238906	1.03E-16	0.498309979	0.781702	0.49831	0.781702

Appendix 3b: The regression between the MSCI World Index and the country Real Exchange Rate (RER)

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.569044531					
R Square	0.323811679					
Adjusted R Square	0.321200913					
Standard Error	1.761343086					
Observations	261					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	384.78003	384.78003	124.0293896	8.51293E-24	
Residual	259	803.5033318	3.102329466			
Total	260	1188.283362				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	91.24555796	0.836395062	109.0938506	1.6625E-218	89.59855761	92.8925583
MSCI World Index	0.010871774	0.000976198	11.13684828	8.51293E-24	0.008949478	0.012794071

Appendix 3c: T test for Correlation between Equity Market Index and MSCI

t statistic	8.894
df	259
t critical	2.254508761

Appendix 3d: T test for Correlation between RER and MSCI

t statistic	11.13
df	259
t critical	2.254508761

Thi Khanh Hoa Nguyen-102227966