Master Thesis

Performance Analysis of European Companies and Industries with Multifactor Models

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by

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Vienna, 15.04.2024

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Signature

Affidavit

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I also want to say thank you to my parents, who always remind me what is important in life and thank all my friends and study colleagues for the great time we have had.

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Abstract

In this thesis, we investigate whether local five-factor asset pricing models (see Fama and French (2015)) with locally calculated factors perform better than global five-factor models (FF5). Moreover, we investigate industry-specific five-factor asset pricing models with calculated factors within industrial sectors to determine whether they outperform the local models. The empirical out-of-sample study comprises England, France, Germany, Sweden, and Switzerland, and the local country-specific models are compared to a global European model that includes all five countries. For the specific industry models, we investigate the following sectors: alternative energy, automobiles and parts, construction and materials, Health care equipment and services, real estate investment and services, software and computer services, and technology hardware and equipment. The companies for the sector models are selected from all five named countries. All the empirical out-of-sample models have a monthly time series from the period 2003–2023. According to our results, the local (country) FF5 models generally outperform the global (Europe) FF5 model except the FF5 model for England. Furthermore, the industry-specific FF5 models have a lower performance than the global (Europe) FF5 model and local (country) FF5 models.

Kurzfassung

In dieser Masterarbeit untersuchen wir, ob die lokalen Fünf-Faktor-Asset-Pricing-Modelle (FF5) (siehe Fama und French (2015)) mit lokal berechneten Faktoren eine bessere Leistung erbringen als globale Fünf-Faktoren-Modelle. Darüber hinaus wird untersucht, ob branchenspezifische Fünf-Faktor-Asset-Pricing-Modelle mit berechneten Faktoren innerhalb der Branchen die lokalen Modelle übertreffen. Die empirische Out-of-Sample-Studie umfasst die Länder England, Frankreich, Deutschland, Schweden und die Schweiz und die lokalen länderspezifischen Modelle werden mit einem globalen Europa-Modell mit allen fünf Ländern zusammen verglichen. Für die spezifischen Branchenmodelle werden die Sektoren Alternative Energie, Automobile und Teile, Bau und Materialien, Gesundheitsausrüstung und -dienstleistungen, Immobilieninvestitionen und -dienstleistungen, Software und Computerdienstleistungen, Technologiehardware und -ausrüstung untersucht. Die Unternehmen für die Branchenmodelle werden aus allen diesen 5 Ländern ausgewählt. Alle empirischen Out-of-Sample-Modelle haben eine Zeitreihe zwischen 2003 und 2023. Unseren Ergebnissen zufolge übertreffen die lokalen (Länder-)FF5-Modelle im Allgemeinen das globale (Europa-)FF5-Modell, mit Ausnahme des FF5-Modells für England. Darüber hinaus haben die branchenspezifischen FF5-Modelle eine geringere Leistung als das globale (Europa) FF5-Modell und die lokalen (Länder) FF5-Modelle.

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List of Abbreviations and Symbols

CAPM	Capital Asset Pricing Model
FF3	Fama-French 3-Factor Model
FF5	Fama-French 5-Factor Model
RMRT	Market Risk Factor
SMB	Size Factor
HML	Valur Factor
CMA	Profitability Factor
RMW	Investment Factor
SPDR	Standard & Poor's Depositary Receipts
GDP	Gross Domestic Product
SML	Market Security Line
ME	Market Equity
BE	Book Value
B/M	Book to Market Value
OP	Operating Profitability
INV	Investment
SD	Standard Deviation
SH	Small High
SN, B/M	Small Neutral Value
SL	Small Low
BH	Big High
BN, B/M	Big Neutral Value

BL	Big Low
SR	Small Robust
SN, OP	Small Neutral Operating Profit
SW	Small Weak
BR	Big Robust
BN, OP	Big Neutral Operating Profit
BW	Big Weak
SA	Small Aggressive
SN, INV	Small Neutral Investment
SC	Small Conservative
BA	Big Aggressive
BN, INV	Big Neutral Investment
BC	Big Conservative
VIF	Variance inflation factors
COEF.	Coefficient

.1 Introduction

Asset pricing models explain the expected rates of return of financial assets, such as common stocks, bonds, options, and futures contracts. Such models use time-series of prices as a function and express the future prices of the assets. Asset pricing can also be used to build and manage portfolios (see Wayne (2019)).

There are several asset pricing models, and they can perform differently in real-life situations depending on financial markets, industries, and other parameters. Their performance can also vary depending on the observed period. It is important to test the models empirically with unseen data and new portfolios to evaluate their performance.

In this thesis, we use the Fama–French five-factor model (FF5) developed by Eugene Fama and Kenneth French (2015), which includes market risk factor (RMRF), size factor (SMB), value factor (HML), profitability factor (RMW), and investment factor (CMA) (see Fama and French (2015)). The FF5 is based on the capital asset pricing model (CAPM) (see Sharpe (1964) and Lintner (1965)) and is an extension of the Fama–French three-factor model (FF3) (see Fama and French (1992)). To build the FF5, Fama and French (2015) added two more factors to the FF3. The added factors provide additional information for the model and aim to better express the future prices of financial assets (see Fama and French (2015)).

We empirically test the FF5 with a dataset from European stock markets. An out-of-sample test was carried out on data from 2003 to 2023. The test was carried out on specific portfolios, such as 5 European countries (namely, Germany, France, Sweden, Switzerland, England), and

the alternative energy, automobiles and parts, construction and materials, health care equipment and services, real estate investment and services, software and computer services, and technology hardware and equipment sectors.

The thesis is structured as follows. In Chapter 2, a literature review of asset pricing is provided, and the factors influencing European stock markets are briefly explained. In Chapter 3, CAPM, FF3, and FF5 and their factors are outlined. In Chapter 4, the methodological steps taken in this research are explained, and the data source is introduced. In Chapter 5, the empirical results for Europe and the countries and sectors named above are visualised and discussed. Finally, Chapter 6 provides the conclusion.

2 Literature Review

Alexiou and Tygi (2020) provide empirical evidence for different sector rotation strategies for the U.S and European markets using historical data from the period 1999–2019. They measured the performance by using the alpha of the FF3 and FF5 models as a decision-making sign of whether to enter or exit a particular sector. They also relate the results to other macroeconomic factors, such as changes in the gross domestic product (GDP) of each country and their interest rates. The authors analyse nine U.S. and 10 European sector EFTs from Standard & Poor's Depositary Receipts (SPDR). Using regression with 36-month period, the mean alpha for all U.S. sectors was -17% with a standard deviation of 43%. Moreover, the energy sector (XLE US Equity) had the highest mean alpha, at 15%, and highest standard deviation, at 42%. In the European sectors, the mean alpha for all sectors was 30% with a standard deviation of 80%. The health care sector (STW FP Equity) had the highest mean alpha, at 75%, with a standard deviation of 83%. Furthermore, Alexiou and Tygi (2020) report that three out of the 10 European sector alphas (healthcare, technology, and communication) were statistically significant for the FF5, and only two sector alphas (consumer staples and healthcare) were statistically significant for the FF3. Moreover, they provide evidence for the European market that the majority of betas for each model were statistically significant.

Chikashi (2010) investigated the performance of SMB and HML using 30 U.S. industry index returns for the period February 1947 to December 2002. He found evidence that industry portfolio returns can predict the movements of SMB and HML. Additionally, using factor analysis, he reported that the factors are highly effective for SMB and HML volatility forecasting. Moreover, U.S. industry returns can provide effective predictions with SMB about the next

month's returns.

Rapach et al. (2011) provide an out-of-sample test about return predictability for industry portfolios. They used the data from Kenneth French's Data Library and monthly returns on 33 industry portfolios in the period 1946–2008. The authors used a principal component approach and found that excess returns are significantly predictable for a majority of industries. They also found evidence that the textile mill products (TXTLS), furniture and fixtures (CHAIR), printing and publishing (PRINT), transportation and equipment (CARS), apparel and other textile products (APPRL), miscellaneous manufacturing industries (MANUF), and wholesale (WHLSL) industries had the strongest degree of return predictability. Moreover, they show that the SMB factor of FF3 can explain most of the differences in returns across industries.

Griffin (2002) analyses whether the country-specific or global version of FF3 better explains stock returns using monthly returns from 1980 to 1995. The author investigated 1521 firms in Japan, 1234 in the UK, and 631 in Canada, yielding a total of 3386 non-U.S. firms. Griffin (2002) examined the performance of the domestic, world, and international versions of FF3 and reported that none of these versions completely capture average returns. Nonetheless, country-specific versions of FF3 perform better than the global version (see Griffin (2002)).

Fama and French (2017) analyse the global FF5 with regional companies/portfolios and indicated that the local models with factors and returns from the same region might outperform the global five-factor model. Moerman (2005) used FF3 to analyse European countries and industry portfolios and calculated the FF3 factors for industry portfolios within specific European industries. The research compared the results of the FF3 model on European country portfolios with those of the FF3 model on European industry portfolios and indicated that the

industry-specific FF3 models with industry-based calculated factors might outperform the FF3 models for the country portfolios from Europe.

Alves (2013) compared the performance of the CAPM and FF3 and aimed to identify evidence of the benefits of the FF3 over the CAPM. Alves (2013) considered the Economic and Monetary Union (EMU) countries (except Greece and Luxemburg), focused on the period 1990–2003, and reported that the FF3 is more suitable than the CAPM for small and high book-to-market (B/M) firms.

2.1 Factors Influencing European Stock Markets

The performance of stock markets can be crucial for local and global economies and their growth. However, stock markets can be influenced by many factors, as researchers have shown over last few years. Mirza et al. (2022) report the damaging effects of the COVID-19 pandemic on global stock markets, while Ahmed et al. (2022) affirmed the negative reaction of the European stock markets to the Russian invasion of Ukraine and corresponding increased political uncertainty.

Errunza and Hogan (1998) analyse certain macroeconomic factors and researched their influence on Belgium, France, Germany, the Netherlands, Italy, Switzerland, the UK, and the USA. They found that for Germany and France, monetary instability is a significant factor in the volatility of their stock market returns while for Italy and the Netherlands, the significant factor in such volatility is industrial production. The researchers report that industrial productivity growth rate, money supply growth rate, and inflation rate influence the volatility of each regional stock market return.

However, whereas macroeconomic factors can be measured, and their influence predicted, we have witnessed that global epidemic crises, such as COVID-19, can influence stock market returns in very surprising ways. On the one hand, the reactions of investors to these circumstances can be very complex; on the other, global economic activities were reduced due to the pandemic, which can have a direct influence on stock market returns. With broken supply chains and a lack of customers, companies had to publish negative financial statements, which had a negative influence on stock market returns. Aslam et al. (2021) report that the European financial markets saw very high volatility and spillovers across the markets during COVID-19. However, Mirza et al. (2022) claimed that the European markets recovered very quickly and even observe significantly higher returns post-COVID.

The latest case to influence the European stock markets is the political tension that has emerged between Russia and European countries because of the Russian invasion of Ukraine. Ahmed et al. (2022) report that European stock markets have tended to react negatively to the Russian invasion.

3 Multi-Factor Models

3.1 Capital Asset Pricing Model

The CAPM is one of the most widely used asset pricing models (see Stafford (2014)). The CAPM was introduced in the 1960s by William F. Sharpe and John Lintner (see Sharpe (1964) Lintner (1965)), and in 1990, Sharpe won a Nobel Prize for his work (see Fama and French (2004)). The CAPM uses the fundamentals of Harry Markowitz's (1952, 1959) mean-variance portfolio model. Markowitz's model relates return variance and expected return and claims that investors choose to minimise portfolio return variance by given expected returns and maximise expected returns by given variance. The CAPM provides an equation (see Equation 3.1) that relates risk and expected returns to create efficient portfolios and defines a linear relation between the expected return of an asset and its beta (see Equation 3.2) in a portfolio (see Fama and French (2004)).

$$E(R_i) = R_f + \beta_i[R_m - R_f] \tag{3.1}$$

$$\beta_{im} = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)} \tag{3.2}$$

In Equation 3.1 (see Stafford (2014)), $E(R_i)$ stands for the expected return of the asset i, R_f for the risk-free rate, β_i for the systematic risk of asset i, and R_m for the average return of the portfolio m. R_f can be chosen by investors, but it must carry as low a risk as possible. Returns of short-term government bonds are mostly chosen for risk free rates.

In Equation 3.2 (see Fama and French, (2004)), $Cov(R_{i,}R_m)$ stands for the covariance between $R_{i,}$ and R_m, $\sigma^2(R_m)$ for the variance of the portfolio m.

Beta (β_{im}) measures the asset's rate of return variability relative to the portfolio's average rate of return variability. If the asset's beta is equal to 1, the asset and portfolio have the same variability. If the asset's beta is smaller than 1, the asset has less variability than the portfolio, and if the asset's beta is higher than 1, the asset has higher variability than the portfolio.

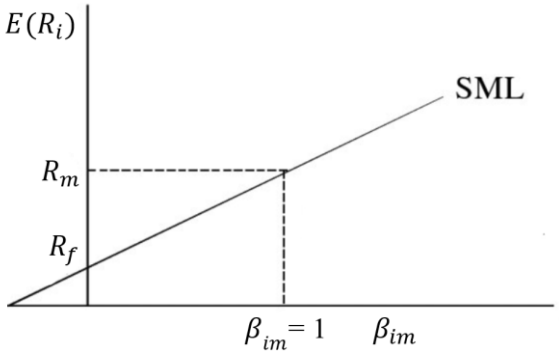

Figure 3.1: Security market line (see Stafford (2014))

Figure 3.1 presents a graphical representation of the CAPM and shows the relation between the beta and a security equilibrium return. The line is known as the security market line (SML) (see Stafford (2014)). A higher beta means that the asset has higher expected returns, but at the same time, it carries a higher systematic risk. Contrariwise, an asset with a smaller beta carries a smaller systematic risk and has lower expected returns.

3.2 Three-Factor Asset Pricing Model

Fama and French (1992) analyse NYSE, AMEX, and NASDAQ stocks during a test period of 1963–1990. They indicated that stock returns can be associated with size, earnings to price ratio (E/P), B/M equity, and leverage. According to these results, the authors added two more factors to the CAPM. The first factor added is SMB, which captures the size effect introduced by Banz (see Banz (1981)), where size is defined as stock price multiplied by the total number of outstanding shares. It relates the size of the asset's market capitalisation with its return rate. Fama and French (1992) named the size of the market capitalisation 'market equity' (ME) in their research. Their research showed that stocks with low ME tend to have higher returns and that stocks with high ME tend to have lower returns.

The second added factor is HML, which captures the value effect of Stattman (1980) and Lanstein et al. (1985). HML is the ratio of the firm's book value (BE) to its ME. The research claims that a higher value factor leads to a higher return of the stock. In general, the researchers aim to evaluate the advantage of both E/P and leverage. E/P is defined as the ratio of the earnings per share of a stock to its price per share. In the research, a higher E/P was related with higher returns and a lower E/P with lower returns (see Fama and French (1992)). Leverage is defined as firm's total liabilities divided by its market value of equity. Fama and French (1992) report that the E/P value factor and leverage factor are absorbed by the combination of size and value factors. Therefore, the factors are not used in FF3 (see Fama and French (1992)).

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + e_{it} \tag{3.3}$$

In Equation 3.3 (see Fama and French (1992)), R_{it} stands for the return on security or portfolio i for period t, R_{Ft} stands for the risk-free return, R_{Mt} is the return on the value-weight market

portfolio, SMB_t is the return on a diversified portfolio of small stocks minus the return on a diversified portfolio of big stocks, HML_t is the difference between the returns on a diversified portfolio of high and low B/M stocks, e_{it} is a zero-mean residual, and a_i is the intercept. The factor exposures b_i, s_i, and h_i capture variations in expected returns.

3.2.1 Size Factor

SMB is the difference between the returns of stocks with a small market capitalisation (small cap stocks) and those with a large capitalisation (large cap stocks). Fama and French (1992) report that small cap stocks historically outperform large cap stocks, and the size factor captures this behaviour in the model. This behaviour can be explained by the growth potential of small cap stocks and their higher risk (see Fama and French., (1992)).

3.2.2 Value Factor

HML is the difference between the returns of stocks with high B/M value (value stocks) and those of stocks with low B/M value (growth stocks). Fama and French (1992) observed that value stocks historically outperform growth stocks (see Fama and French (1992)).

3.3 Five-Factor Asset Pricing Model

Fama and French (2015) test the FF5 with 21 years of new data generated since they developed FF3. They added two more factors, namely, operating profit factor 'RMW' and investment factor 'CMA', to the FF3. The new FF5 model has been researched and discussed on a large scale across the finance community. Fama and French (2015) reported that FF5 outperformed FF3 and explained between 71% and 94% of the expected returns they examined in their research.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it} \quad (3.4)$$

In Equation 3.4 (Fama and French, (2015)), additionally to Equation 3.3, RMW_t stands for the difference between the returns on diversified portfolios of stocks with robust and weak profitability, CMA_t stands for the difference between the returns on diversified portfolios of stocks with low and high investment, and r_i and c_i capture variation in expected returns.

3.3.1 Profitability Factor

The profitability factor RMW is described as robust minus weak profitability and shows the difference between the returns of high-profitable and low-profitable stocks. To measure profitability, Fama and French (2015) use operating profitability (OP), that is, in the fiscal year *t* and *t - 1* revenues minus cost of goods sold minus selling general, and administrative expenses, minus interest expense all divided by book equity (see Fama and French (2015)). The authors show that firms with high profitability tend to have higher returns than those with lower profitability, possibly because of the higher cash flows that firms collect, which can lead to future growth and higher returns. On the other hand, lower profitability could mean financial difficulties, which could lead to lower returns in the future (see Fama and French (2015)).

3.3.2 Investment Factor

The investment factor CMW is described as conservative minus aggressive and shows the difference between the returns of conservatively investing and aggressively investing firms. To measure the investment, the rate of growth of total assets from the fiscal year ending in year t-2 to the fiscal year ending in t-1 is used (see Fama and French (2015)).

4 Methodology and Data Source

4.1 Factor Calculation

To calculate the SMB, HML, RMW and CMA factors, Fama and French (2015) introduced three sorts of portfolio groups. The first group is 2x3 sorts on size and B/M, size and OP, and size and inv, where size is measured with ME, B/M is book to market value, OP is operating profitability, and inv is investment. They used the NYSE median for size and 30th and 70th percentiles for each B/M, OP, and inv. The second group is 2x2 sorts on size and B/M, size and OP, and size and inv. The third group is 2x2x2x2 sorts on size and B/M, size and OP, and size and inv. The second and third groups use the NYSE median for size, B/M, OP, and inv, but the portfolios are built differently and the SMB, HML, RMW, and CMA factors are not calculated in the same way. In this thesis, we use the first group, namely, 2x3, and build the following 18 portfolios:

Small-high (SH) contains the returns of stocks with a smaller market capitalisation than the market equity median and a B/M value between the 70th and 100th percentile.

Small-neutral value (SN, B/M) contains the returns of stocks with a smaller market capitalisation than the market equity median and a B/M value between the 30th and 70th percentile.

Small-low (SL) contains the returns of stocks with a smaller market capitalisation than the market equity median and a B/M value between the 0th and 30th percentile.

Big-high (BH) contains the returns of stocks with a higher market capitalisation than the market equity median and a B/M value between the 70th and 100th percentile.

Big-neutral value (BN, B/M) contains the returns of stocks with a higher market capitalisation than the market equity median and a B/M value between the 30th and 70th percentile.

Big-low (BL) contains the returns of stocks with a higher market capitalisation than the market equity median and a B/M value between the 0th and 30th percentile.

Small-robust (SR) contains the returns of stocks with a smaller market capitalisation than the market equity median and an operating profit between the 70th and 100th percentile.

Small-neutral operating profit (SN, OP) contains the returns of stocks with a smaller market capitalisation than the market equity median and an operating profit between the 30th and 70th percentile.

Small-weak (SW) contains the returns of stocks with a smaller market capitalisation than the market equity median and an operating profit between the 0th and 30th percentile.

Big-robust (BR) contains the returns of stocks with a higher market capitalisation than the market equity median and an operating profit between the 70th and 100th percentile.

Big-neutral operating profit (BN, OP) contains the returns of stocks with a higher market capitalisation than the market equity median and an operating profit between the 30th and 70th percentile.

Big-weak (BW) contains the returns of stocks with a higher market capitalisation than the

market equity median and an operating profit between the 0th and 30th percentile.

Small-aggressive (SA) contains the returns of stocks with a smaller market capitalisation than the market equity median and an investment between the 70th and 100th percentile.

Small-neutral investment (SN, INV) contains the returns of stocks with a smaller market capitalisation than the market equity median and an investment between the 30th and 70th percentile.

Small-conservative (SC) contains the returns of stocks with a smaller market capitalisation than the market equity median and an investment between the 0th and 30th percentile.

Big-aggressive (BA) contains the returns of stocks with a higher market capitalisation than the market equity median and an investment between the 70th and 100th percentile.

Big-neutral investment (BN, INV) contains the returns of stocks with a higher market capitalisation than the market equity median and an investment between the 30th and 70th percentile.

Big-conservative (BC) contains the returns of stocks with a higher market capitalisation than the market equity median and an investment between the 0th and 30th percentile.

Figures 4.1, 4.2, and 4.3 visualise all 18 portfolios used for the factor calculation.

	Median ME	
70th B/M Percentile	Small High (SH)	Big High (BH)
	Small Neutral (SN)	Big Neutral (BN)
30th B/M Percentile	Small Low (SL)	Big Low (BL)

Figure 4.1: Six B/M portfolios for factor calculation (see Fama and French (2015))

	Median ME	
70th OP Percentile	Small Robust (SR)	Big Robust (BR)
	Small Neutral (SN)	Big Neutral (BN)
30th OP Percentile	Small Weak (SW)	Big Weak (BW)

Figure 4.2: Six operating profit portfolios for factor calculation (see Fama and French (2015))

	Median ME	
70th Inv Percentile	Small Conservative (SC)	Big Conservative (BC)
	Small Neutral (SN)	Big Neutral (BN)
30th Inv Percentile	Small Aggressive (SA)	Big Aggressive (BA)

Figure 4.3: Six investment portfolios for factor calculation (see Fama and French (2015))

To calculate SMB, we calculate the arithmetic mean of $SMB_{B/M}, SMB_{OP}, SMB_{Inv}$ (see Equation 4.1).

$$SMB = (SMB_{B/M} + SMB_{OP} + SMB_{Inv})/3 \tag{4.1}$$

$SMB_{B/M}$ is the arithmetic mean of the portfolios SH, SN, SL minus the arithmetic mean of the portfolios BH, BN, BL (see Equation 4.2). S stands for small, B for big, H for high, N for

neutral, and L for low.

$$SMB_{B/M} = (SH + SN + SL)/3 - (BH + BN + BL)/3 \quad (4.2)$$

SMB_{OP} is the arithmetic mean of the portfolios SR, SN, SW minus the arithmetic mean of the portfolios BR, BN, BW (see Equation 4.3). R stands for robust and W for weak.

$$SMB_{OP} = (SR + SN + SW)/3 - (BR + BN + BW)/3 \quad (4.3)$$

SMB_{Inv} is the arithmetic mean of the portfolios SC, SN, SA minus the arithmetic mean of the portfolios BC, BN, BA (see Equation 4.4). C stands for conservative and A for aggressive.

$$SMB_{Inv} = (SC + SN + SA)/3 - (BC + BN + BA)/3 \quad (4.4)$$

HML is the arithmetic mean of the portfolios $SH\ and\ BH$ minus the arithmetic mean of the portfolios $SL\ and\ BL$ (see Equation 4.5).

$$HML = (SH + BH)/2\ - (SL + BL)/2 = [(SH - SL) + (BH - BL)]/2 \quad (4.5)$$

RMW is the arithmetic mean of the portfolios $SR\ and\ BR$ minus the arithmetic mean of the portfolios $SW and\ BW$ (see Equation 4.6).

$$RMW = (SR + BR)/2\ - (SW + BW)/2 = [(SR - SW) + (BR - BW)]/2 \quad (4.6)$$

CMA is the arithmetic mean of the portfolios $SC\ and\ BC$ minus the arithmetic mean of the

portfolios $SA\ and\ BA$ (see Equation 4.7).

$$CMA = (SC + BC)/2\ - (SA + BA)/2 = [(SC - SA) + (BC - BA)]/2 \tag{4.7}$$

4.2 Data Source

In this thesis, the European countries England, France, Germany, Sweden, and Switzerland were selected for investigation. For each country, we built a portfolio, and to compare the local models with the global model, we built a 'Europe' portfolio including all five countries. To investigate specific industry models, we built further sector portfolios, namely, alternative energy, automobiles and parts, construction and materials, health care equipment and services, real estate investment and services, software and computer services, and technology hardware and equipment, from the Europe portfolio. For the calculation, each company in the countries and sectors were downloaded from the data source Refinitiv, which is a global provider of financial market data and infrastructure (see Refinitiv). Ten variables monthly in the period 2003–2023 were downloaded and used for the portfolio building and factor calculations. The downloaded 10 variables and their codes in Refinitiv are total return index (RI), price to book value (PTBV), market capitalisation (WC8001), net sales or revenues (WC1001), cost of goods sold (excl. Depreciation) (WC01051), interest expense on debt (WC01251), selling, general and administrative expenses (WC01101), total assets (WC02999), book value per share (WC05476), and number of shares (NOSH). The market data were downloaded in an Excel format and structured and manipulated by code written in R-script. For the data manipulation, the R-script libraries used were tidyverse, readxl, dplyr, openxlsx, moments, and car. For some companies, the downloaded market data did not include all the variables. In such cases, the variables have the column name '#ERROR', and all companies with at least one missing variable were deleted.

Furthermore, there are two types of companies in the market data, namely, active and dead, 'Active' companies are still listed in stock markets and have actual and updated data, while 'death' companies have either merged with another company or gone bankrupt. In some cases, 'death' companies still have market data with the last values (returns, market capitalisation, etc.) until the end of the 2023 even though they are no longer listed in stock markets. These companies were also deleted from the market data. The algorithm to delete data from 'death' companies after the date of their removal from the stock market follows the following logic: If a company's return remains unchanged for five months, we delete all collected market data, starting from the first month of that five-month period. This ensured that we analyse data only from companies before their removal from the stock market. Moreover, to filter possible anomalies, only B/M values of between 0 and 100, ME of higher than 50 million Euros, according to FF5, calculated investment of between 2 and -0.6, according to FF5, and calculated operating profit of between 80 and -40 were processed, and the rest were filtered by the code. We also carried out a winsorizing for minimum and maximum 2% for returns and minimum and maximum 5% for all other variables to minimise the effect of outliers on the analysis. In Tables 4.4 through 4.8, the minimum and maximum values for Europa do not encompass the minimum and maximum values for the countries due to the winsorization process we applied. For the risk-free rate, the monthly rates of Euribor were selected and used for the calculation of the RMRF factor (see Euribor).

Table 4.1: Number of all European companies included in the multi-factor global model

Europe	3038

The number of investigated companies for the global 'Europe' portfolio after filtering within

the boundaries defined above is shown in Table 4.1 and includes the five investigated countries.

Table 4.2: Number of companies for each country's local model included in the multi-factor model

England	710
France	558
Germany	927
Sweden	644
Switzerland	199

The number of all the investigated companies for the local country portfolios after filtering within the boundaries defined above is shown in Table 4.2.

Table 4.3: Number of companies across selected sectors in all European countries

Alternative Energy	60
Automobiles and Parts	49
Construction and Materials	58
Health Care Equipment and Services	160
Real Estate Investment and Services	170
Software and Computer Services	316
Technology Hardware and Equipment	106

Table 4.3 provides an overview of the number of companies within each selected sector across all European countries. The software and computer services sector has the highest number of companies (316 across the 5 European countries) while the automobiles and parts sector have the lowest (49 companies). Compared to the numbers of all companies across each country, the numbers of companies across the sectors are much smaller.

Table 4.4: This table provides return statistics for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and for all European Countries Across Selected Sectors. Stock returns are measured in Euros (€). Mean, median, minimum (Min), and maximum (Max) returns measured in percentage form (%/100). SD stands for standard deviation.

	Return						
	Mean	Median	SD	Max	Min	Skewness	Kurtosis
Europe	0.007	0.003	0.118	0.355	-0.282	0.359	4.247
England	0.006	0.000	0.130	0.394	-0.296	0.469	4.184
France	0.004	0.002	0.110	0.328	-0.263	0.328	4.160
Germany	0.006	0.001	0.127	0.393	-0.308	0.425	4.486
Sweden	0.008	0.003	0.131	0.398	-0.289	0.482	4.088
Switzerland	0.007	0.006	0.086	0.236	-0.212	0.092	3.795
Alternative Energy	-0.003	-0.017	0.192	0.607	-0.425	0.695	4.595
Automobiles and Parts	0.009	0.005	0.107	0.302	-0.257	0.221	3.808
Construction and Materials	0.009	0.009	0.095	0.248	-0.235	-0.047	3.554
Health Care Equipment and Services	0.006	-0.004	0.132	0.406	-0.295	0.564	4.267
Real Estate Investment and Services	0.006	0.005	0.103	0.312	-0.264	0.241	4.633
Software and Computer Services	0.006	-0.002	0.132	0.402	-0.297	0.510	4.202
Technology Hardware and Equipment	0.007	0.001	0.130	0.383	-0.290	0.430	3.916

Table 4.4 provides insight into the monthly return statistics for the selected European country and sector portfolios across the selected European countries in the period 2003-2023. All stock returns are measured in percentage form (%/100), and the statistics include mean, median, standard deviation, maximum, minimum, skewness, and kurtosis. Among the selected countries and sectors, Sweden has the highest performance, with a mean return of 0.008 and a maximum return of 0.398, while France has the lowest performance, with mean returns of 0.004 and maximum returns of 0.328, respectively. Among the selected sectors, automobiles and parts and construction and materials have the highest performance, with the highest mean return of 0.009 and a maximum return of 0.302 and 0,248, while the alternative energy sector

has the lowest performance, with the lowest mean return of -0.003 and a maximum return of 0.607.

Table 4.5: This table provides a book to market value (BE/ME) statistics for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and for all European Countries Across Selected Sectors. Mean, median, minimum (Min), and maximum (Max) values are ratios. SD stands for standard deviation.

	Book to Market Value						
	Mean	Median	SD	Max	Min	Skewness	Kurtosis
Europe	0.723	0.565	0.558	2.293	0.111	1.357	4.339
England	0.759	0.518	0.718	2.941	0.076	1.715	5.467
France	0.695	0.584	0.452	1.724	0.122	0.787	2.689
Germany	0.766	0.606	0.569	2.381	0.132	1.387	4.446
Sweden	0.528	0.405	0.383	1.408	0.082	0.888	2.745
Switzerland	0.638	0.565	0.394	1.515	0.123	0.630	2.480
Alternative Energy	1.119	0.535	1.741	7.692	0.101	2.972	11.074
Automobiles and Parts	0.841	0.719	0.455	1.961	0.267	0.996	3.225
Construction and Materials	0.599	0.505	0.340	1.429	0.175	0.950	3.134
Health Care Equipment and Services	0.446	0.319	0.362	1.389	0.062	1.230	3.675
Real Estate Investment and Services	0.968	0.909	0.470	2.083	0.255	0.685	3.070
Software and Computer Services	0.585	0.467	0.426	1.667	0.085	1.061	3.367
Technology Hardware and Equipment	0.613	0.524	0.382	1.538	0.146	0.963	3.111

Table 4.5 provides monthly book to market value (B/M) statistics for the selected European country and across the sector portfolios in the period 2003-2023. The values are represented as ratios and give information about the valuation dynamics for the selected countries and sectors. The statistics include mean, median, standard deviation, maximum, minimum, skewness, and kurtosis. Among the selected countries and sectors, Germany has the highest mean of B/M value ratio, at 0.766, indicating higher market valuations. In contrast, Sweden has the

lowest mean ratios, of 0.528, respectively. Among the sectors, alternative energy has the highest mean of B/M ratio, at 1.119, while health care equipment and services has the lowest at 0.446. These ratios provide valuable information about the relative market valuations of the countries and sectors, which can be a foundation for strategic decision-making.

Table 4.6: This table provides market equity statistics for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and for all European Countries Across Selected Sectors. Market equites, mean, median, minimum (Min), and maximum (Max) values measured in Euros/1000000 (€/1000000). SD stands for standard deviation.

	Market Equity						
	Mean	Median	SD	Max	Min	Skewness	Kurtosis
Europe	2665	504	5148	20585	63	2.615	8.845
England	2095	458	3728	14861	61	2.457	8.162
France	3907	609	6963	26456	61	2.277	7.159
Germany	2491	355	5148	20500	59	2.666	9.020
Sweden	12798	1434	25262	98314	81	2.471	8.080
Switzerland	3640	768	6882	26759	82	2.515	8.183
Alternative Energy	693	327	820	3043	57	1.649	4.771
Automobiles and Parts	9980	1692	16463	58934	101	1.971	5.750
Construction and Materials	9481	2439	14370	52734	105	1.955	5.916
Health Care Equipment and Services	2673	403	5470	22105	60	2.689	9.231
Real Estate Investment and Services	4545	1015	7434	27554	70	2.065	6.217
Software and Computer Services	2769	305	6250	25504	57	2.852	10.026
Technology Hardware and Equipment	3250	416	7402	31366	63	3.110	11.624

Table 4.6 provides market equity (ME) statistics for the selected European country and sector portfolios in the period 2003-2023. ME values are measured in Euros per million (€/1000000). Of the countries, Sweden has the highest mean ME, at €12.789 billion. Of the sectors, automobiles and parts has the highest mean return, at € 9.980 billion. The ME statistics have high kurtosis values in general, indicating there are overall outliers in the analysis.

Table 4.7: This table provides operating profitability (OP) statistics for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and for all European Countries Across Selected Sectors. OP for the year t is measured with accounting data for the fiscal year ending in year t-1 and is revenues minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense all divided by book equity. All values used for OP calculation are in Euros (€). Mean, median, minimum (Min), and maximum (Max) are ratios. SD stands for standard deviation.

	Operating Profit						
	Mean	Median	SD	Max	Min	Skewness	Kurtosis
Europe	0.333	0.225	0.454	1.705	-0.271	1.649	5.573
England	0.216	0.173	0.373	1.245	-0.459	0.963	4.430
France	0.222	0.195	0.486	1.374	-0.875	0.184	3.963
Germany	0.325	0.230	0.419	1.516	-0.264	1.365	4.642
Sweden	0.488	0.233	1.086	3.813	-1.084	1.712	5.964
Switzerland	0.627	0.254	1.076	4.335	-0.139	2.580	8.703
Alternative Energy	-0.002	0.050	0.402	0.592	-1.173	-1.366	5.020
Automobiles and Parts	0.556	0.413	0.470	1.771	0.019	1.346	3.881
Construction and Materials	0.471	0.310	0.457	1.901	0.000	1.861	5.994
Health Care Equipment and Services	0.104	0.123	0.732	1.783	-1.596	-0.048	3.948
Real Estate Investment and Services	0.120	0.069	0.190	0.688	-0.159	1.533	5.386
Software and Computer Services	0.328	0.212	0.504	1.644	-0.485	1.097	3.966
Technology Hardware and Equipment	0.233	0.201	0.354	1.275	-0.358	1.215	5.155

Table 4.7 provides operating profit (OP) statistics for the selected European country and selected sector portfolios in the period 2003-2023. OP is measured for the year t with accounting data for the fiscal year ending in year t-1 and represents revenues minus cost of goods sold minus selling, general, and administrative expenses minus interest expenses, all divided by book equity. All values used for OP calculation are in Euros (€). The statistics include mean, median, standard deviation, maximum, minimum, skewness, and kurtosis. Of the selected countries and sectors, Switzerland leads, with a mean OP ratio of 0.627, which indicates robust

OP. Switzerland also has the highest maximum OP ratio, at 4.335, showcasing potential extreme profitability. England has the lowest mean ratio, at 0.216. Of the sectors, automobiles and parts has the highest mean OP ratio, at 0.556, which indicates a strong OP, while alternative energy has the lowest, at -0.002.

Table 4.8: This table provides Investment statistics for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and all selected sectors combined. Investment is the change in total assets from the fiscal year ending in year t-2 to the fiscal year ending in t-1, divided by t-2 total assets. Mean, median, minimum (Min), and maximum (Max) values are ratios. SD stands for standard deviation.

	Investment						
	Mean	Median	SD	Max	Min	Skewness	Kurtosis
Europe	0.084	0.045	0.209	0.634	-0.241	1.023	3.922
England	0.111	0.058	0.247	0.775	-0.252	1.157	4.119
France	0.097	0.043	0.228	0.729	-0.221	1.308	4.460
Germany	0.072	0.039	0.212	0.622	-0.275	0.903	3.798
Sweden	0.169	0.089	0.309	0.989	-0.258	1.192	3.965
Switzerland	0.052	0.029	0.154	0.461	-0.201	0.909	3.945
Alternative Energy	0.209	0.111	0.395	1.202	-0.322	1.057	3.517
Automobiles and Parts	0.059	0.054	0.105	0.288	-0.123	0.361	2.739
Construction and Materials	0.079	0.048	0.146	0.494	-0.116	1.318	4.574
Health Care Equipment and Services	0.128	0.068	0.292	0.888	-0.305	1.066	3.867
Real Estate Investment and Services	0.137	0.077	0.246	0.777	-0.248	1.065	3.843
Software and Computer Services	0.106	0.054	0.261	0.783	-0.292	1.024	3.809
Technology Hardware and Equipment	0.082	0.040	0.233	0.703	-0.264	1.071	3.990

Table 4.8 provides statistics about investment for the selected European country and sector portfolios in the period 2003-2023. Investment is calculated as the change in total assets from the fiscal year ending in the year t-2 to the fiscal year ending in t-1, divided by t-2 total assets. All values are presented as ratios, and the statistics include mean, median, standard deviation, maximum, minimum, skewness, and kurtosis. Of the countries, Sweden has the highest mean investment ratio, at 0.169, which indicates a relatively high investment rate. Switzerland has

the lowest mean ratio, at 0.052, demonstrating a comparatively low investment rate. Of the sectors, real estate investment has the highest mean investment ratio, at 0.137, while automobiles and parts has the lowest, at 0.059.

Table 4.9: This table provides arithmetic means of the factors for selected sectors and European countries. It includes data for all selected European countries together, each European country individually, and for all European Countries Across Selected Sectors.

	RMRF	SMB	HML	RMW	CMA
Europe	0.004	0.019	0.003	0.004	0.013
England	0.005	0.021	0.006	-0.001	0.015
France	0.003	0.016	0.004	0.002	0.012
Germany	0.005	0.023	0.004	0.005	0.017
Sweden	0.006	0.023	0.007	0.005	0.016
Switzerland	0.001	0.013	0.001	0.004	0.010
Alternative Energy	0.027	0.182	0.005	-0.014	0.069
Automobiles and Parts	0.006	0.022	0.008	0.005	0.018
Construction and Materials	0.005	0.017	0.005	0.007	0.010
Health Care Equipment and Services	0.007	0.024	0.001	-0.009	0.018
Real Estate Investment and Services	0.009	0.014	0.005	0.011	0.014
Software and Computer Services	0.007	0.025	0.000	0.006	0.012
Technology Hardware and Equipment	-0.001	0.014	-0.004	0.005	0.010

Table 4.9 provides the means of the FF5 model factors for the selected country and sector portfolios for the period 2003–2023. RMRF represents the average monthly returns of the portfolios for the period 2003–2023 over the risk-free rate. A negative RMRF shows that the portfolio did not provide a premium over the risk-free rate during the period 2003–2023. The technology hardware and equipment sector is the only portfolio that had a negative RMRF over the selected period. All the selected European companies together provide an RMRF of

0.005. Of the European countries, Sweden has the highest RMRF factor, at 0.006, which represents the highest performance over the risk-free rate. Switzerland, with an RMRF factor of 0.001, has the lowest performance over the risk-free rate. Of the sectors, real estate investment and services has the highest performance, with an RMRF factor 0.009 over the risk rate. In comparison, the technology hardware and equipment sector has the lowest performance, with an RMRF factor of -0.001 over the risk-free rate.

The SMB factor measures the historical outperformance of the companies with small market capitalisation of the companies with a larger market capitalisation. A positive SMB factor indicates that the companies with a small market capitalisation outperform, on average, those with a large market capitalisation. In our research, all the companies and sectors have positive SMB factors except the alternative energy sector, which indicates that, in general, companies with a small market capitalisation in country and sector portfolios outperform those with a large market capitalisation, which supports the results of Fama and French (2015). The negative SMB factor of the alternative energy sector indicates that that specific sector might not align with the results of Fama and French (2015). Of the countries, Germany and Sweden have the highest SMB factor, at 0.023, and Switzerland has the lowest, at 0.013. Of the sectors, software and computer services has the highest SMB factor, at 0.025, which is greater than the SMB factor of the selected countries.

The HML factor captures the performance difference between companies with high B/M ratios and those with low B/M ratios. A positive HML indicates that the companies with high B/M ratios outperform those with low B/M ratios. In our research, the results (Table 4.9) show that the countries with high B/M ratios outperform the companies with small B/M ratios. This result supports the results of Fama and French (2015). Of the sectors, alternative energy and

technology equipment and hardware have negative HMB factors, which indicates that the average returns of the companies with low B/M ratios in these two sectors are higher than those of the companies with higher B/M ratios. Of the countries, Sweden has the highest HML factor, at 0.007, which indicates that the Swedish companies with the high B/M ratios most outperform companies with low B/M ratios. Switzerland, on the other hand, has the lowest HML factor, at 0.001. Among the sectors, automobiles and parts and construction and materials have the highest HML factor, at 0.008, and technology hardware and equipment has the lowest, at -0.004.

The RMW factor shows the performance difference between companies with robust and weak profitability. Fama and French (2015) calculated the profitability with five variables of companies. Operating profit (Fama and French, 2015) for the year t is measured with accounting data for the fiscal year ending in year t-1 and is revenues minus cost of goods sold minus selling, general, and administrative expenses minus interest expense, all divided by book equity. A positive RMW factor indicates that companies with robust profitability outperform those with weak profitability, on average. Of the countries, Germany and Sweden have the highest RMW factor, at 0.005, and England has the lowest, at -0.001, which shows that companies in Germany and Sweden with robust profitability have, on average, higher returns than those with weak profitability. Of the sectors, real estate investment and services has the highest RMW factor, at 0.011, and alternative energy has the lowest, at -0.014.

The CMA factor measures the performance difference between companies with conservative and aggressive investment strategies. Fama and French (2015) calculated the investment of companies through their total assets. Investment is the change in total assets from the fiscal year ending in year t-2 to the fiscal year ending in t-1, divided by t-2 total assets. A positive

CMA factor suggests that companies with conservative investment strategies outperform, on average, those with aggressive investment strategies. In our calculation (Table 4.9), all the countries and sectors have positive CMA factors. Of the countries, Germany has the highest CMA factor, at 0.017, and Switzerland has the lowest, at 0.010. Of the sectors, alternative energy has the highest CMA factor, at 0.069, and construction and materials and technology hardware and equipment have the lowest, at 0.010.

5 Empirical Results

5.1 Europe

In the multi-factor global model, a total of 3038 European companies were statistically analysed (see Table 4.1), namely, 710 from England, 558 from France, 927 from Germany, 644 from Sweden, and 199 from Switzerland (see Table 4.2).

Over the period 2003–2023, the European companies provided a positive monthly mean return of 0.7% with a standard deviation of 0.118. The return distribution had a skewness of 0.359, which shows a slightly positively skewed distribution, and a kurtosis of 4.247, which indicates a leptokurtic behavior, meaning a heavier-tailed than normal distribution that has a kurtosis of 3 (see Table 4.4).

The mean B/M value of the global model was 0.723 with a standard deviation of 0.558. The B/M value distribution had a skewness of 1.357, which shows a positively skewed distribution, indicating a high number of companies with higher B/M value. A kurtosis value of 4.339 indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution. Leptokurtic behaviour refers to some outliers with higher B/M value (see Table 4.5).

The mean market equity of the Europe portfolio was € 2 665 Million with a standard deviation of € 9 296 Million. The market equity distribution had a skew of 2.615, which shows a positively skewed distribution; thus, there is a high number of companies with higher market equity. A kurtosis value of 8.845 shows a leptokurtic behaviour, which refers to the fact there is a high number of outliers in the distribution (see Table 4.6).

The mean operating profit of the global model was 0.333 with a standard deviation of 0.454. The operating profit distribution across Europe had a skewness of 1.649, which shows a positively skewed distribution. The operating profit distribution had a kurtosis of 5.573, which shows a leptokurtic behaviour. A kurtosis value of 5.573 indicates a heavier tail than a normal distribution (see Table 4.7).

The mean investment of the global model was 0.084 with a standard deviation of 0.209. The investment distribution of the global model had a skewness of 1.023 and a kurtosis of 3.922, indicating that there are more companies with higher investment factor. A kurtosis of 3.922 shows a leptokurtic behaviour, which indicates the investment distribution of the global model has some outliers (see Table 4.8).

The highest mean of FF5 factors of the global multi-factor model was SMB, with a value of 0.019. This shows that the size factor had a significant impact on explaining the returns of the European countries over the period 2003–2023. Conversely, the lowest means of the FF5 factors of the global multi-factor model was RMW, with a value of 0.003. This finding shows that the operating profit factor had lower impacts on explaining the returns of the European countries over the period 2003–2023 (see Table 4.9).

Table 5.1 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML, and CMA. Conversely, it has a weak negative correlation with RMW. SMB has a strong positive correlation with RMRF, HML, and CMA. Conversely, it has a negative correlation with RMW. HML has a strong positive correlation with RMRF, SMB, and CMA. Conversely, it has a negative correlation with RMW. RMW has negative correlations with all other factors. CMA has strong positive correlations with RMRF, SMB, and HML. Conversely,

it has a negative correlation with RMW (see Table 5.1).

Table 5.1: Correlation matrix for the Factors of Europe

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.712	1.000			
HML	0.739	0.822	1.000		
RMW	-0.236	-0.462	-0.450	1.000	
CMA	0.796	0.735	0.802	-0.410	1.000

Table 5.2: Variance inflation factors (VIF) for the regression model of Europa. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	3.324	3.542	4.340	1.411	3.935

In the regression analysis for the multi-factor global model, the adjusted R-squared values range from 0.656 to 0.937 (see Fig 5.1). These high adjusted R-squared values indicate that a large proportion of the returns can be explained by the factors listed by Fama and French Factors in the global model. The p-values of the regression model for Europe are close to zero, which indicates a high level of statistical significance (see table 5.3).

Table 5.3: Average regression statistics for Europa across each FF5 portfolio

Residual standard error	0.021
F statistics	229.141
P value	0.005

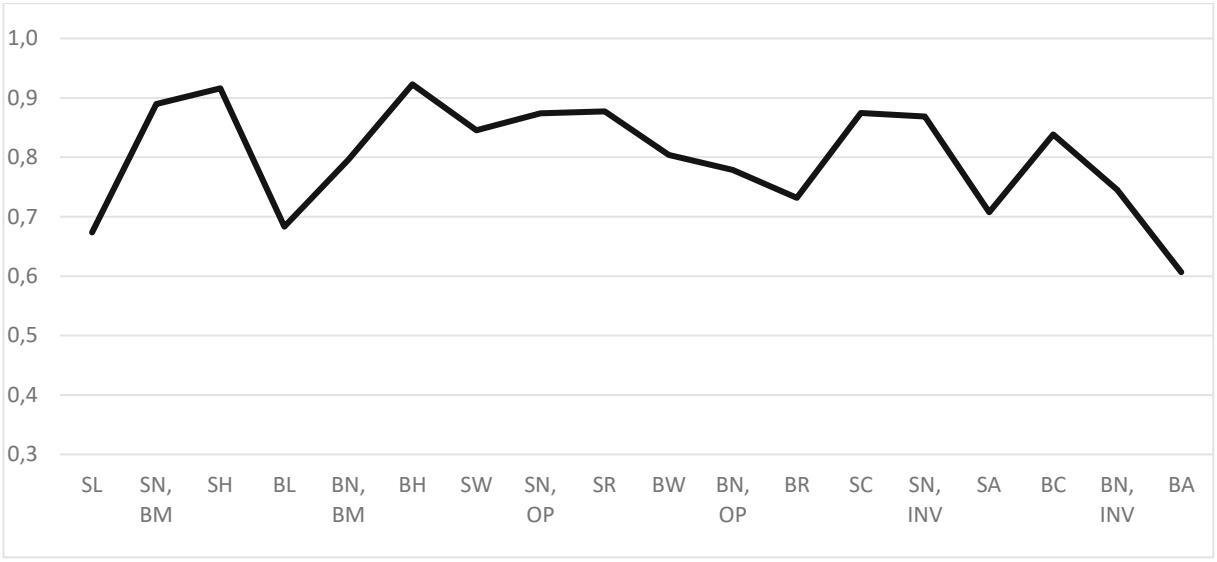

Figure 5.1: Adjusted R-squared values of Europa

Table 5.4: Adjusted R-squared values for Europa across each FF5 portfolios

SL	0.673	BW	0.804
SN, BM	0.890	BN, OP	0.779
SH	0.916	BR	0.732
BL	0.683	SC	0.875
BN, BM	0.796	SN, INV	0.869
BH	0.923	SA	0.708
SW	0.845	BC	0.838
SN, OP	0.874	BN, INV	0.745
SR	0.877	BA	0.607

5.2 England

In the multi-factor model for England, a total of 710 companies were statistically analysed (see Table 4.2). Over the period 2003–2022, the companies provided a monthly mean return of 0.6% with a standard deviation of 0.130. The return distribution had a skewness of 0.469, which shows a positively skewed distribution, and a kurtosis of 4.184, which indicates a leptokurtic behavior, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of England was 0.759 with a standard deviation of 0.718, which is the highest standard deviation between the countries. The B/M value distribution had a skewness of 1.715, which shows the most positively skewed distribution of all the countries. This finding indicates there is a high number of companies with a higher B/M value in England. England also had the highest kurtosis value, at 5.467, indicating a leptokurtic behavior, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in England was € 2 095 Million with a standard deviation of € 3 728 Million. The market equity distribution had a skew of 2.457, which shows a positively skewed distribution and a high number of companies with high market equity. A kurtosis value of 8.162 shows a leptokurtic behaviour, which refers to the fact there is a high number of outliers in the distribution (see Table 4.6).

The mean OP in England was 0.216 with a standard deviation of 0.373. England had the lowest mean operating profit with the lowest standard deviation of all the countries. The operating profit distribution over Europe had a skew of 0.963, which shows a positively skewed distribution. The operating profit distribution had a kurtosis of 4.432, which shows a leptokurtic behaviour. A kurtosis value of 4.432 indicates a heavier tail than in a normal distribution (see Table 4.7).

The mean INV factor of the multi-factor model for England was 0.111 with a standard deviation of 0.247. The investment distribution of the multi-factor model for England had a skewness of 1.157 and a kurtosis of 4.119, indicating that there are more companies with higher investment factor. A kurtosis of 4.119 shows a leptokurtic behavior, which indicates the investment distribution of the multi-factor model for England has some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for England is SMB, with a value of 0.021. This finding shows that the size factor has a significant impact on explaining the returns of England over the period 2003–2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for England is RMW, with a value of -0.001. This finding shows that the operating profit factor has comparatively low impacts on explaining the returns of England over the period 2003–2023 (see Table 4.9).

Table 5.5 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML, and CMA, at over 0.6. Conversely, it has a weak negative correlation with RMW, at -0.115. SMB has the strongest positive correlation with HML, at 0.842, and the lowest negative correlation with RMW, at -0.553, of the factors for England. HML also has a strong positive correlation with CMA, at 0.792. Conversely, it has a negative correlation with RMW, at -0.347. RMW has negative correlations with all other factors besides RMRF. RMW has generally low correlations with other factors. CMA has strong positive correlations with RMRF, SMB, and HML, with a correlation over 0.7 (see Table 5.5).

Table 5.5: Correlation matrix for the Factors of England

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.687	1.000			
HML	0.640	0.842	1.000		
RMW	-0.115	-0.553	-0.347	1.000	
CMA	0.713	0.829	0.792	-0.428	1.000

Table 5.6: Variance inflation factors (VIF) for the regression model of England. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.714	6.716	4.102	1.937	4.085

In the regression analysis for the multi-factor model of England, the adjusted R-squared values range from 0.626 to 0.905 (see fig 5.2). These highly adjusted R-squared values indicate that a large proportion of the returns can be explained by the FF5 factors in the multi-factor model for England. The p-value of the regression model for England is close to zero, which indicates a high level of statistical significance (see table 5.7). The FF5 factors can explain the SN, B/M, SH portfolios with an adjusted R-squared around 0.9, which has a high accuracy. The BN, B/M, BN, OP, and BA portfolios can be explained as the worst in the regression model with an adjusted R-squared of between 0.626 and 0.652, which still has a high accuracy (see Fig 5.2).

Table 5.7: Average regression statistics for England across each FF5 portfolio

Residual standard error	0.029
F statistics	221.158
P value	0.000

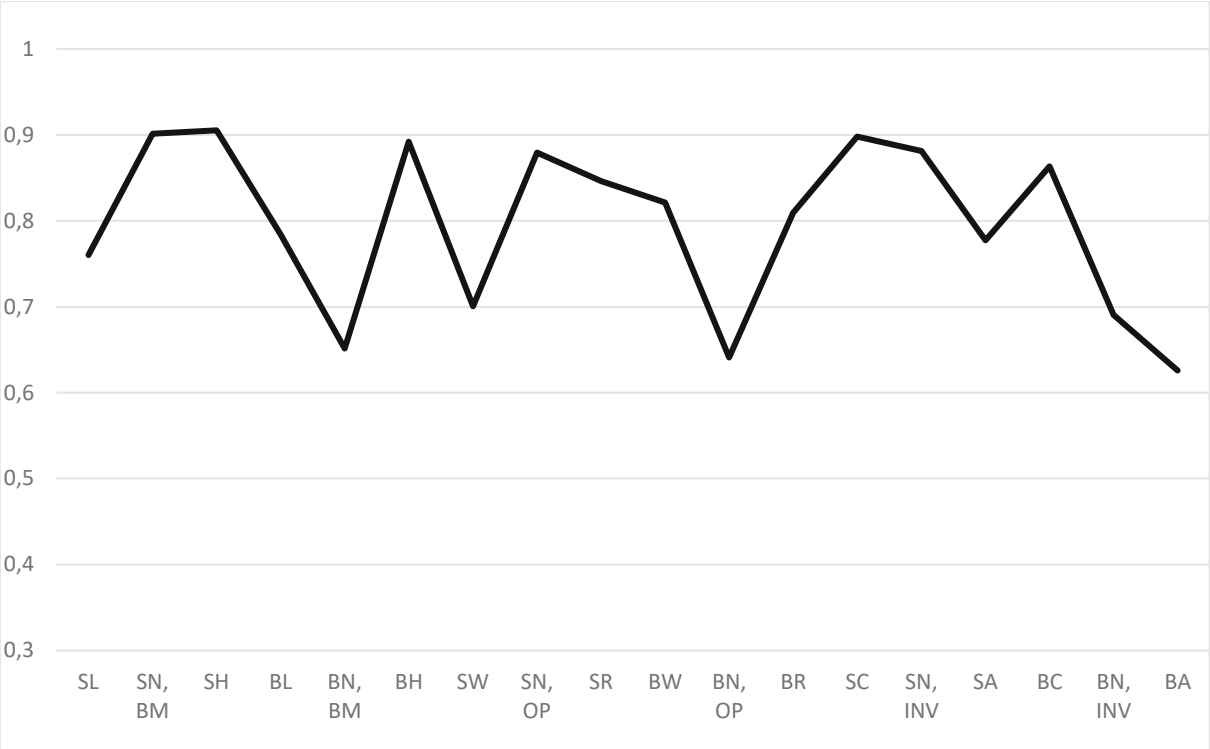

Figure 5.2: Adjusted R-squared values of England

Table 5.8: Adjusted R-squared values for England across each FF5 portfolios

SL	0.760	BW	0.821
SN, BM	0.901	BN, OP	0.641
SH	0.905	BR	0.809
BL	0.784	SC	0.898
BN, BM	0.652	SN, INV	0.881
BH	0.892	SA	0.777
SW	0.701	BC	0.863
SN, OP	0.879	BN, INV	0.690
SR	0.846	BA	0.626

5.3 France

In the multi-factor model for France, a total of 558 companies were statistically analysed (see Table 4.2). Over the period from 2003 to 2023, the companies provided, a monthly mean return of 0.4% with a standard deviation of 0.110. The mean return of France with 0.004% are the lowest mean return between the countries. The return distribution had a skewness of -0,328 which shows a positively skewed distribution. That indicates that there are slightly more

higher returns in the return distribution of France. The kurtosis of the distribution is 4.160, which indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see table 4.4).

The mean B/M value of France was 0.695 with a standard deviation of 0.452. The book-to-market value distribution has a skewness of 0.787, which indicates there are a higher number of companies with higher B/M in France. France has a kurtosis value with 2.689. That indicates a Platykurtic behaviour, meaning a thinner-tailed than normal distribution (see table 4.5).

The mean ME in France was € 3 907 Million with a standard deviation of € 6 963 Million. The ME distribution had a skew of 2.277, which shows a positively skewed distribution. That shows that there were a higher number of companies with higher ME. France has also the lowest amount of skewness between the countries. A kurtosis value of 7.159 shows a Leptokurtic behaviour which refers to the fact there are a high number of outliers in the distribution. France has also the lowest number of kurtosis value between the countries (see Table 4.6).

The mean OP in France was 0.222 with a standard deviation of 0.486. The OP distribution has a skew of 0.184, which shows a positively skewed distribution. France had also the lowest amount of skewness for the operating profit distribution between the countries. The operating profit distribution of France had a kurtosis of 3.963, that shows a leptokurtic behaviour. The OP distribution of France had also the lowest kurtosis value between the countries. A kurtosis value of 3.963 indicates a heavier tail compared to normal distribution (see Table 4.7).

The mean investment of the multi-factor model for France was 0.097 with a standard deviation of 0.228. The investment distribution of France had a skewness of 1.308 and a Kurtosis

of 4.460. The kurtosis value of the mean investment distribution for France has the highest value between the countries. This indicates that there were more companies with higher investment in France. A kurtosis of 4.460 shows a leptokurtic behaviour, which indicates the investment distribution of the multi-factor model for France had some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for France is SMB with a value of 0.016. This shows that the size factor had a significant impact on explaining the returns of France over the period 2003-2023. Conversely, the lowest means of FF5 factors of the multi-factor model for France is RMW with a value of 0.002. This shows that the operating profit factor had the lowest impact on explaining the returns of France (see Table 4.9).

Table 5.9 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML and CMA over 0.75. Conversely, it has a weak negative correlation with RMW at -0.203. SMB has the strongest positive correlation with CMA at 0.885 and the lowest negative correlation with RMW with a correlation -0.537 between the factors of France. HML also has a strong positive correlation with CMA at 0.874. Conversely, HML has a negative correlation with RMW with -0.386. RMW has negative correlations with all other factors. CMA has strong positive correlations with RMRF, SMB and HML with a correlation over 0.75 (see Table 5.9).

Table 5.9: Correlation matrix for the Factors of France

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.800	1.000			
HML	0.817	0.859	1.000		
RMW	-0.203	-0.537	-0.384	1.000	
CMA	0.767	0.885	0.874	-0.458	1.000

Table 5.10: Variance inflation factors (VIF) for the regression model of France. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	4.112	7.513	5.742	1.767	5.991

In the regression analysis for the multi-factor model of France, the adjusted R-squared values range from 0.791 to 0.955 (see Fig. 5.3). These high adjusted R-squared values indicate that a large proportion of the returns can be explained by the Fama French factors in the multi-factor model for France. The p-value of the regression model for France is close to zero, which indicates a high level of statistical significance (see table 11). The FF5 factors can explain all portfolios with an adjusted R-squared over 0.791, which has a high accuracy. The BA portfolio can be explained as the worst in the regression model with an adjusted R-squared around 0,791.

Table 5.11: Average regression statistics for France across each FF5 portfolio

Residual standard error	0.023
F statistics	297.807
P value	0.000

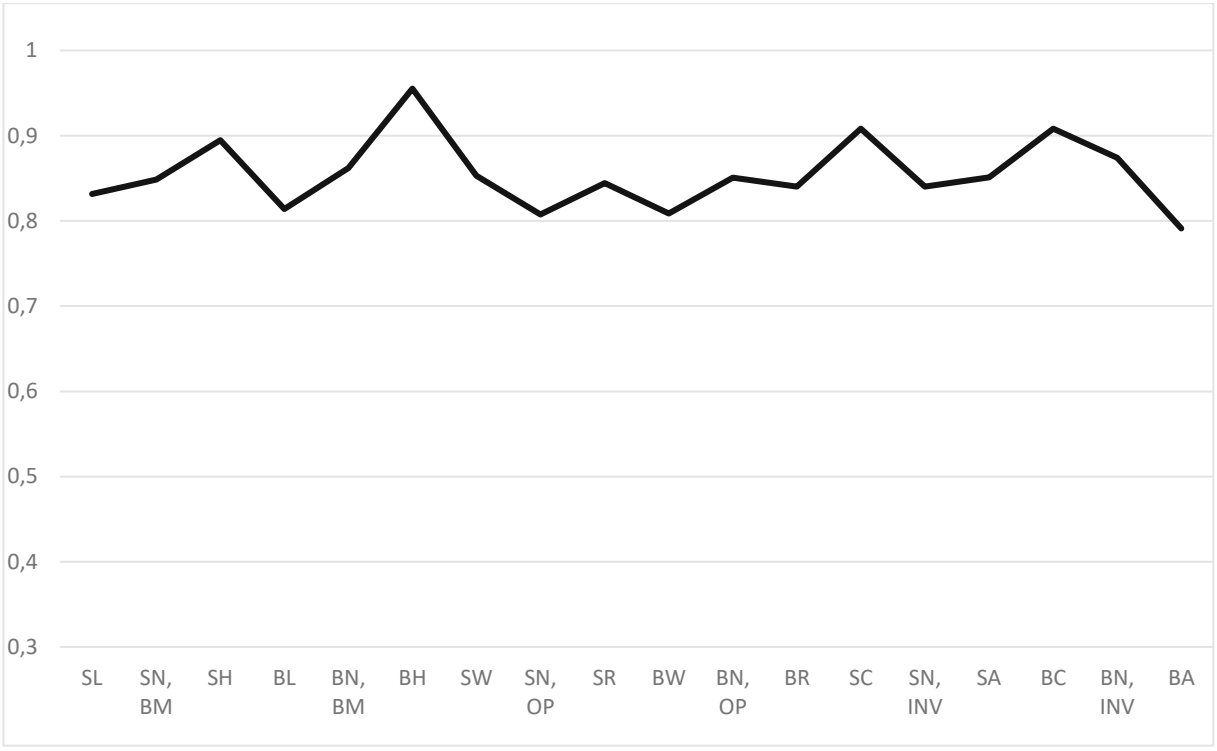

Figure 5.3: Adjusted R-squared values of France

Table 5.12: Adjusted R-squared values for France across each FF5 portfolios

SL	0.831	BW	0.809
SN, BM	0.849	BN, OP	0.851
SH	0.895	BR	0.840
BL	0.814	SC	0.908
BN, BM	0.862	SN, INV	0.840
BH	0.955	SA	0.851
SW	0.853	BC	0.908
SN, OP	0.808	BN, INV	0.874
SR	0.844	BA	0.791

5.4 Germany

In the multi-factor model for Germany, a total of 927 companies were statistically analysed (see Table 4.2). Over the period from 2003 to 2023, the companies provided a monthly mean return of 0.6% with a standard deviation of 0.127. The return distribution had a skewness of 0,425 which shows a positively skewed distribution. The kurtosis of the distribution is 4.486, that indicates a leptokurtic behaviour, meaning a haeiver-tailed than normal distribution that

has a kurtosis of 0 (see Table 4.4).

The mean B/M value of Germany was 0.766 with a standard deviation of 0.569. The mean B/M value distribution of Germany had a skew of 1.387, which indicates there were a higher number of companies with higher B/M value in Germany. Germany had a kurtosis value of 4.446, which indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in Germany was € 2 491 Million with a standard deviation of € 5 148 Million. The ME distribution of Germany had a positive skew of 2.666, which shows that there were a higher number of companies with higher ME. A kurtosis value of 9.020 shows a Leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution. Germany had the highest kurtosis value between the countries (see Table 4.6).

The mean OP of Germany was 0.325 with a standard deviation of 0.419. The OP distribution of Germany had a skew of 1.365, which shows a positively skewed distribution. The OP distribution of Germany had a kurtosis of 4.645 that shows a leptokurtic behaviour. A kurtosis value of 4.645 indicates a heavier tail compared to normal distribution (see Table 4.7).

The mean investment of the multi-factor model for Germany was 0.072 with a standard deviation of 0.212. The investment distribution in Germany had a skewness of 0.903, which indicates, that there were more companies with higher investment in Germany. The kurtosis of the mean investment distribution in Germany was the lowest kurtosis with 3.798 between the countries. A Kurtosis of 3.798 shows a leptokurtic behaviour, which indicates the investment distribution of the multi-factor model for Germany had some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for Germany is SMB with a value of 0.023, which shows that the size factor had a significant impact on explaining the returns of Germany over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for Germany is HML with a value of 0.004. This finding shows that the value factor had the lowest impact on explaining the returns of Germany (see Table 4.9).

Table 5.13 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML and CMA at over 0.7. Conversely, it has a weak negative correlation with RMW with at -0.031. SMB has the strongest positive correlation with RMRF at 0.734 and the lowest negative correlation with RMW at -0.192 of the factors for Germany. HML has a strong positive correlation with RMRF at 0.878. Conversely, HML has a negative correlation with RMW with -0.159. RMW has a negative correlation with all other factors. RMW has generally low correlations with other factors. CMA has strong positive correlations with RMRF, SMB and HML at over 0.69 (see Table 5.13).

Table 5.13: Correlation matrix for the Factors of Germany

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.734	1.000			
HML	0.878	0.714	1.000		
RMW	-0.031	-0.192	-0.159	1.000	
CMA	0.778	0.698	0.843	-0.379	1.000

Table 5.14: Variance inflation factors (VIF) for the regression model of Germany. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	5.590	2.419	6.117	1.489	4.904

In the regression analysis for the multi-factor model of Germany, the adjusted R-squared values range from 0.732 to 0.903 (see Fig. 5.4). These high adjusted R-squared values indicate that a large proportion of the returns can be explained by the Fama French factors in the multi-factor model for Germany. The p-value of the regression model for Germany is close to zero, which indicates a high level of statistical significance (see table 5.15).

Table 5.15: Average regression statistics for Germany across each FF5 portfolio

Residual standard error	0.030
F statistics	241.522
P value	0.000

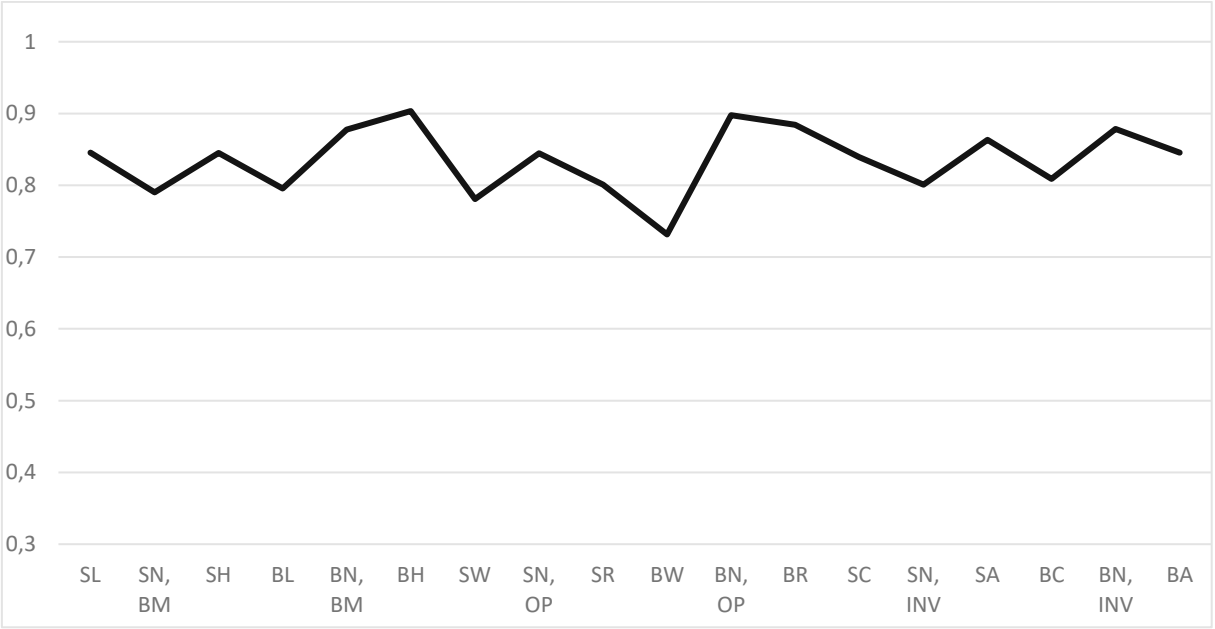

Figure 5.4: Adjusted R-squared values of Germany

Table 5.16: Adjusted R-squared values for Germany across each FF5 portfolios

SL	0.846	BW	0.732
SN, BM	0.790	BN, OP	0.898
SH	0.845	BR	0.884
BL	0.796	SC	0.839
BN, BM	0.878	SN, INV	0.801
BH	0.903	SA	0.863
SW	0.781	BC	0.809
SN, OP	0.844	BN, INV	0.879
SR	0.801	BA	0.845

5.5 Sweden

In the multi-factor model for Sweden, a total of 644 companies were statistically analysed (see Table 4.2). Over the period 2003-2023, the companies provided a monthly mean return of 0.8% with a standard deviation of 0.131. The return distribution had a skewness of 0482, which shows a slightly positively skewed distribution. The kurtosis of the distribution was 4.088, which indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value in Sweden was 0.528 with a standard deviation of 0.383. Sweden had the lowest standard deviation for mean B/M value between the countries. The mean B/M value distribution of Sweden had a skew of 0.888, which indicates there were a higher number of companies with higher B/M value in Sweden. Sweden had a kurtosis value of 2.745. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in Sweden was € 12 798 Million with a standard deviation of € 25 562 Million. Sweden had the highest mean ME between the countries. The ME distribution in Sweden had

a skew of 2.471, which shows a positively skewed distribution. A kurtosis value of 8.080 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution (see Table 4.6).

The mean OP in Sweden was 0.488 with a standard deviation of 1.086. The OP distribution in Sweden had a skew of 1.712, that shows a positively skewed distribution. The operating profit distribution of Sweden has a kurtosis of 5.964, that shows a leptokurtic behaviour. A kurtosis value of 5.964 indicates a heavier tail than normal distribution (see table 4.7).

The mean investment of the multi-factor model for Sweden was 0.169 with a standard deviation of 0.309. The mean investment of the multi-factor model for Sweden was the highest between the countries. The investment distribution of Sweden had a skewness of 1.192, which indicates that there are more companies with higher investment in Sweden. The kurtosis of the mean investment distribution for Sweden was 3.965. A kurtosis of 3.965 shows a leptokurtic behaviour, which indicates the investment distribution of the multi-factor model for Sweden has some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for Sweden is SMB with a value of 0.023, which shows that the size factor had a significant impact on explaining the returns of Sweden over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for Sweden is RMW with a value of 0.005. This shows that operating profit factor had the lowest impact on explaining the returns of Sweden (see Table 4.9).

Table 5.17 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML and CMA at over 0.85. Conversely, it has a weak negative correlation with

RMW at -0.286. SMB has the strongest positive correlation with HML at 0.937 and the lowest negative correlation with RMW at -0.262 of the factors for Sweden. HML also has a strong positive correlation with CMA at 0.923. Conversely, HML has a negative correlation with RMW at -0.309. RMW has with all other factors a negative correlation. RMW has generally low correlations with other factors. CMA has strong positive correlations with RMRF, SMB, and HML at over 0.85 (see Table 5.17).

Table 5.17: Correlation matrix for the Factors of Sweden

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.855	1.000			
HML	0.879	0.923	1.000		
RMW	-0.286	-0.433	-0.309	1.000	
CMA	0.876	0.910	0.911	-0.315	1.000

Table 5.18: Variance inflation factors (VIF) for the regression model of Sweden. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	5.190	10.091	9.608	1.340	8.113

In the regression analysis for the multi-factor model of Sweden, the adjusted R-squared values range from 0.804 to 0.945 (see Fig. 5.5). These high adjusted R-squared values indicate that a large proportion of the returns can be explained by the FF5 factors in the multi-factor model for Sweden. The p-value of the regression model for Sweden is close to zero, which indicates a high level of statistical significance (see table 5.19). The FF5 factors can explain all portfolios with an adjusted R-squared at over 0.8, which has a high accuracy. The BW portfolio can be explained as the worst in the regression model with an adjusted R-squared at 0.804 (see Fig. 5.5).

Table 5.19: Average regression statistics for Sweden across each FF5 portfolio

Residual standard error	0.023
F statistics	338.093
P value	0.000

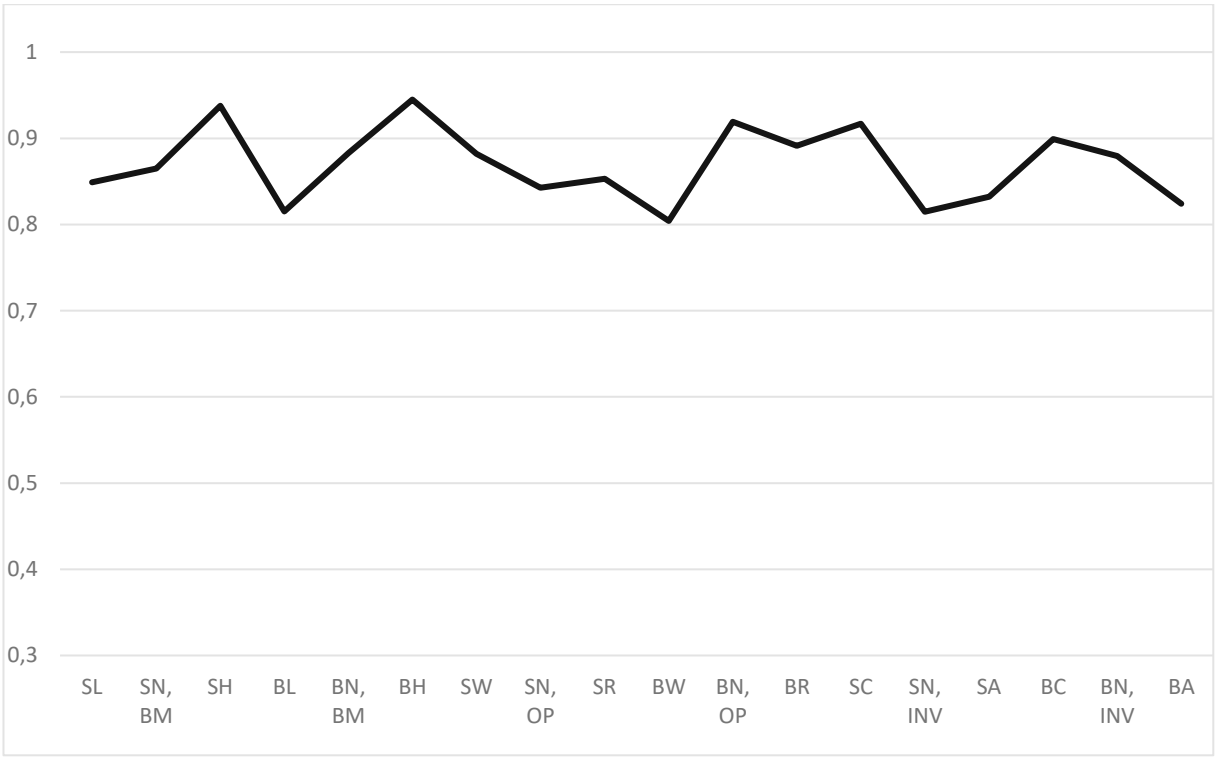

Figure 5.5: Adjusted R-squared values for Sweden

Table 5.20: Adjusted R-squared values for Sweden across each FF5 portfolios

SL	0.849	BW	0.804
SN, BM	0.865	BN, OP	0.919
SH	0.938	BR	0.891
BL	0.815	SC	0.917
BN, BM	0.883	SN, INV	0.815
BH	0.945	SA	0.832
SW	0.882	BC	0.899
SN, OP	0.843	BN, INV	0.879
SR	0.853	BA	0.824

5.6 Switzerland

In the multi-factor model for Switzerland, a total of 199 companies were statistically analysed (see Table 4.2). Over the period 2003-2023, the companies provided a monthly mean return of 0.7% with a standard deviation of 0.086. The return distribution had a skew of 0.092 that shows a slightly positively skewed distribution. That indicates that there were slightly higher returns in Switzerland. The kurtosis of the distribution is 3.795, which indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of Switzerland was 0.638 with a standard deviation of 0.394. The mean B/M value distribution of Switzerland had a skew of 0.630. The mean B/M value distribution of Switzerland had the lowest skewness between the countries. The mean B/M value distribution of Switzerland has the lowest kurtosis with 2.480, which indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in Switzerland was € 3 640 Million with a standard deviation of € 6 882 Million. The ME distribution in Switzerland had a skew of 2.515, which shows a positively skewed distribution. A kurtosis of 8.183 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution (see Table 4.6).

The mean OP in Switzerland was 0.627 with a standard deviation of 1.076. Switzerland provides the highest mean operating profit between the countries. The OP distribution for Switzerland has a skew of 2.580, which shows a positively skewed distribution. The OP distribution in Switzerland had a kurtosis of 8.703, which shows a leptokurtic behaviour. A kurtosis of 8.703 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model in Switzerland was 0.052 with a standard deviation of 0.154. The mean investment of the multi-factor model in Switzerland was the lowest between the countries. The investment distribution in Switzerland had a skewness of 0.909, which indicates, that there were more companies with higher investment in Switzerland. The kurtosis of the mean investment distribution was 3.945. A kurtosis of 3.945 shows a leptokurtic behaviour, which indicates the investment distribution of the multi-factor model for Switzerland had some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for Switzerland is SMB with a value of 0.013, which shows that the size factor had a significant impact on explaining the returns of Switzerland over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for Switzerland are RMRF and HML with a value of 0.001. This finding shows that the market and value factors had the lowest impact on explaining the returns of Switzerland (see Table 4.9).

Table 5.21 shows the correlations between the factors. RMRF has a strong positive correlation with SMB, HML and CMA at over 0.7. Conversely, it has a weak correlation with RMW at 0.088. SMB has the strongest positive correlation with HML at 0.860 and the lowest negative correlation with RMW at -0.136 between the factors for Switzerland. HML has also a strong positive correlation with CMA with a correlation of 0.815. Conversely, HML has a negative correlation with RMW at -0.143. RMW has generally low correlations with all other factors. CMA has a strong positive correlation with RMRF, SMB and HML at over 0.7 (see Table 5.21).

Table 5.21: Correlation matrix for the Factors of Switzerland

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.796	1.000			
HML	0.707	0.860	1.000		
RMW	0.088	-0.136	-0.143	1.000	
CMA	0.776	0.875	0.815	-0.090	1.000

Table 5.22: Variance inflation factors (VIF) for the regression model of Switzerland. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	3.297	6.788	4.121	1.150	4.884

In the regression analysis for the multi-factor model of Switzerland, the adjusted R-squared values range from 0.733 to 0.944 (see Fig. 5.6). These high adjusted R-squared values indicate that a large proportion of the returns can be explained by the FF5 Factors in the multi-factor model for Switzerland. The p-value of the regression model for Switzerland is close to zero, which indicates a high level of statistical significance (see table 5.23). The FF5 factors can explain all portfolios with an adjusted R-squared at over 0.733, which has a high accuracy. The BW portfolio can be explained as the worst in the regression model with an adjusted R-squared at around 0,733.

Table 5.23: Average regression statistics for Switzerland across each FF5 portfolio

Residual standard error	0.021
F statistics	292.041
P value	0.000

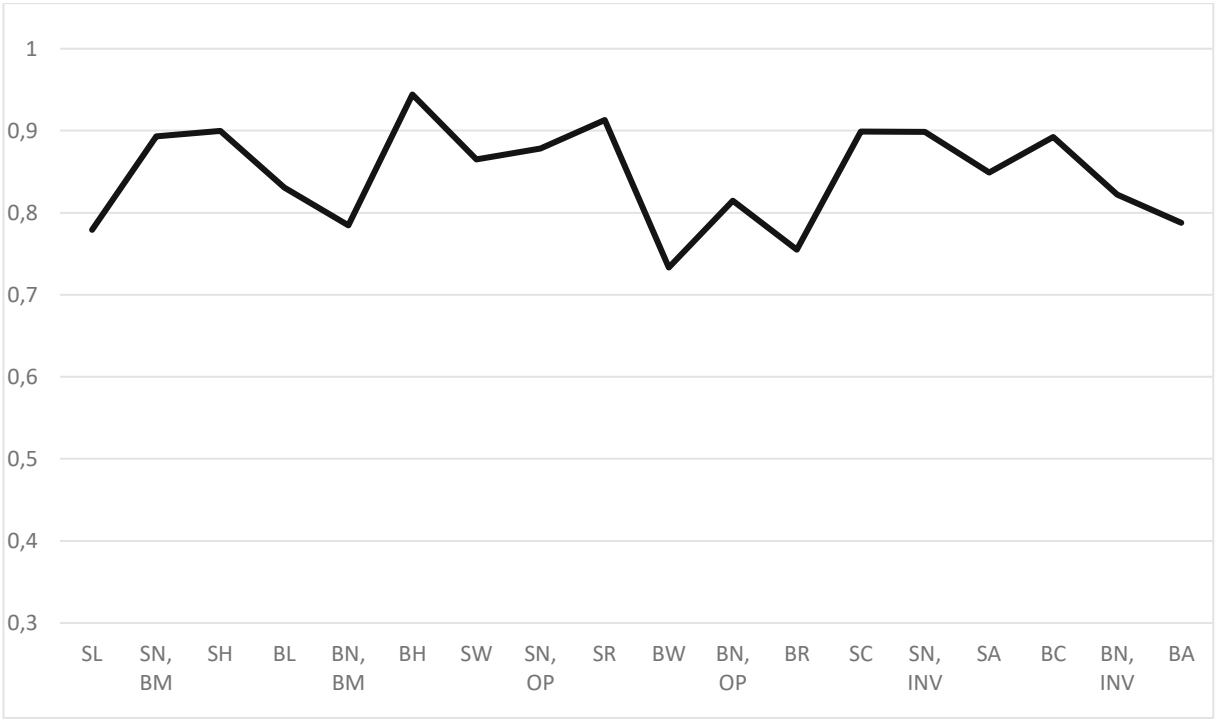

Figure 5.6: Adjusted R-squared values for Switzerland

Table 5.24: Adjusted R-squared values for Switzerland across each FF5 portfolios

SL	0.779	BW	0.733
SN, BM	0.893	BN, OP	0.815
SH	0.900	BR	0.755
BL	0.831	SC	0.899
BN, BM	0.785	SN, INV	0.899
BH	0.944	SA	0.849
SW	0.865	BC	0.893
SN, OP	0.878	BN, INV	0.822
SR	0.913	BA	0.788

5.7 Alternative Energy

In the multi-factor model for the alternative energy sector, a total of 60 companies were statistically analysed (see Table 4.3). Over the period 2003- 2023, the companies provided a monthly mean return of -3% with a standard deviation of 0.192. The mean return of the Alternative Energy sector had the lowest value between the sectors. The return distribution had a skewness of 0.695, which shows a slightly positively skewed distribution. That indicates that

there were slightly higher returns in the alternative energy sector. The kurtosis of the distribution is 4.595, that indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of the alternative energy sector was 1.119 with a standard deviation of 1.741. The alternative energy sector had the highest mean B/M value between the sectors. The B/M value distribution had a skew of 2.972, which is the highest between the sectors. That indicates that there were a higher number of companies with higher B/M in the alternative energy sector. The alternative energy sector had a kurtosis of 11.074, which indicates a Leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in the alternative energy sector was € 693 Million with a standard deviation of € 820 Million. The alternative energy sector had the lowest mean ME between the sectors. The ME distribution of the alternative energy sector had a skew of 1.649, which shows a higher number of companies with higher ME. The alternative energy sector also had the lowest amount of skewness between the sectors. A kurtosis of 4.771 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution. The alternative energy sector also had the lowest kurtosis value (see Table 4.6).

The mean OP in the alternative energy sector was -0.002 with a standard deviation of 0.402. The mean OP of the alternative energy sector was the lowest between the sectors. The mean OP distribution in the alternative energy sector had a skew of -1.366, which shows a negatively skewed distribution. The mean OP of the alternative energy sector also had the lowest amount of skewness between the sectors. The mean OP in the Alternative Energy sector had a kurtosis

of 5.020, which shows a leptokurtic behaviour. A kurtosis value of 5.020 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the alternative energy sector was 0.209 with a standard deviation of 0.395. The investment distribution in the Alternative Energy sector had a skewness of 1.057. This indicates that there were more companies with higher investment in the alternative energy sector. A kurtosis of 3.517 shows a leptokurtic behaviour, which indicates the investment distribution of the multi-factor model for the Alternative Energy sector had some outliers (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the alternative energy sector is SMB with a value of 0.182, which shows that the size factor had a significant impact explaining the returns of the alternative energy sector over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for the alternative energy sector is RMW with a value of -0.014, which shows that the operating profit factor had the lowest impact on explaining the returns of the alternative energy sector (see Table 4.9).

Table 5.25 shows the correlations between the factors. RMRF has a positive correlation with SMB, HML and CMA. Conversely, it has a weak negative correlation with RMW at -0.029. SMB has the strongest positive correlation with RMRF at 0.911 and the lowest negative correlation with RMW at -0.190 of the factors for the alternative energy sector. HML has a positive correlation with CMA at 0.527. Conversely, HML has a negative correlation with RMW at -0.085. RMW has negative correlations with all other factors. CMA has a positive correlation with RMRF, SMB and HML (see Table 5.25).

Table 5.25: Correlation matrix for the Factors of Alternative Energy sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.911	1.000			
HML	0.333	0.197	1.000		
RMW	-0.029	-0.190	-0.085	1.000	
CMA	0.315	0.271	0.527	-0.673	1.000

Table 5.26: Variance inflation factors (VIF) for the regression model of alternative energy. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	10.240	9.226	1.727	3.327	3.857

In the regression analysis for the multi-factor model of the alternative energy sector, the adjusted R-squared values range from 0.141 to 0.991 (see Fig. 5.7). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 Factors in the multi-factor model for the alternative energy sector. The p-value of the regression model for the alternative energy sector is 0.151, which indicates a low level of statistical significance (see table 5.27).

Table 5.27: Average regression statistics for alternative energy across each FF5 portfolio

Residual standard error	0.124
F statistics	175.045
P value	0.151

Figure 5.7: Adjusted R-squared values of the alternative energy sector

Table 5.28: Adjusted R-squared values for alternative energy across each FF5 portfolios

SL	0.991	BW	0.486
SN, BM	0.350	BN, OP	0.577
SH	0.804	BR	0.550
BL	0.794	SC	0.957
BN, BM	0.533	SN, INV	0.989
BH	0.781	SA	0.141
SW	0.974	BC	0.699
SN, OP	0.200	BN, INV	0.502
SR	0.491	BA	0.427

5.8 Automobiles and Parts

In the multi-factor model for the automobiles and parts sector, a total of 49 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.9% with a standard deviation of 0.107. The return distribution has a skewness of 0.221, which shows a slightly positively skewed distribution. That indicates that

there were slightly higher returns in the automobiles and parts sector. The kurtosis of the distribution was 3.808, which indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value in the automobiles and parts sector was 0.841 with a standard deviation of 0.455. The B/M value distribution had a skew of 0.996, which indicates that there were a higher number of companies with higher B/M value in the automobiles and parts sector. The automobiles and parts sector had a kurtosis of 3.225. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in the automobiles and parts sector was € 9 980 Million with a standard deviation of € 16 463 Million. The Automobiles and Parts sector had the highest mean ME between the sectors. The ME distribution in the automobiles and parts sector had a skew of 1.971, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis of 5.750 shows a leptokurtic behaviour, which refers to the fact there were a high number of outliers in the distribution. The automobiles and parts sector also had the lowest number of kurtosis value (see Table 4.6).

The mean OP in the automobiles and parts sector was 0.556 with a standard deviation of 0.470. The mean OP in the Automobiles and Parts sector was the highest between the sectors. The OP distribution of the automobiles and parts sector had a skew of 1.346, which shows a positively skewed distribution. The OP distribution of the automobiles and parts sector had a kurtosis of 3.881, which shows a leptokurtic behaviour. A kurtosis value of 3.881 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the automobiles and parts sector was 0.059 with a standard deviation of 0.105. The investment distribution in the automobiles and parts sector had a skew of 0.361. This indicates that there were more companies with higher investment in the automobiles and parts sector. A kurtosis of 2.747 shows a leptokurtic behaviour (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the automobiles and parts sector was CMA with a value of 0.018. This shows that the investment factor had a significant impact on explaining the returns of the automobiles and parts sector over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for the alternative energy sector is RMW with a value of 0.005. This shows that the operating profit factor had the lowest impact on explaining the returns of the automobiles and parts sector (see Table 4.9).

Table 5.29 shows the correlations between the factors. RMRF has a weak negative correlation with SMB, HML, CMA and RMW. SMB, HML, RMW and CMA have strong correlations with each other (see Table 5.29).

Table 5.29: Correlation matrix for the Factors of Automobiles and Parts sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.757	1.000			
HML	0.754	0.807	1.000		
RMW	-0.154	-0.332	-0.350	1.000	
CMA	0.623	0.646	0.757	-0.349	1.000

Table 5.30: Variance inflation factors (VIF) for the regression model of automobiles and parts. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.920	3.465	4.344	1.244	2.441

In the regression analysis for the multi-factor model of the Automobiles and Parts sector, the adjusted R-squared values range from 0.379 to 0.878 (see Fig. 5.8). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 Factors in the multi-factor model for the automobiles and parts sector. The p-value of the regression model for the automobiles and parts sector is close to zero, which indicates a high level of statistical significance (see table 5.31).

Table 5.31: Average regression statistics for automobiles and parts across each FF5 portfolio

Residual standard error	0.042
F statistics	128.432
P value	0.000

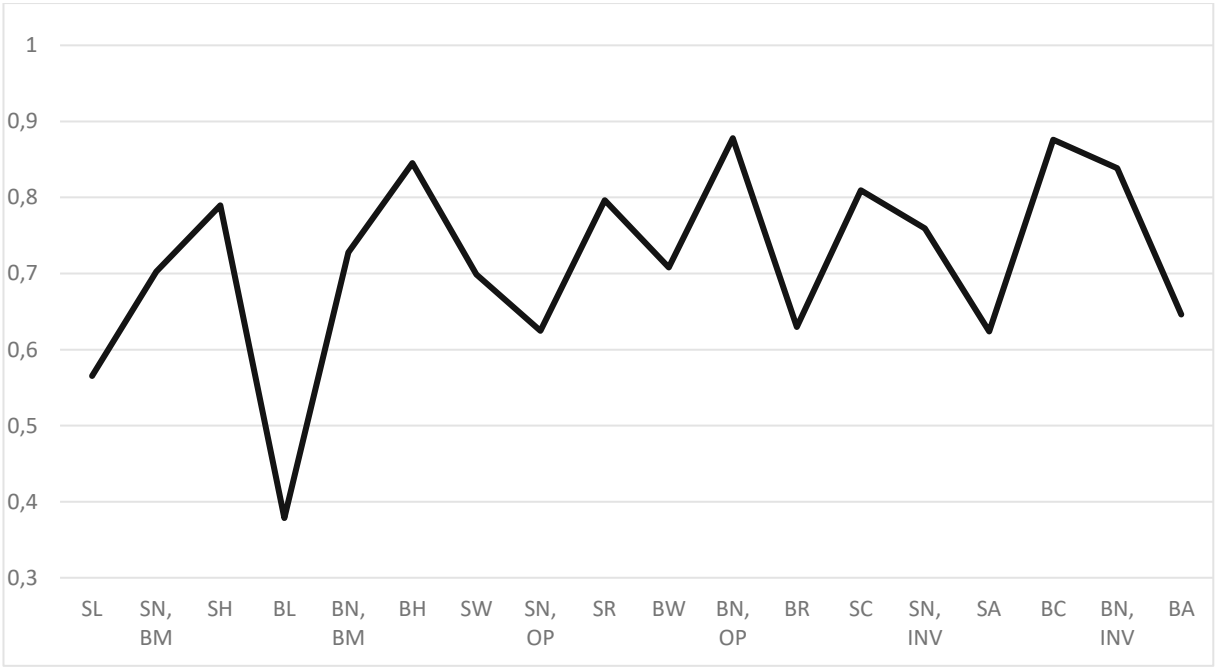

Figure 5.8: Adjusted R-squared values of the automobiles and parts sector

Table 5.32: Adjusted R-squared values for automobiles and parts across each FF5 portfolios

SL	0.565	BW	0.708
SN, BM	0.703	BN, OP	0.878
SH	0.789	BR	0.630
BL	0.379	SC	0.809
BN, BM	0.728	SN, INV	0.759
BH	0.845	SA	0.624
SW	0.699	BC	0.876
SN, OP	0.625	BN, INV	0.839
SR	0.797	BA	0.646

5.9 Construction and Materials

In the multi-factor model for the construction and materials sector, a total of 58 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.9% with a standard deviation of 0.095. The return distribution had a skewness of -0.047, which shows a slightly negatively skewed distribution. That indicates that there were slightly lower returns in the return distribution in the construction and materials sector. The kurtosis of the distribution was 3.554, that indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean ME value of the construction and materials sector was 0.599 with a standard deviation of 0.340. The B/M value distribution had a skew of 0.950. That indicates there were a higher number of companies with higher B/M value in the construction and materials sector. The construction and materials sector had a kurtosis value of 3.134. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME in the construction and materials sector was € 9 481 Million with a standard deviation of € 14 370 Million. The ME distribution in the construction and materials sector had a skew of 1.955, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis value of 5.916 shows a leptokurtic behaviour, which refers to the fact there were a high number of outliers in the distribution (see Table 4.6).

The mean OP of the construction and materials sector was 0.471 with a standard deviation of 0.457. The OP distribution in the construction and materials sector had a skew of 1.861, which shows a positively skewed distribution. The OP distribution of the construction and materials sector had a kurtosis of 5.994, which shows a leptokurtic behaviour. A kurtosis value of 5.994 indicates a heavier-tail compared to normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the construction and materials sector was 0.079 with a standard deviation of 0.146. The investment distribution of the construction and materials sector had a skew of 1.318. This indicates that there were more companies with higher investment in the Construction and Materials sector (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the construction and materials sector was SMB with a value of 0.017. This shows that the size factor had a significant impact on explaining the returns of the construction and materials sector over the period 2003-2023. Conversely, the lowest means of FF5 factors of the multi-factor model for the construction and materials sector are RMRF and HML with a value of 0.005. This shows that the market and value factors had the lowest impact, explaining the returns of the construction and materials sector (see Table 4.9).

Table 5.33 shows the correlations between the factors. RMRF has a positive correlation with SMB, HML and CMA at over 0.67. Conversely, RMRF has a weak positive correlation with RMW at 0.123. SMB has a high correlation with RMRF, HML and CMA at over 0.7. RMW has weak correlations with all other factors. CMA has positive correlations with all factors at over 0.7, except RMW (see Table 5.33).

Table 5.33: Correlation matrix for the Factors of Construction and Materials sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.713	1.000			
HML	0.675	0.746	1.000		
RMW	0.123	-0.109	-0.164	1.000	
CMA	0.710	0.792	0.791	-0.055	1.000

Table 5.34: Variance inflation factors (VIF) for the regression model of construction and materials. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.649	3.331	3.242	1.171	3.747

In the regression analysis for the multi-factor model of the construction and materials sector, the adjusted R-squared values range from 0.400 to 0.849 (see Fig. 5.9). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 factors in the multi-factor model for the construction and materials sector. The p-value of the regression model for the construction and materials sector is close to zero, which indicates a high level of statistical significance (see table 5.35).

Table 5.35: Average regression statistics for construction and materials across each FF5 portfolio	
Residual standard error	0.036
F statistics	139.436
P value	0.000

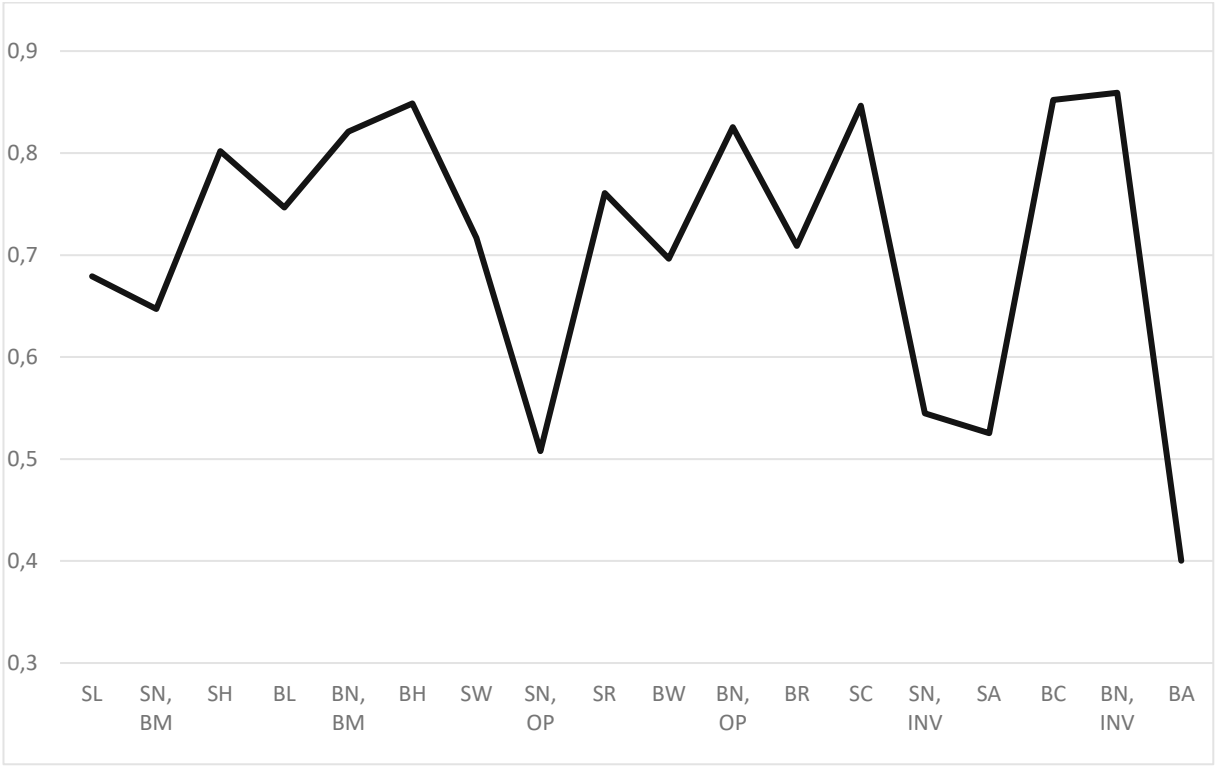

Figure 5.9: Adjusted R-squared values of the construction and materials sector

Table 5.36: Adjusted R-squared values for construction and materials across each FF5 portfolios			
SL	0.679	BW	0.696
SN, BM	0.647	BN, OP	0.825
SH	0.802	BR	0.709
BL	0.747	SC	0.846
BN, BM	0.821	SN, INV	0.545
BH	0.849	SA	0.525
SW	0.717	BC	0.852
SN, OP	0.508	BN, INV	0.859
SR	0.761	BA	0.400

5.10 Health Care Equipment and Services

In the multi-factor model for the health care equipment and services sector, a total of 160 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.9% with a standard deviation of 0.095. The return distribution had a skewness of -0.047, which shows a slightly negatively skewed distribution. That indicates that there were slightly lower returns in the return distribution of the health care equipment and services sector. The kurtosis of the distribution is 3.554, that indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of the health care equipment and services was 0.446 with a standard deviation of 0.362. The B/M value distribution had a skew of 1.230. That indicates there were a higher number of companies with higher B/M in the health care equipment and services. The health care equipment and services had a kurtosis value of 3.675. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME of the health care equipment and services sector was € 2 673 Million with a standard deviation of € 5 470 Million. The ME distribution of the health care equipment and services had a skew of 2.689, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis value of 9.231 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution (see Table 4.6).

The mean OP of the health care equipment and services was 0.104 with a standard deviation of 0.732. The OP distribution over the mean OP of the health care equipment and services

sector has a skew of -0.048, which shows a negatively skewed distribution. The OP distribution of the health care equipment and services had a kurtosis of 3.956, which shows a leptokurtic behaviour. A kurtosis value of 3.948 indicates a heavier tail compared to normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the health care equipment and services sector was 0.128 with a standard deviation of 0.292. The investment distribution of the health care equipment and services sector had a skew of 1.066. This indicates that there were more companies with higher investment in the health care equipment and services sector (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the health care equipment and services sector is SMB with a value of 0.024. This shows that the size factor had a significant impact on explaining the returns of the health care equipment and services sector over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for the health care equipment and services sector is RMW with a value of -0.009. This shows that the operating profit factor had the lowest impact on explaining the returns of the health care equipment and services sector (see Table 4.9).

Table 5.37 shows the correlations between the factors. RMRF has a positive correlation with SMB, HML and CMA at over 0.56. Conversely, RMRF has a weak positive correlation with RMW at 0.047. SMB has a high correlation with RMRF, HML and CMA at over 0.6. RMW has weak correlations with all other factors. CMA has positive correlations with all factors at over 0.52, except RMW (see Table 5.37).

Table 5.37: Correlation matrix for the Factors of Health Care Equipment and Services sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.630	1.000			
HML	0.560	0.637	1.000		
RMW	0.047	-0.463	-0.105	1.000	
CMA	0.634	0.666	0.520	-0.230	1.000

Table 5.38: Variance inflation factors (VIF) for the regression model of health care equipment and services. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.548	3.707	1.885	1.749	2.111

In the regression analysis for the multi-factor model of the health care equipment and services sector, the adjusted R-squared values range from 0.489 to 0.845 (see Fig. 5.10). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 factors in the multi-factor model the health care equipment and services sector. The p-value of the regression model for the health care equipment and services sector is close to zero, which indicates a high level of statistical significance (see table 5.39).

Table 5.39: Average regression statistics for health care equipment and services across each FF5 portfolio

Residual standard error	0.046
F statistics	78.267
P value	0.000

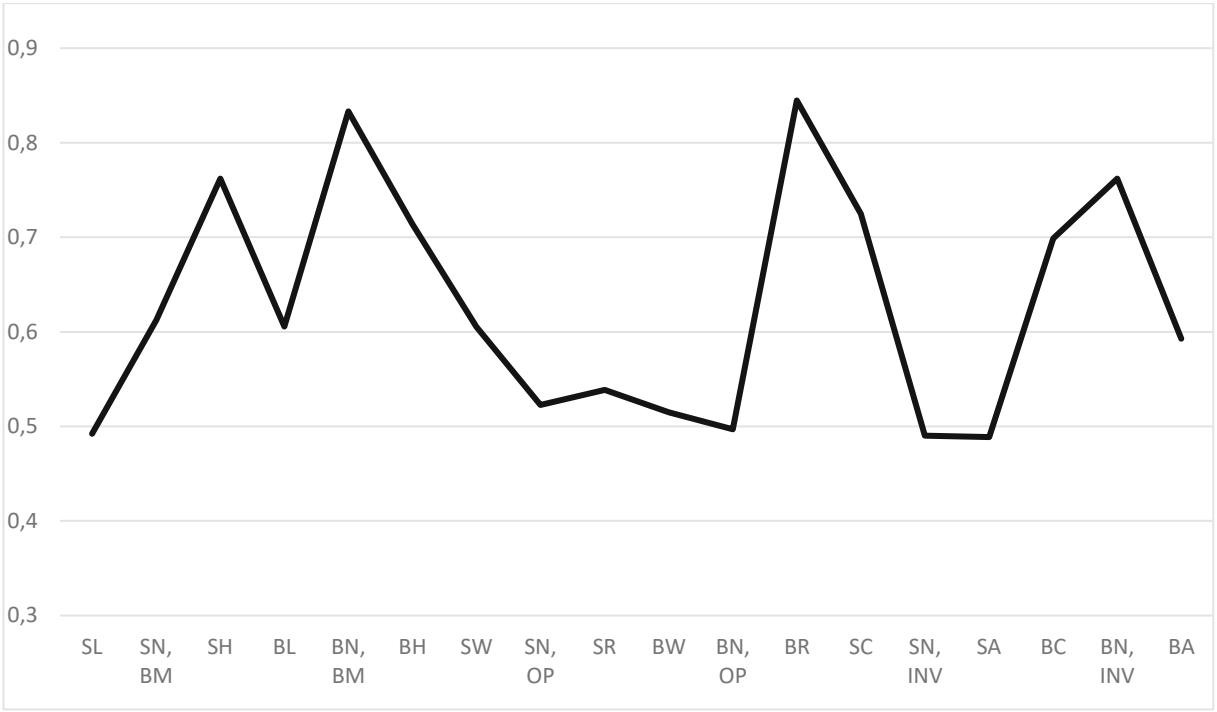

Figure 5.10: Adjusted R-squared values of the health care equipment and services sector

Table 5.40: Adjusted R-squared values for health care equipment and services across each FF5 portfolios

SL	0.492	BW	0.515
SN, BM	0.612	BN, OP	0.497
SH	0.762	BR	0.845
BL	0.606	SC	0.725
BN, BM	0.833	SN, INV	0.490
BH	0.714	SA	0.489
SW	0.605	BC	0.699
SN, OP	0.523	BN, INV	0.762
SR	0.538	BA	0.593

5.11 Real Estate Investment and Services

In the multi-factor model for the real estate investment and services sector, a total of 170 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.6% with a standard deviation of 0.103. The return distribution had a skewness of 0.241, which shows a slightly positively skewed distribution. That indicates that there were slightly higher returns in the return distribution of the real estate

investment and services sector. The kurtosis of the distribution was 4.633, which indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of the real estate investment and services sector was 0.968 with a standard deviation of 0.470. The B/M value distribution had a skew of 0.685. That indicates there were a higher number of companies with higher B/M value in the real estate investment and services sector. the real estate investment and services sector had a kurtosis value of 3.070. That indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution (see Table 4.5).

The mean ME of the real estate investment and services sector were € 4 545 Million with a standard deviation of € 7 434 Million. The ME distribution the real estate investment and services sector had a skew of 2.065, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis value of 6.217 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution (see Table 4.6).

The mean OP of the real estate investment and services sector was 0.120 with a standard deviation of 0.190. The OP distribution of the real estate investment and services sector had a skew of 1.533, which shows a positively skewed distribution. The OP distribution of the real estate investment and services sector has a kurtosis of 5.386, that shows a leptokurtic behaviour. A kurtosis value of 5.386 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the real estate investment and services

sector was 0.137 with a standard deviation of 0.246. The investment distribution of the Real estate investment and services sector had a skew of 1.065. This indicates that there were more companies with higher investment in the real estate investment and services sector (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the real estate investment and services sector were SMB and CMA with a value of 0.014. Conversely, the lowest means of the FF5 factors of the multi-factor model for the real estate investment and services sector is HML with a value of 0.005. This shows that the value factor had the lowest impact, explaining the returns of the real estate investment and services sector (see Table 4.9).

Table 5.41 shows the correlations between the factors. RMRF has a positive correlation with SMB, HML and CMA at over 0.56. Conversely, RMRF has a weak negative correlation with RMW at -0.078. SMB has a high correlation with RMRF, HML and CMA at over 0.59.

Table 5.41: Correlation matrix for the Factors of Real Estate Investment and Services sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.655	1.000			
HML	0.714	0.808	1.000		
RMW	-0.078	-0.490	-0.327	1.000	
CMA	0.562	0.590	0.576	-0.237	1.000

Table 5.42: Variance inflation factors (VIF) for the regression model of real estate investment and services. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.531	3.985	3.523	1.526	1.692

In the regression analysis for the multi-factor model of the real estate investment and services sector, the adjusted R-squared values range from 0.282 to 0.900 (see Fig. 5.11). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 factors in the multi-factor model for the real estate investment and services sector. The p-value of the regression model for the real estate investment and services sector is close to zero, which indicates a high level of statistical significance (see table 5.43).

Table 5.43: Average regression statistics for real estate investment and services across each FF5 portfolio

Residual standard error	0.035
F statistics	131.311
P value	0.000

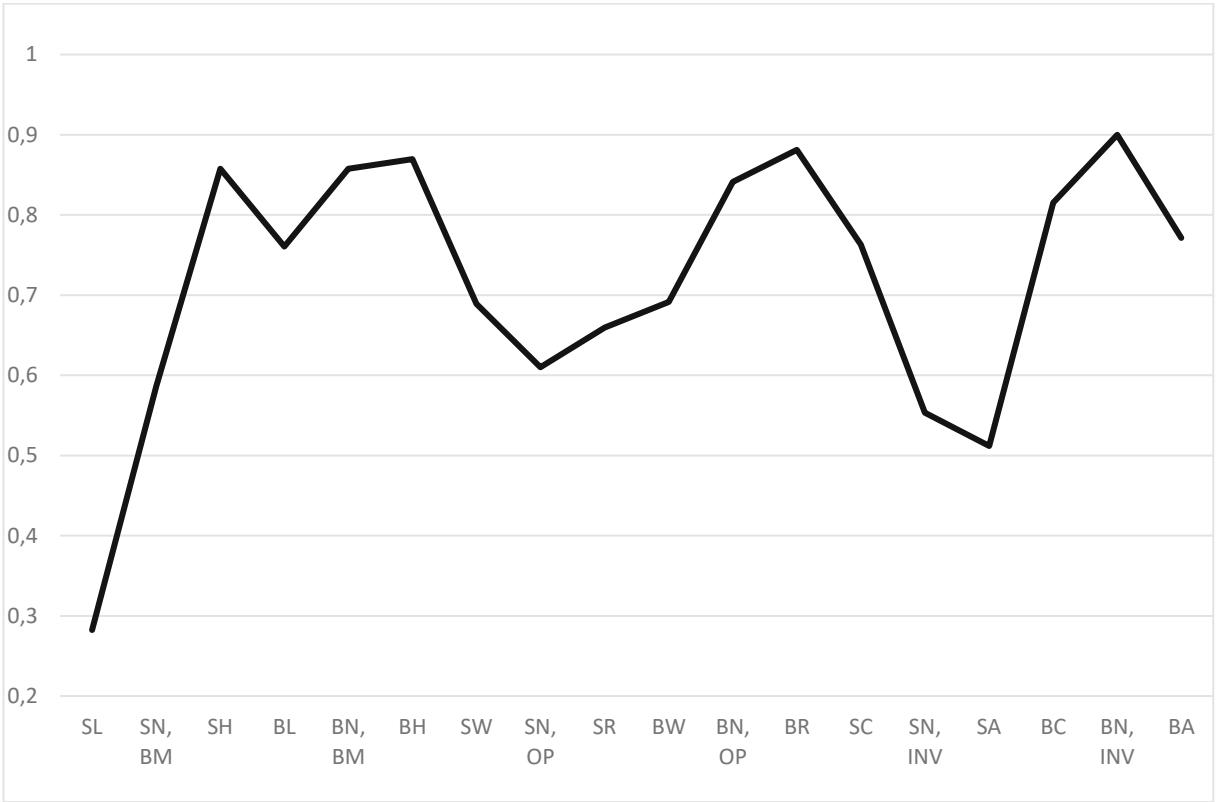

Figure 5.11: Adjusted R-squared values of the real estate investment and services sector

Table 5.44: Adjusted R-squared values for real estate investment and services across each FF5 portfolios

SL	0.282	BW	0.692
SN, BM	0.587	BN, OP	0.841
SH	0.858	BR	0.881
BL	0.760	SC	0.763
BN, BM	0.858	SN, INV	0.553
BH	0.870	SA	0.512
SW	0.689	BC	0.815
SN, OP	0.610	BN, INV	0.900
SR	0.660	BA	0.771

5.12 Software and Computer Services

In the multi-factor model for the software and computer services sector, a total of 316 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.6% with a standard deviation of 0.132. The return distribution had a skewness of 0.510, which shows a positively skewed distribution. That indicates higher returns in the return distribution in the Software and Computer Services sector. The kurtosis of the distribution was 4.202, that indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of the software and computer services sector was 0.585 with a standard deviation of 0.427. The B/M value distribution had a skew of 1.061. That indicates there were a higher number of companies with higher B/M value in the software and computer services sector. The software and computer services sector had a kurtosis value of 3.367. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME of the software and computer services sector was € 2 769 Million with a standard deviation of € 6 250 Million. The ME distribution in the software and computer services sector had a skew of 2.852, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis value of 10.026 shows a leptokurtic behaviour, which refers to the fact there are a high number of outliers in the distribution (see Table 4.6).

The mean OP of the software and computer services sector was 0.328 with a standard deviation of 0.504. The OP distribution in the software and computer services sector had a skew of 1.097, which shows a positively skewed distribution. The OP distribution of the software and computer services sector had a kurtosis of 3.966, which shows a leptokurtic behaviour. A kurtosis value of 3.966 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the software and computer services sector was 0.106 with a standard deviation of 0.261. The investment distribution in the software and computer services sector had a skew of 1.024. This indicates that there were more companies with higher investment in the software and computer services sector (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the software and computer services sector is SMB with a value of 0.025, which shows that the size factor had a significant impact on explaining the returns of the software and computer services sector over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for the software and computer services sector is HML with a value of 0.000. This shows that the value factor had the lowest impact on explaining the returns of the software and computer services sector (see Table 4.9).

Table 5.45 shows the correlations between the factors. RMRF has a positive correlation with SMB, HML and CMA at over 0.59. Conversely, RMRF has a correlation with RMW at -0.096. SMB has a high correlation with RMRF, HML and CMA at over 0.64. RMW has weak negative correlations with all other factors. CMA has positive correlations with all factors at over 0.59, except RMW.

Table 5.45: Correlation matrix for the Factors of Software and Computer Services sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.679	1.000			
HML	0.640	0.694	1.000		
RMW	-0.096	-0.198	-0.185	1.000	
CMA	0.590	0.670	0.689	-0.135	1.000

Table 5.46: Variance inflation factors (VIF) for the regression model of software and computer services. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	2.116	2.606	2.508	1.053	2.242

In the regression analysis for the multi-factor model of the software and computer services sector, the adjusted R-squared values range from 0.526 to 0.812 (see Fig. 5.12). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 factors in the multi-factor model for the software and computer services sector. The p-value of the regression model for the software and computer services sector is close to zero, which indicates a high level of statistical significance (see table 5.47).

Table 5.47: Average regression statistics for software and computer services across each FF5 portfolio

Residual standard error	0.037
F statistics	97.161
P value	0.000

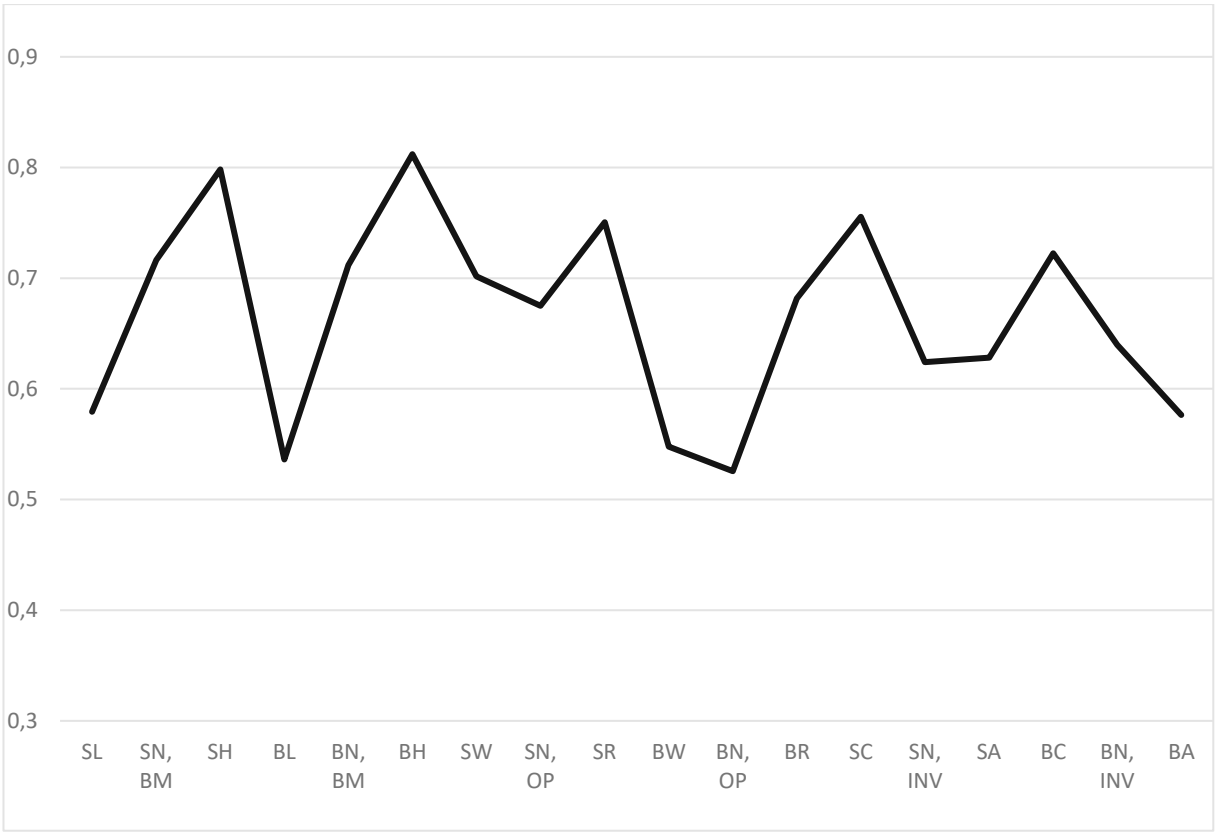

Figure 5.12: Adjusted R-squared values of the software and computer services sector

Table 5.48: Adjusted R-squared values for software and computer services across each FF5 portfolios

SL	0.579	BW	0.548
SN, BM	0.716	BN, OP	0.526
SH	0.798	BR	0.682
BL	0.536	SC	0.755
BN, BM	0.712	SN, INV	0.624
BH	0.812	SA	0.628
SW	0.702	BC	0.722
SN, OP	0.675	BN, INV	0.640
SR	0.751	BA	0.576

5.13 Technology Hardware and Equipment

In the multi-factor model for the technology hardware and equipment sector, a total of 106 companies were statistically analysed (see Table 4.3). Over the period 2003-2023, the companies provided a monthly mean return of 0.7% with a standard deviation of 0.130. The return distribution had a skewness of 0.430, which shows a slightly positively skewed distribution. That indicates that there were slightly higher returns in the return distribution of the technology hardware and equipment sector. The kurtosis of the distribution was 3.916, that indicates a leptokurtic behaviour, meaning a heavier-tailed than normal distribution that has a kurtosis of 0 (see Table 4.4).

The mean B/M value of the technology hardware and equipment sector was 0.613 with a standard deviation of 0.382. The B/M value distribution had a skew of 0.963. That indicates there were a higher number of companies with higher B/M value in the technology hardware and equipment sector. The technology hardware and equipment sector had a kurtosis of 3.111. That indicates a leptokurtic behaviour, meaning a heavier-tailed distribution than normal distribution (see Table 4.5).

The mean ME of the technology hardware and equipment sector was € 3 250 Million with a standard deviation of € 7 402 Million. The ME distribution in the technology hardware and equipment sector had a skew of 3.110, which shows a positively skewed distribution. That indicates that there were a higher number of companies with higher ME. A kurtosis of 11.624 shows a leptokurtic behaviour, which refers to the fact there were a high number of outliers in the distribution (see Table 4.6).

The mean OP in the technology hardware and equipment sector was 0.233 with a standard

deviation of 0.354. The OP distribution of the technology hardware and equipment sector had a skew of 1.215, which shows a positively skewed distribution. The OP distribution of the technology hardware and equipment sector had a kurtosis of 5.155, which shows a leptokurtic behaviour. A kurtosis value of 5.155 indicates a heavier tail than normal distribution (see Table 4.7).

The mean investment of the multi-factor model for the technology hardware and equipment sector was 0.082 with a standard deviation of 0.233. The investment distribution in the technology hardware and equipment sector had a skew of 1.071 (see Table 4.8).

The highest mean of the FF5 factors of the multi-factor model for the technology hardware and equipment sector is SMB with a value of 0.016. This shows that the size factor had a significant impact on explaining the returns of the technology hardware and equipment sector over the period 2003-2023. Conversely, the lowest means of the FF5 factors of the multi-factor model for the technology hardware and equipment sector is HML with a value of -0.004. This shows that the value factor had the lowest impact on explaining the returns of the technology hardware and equipment sector (see Table 4.9).

Table 5.49 shows the correlations between the factors. RMRF has low correlations with SMB, HML, RMW and CMA under 0.5. SMB has a high correlation with HML and CMA over 0.64. RMW has negative correlations with SMB and HML. CMA has positive correlations with all factors over 0.38, except RMW.

Table 5.49: Correlation matrix for the Factors of Technology Hardware and Equipment sector

	RMRF	SMB	HML	RMW	CMA
RMRF	1.000				
SMB	0.436	1.000			
HML	0.368	0.646	1.000		
RMW	0.148	-0.341	-0.238	1.000	
CMA	0.384	0.649	0.568	-0.456	1.000

Table 5.50: Variance inflation factors (VIF) for the regression model of technology hardware and equipment. b,s,h,r and c are the factor exposures.

	b	s	h	r	c
VIF values	1.552	2.324	1.855	1.553	2.244

In the regression analysis for the multi-factor model of the technology hardware and equipment sector, the adjusted R-squared values range from 0.346 to 0.877 (see fig. 5.12). the adjusted R-squared values indicate that the returns can be explained volatilely by the FF5 factors in the multi-factor model for the technology hardware and equipment sector. The p-values of the regression model for the technology hardware and equipment sector is close to zero, which indicates a high level of statistical significance (see table 5.51).

Table 5.51: Average regression statistics for technology hardware and equipment across each FF5 portfolio

Residual standard error	0.053
F statistics	85.161
P value	0.003

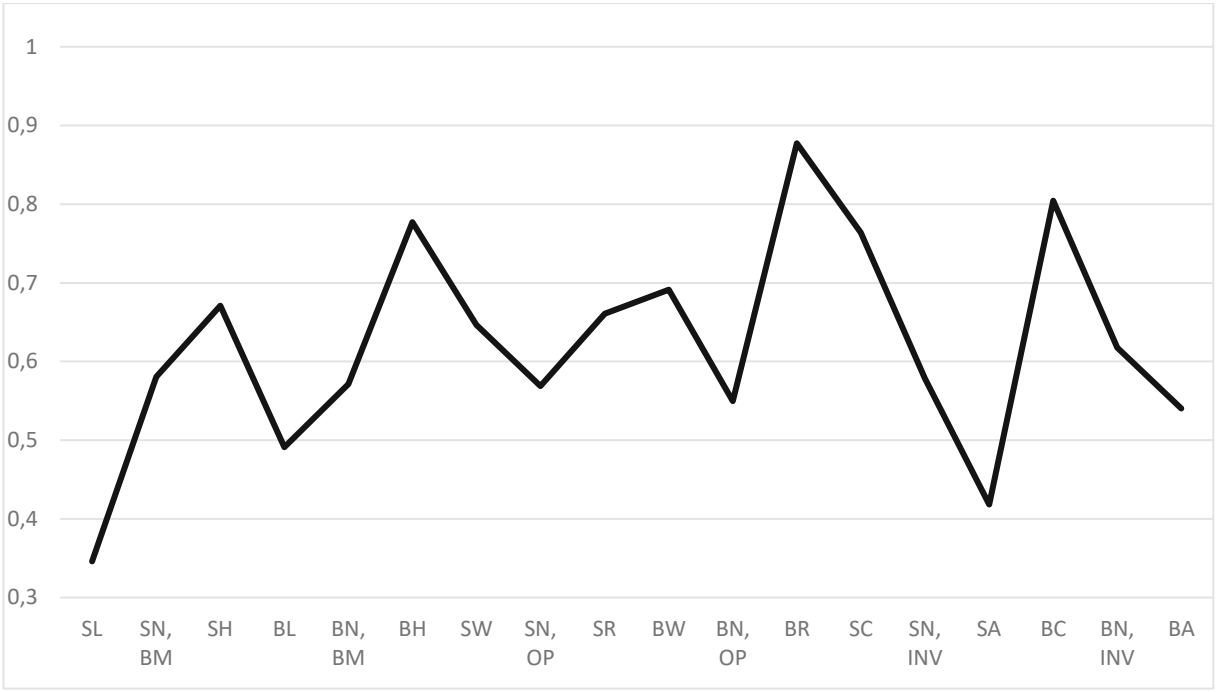

Figure 5.13: Adjusted R^2 values of the technology hardware and equipment sector

Table 5.52: Adjusted R-squared values for technology hardware and equipment across each FF5 portfolios

SL	0.346	BW	0.691
SN, BM	0.580	BN, OP	0.550
SH	0.671	BR	0.877
BL	0.491	SC	0.764
BN, BM	0.571	SN, INV	0.579
BH	0.777	SA	0.418
SW	0.646	BC	0.805
SN, OP	0.569	BN, INV	0.618
SR	0.661	BA	0.540

6 Conclusion

This thesis analyses the performance of the Fama and French (2015) 5 factor model with global, local, and industry-specific portfolios from Europe. For each portfolio, the model factors are calculated within the portfolios. We separate the portfolios as in the Fama and French (2015) with the method, namely, 2x3, which sorts portfolios in terms of size and B/M, size and OP, and size and INV. In total, we built 18 sub-portfolios for each country and industry analysis.

We compute the adjusted R-squared for each sub-portfolio as a measure of how well estimated regression models fit the data, and then determine the arithmetic mean of adjusted R-squared for each country and industry portfolio. The arithmetic mean of the adjusted R-squared of the sub-portfolio for Europe is 0.802, for England 0.796, for France 0.855, for Germany 0.835, for Sweden 0.870, for Switzerland 0.847, for the alternative energy sector 0.625, for the automobiles and parts sector 0.717, for the construction and materials sector 0.710, for the health care equipment and services sector 0.628, for the real estate investment and services sector 0.717, for the software and computer services sector 0.666, and for the technology hardware and equipment sector 0.620.

The country FF5 models have higher arithmetic means of the adjusted R-squared than the Europe FF5 model except the FF5 model for England. This result indicates that the local FF5 models perform better than the global (Europe) FF5 model, which also supports Griffin (2002) and Fama and French (2017).

The industry-specific FF5 models have lower arithmetic means of the adjusted R-squared than

the global (Europe) FF5 model and local (country) FF5 models, indicating that the former have a lower performance than the latter.

List of References

Ahmed, S., Hasan, M.M., Kamal, M.R. (2022): Russia–Ukraine crisis: The effects on the European stock market, *European Financial Management,* Vol. 29, pp. 1078-1118.

Alexiou, C., Tygi, A. (2020): Gauging the Effectiveness of Sector Rotation Strategies: Evidence from the U.S and Europe, *Journal of Asset Management*, Vol. 21, pp. 239-260.

Alves, P. (2013): The fama french model or the capital asset pricing model: international evidence, *The International Journal of Business and Finance Research,* Vol.7, N.2, pp. 79-87.

Aslam, F., Paulo F., Khurrum, S. M., Beenish, B. (2021): Intraday Volatility Spillovers among European Financial Markets during COVID-19, *International Journal of Financial Studies,* Vol. 9, pp. 1-19.

Banz, R. W. (1981): The relationship between return and market value of common stocks, *Journal of Financial Economics*, Vol. 9, pp. 3-18.

Brebels, A., Janovsky, T.A., Kamaev, V.A., Shcherbakov, M.V., Shcherbakova, N. L., Tyukov, A.P. (2013): A survey of forecast error measures, *World Applied Sciences Journal,* Vol. 24, pp. 171-176.

Chikashi, T. (2010): Do industries contain predictive information for the Fama–French factors?, *Quantitative Finance,* Vol. 12, No. 6, pp. 969-991.

Dempsey, M. (2012): The Capital Asset Pricing Model (CAPM): The History of a Failed Revolutionary Idea in Finance?, *A Journal of Accounting, Finance and Business Studies,* Vol.49, pp. 7-23.

Euribor: monthly Euribor rates, https://data.ecb.europa.eu/search-results?searchTerm=Euribor, date 12.11.2023

Errunza, V., Hogan, K. (1998): Macroeconomic determinants of European stock market volatility, *European Financial Management*, Vol. 4, No. 3, pp. 361–377.

Fama, E.F., French, K.R. (1992): The Cross-Section of Expected Stock Returns, *The Journal of Finance,* Vol. 47, pp. 427-465.

Fama, E.F., French, K.R. (2004): The Capital Asset Pricing Model: Theory and Evidence, *Journal of Economic Perspectives*, Vol.18, No.3, pp.25-46.

Fama, E.F., French, K.R. (2015): A five-factor asset pricing model, *Journal of Financial Economics*, Vol. 116, pp. 1-22.

Fama, E.F., French, K.R. (2017): International tests of a five-factor asset pricing model, *Journal of Financial Economics*, Vol. 123, pp. 441-463.

Fama, E.F., French, K.R. (2018): Choosing factors, *Journal of Financial Economics*, Vol. 128, pp. 234–252.

Griffin, J.M. (2002): Are the Fama and French Factors Global or Country Specific?, *The Review of Financial Studies,* Vol. 15, No. 3, pp. 783-803.

Lanstein, R., Reid, K., Rosenberg, B., (1985): Persuasive Evidence of Market Inefficiency, *Journal of Portfolio Management*, Vol. 11, Iss. 3, pp. 9-17.

Lintner, J. (1965): The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *The Review of Economics and Statistics,* Vol. 47, No. 1, pp. 13-37.

Markowitz, H.M. (1952): Portfolio Selection, *The Journal of Finance*, Vol. 7, No. 1., pp. 77-91.

Markowitz, H.M. (1959): *Portfolio Selection: Efficient Diversification of Investments*, John Wiley & Sons, New York.

Mirza, N., Naqvi, B., Rizvi, S.K.A., Su, C.W. (2022): COVID19: A blessing in disguise for European stock markets?, *Finance Research Letters*, Vol. 49, pp. 1-9.

Moerman, G.A. (2005): How Domestic is the Fama and French Three-Factor Model? An Application to the Euro Area, *Erim Report Series Research in Management*, *The Netherlands, Erasmus University Rotterdam.*

Novy-Marx, R. (2013): The other side of value: The gross profitability premium, *Journal of Financial Economics*, Vol. 108, pp.1–28.

Rapach, D.E., Strauss, J.K., TU, J., Zhou, G. (2011): Out-of-Sample Industry Return Predictability: Evidence from A Large Number of Predictors, *Institutional Knowledge at Singapore Management University.*

Refinitiv: Provider of financial market data, https://www.refinitiv.com/en, date 12.11.2023

Sharpe, W.F. (1964): Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, *The Journal of Finance,* Vol. 19, No. 3, pp. 425-442.

Stafford, J.R. (2014): *Equity Markets and Portfolio Analysis*, United States, Wiley.

Stattman, D. (1980): Book values and stock returns, *The Chicago MBA: A Journal of Selected Papers,* Vol .4, pp. 25-45.

Titman, S., Wei, K., Xie, F. (2004): Capital investments and stock returns, *Journal of Financial and Quantitative Analysis*, Vol. 39, pp. 677–700.

Wayne, F. (2019): *Empirical Asset Pricing*: Models and Methods, The MIT Press.

7 Appendix

Table 7.1: Monthly Euribor Rates in percentage form (%) between 2003 - 2023

31/01/2003	0.029	31/01/2007	0.036	31/01/2011	0.008	31/01/2015	0.000	31/01/2019	-0.004
28/02/2003	0.028	28/02/2007	0.037	28/02/2011	0.009	28/02/2015	0.000	28/02/2019	-0.004
31/03/2003	0.026	31/03/2007	0.038	31/03/2011	0.009	31/03/2015	0.000	31/03/2019	-0.004
30/04/2003	0.026	30/04/2007	0.039	30/04/2011	0.011	30/04/2015	0.000	30/04/2019	-0.004
31/05/2003	0.025	31/05/2007	0.039	31/05/2011	0.012	31/05/2015	0.000	31/05/2019	-0.004
30/06/2003	0.022	30/06/2007	0.041	30/06/2011	0.013	30/06/2015	-0.001	30/06/2019	-0.004
31/07/2003	0.021	31/07/2007	0.041	31/07/2011	0.014	31/07/2015	-0.001	31/07/2019	-0.004
31/08/2003	0.021	31/08/2007	0.043	31/08/2011	0.014	31/08/2015	-0.001	31/08/2019	-0.004
30/09/2003	0.021	30/09/2007	0.044	30/09/2011	0.013	30/09/2015	-0.001	30/09/2019	-0.004
31/10/2003	0.021	31/10/2007	0.042	31/10/2011	0.014	31/10/2015	-0.001	31/10/2019	-0.005
30/11/2003	0.021	30/11/2007	0.042	30/11/2011	0.012	30/11/2015	-0.001	30/11/2019	-0.005
31/12/2003	0.021	31/12/2007	0.047	31/12/2011	0.011	31/12/2015	-0.002	31/12/2019	-0.005
31/01/2004	0.021	31/01/2008	0.042	31/01/2012	0.008	31/01/2016	-0.002	31/01/2020	-0.005
29/02/2004	0.021	29/02/2008	0.042	29/02/2012	0.006	29/02/2016	-0.002	29/02/2020	-0.005
31/03/2004	0.020	31/03/2008	0.043	31/03/2012	0.005	31/03/2016	-0.003	31/03/2020	-0.005
30/04/2004	0.021	30/04/2008	0.044	30/04/2012	0.004	30/04/2016	-0.003	30/04/2020	-0.004
31/05/2004	0.021	31/05/2008	0.044	31/05/2012	0.004	31/05/2016	-0.003	31/05/2020	-0.005
30/06/2004	0.021	30/06/2008	0.045	30/06/2012	0.004	30/06/2016	-0.004	30/06/2020	-0.005
31/07/2004	0.021	31/07/2008	0.045	31/07/2012	0.002	31/07/2016	-0.004	31/07/2020	-0.005
31/08/2004	0.021	31/08/2008	0.045	31/08/2012	0.001	31/08/2016	-0.004	31/08/2020	-0.005
30/09/2004	0.021	30/09/2008	0.047	30/09/2012	0.001	30/09/2016	-0.004	30/09/2020	-0.005
31/10/2004	0.021	31/10/2008	0.048	31/10/2012	0.001	31/10/2016	-0.004	31/10/2020	-0.005
30/11/2004	0.021	30/11/2008	0.038	30/11/2012	0.001	30/11/2016	-0.004	30/11/2020	-0.005
31/12/2004	0.022	31/12/2008	0.030	31/12/2012	0.001	31/12/2016	-0.004	31/12/2020	-0.006
31/01/2005	0.021	31/01/2009	0.021	31/01/2013	0.001	31/01/2017	-0.004	31/01/2021	-0.006
28/02/2005	0.021	28/02/2009	0.016	28/02/2013	0.001	28/02/2017	-0.004	28/02/2021	-0.006
31/03/2005	0.021	31/03/2009	0.013	31/03/2013	0.001	31/03/2017	-0.004	31/03/2021	-0.006
30/04/2005	0.021	30/04/2009	0.010	30/04/2013	0.001	30/04/2017	-0.004	30/04/2021	-0.006
31/05/2005	0.021	31/05/2009	0.009	31/05/2013	0.001	31/05/2017	-0.004	31/05/2021	-0.006
30/06/2005	0.021	30/06/2009	0.009	30/06/2013	0.001	30/06/2017	-0.004	30/06/2021	-0.006
31/07/2005	0.021	31/07/2009	0.006	31/07/2013	0.001	31/07/2017	-0.004	31/07/2021	-0.006
31/08/2005	0.021	31/08/2009	0.005	31/08/2013	0.001	31/08/2017	-0.004	31/08/2021	-0.006
30/09/2005	0.021	30/09/2009	0.005	30/09/2013	0.001	30/09/2017	-0.004	30/09/2021	-0.006
31/10/2005	0.021	31/10/2009	0.004	31/10/2013	0.001	31/10/2017	-0.004	31/10/2021	-0.006
30/11/2005	0.022	30/11/2009	0.004	30/11/2013	0.001	30/11/2017	-0.004	30/11/2021	-0.006
31/12/2005	0.024	31/12/2009	0.005	31/12/2013	0.002	31/12/2017	-0.004	31/12/2021	-0.006
31/01/2006	0.024	31/01/2010	0.004	31/01/2014	0.002	31/01/2018	-0.004	31/01/2022	-0.006
28/02/2006	0.025	28/02/2010	0.004	28/02/2014	0.002	28/02/2018	-0.004	28/02/2022	-0.006
31/03/2006	0.026	31/03/2010	0.004	31/03/2014	0.002	31/03/2018	-0.004	31/03/2022	-0.005
30/04/2006	0.026	30/04/2010	0.004	30/04/2014	0.003	30/04/2018	-0.004	30/04/2022	-0.005
31/05/2006	0.027	31/05/2010	0.004	31/05/2014	0.003	31/05/2018	-0.004	31/05/2022	-0.005
30/06/2006	0.029	30/06/2010	0.004	30/06/2014	0.002	30/06/2018	-0.004	30/06/2022	-0.005
31/07/2006	0.029	31/07/2010	0.006	31/07/2014	0.001	31/07/2018	-0.004	31/07/2022	-0.003
31/08/2006	0.031	31/08/2010	0.006	31/08/2014	0.001	31/08/2018	-0.004	31/08/2022	0.000
30/09/2006	0.032	30/09/2010	0.006	30/09/2014	0.000	30/09/2018	-0.004	30/09/2022	0.006
31/10/2006	0.034	31/10/2010	0.008	31/10/2014	0.000	31/10/2018	-0.004	31/10/2022	0.009
30/11/2006	0.034	30/11/2010	0.008	30/11/2014	0.000	30/11/2018	-0.004	30/11/2022	0.014
31/12/2006	0.036	31/12/2010	0.008	31/12/2014	0.000	31/12/2018	-0.004	31/12/2022	0.017

Table 7.2: Regression Statistics of 6 Value Portfolios -Europa in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.008	-1.610	0.109	-0.001	-0.475	0.635	-0.006	-5.133	0.000
b	-0.456	-2.531	0.012	-0.185	-3.900	0.000	-0.177	-3.657	0.000
s	2.785	20.929	0.000	0.485	13.823	0.000	0.252	7.063	0.000
h	-1.602	-10.107	0.000	0.333	7.965	0.000	0.713	16.765	0.000
r	0.260	1.829	0.069	0.151	4.016	0.000	-0.055	-1.436	0.153
c	-0.662	-3.613	0.000	0.255	5.268	0.000	0.189	3.833	0.000
Residual standard error	0.053			0.014			0.014		
adj. R^2	0.673			0.890			0.916		
F Value	90.506			351.128			473.761		
P Value	0.099			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.009	5.247	0.000	0.001	0.339	0.735	0.006	5.133	0.000
b	0.792	12.023	0.000	0.213	3.657	0.000	0.177	3.657	0.000
s	-0.019	-0.385	0.700	0.226	5.255	0.000	-0.252	-7.063	0.000
h	-0.305	-5.261	0.000	0.301	5.892	0.000	1.287	30.262	0.000
r	0.154	2.966	0.003	0.162	3.517	0.001	0.055	1.436	0.153
c	0.328	4.897	0.000	0.145	2.445	0.015	-0.189	-3.833	0.000
Residual standard error	0.020			0.017			0.014		
adj. R^2	0.683			0.796			0.923		
F Value	94.697			170.345			520.219		
P Value	0.000			0.000			0.000		

Table 7.3: Regression Statistics of 6 Operating Income Portfolios - Europa, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.001	-0.569	0.570	0.001	0.881	0.379	0.003	2.274	0.024
b	-0.233	-3.337	0.001	-0.129	-2.555	0.011	-0.214	-4.228	0.000
s	0.438	8.484	0.000	0.397	10.613	0.000	0.487	13.007	0.000
h	0.128	2.083	0.038	0.429	9.626	0.000	0.394	8.844	0.000
r	-0.415	-7.517	0.000	0.079	1.973	0.050	0.344	8.586	0.000
c	0.585	8.224	0.000	0.165	3.208	0.002	0.260	5.051	0.000
Residual standard error	0.021			0.015			0.015		
adj. R^2	0.845			0.874			0.877		
F Value	238.445			301.760			310.639		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.012	5.640	0.000	0.003	2.194	0.029	0.008	5.235	0.000
b	0.596	7.386	0.000	0.430	7.514	0.000	0.577	10.070	0.000
s	0.071	1.196	0.233	0.063	1.491	0.138	0.022	0.526	0.599
h	0.284	3.998	0.000	0.217	4.300	0.000	0.017	0.345	0.730
r	-0.889	-13.947	0.000	0.073	1.624	0.106	0.352	7.785	0.000
c	-0.116	-1.419	0.157	0.163	2.795	0.006	0.208	3.565	0.000
Residual standard error	0.024			0.017			0.017		
adj. R^2	0.804			0.779			0.732		
F Value	179.309			153.868			119.461		
P Value	0.000			0.000			0.000		

Table 7.4: Regression Statistics of 6 Investment Portfolios -Europa, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.000	-0.055	0.956	0.003	2.548	0.012	-0.015	-3.935	0.000
b	-0.267	-4.707	0.000	-0.141	-2.836	0.005	-0.327	-2.208	0.028
s	0.216	5.155	0.000	0.353	9.630	0.000	2.385	21.849	0.000
h	0.248	4.967	0.000	0.438	10.025	0.000	-0.942	-7.240	0.000
r	-0.098	-2.180	0.030	0.027	0.687	0.493	0.355	3.040	0.003
c	0.801	13.861	0.000	0.153	3.035	0.003	-0.777	-5.163	0.000
Residual standard error	0.017			0.015			0.044		
adj. R^2	0.875			0.869			0.708		
F Value	304.253			287.840			106.007		
P Value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.000	0.055	0.956	0.006	4.262	0.000	0.007	2.740	0.007
b	0.267	4.707	0.000	0.446	7.810	0.000	0.676	7.078	0.000
s	-0.216	-5.155	0.000	0.041	0.980	0.328	0.374	5.310	0.000
h	-0.248	-4.967	0.000	0.311	6.194	0.000	0.109	1.297	0.196
r	0.098	2.180	0.030	0.125	2.772	0.006	0.231	3.065	0.002
c	1.199	20.744	0.000	-0.017	-0.296	0.767	-0.253	-2.602	0.010
Residual standard error	0.017			0.017			0.028		
adj. R^2	0.838			0.745			0.607		
F Value	226.291			128.069			67.935		
P Value	0.000			0.000			0.000		

Table 7.5: Regression Statistics of 6 Value Portfolios -England, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.011	4.730	0.000	-0.003	-2.041	0.043	-0.010	-5.825	0.000
b	-0.107	-1.761	0.080	-0.307	-8.172	0.000	-0.349	-7.683	0.000
s	0.912	13.495	0.000	0.848	20.310	0.000	0.472	9.368	0.000
h	-0.193	-3.001	0.003	0.006	0.161	0.872	0.658	13.694	0.000
r	0.107	2.708	0.007	0.185	7.590	0.000	0.058	1.991	0.048
c	0.010	0.150	0.881	0.135	3.413	0.001	0.139	2.906	0.004
Residual standard error	0.028			0.018			0.021		
adj. R^2	0.760			0.901			0.905		
F Value	138.565			397.275			415.682		
P Value	0.000			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.008	3.916	0.000	0.001	0.347	0.729	0.010	5.825	0.000
b	1.034	17.926	0.000	0.479	6.928	0.000	0.349	7.683	0.000
s	0.221	3.446	0.001	0.176	2.292	0.023	-0.472	-9.368	0.000
h	-0.465	-7.611	0.000	0.159	2.171	0.031	1.342	27.900	0.000
r	0.089	2.388	0.018	0.075	1.673	0.096	-0.058	-1.991	0.048
c	0.061	1.008	0.315	0.053	0.723	0.471	-0.139	-2.906	0.004
Residual standard error	0.027			0.032			0.021		
adj. R^2	0.784			0.652			0.892		
F Value	158.599			82.150			360.102		
P Value	0.000			0.000			0.000		

Table 7.6: Regression Statistics of 6 Operating Income Portfolios - England, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.008	2.275	0.024	-0.004	-2.582	0.010	-0.001	-0.362	0.718
b	0.058	0.593	0.554	-0.215	-5.194	0.000	-0.442	-8.771	0.000
s	0.835	7.628	0.000	0.651	14.174	0.000	0.929	16.633	0.000
h	-0.180	-1.724	0.086	0.216	4.932	0.000	0.070	1.311	0.191
r	-0.273	-4.275	0.000	0.133	4.977	0.000	0.293	9.005	0.000
c	0.074	0.714	0.476	0.088	2.021	0.045	0.137	2.592	0.010
Residual standard error	0.046			0.019			0.024		
adj. R^2	0.701			0.879			0.846		
F Value	102.612			317.454			239.875		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.002	0.475	0.635	-0.001	-0.376	0.707	0.011	5.856	0.000
b	0.503	4.488	0.000	0.400	5.241	0.000	1.003	19.858	0.000
s	0.073	0.590	0.556	0.258	3.042	0.003	-0.021	-0.374	0.709
h	0.174	1.464	0.145	0.245	3.032	0.003	-0.076	-1.423	0.156
r	-1.370	-18.886	0.000	0.159	3.226	0.001	0.064	1.970	0.050
c	0.071	0.600	0.549	0.028	0.346	0.730	0.008	0.142	0.887
Residual standard error	0.052			0.036			0.024		
adj. R^2	0.821			0.641			0.809		
F Value	200.324			78.539			185.257		
P Value	0.000			0.000			0.000		

Table 7.7: Regression Statistics of 6 Investment Portfolios -England, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.001	-0.551	0.582	-0.001	-0.690	0.491	-0.004	-1.464	0.145
b	-0.346	-6.802	0.000	-0.241	-6.413	0.000	-0.284	-4.310	0.000
s	0.516	9.127	0.000	0.632	15.191	0.000	1.178	16.106	0.000
h	0.068	1.256	0.211	0.253	6.377	0.000	-0.107	-1.529	0.128
r	-0.008	-0.240	0.810	0.136	5.616	0.000	0.291	6.831	0.000
c	0.729	13.601	0.000	0.001	0.032	0.975	-0.105	-1.508	0.133
Residual standard error	0.024			0.018			0.031		
adj. R^2	0.898			0.881			0.777		
F Value	382.620			322.508			152.362		
P Value	0.000			0.000			0.000		
	Big Conservative			**Big Neutral, Investment**			**Big Aggressive**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.001	0.551	0.582	0.005	2.261	0.025	0.011	3.238	0.001
b	0.346	6.802	0.000	0.598	10.497	0.000	0.916	10.234	0.000
s	-0.516	-9.127	0.000	0.127	2.014	0.045	0.163	1.637	0.103
h	-0.068	-1.256	0.211	0.053	0.882	0.379	0.239	2.527	0.012
r	0.008	0.240	0.810	0.015	0.402	0.688	0.122	2.106	0.036
c	1.271	23.709	0.000	-0.012	-0.195	0.846	-0.270	-2.867	0.005
Residual standard error	0.024			0.027			0.042		
adj. R^2	0.863			0.690			0.626		
F Value	275.529			97.817			73.581		
P Value	0.000			0.000			0.000		

Table 7.8: Regression Statistics of 6 Value Portfolios -France, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.003	1.426	0.155	-0.003	-2.202	0.029	-0.004	-2.838	0.005
b	-0.292	-3.704	0.000	-0.194	-4.187	0.000	-0.268	-6.328	0.000
s	1.416	16.392	0.000	0.720	14.154	0.000	0.329	7.068	0.000
h	-0.733	-9.053	0.000	0.039	0.817	0.415	0.783	17.959	0.000
r	0.029	0.589	0.557	0.164	5.580	0.000	0.127	4.719	0.000
c	0.419	4.926	0.000	0.108	2.159	0.032	-0.096	-2.104	0.037
Residual standard error	0.032			0.019			0.017		
adj. R^2	0.831			0.849			0.895		
F Value	215.147			244.265			370.228		
P Value	0.000			0.000			0.000		

	Big Low			Big Neutral, Book to Market Value			Big High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.012	6.757	0.000	0.004	2.507	0.013	0.004	2.838	0.005
b	0.859	14.653	0.000	0.558	11.948	0.000	0.268	6.328	0.000
s	0.278	4.321	0.000	-0.040	-0.772	0.441	-0.329	-7.068	0.000
h	-0.120	-1.985	0.048	0.089	1.855	0.065	1.217	27.913	0.000
r	0.105	2.841	0.005	0.057	1.910	0.057	-0.127	-4.719	0.000
c	-0.137	-2.158	0.032	0.274	5.421	0.000	0.096	2.104	0.037
Residual standard error	0.023			0.019			0.017		
adj. R^2	0.814			0.862			0.955		
F Value	190.766			271.891			928.019		
P Value	0.000			0.000			0.000		

Table 7.9: Regression Statistics of 6 Operating Income Portfolios - France, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.011	-4.435	0.000	0.000	-0.114	0.909	-0.003	-1.619	0.107
b	-0.296	-3.592	0.000	-0.190	-3.195	0.002	-0.405	-7.430	0.000
s	1.169	12.946	0.000	0.475	7.269	0.000	0.960	16.031	0.000
h	-0.451	-5.337	0.000	0.418	6.823	0.000	0.268	4.770	0.000
r	-0.262	-5.033	0.000	0.134	3.557	0.000	0.412	11.916	0.000
c	0.464	5.217	0.000	0.078	1.216	0.225	-0.037	-0.627	0.531
Residual standard error	0.033			0.024			0.022		
adj. R^2	0.853			0.808			0.844		
F Value	252.954			183.329			236.183		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.014	4.253	0.000	0.006	4.050	0.000	0.005	3.327	0.001
b	0.666	6.251	0.000	0.589	12.016	0.000	0.776	14.626	0.000
s	-0.059	-0.506	0.614	0.080	1.478	0.141	0.150	2.576	0.011
h	0.614	5.605	0.000	0.110	2.192	0.029	-0.105	-1.931	0.055
r	-1.127	-16.708	0.000	-0.002	-0.049	0.961	0.198	5.908	0.000
c	-0.398	-3.457	0.001	0.075	1.425	0.156	0.103	1.796	0.074
Residual standard error	0.043			0.020			0.021		
adj. R^2	0.809			0.851			0.840		
F Value	184.339			248.473			229.576		
P Value	0.000			0.000			0.000		

Table 7.10: Regression Statistics of 6 Investment Portfolios -France, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.009	-5.923	0.000	0.000	-0.236	0.814	-0.001	-0.589	0.557
b	-0.484	-9.276	0.000	-0.175	-3.587	0.000	-0.113	-2.006	0.046
s	0.724	12.656	0.000	0.499	9.302	0.000	0.849	13.758	0.000
h	-0.303	-5.655	0.000	0.439	8.738	0.000	0.087	1.501	0.135
r	0.046	1.385	0.168	0.127	4.089	0.000	0.072	2.019	0.045
c	0.917	16.283	0.000	-0.061	-1.151	0.251	-0.026	-0.426	0.670
Residual standard error	0.021			0.020			0.023		
adj. R^2	0.908			0.840			0.851		
F Value	429.652			228.982			248.881		
P Value	0.000			0.000			0.000		
	Big Conservative			**Big Neutral, Investment**			**Big Aggressive**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.009	5.923	0.000	0.007	4.784	0.000	0.004	2.011	0.046
b	0.484	9.276	0.000	0.678	14.391	0.000	0.595	8.594	0.000
s	-0.724	-12.656	0.000	0.214	4.146	0.000	0.484	6.371	0.000
h	0.303	5.655	0.000	0.108	2.241	0.026	0.066	0.933	0.352
r	-0.046	-1.385	0.168	0.065	2.190	0.030	0.079	1.811	0.072
c	1.083	19.238	0.000	-0.099	-1.950	0.052	-0.199	-2.657	0.008
Residual standard error	0.021			0.019			0.028		
adj. R^2	0.908			0.874			0.791		
F Value	430.681			301.727			165.430		
P Value	0.000			0.000			0.000		

Table 7.11: Regression Statistics of 6 Value Portfolios -Germany, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.023	-3.199	0.002	0.004	1.916	0.057	-0.004	-1.926	0.055
b	-1.777	-6.793	0.000	0.237	3.470	0.001	-0.283	-3.902	0.000
s	3.828	33.317	0.000	0.169	5.626	0.000	0.182	5.725	0.000
h	-0.835	-3.667	0.000	0.202	3.405	0.001	0.872	13.821	0.000
r	0.228	1.216	0.225	0.117	2.399	0.017	-0.005	-0.105	0.916
c	-0.721	-3.290	0.001	0.170	2.971	0.003	0.044	0.722	0.471
Residual standard error	0.089			0.023			0.025		
adj. R^2	0.846			0.790			0.845		
F Value	238.797			164.542			237.340		
P Value	0.000			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.009	4.993	0.000	0.005	3.361	0.001	0.004	1.926	0.055
b	0.795	12.038	0.000	0.748	13.227	0.000	0.283	3.902	0.000
s	0.079	2.729	0.007	0.005	0.191	0.849	-0.182	-5.725	0.000
h	-0.254	-4.416	0.000	0.130	2.647	0.009	1.128	17.892	0.000
r	0.119	2.518	0.013	0.098	2.410	0.017	0.005	0.105	0.916
c	0.214	3.878	0.000	0.059	1.240	0.216	-0.044	-0.722	0.471
Residual standard error	0.023			0.019			0.025		
adj. R^2	0.796			0.878			0.903		
F Value	169.862			311.942			407.038		
P Value	0.000			0.000			0.000		

Table 7.12: Regression Statistics of 6 Operating Income Portfolios - Germany, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.001	0.472	0.637	0.002	1.317	0.189	0.008	3.990	0.000
b	-0.007	-0.067	0.946	0.146	2.381	0.018	0.004	0.052	0.958
s	0.170	3.907	0.000	0.201	7.448	0.000	0.194	6.423	0.000
h	0.050	0.582	0.561	0.288	5.381	0.000	0.303	5.083	0.000
r	-0.540	-7.629	0.000	0.196	4.447	0.000	0.419	8.533	0.000
c	0.655	7.906	0.000	0.187	3.626	0.000	0.278	4.843	0.000
Residual standard error	0.034			0.021			0.023		
adj. R^2	0.781			0.844			0.801		
F Value	155.812			236.510			175.542		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.013	4.900	0.000	0.005	3.456	0.001	0.007	4.859	0.000
b	0.704	7.157	0.000	0.730	13.657	0.000	0.693	13.231	0.000
s	0.039	0.902	0.368	-0.018	-0.781	0.436	0.015	0.657	0.512
h	0.283	3.308	0.001	0.165	3.553	0.000	0.030	0.649	0.517
r	-0.706	-10.027	0.000	-0.009	-0.235	0.815	0.335	8.917	0.000
c	-0.206	-2.506	0.013	0.106	2.377	0.018	0.170	3.879	0.000
Residual standard error	0.034			0.018			0.018		
adj. R^2	0.732			0.898			0.884		
F Value	119.274			382.101			332.707		
P Value	0.000			0.000			0.000		

Table 7.13: Regression Statistics of 6 Investment Portfolios -Germany, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.002	-0.802	0.424	0.004	2.271	0.024	-0.024	-3.919	0.000
b	-0.295	-3.468	0.001	0.137	2.171	0.031	-1.420	-6.473	0.000
s	0.163	4.349	0.000	0.144	5.222	0.000	3.415	35.435	0.000
h	-0.142	-1.913	0.057	0.294	5.372	0.000	-0.200	-1.050	0.295
r	-0.124	-2.032	0.043	0.188	4.177	0.000	0.286	1.818	0.071
c	1.207	16.941	0.000	0.154	2.917	0.004	-1.289	-7.017	0.000
Residual standard error	0.029			0.021			0.075		
adj. R^2	0.839			0.801			0.863		
F Value	227.601			175.404			275.384		
P Value	0.000			0.000			0.000		
	Big Conservative			**Big Neutral, Investment**			**Big Aggressive**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.002	0.802	0.424	0.007	4.684	0.000	0.007	3.795	0.000
b	0.295	3.468	0.001	0.673	12.491	0.000	0.880	13.192	0.000
s	-0.163	-4.349	0.000	-0.012	-0.516	0.607	0.112	3.826	0.000
h	0.142	1.913	0.057	0.154	3.274	0.001	-0.011	-0.186	0.853
r	0.124	2.032	0.043	0.159	4.133	0.000	0.039	0.811	0.418
c	0.793	11.122	0.000	0.088	1.954	0.052	-0.027	-0.480	0.631
Residual standard error	0.029			0.018			0.023		
adj. R^2	0.809			0.879			0.845		
F Value	184.496			314.826			238.221		
P Value	0.000			0.000			0.000		

Table 7.14: Regression Statistics of 6 Value Portfolios -Sweden, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.011	4.179	0.000	-0.008	-4.588	0.000	-0.009	-7.222	0.000
b	-0.175	-2.185	0.030	-0.272	-4.791	0.000	-0.422	-11.427	0.000
s	1.441	16.676	0.000	0.848	13.857	0.000	0.272	6.824	0.000
h	-0.875	-7.505	0.000	0.011	0.134	0.894	1.086	20.220	0.000
r	-0.065	-1.110	0.268	0.138	3.342	0.001	0.087	3.232	0.001
c	0.235	2.245	0.026	0.100	1.343	0.181	-0.053	-1.104	0.271
Residual standard error	0.031			0.022			0.014		
adj. R^2	0.849			0.865			0.938		
F Value	244.750			278.603			656.660		
P Value	0.000			0.000			0.000		

	Big Low			Big Neutral, Book to Market Value			Big High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.009	4.363	0.000	0.004	2.593	0.010	0.009	7.222	0.000
b	0.751	11.499	0.000	0.730	14.043	0.000	0.422	11.427	0.000
s	0.139	1.978	0.049	-0.038	-0.683	0.495	-0.272	-6.824	0.000
h	-0.146	-1.532	0.127	0.043	0.572	0.568	0.914	17.017	0.000
r	0.121	2.553	0.011	0.103	2.733	0.007	-0.087	-3.232	0.001
c	0.144	1.690	0.093	0.252	3.717	0.000	0.053	1.104	0.271
Residual standard error	0.026			0.020			0.014		
adj. R^2	0.815			0.883			0.945		
F Value	192.274			327.290			745.487		
P Value	0.000			0.000			0.000		

Table 7.15: Regression Statistics of 6 Operating Income Portfolios - Sweden, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.006	-2.910	0.004	-0.003	-1.396	0.164	0.001	0.740	0.460
b	-0.348	-5.134	0.000	-0.232	-3.456	0.001	-0.291	-5.136	0.000
s	0.984	13.470	0.000	0.875	12.073	0.000	0.971	15.893	0.000
h	-0.239	-2.422	0.016	0.160	1.633	0.104	-0.059	-0.715	0.476
r	-0.419	-8.516	0.000	0.152	3.120	0.002	0.558	13.544	0.000
c	0.287	3.246	0.001	-0.030	-0.341	0.734	0.027	0.363	0.717
Residual standard error	0.026			0.026			0.022		
adj. R^2	0.882			0.843			0.853		
F Value	325.426			233.667			253.337		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.014	4.920	0.000	0.006	4.246	0.000	0.007	4.271	0.000
b	0.733	8.038	0.000	0.697	16.290	0.000	0.677	13.762	0.000
s	-0.088	-0.892	0.373	0.014	0.304	0.761	-0.075	-1.417	0.158
h	0.280	2.113	0.036	0.218	3.508	0.001	0.101	1.410	0.160
r	-0.806	-12.154	0.000	0.007	0.212	0.832	0.217	6.062	0.000
c	0.047	0.391	0.696	0.042	0.760	0.448	0.307	4.776	0.000
Residual standard error	0.036			0.017			0.019		
adj. R^2	0.804			0.919			0.891		
F Value	179.220			494.216			357.119		
P Value	0.000			0.000			0.000		

Table 7.16: Regression Statistics of 6 Investment Portfolios -Sweden, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.008	-5.128	0.000	-0.001	-0.636	0.525	-0.001	-0.525	0.600
b	-0.452	-9.261	0.000	-0.235	-3.494	0.001	-0.194	-2.606	0.010
s	0.427	8.103	0.000	0.961	13.259	0.000	1.116	13.922	0.000
h	-0.077	-1.082	0.280	0.160	1.635	0.104	-0.021	-0.197	0.844
r	-0.053	-1.493	0.137	0.242	4.945	0.000	0.009	0.164	0.869
c	1.004	15.748	0.000	-0.248	-2.825	0.005	-0.226	-2.326	0.021
Residual standard error	0.019			0.026			0.029		
adj. R^2	0.917			0.815			0.832		
F Value	480.419			192.010			216.088		
P Value	0.000			0.000			0.000		
	Big Conservative			**Big Neutral, Investment**			**Big Aggressive**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.008	5.128	0.000	0.008	4.503	0.000	0.007	3.105	0.002
b	0.452	9.261	0.000	0.741	13.535	0.000	0.519	7.926	0.000
s	-0.427	-8.103	0.000	-0.009	-0.148	0.883	0.313	4.440	0.000
h	0.077	1.082	0.280	0.344	4.315	0.000	0.205	2.158	0.032
r	0.053	1.493	0.137	0.059	1.486	0.139	0.051	1.064	0.289
c	0.996	15.625	0.000	-0.065	-0.910	0.364	-0.160	-1.871	0.063
Residual standard error	0.019			0.021			0.026		
adj. R^2	0.899			0.879			0.824		
F Value	387.324			317.243			204.547		
P Value	0.000			0.000			0.000		

Table 7.17: Regression Statistics of 6 Value Portfolios -Switzerland, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.002	-0.757	0.450	0.000	-0.218	0.828	-0.007	-5.832	0.000
b	-0.534	-5.459	0.000	-0.185	-4.385	0.000	-0.226	-5.771	0.000
s	1.204	11.467	0.000	0.701	15.446	0.000	0.437	10.377	0.000
h	-0.609	-6.102	0.000	0.193	4.480	0.000	0.486	12.135	0.000
r	-0.359	-4.562	0.000	0.259	7.605	0.000	0.181	5.727	0.000
c	0.718	6.953	0.000	0.027	0.597	0.551	0.061	1.469	0.143
Residual standard error	0.037			0.016			0.015		
adj. R^2	0.779			0.893			0.900		
F Value	154.209			364.506			390.493		
P Value	0.000			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.007	5.385	0.000	0.003	1.791	0.075	0.007	5.832	0.000
b	0.725	15.764	0.000	0.561	8.268	0.000	0.226	5.771	0.000
s	0.215	4.354	0.000	-0.045	-0.616	0.538	-0.437	-10.377	0.000
h	-0.178	-3.783	0.000	0.215	3.108	0.002	1.514	37.841	0.000
r	0.124	3.355	0.001	-0.092	-1.688	0.093	-0.181	-5.727	0.000
c	-0.010	-0.201	0.841	0.348	4.858	0.000	-0.061	-1.469	0.143
Residual standard error	0.018			0.026			0.015		
adj. R^2	0.831			0.785			0.944		
F Value	213.687			159.236			735.245		
P Value	0.000			0.000			0.000		

Table 7.18: Regression Statistics of 6 Operating Income Portfolios - Switzerland, in time 2003 - 2023. α is the inter-ceH34:Q53pt term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.008	-4.903	0.000	-0.002	-1.691	0.092	0.001	0.753	0.452
b	-0.338	-5.952	0.000	-0.221	-4.555	0.000	-0.327	-7.500	0.000
s	0.780	12.777	0.000	0.698	13.392	0.000	0.743	15.876	0.000
h	-0.239	-4.123	0.000	0.275	5.540	0.000	0.384	8.641	0.000
r	-0.362	-7.906	0.000	0.237	6.068	0.000	0.562	16.010	0.000
c	0.501	8.336	0.000	0.043	0.837	0.403	0.024	0.515	0.607
Residual standard error	0.022			0.019			0.017		
adj. R^2	0.865			0.878			0.913		
F Value	279.086			314.058			455.821		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.014	6.123	0.000	0.007	4.506	0.000	0.005	2.701	0.007
b	0.561	7.224	0.000	0.725	13.959	0.000	0.549	9.052	0.000
s	-0.078	-0.936	0.350	0.245	4.398	0.000	-0.041	-0.624	0.533
h	0.648	8.170	0.000	-0.037	-0.702	0.483	0.024	0.389	0.698
r	-0.690	-11.027	0.000	-0.007	-0.175	0.861	0.386	7.900	0.000
c	-0.184	-2.241	0.026	-0.092	-1.683	0.094	0.293	4.573	0.000
Residual standard error	0.030			0.020			0.023		
adj. R^2	0.733			0.815			0.755		
F Value	120.325			192.016			134.837		
P Value	0.000			0.000			0.000		

Table 7.19: Regression Statistics of 6 Investment Portfolios -Switzerland, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.004	-2.804	0.006	-0.001	-0.772	0.441	-0.004	-2.526	0.012
b	-0.460	-8.819	0.000	-0.172	-4.440	0.000	-0.153	-2.926	0.004
s	0.759	13.542	0.000	0.572	13.758	0.000	0.772	13.750	0.000
h	-0.128	-2.407	0.017	0.361	9.129	0.000	0.252	4.726	0.000
r	-0.107	-2.548	0.012	0.276	8.845	0.000	0.251	5.957	0.000
c	0.653	11.856	0.000	-0.040	-0.986	0.325	-0.137	-2.484	0.014
Residual standard error	0.020			0.015			0.020		
adj. R^2	0.899			0.899			0.849		
F Value	386.831			386.183			245.244		
P Value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.004	2.804	0.006	0.006	4.409	0.000	0.005	2.869	0.005
b	0.460	8.819	0.000	0.683	13.851	0.000	0.597	8.991	0.000
s	-0.759	-13.542	0.000	0.302	5.714	0.000	0.459	6.444	0.000
h	0.128	2.407	0.017	-0.021	-0.411	0.682	0.065	0.956	0.340
r	0.107	2.548	0.012	0.032	0.810	0.419	0.008	0.150	0.881
c	1.347	24.431	0.000	-0.163	-3.139	0.002	-0.169	-2.404	0.017
Residual standard error	0.020			0.019			0.025		
adj. R^2	0.893			0.822			0.788		
F Value	361.372			201.625			161.964		
P Value	0.000			0.000			0.000		

Table 7.20: Regression Statistics of 6 Value Portfolios -Alternative Energy, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.024	-0.357	0.723	-0.006	-0.330	0.743	0.001	0.098	0.922
b	-4.364	-4.506	0.000	0.647	2.465	0.017	-0.369	-2.691	0.010
s	7.104	30.200	0.000	-0.176	-2.767	0.008	0.106	3.197	0.002
h	-0.510	-0.782	0.438	0.085	0.479	0.634	1.162	12.599	0.000
r	1.207	5.550	0.000	0.046	0.773	0.443	-0.007	-0.240	0.811
c	-1.190	-2.250	0.029	0.321	2.245	0.029	-0.062	-0.827	0.412
Residual standard error	0.433			0.117			0.061		
adj. R^2	0.991			0.350			0.804		
F Value	1170.008			7.029			46.969		
P Value	0.000			0.080			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.002	0.203	0.840	0.006	0.416	0.679	-0.001	-0.098	0.922
b	1.619	12.980	0.000	0.972	4.852	0.000	0.369	2.691	0.010
s	-0.425	-14.016	0.000	-0.281	-5.779	0.000	-0.106	-3.197	0.002
h	-0.209	-2.493	0.016	0.073	0.541	0.591	0.838	9.095	0.000
r	-0.132	-4.718	0.000	-0.062	-1.369	0.177	0.007	0.240	0.811
c	-0.076	-1.115	0.270	0.164	1.496	0.141	0.062	0.827	0.412
Residual standard error	0.056			0.090			0.061		
adj. R^2	0.794			0.533			0.781		
F Value	44.125			13.799			40.986		
P Value	0.233			0.448			0.000		

Table 7.21: Regression Statistics of 6 Operating Income Portfolios - Alternative Energy, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for cH34:Q58oefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.055	2.330	0.024	0.016	0.559	0.578	0.012	1.146	0.257
b	-0.768	-2.239	0.030	0.100	0.246	0.807	0.154	0.984	0.330
s	0.209	2.507	0.015	-0.062	-0.624	0.535	-0.024	-0.617	0.540
h	0.277	1.201	0.235	-0.179	-0.656	0.515	0.317	3.004	0.004
r	-1.651	-21.430	0.000	0.201	2.200	0.032	0.064	1.818	0.075
c	0.707	3.778	0.000	0.722	3.260	0.002	0.203	2.371	0.022
Residual standard error	0.153			0.182			0.070		
adj. R^2	0.974			0.200			0.491		
F Value	419.899			3.800			11.786		
P Value	0.000			0.505			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.030	-1.717	0.092	-0.003	-0.263	0.793	0.012	0.873	0.387
b	1.536	5.938	0.000	1.185	6.422	0.000	0.614	3.056	0.004
s	-0.393	-6.262	0.000	-0.318	-7.104	0.000	-0.161	-3.301	0.002
h	0.196	1.130	0.264	-0.099	-0.800	0.427	0.157	1.160	0.252
r	-0.201	-3.463	0.001	-0.048	-1.168	0.248	0.084	1.867	0.068
c	-0.139	-0.987	0.328	0.146	1.452	0.153	0.365	3.329	0.002
Residual standard error	0.116			0.083			0.090		
adj. R^2	0.486			0.577			0.550		
F Value	11.571			16.248			14.682		
P Value	0.088			0.141			0.003		

Table 7.22: Regression Statistics of 6 Investment Portfolios -Alternative Energy, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.016	1.384	0.172	-0.039	-1.084	0.283	-0.022	-1.047	0.300
b	-0.792	-4.630	0.000	-1.409	-2.674	0.010	0.770	2.507	0.015
s	0.214	5.139	0.000	3.448	26.936	0.000	-0.218	-2.930	0.005
h	-0.158	-1.374	0.175	0.080	0.226	0.822	0.225	1.089	0.281
r	-0.067	-1.751	0.086	1.231	10.401	0.000	-0.227	-3.287	0.002
c	1.599	17.131	0.000	-1.157	-4.021	0.000	-0.386	-2.301	0.025
Residual standard error	0.076			0.236			0.137		
adj. R^2	0.957			0.989			0.141		
F Value	252.052			1046.352			2.831		
P Value	0.000			0.000			0.394		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.016	-1.384	0.172	-0.003	-0.191	0.849	0.015	0.973	0.335
b	0.792	4.630	0.000	1.212	6.052	0.000	1.283	5.781	0.000
s	-0.214	-5.139	0.000	-0.328	-6.745	0.000	-0.337	-6.249	0.000
h	0.158	1.374	0.175	-0.005	-0.035	0.972	-0.101	-0.679	0.500
r	0.067	1.751	0.086	-0.100	-2.221	0.031	-0.094	-1.895	0.064
c	0.401	4.290	0.000	0.006	0.053	0.958	-0.033	-0.270	0.788
Residual standard error	0.076			0.090			0.099		
adj. R^2	0.699			0.502			0.427		
F Value	27.023			12.296			9.351		
P Value	0.000			0.412			0.408		

Table 7.23: Regression Statistics of 6 Value Portfolios -Automobiles and Parts, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.009	2.439	0.016	-0.002	-0.490	0.625	-0.011	-3.656	0.000
b	-0.069	-0.740	0.460	-0.239	-3.181	0.002	-0.577	-7.916	0.000
s	0.923	11.649	0.000	0.670	10.565	0.000	0.694	11.268	0.000
h	-0.377	-3.867	0.000	0.205	2.631	0.009	0.653	8.614	0.000
r	-0.017	-0.284	0.777	0.032	0.657	0.512	0.174	3.642	0.000
c	0.089	1.117	0.265	0.092	1.455	0.147	0.063	1.014	0.312
Residual standard error	0.051			0.040			0.039		
adj. R^2	0.565			0.703			0.789		
F Value	51.945			93.624			147.955		
P Value	0.000			0.000			0.000		

	Big Low			Big Neutral, Book to Market Value			Big High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.013	2.987	0.003	0.003	0.938	0.349	0.011	3.656	0.000
b	0.543	5.017	0.000	0.860	11.821	0.000	0.577	7.916	0.000
s	0.430	4.697	0.000	0.199	3.240	0.001	-0.694	-11.268	0.000
h	-0.428	-3.798	0.000	-0.206	-2.716	0.007	1.347	17.780	0.000
r	0.060	0.851	0.396	0.072	1.519	0.130	-0.174	-3.642	0.000
c	0.078	0.846	0.399	0.150	2.441	0.016	-0.063	-1.014	0.312
Residual standard error	0.058			0.039			0.039		
adj. R^2	0.379			0.728			0.845		
F Value	24.874			105.750			215.240		
P Value	0.000			0.000			0.000		

Table 7.24: Regression Statistics of 6 Operating Income Portfolios - Automobiles and Parts, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.004	-1.041	0.299	0.000	-0.136	0.892	-0.002	-0.701	0.484
b	-0.306	-3.127	0.002	-0.001	-0.012	0.990	-0.689	-9.468	0.000
s	1.034	12.494	0.000	0.676	10.002	0.000	0.859	13.977	0.000
h	-0.236	-2.320	0.021	0.010	0.118	0.907	0.422	5.575	0.000
r	-0.385	-6.003	0.000	-0.022	-0.418	0.676	0.554	11.611	0.000
c	0.182	2.196	0.029	-0.052	-0.769	0.443	0.304	4.928	0.000
Residual standard error	0.053			0.043			0.039		
adj. R^2	0.699			0.625			0.797		
F Value	91.926			66.241			154.477		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.006	1.210	0.228	0.004	1.671	0.096	0.004	1.274	0.204
b	0.046	0.370	0.712	1.200	23.315	0.000	0.429	5.424	0.000
s	-0.179	-1.693	0.092	0.119	2.735	0.007	-0.004	-0.067	0.946
h	1.114	8.543	0.000	-0.215	-4.013	0.000	0.456	5.543	0.000
r	-0.691	-8.402	0.000	0.020	0.607	0.545	0.370	7.144	0.000
c	0.092	0.866	0.387	0.001	0.029	0.977	-0.029	-0.439	0.661
Residual standard error	0.068			0.028			0.043		
adj. R^2	0.708			0.878			0.630		
F Value	96.066			282.965			67.629		
P Value	0.000			0.000			0.000		

Table 7.25: Regression Statistics of 6 Investment Portfolios -Automobiles and Parts, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.001	-0.578	0.564	-0.009	-2.938	0.004	0.005	1.358	0.176
b	-0.263	-4.511	0.000	-0.286	-3.647	0.000	-0.387	-4.771	0.000
s	0.320	6.505	0.000	0.884	13.339	0.000	0.866	12.624	0.000
h	0.189	3.120	0.002	0.288	3.530	0.001	0.036	0.432	0.666
r	0.018	0.481	0.631	0.001	0.025	0.980	0.168	3.163	0.002
c	0.617	12.502	0.000	-0.099	-1.483	0.140	0.031	0.449	0.654
Residual standard error	0.031			0.042			0.044		
adj. R^2	0.809			0.759			0.624		
F Value	167.555			124.649			66.051		
P Value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.001	0.578	0.564	0.011	4.600	0.000	-0.004	-1.286	0.200
b	0.263	4.511	0.000	0.962	16.566	0.000	0.474	5.899	0.000
s	-0.320	-6.505	0.000	-0.110	-2.241	0.026	0.596	8.771	0.000
h	-0.189	-3.120	0.002	0.276	4.570	0.000	-0.118	-1.409	0.160
r	-0.018	-0.481	0.631	0.021	0.551	0.583	0.171	3.248	0.001
c	1.383	28.008	0.000	-0.031	-0.641	0.522	-0.226	-3.319	0.001
Residual standard error	0.031			0.031			0.043		
adj. R^2	0.876			0.839			0.646		
F Value	277.719			204.582			72.522		
P Value	0.000			0.000			0.000		

Table 7.26: Regression Statistics of 6 Value Portfolios -Construction and Materials, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.002	0.606	0.545	0.000	-0.111	0.912	-0.006	-2.854	0.005
b	-0.160	-2.373	0.019	-0.411	-5.903	0.000	-0.513	-9.221	0.000
s	1.095	14.993	0.000	0.986	13.068	0.000	0.314	5.211	0.000
h	-0.216	-3.049	0.003	-0.163	-2.233	0.027	1.060	18.125	0.000
r	0.159	3.320	0.001	0.167	3.370	0.001	0.134	3.374	0.001
c	0.030	0.349	0.727	0.288	3.283	0.001	-0.045	-0.635	0.526
Residual standard error	0.038			0.039			0.031		
adj. R^2	0.679			0.647			0.802		
F Value	92.470			80.228			175.726		
P Value	0.000			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.010	4.688	0.000	0.006	3.253	0.001	0.006	2.854	0.005
b	0.816	14.964	0.000	0.838	17.114	0.000	0.513	9.221	0.000
s	0.195	3.308	0.001	0.002	0.028	0.977	-0.314	-5.211	0.000
h	-0.268	-4.672	0.000	-0.003	-0.052	0.959	0.940	16.059	0.000
r	0.030	0.769	0.443	0.006	0.173	0.862	-0.134	-3.374	0.001
c	0.082	1.193	0.234	0.159	2.569	0.011	0.045	0.635	0.526
Residual standard error	0.030			0.027			0.031		
adj. R^2	0.747			0.821			0.849		
F Value	128.222			199.354			243.337		
P Value	0.000			0.000			0.000		

Table 7.27: Regression Statistics of 6 Operating Income Portfolios - Construction and Materials, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.001	-0.362	0.718	-0.002	-0.534	0.594	-0.001	-0.513	0.608
b	-0.233	-2.894	0.004	-0.347	-4.766	0.000	-0.189	-3.359	0.001
s	0.900	10.315	0.000	0.633	8.017	0.000	0.952	15.624	0.000
h	-0.304	-3.594	0.000	0.067	0.876	0.382	0.060	1.010	0.313
r	-0.874	-15.261	0.000	0.147	2.836	0.005	0.491	12.268	0.000
c	0.213	2.095	0.037	0.250	2.716	0.007	-0.063	-0.896	0.371
Residual standard error	0.045			0.041			0.031		
adj. R^2	0.717			0.508			0.761		
F Value	110.413			45.585			138.372		
P Value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.007	2.083	0.038	0.004	2.056	0.041	0.007	2.459	0.015
b	0.834	10.728	0.000	0.920	17.554	0.000	0.790	12.017	0.000
s	-0.075	-0.892	0.373	0.035	0.608	0.544	-0.127	-1.788	0.075
h	0.106	1.301	0.195	0.163	2.961	0.003	-0.258	-3.728	0.000
r	-0.434	-7.853	0.000	-0.040	-1.086	0.279	0.201	4.295	0.000
c	0.225	2.293	0.023	-0.052	-0.790	0.431	0.501	6.044	0.000
Residual standard error	0.043			0.029			0.037		
adj. R^2	0.696			0.825			0.709		
F Value	100.053			205.097			106.291		
P Value	0.000			0.000			0.000		

Table 7.28: Regression Statistics of 6 Investment Portfolios -Construction and Materials, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.007	-3.845	0.000	-0.003	-0.884	0.378	0.003	0.915	0.361
b	-0.605	-12.629	0.000	-0.155	-2.048	0.042	-0.219	-2.562	0.011
s	0.466	8.970	0.000	0.775	9.426	0.000	1.142	12.315	0.000
h	0.015	0.298	0.766	0.371	4.655	0.000	-0.105	-1.165	0.245
r	0.055	1.615	0.108	0.233	4.314	0.000	0.030	0.485	0.629
c	1.027	17.003	0.000	-0.344	-3.598	0.000	-0.220	-2.042	0.042
Residual standard error	0.027			0.042			0.048		
adj. R^2	0.846			0.545			0.525		
F Value	238.857			52.712			48.829		
P Value	0.000			0.000			0.000		
	Big Conservative			**Big Neutral, Investment**			**Big Aggressive**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.007	3.845	0.000	0.005	2.967	0.003	0.004	0.767	0.444
b	0.605	12.629	0.000	0.902	21.476	0.000	0.431	3.625	0.000
s	-0.466	-8.970	0.000	0.071	1.564	0.119	0.601	4.659	0.000
h	-0.015	-0.298	0.766	-0.045	-1.015	0.311	-0.073	-0.580	0.563
r	-0.055	-1.615	0.108	0.032	1.071	0.285	-0.122	-1.441	0.151
c	0.973	16.103	0.000	0.015	0.292	0.771	-0.045	-0.301	0.764
Residual standard error	0.027			0.023			0.066		
adj. R^2	0.852			0.859			0.400		
F Value	250.047			264.423			29.837		
P Value	0.000			0.000			0.000		

Table 7.29: Regression Statistics of 6 Value Portfolios -Health Care Equipment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.020	3.153	0.002	-0.015	-3.999	0.000	-0.004	-1.715	0.088
b	-0.388	-2.297	0.023	-0.212	-2.035	0.043	-0.282	-4.214	0.000
s	1.417	9.197	0.000	0.825	8.676	0.000	0.297	4.869	0.000
h	-0.371	-2.378	0.018	-0.216	-2.241	0.026	1.045	16.926	0.000
r	-0.043	-0.574	0.567	0.174	3.769	0.000	0.065	2.216	0.028
c	-0.153	-1.165	0.245	0.458	5.659	0.000	-0.099	-1.900	0.059
Residual standard error	0.075			0.046			0.030		
adj. R^2	0.492			0.612			0.762		
F Value	36.852			59.449			119.398		
p value	0.000			0.000			0.000		

	Big Low			Big Neutral, Book to Market Value			Big High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.015	4.701	0.000	0.003	1.515	0.132	0.004	1.715	0.088
b	0.887	10.197	0.000	0.911	18.154	0.000	0.282	4.214	0.000
s	0.115	1.455	0.147	0.044	0.964	0.336	-0.297	-4.869	0.000
h	-0.123	-1.535	0.127	-0.026	-0.562	0.575	0.955	15.471	0.000
r	-0.010	-0.262	0.794	0.034	1.527	0.129	-0.065	-2.216	0.028
c	0.000	0.000	1.000	0.026	0.674	0.501	0.099	1.900	0.059
Residual standard error	0.039			0.022			0.030		
adj. R^2	0.606			0.833			0.714		
F Value	57.821			185.762			93.379		
p value	0.000			0.000			0.000		

Table 7.30: Regression Statistics of 6 Operating Income Portfolios - Health Care Equipment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.006	-0.794	0.428	0.000	-0.125	0.901	0.000	-0.110	0.912
b	-0.309	-1.584	0.115	-0.295	-3.039	0.003	-0.266	-3.017	0.003
s	1.127	6.326	0.000	0.798	9.020	0.000	0.630	7.835	0.000
h	-0.141	-0.783	0.435	0.111	1.236	0.218	0.285	3.495	0.001
r	-0.577	-6.693	0.000	0.184	4.300	0.000	0.312	8.023	0.000
c	0.044	0.293	0.770	0.063	0.840	0.402	0.070	1.030	0.304
Residual standard error	0.087			0.043			0.039		
adj. R^2	0.605			0.523			0.538		
F Value	57.750			41.525			44.168		
p value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.012	1.473	0.142	0.003	0.895	0.372	0.006	3.611	0.000
b	0.943	4.328	0.000	0.400	4.745	0.000	0.900	18.508	0.000
s	-0.425	-2.137	0.034	0.203	2.636	0.009	0.073	1.637	0.103
h	0.391	1.944	0.053	0.055	0.706	0.481	-0.035	-0.774	0.440
r	-1.053	-10.946	0.000	0.097	2.596	0.010	0.058	2.693	0.008
c	0.050	0.295	0.768	0.107	1.642	0.102	0.024	0.632	0.528
Residual standard error	0.097			0.038			0.022		
adj. R^2	0.515			0.497			0.845		
F Value	40.274			37.560			202.287		
p value	0.000			0.000			0.000		

Table 7.31: Regression Statistics of 6 Investment Portfolios -Health Care Equipment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.008	-2.364	0.019	-0.001	-0.390	0.697	-0.009	-1.780	0.077
b	-0.610	-6.367	0.000	-0.127	-1.236	0.218	-0.391	-2.916	0.004
s	0.716	8.186	0.000	0.694	7.393	0.000	1.279	10.470	0.000
h	-0.147	-1.660	0.099	0.319	3.352	0.001	-0.099	-0.800	0.425
r	0.170	4.026	0.000	0.099	2.182	0.030	0.261	4.420	0.000
c	0.954	12.837	0.000	-0.161	-2.020	0.045	-0.145	-1.391	0.166
Residual standard error	0.043			0.046			0.060		
adj. R^2	0.725			0.490			0.489		
F Value	98.470			36.558			36.372		
p value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.008	2.364	0.019	0.007	3.252	0.001	0.005	1.447	0.150
b	0.610	6.367	0.000	0.883	15.379	0.000	0.649	7.219	0.000
s	-0.716	-8.186	0.000	0.073	1.388	0.167	0.265	3.235	0.001
h	0.147	1.660	0.099	-0.016	-0.300	0.764	0.002	0.019	0.985
r	-0.170	-4.026	0.000	0.033	1.300	0.195	0.075	1.895	0.060
c	1.046	14.065	0.000	-0.085	-1.907	0.058	0.036	0.523	0.602
Residual standard error	0.043			0.026			0.040		
adj. R^2	0.699			0.762			0.593		
F Value	86.776			119.555			54.853		
p value	0.000			0.000			0.000		

Table 7.32: Regression Statistics of 6 Value Portfolios -Real Estate Investment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.002	0.551	0.582	0.001	0.228	0.820	-0.005	-1.998	0.047
b	-0.214	-2.640	0.009	-0.227	-3.189	0.002	-0.655	-13.485	0.000
s	0.694	6.198	0.000	0.970	9.846	0.000	0.448	6.678	0.000
h	-0.172	-1.598	0.112	-0.272	-2.877	0.005	1.099	17.071	0.000
r	0.080	1.440	0.152	0.067	1.370	0.172	-0.054	-1.606	0.110
c	0.135	1.787	0.076	0.306	4.616	0.000	0.001	0.013	0.990
Residual standard error	0.045			0.039			0.027		
adj. R^2	0.282			0.587			0.858		
F Value	14.850			50.929			212.859		
p value	0.004			0.000			0.000		

	Big Low			Big Neutral, Book to Market Value			Big High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.010	2.943	0.004	0.007	3.562	0.000	0.005	1.998	0.047
b	1.065	14.858	0.000	0.876	20.712	0.000	0.655	13.485	0.000
s	0.224	2.269	0.025	0.032	0.551	0.582	-0.448	-6.678	0.000
h	-0.249	-2.620	0.010	-0.024	-0.436	0.663	0.901	13.990	0.000
r	0.117	2.364	0.019	0.059	2.020	0.045	0.054	1.606	0.110
c	0.055	0.831	0.407	-0.019	-0.491	0.624	-0.001	-0.013	0.990
Residual standard error	0.040			0.023			0.027		
adj. R^2	0.760			0.858			0.870		
F Value	112.742			212.851			235.944		
p value	0.000			0.000			0.000		

Table 7.33: Regression Statistics of 6 Operating Income Portfolios - Real Estate Investment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.000	-0.056	0.956	-0.002	-0.702	0.483	-0.004	-1.352	0.178
b	-0.507	-5.097	0.000	-0.364	-6.146	0.000	-0.452	-7.417	0.000
s	0.964	7.023	0.000	0.662	8.101	0.000	1.146	13.614	0.000
h	0.221	1.675	0.096	0.198	2.526	0.012	0.095	1.173	0.243
r	-0.460	-6.713	0.000	0.123	3.016	0.003	0.618	14.720	0.000
c	0.192	2.082	0.039	0.244	4.431	0.000	-0.133	-2.346	0.020
Residual standard error	0.055			0.033			0.034		
adj. R^2	0.689			0.610			0.660		
F Value	79.074			56.082			69.186		
p value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.004	0.825	0.411	0.004	1.929	0.055	0.008	3.816	0.000
b	0.970	9.009	0.000	0.842	18.492	0.000	0.915	21.090	0.000
s	0.202	1.358	0.176	0.080	1.265	0.208	0.020	0.331	0.741
h	-0.044	-0.306	0.760	-0.003	-0.043	0.966	0.082	1.431	0.154
r	-0.791	-10.659	0.000	0.066	2.094	0.038	0.132	4.402	0.000
c	-0.305	-3.051	0.003	-0.015	-0.361	0.718	0.020	0.495	0.622
Residual standard error	0.059			0.025			0.024		
adj. R^2	0.692			0.841			0.881		
F Value	79.966			187.536			261.432		
p value	0.000			0.000			0.000		

Table 7.34: Regression Statistics of 6 Investment Portfolios -Real Estate Investment and Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.004	-1.553	0.122	-0.002	-0.820	0.413	-0.006	-1.661	0.099
b	-0.524	-8.520	0.000	-0.282	-5.446	0.000	-0.129	-1.658	0.099
s	0.771	9.071	0.000	0.527	7.383	0.000	0.793	7.381	0.000
h	-0.246	-3.017	0.003	0.309	4.512	0.000	0.147	1.427	0.155
r	0.037	0.877	0.381	0.181	5.080	0.000	0.037	0.697	0.487
c	0.918	16.054	0.000	0.017	0.346	0.729	-0.117	-1.616	0.108
Residual standard error	0.034			0.029			0.043		
adj. R^2	0.763			0.553			0.512		
F Value	114.339			44.586			37.919		
p value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.004	1.553	0.122	0.006	3.551	0.000	0.006	1.878	0.062
b	0.524	8.520	0.000	0.950	25.176	0.000	0.746	11.782	0.000
s	-0.771	-9.071	0.000	0.040	0.766	0.445	0.250	2.858	0.005
h	0.246	3.017	0.003	-0.014	-0.282	0.778	0.183	2.183	0.030
r	-0.037	-0.877	0.381	0.079	3.050	0.003	-0.013	-0.296	0.768
c	1.082	18.904	0.000	-0.034	-0.970	0.334	-0.143	-2.437	0.016
Residual standard error	0.034			0.021			0.035		
adj. R^2	0.815			0.900			0.771		
F Value	156.147			317.404			119.759		
p value	0.000			0.000			0.000		

Table 7.35: Regression Statistics of 6 Value Portfolios -Software and Computer Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.010	2.740	0.007	-0.006	-2.576	0.011	-0.009	-4.007	0.000
b	-0.310	-3.129	0.002	-0.167	-2.921	0.004	-0.399	-7.078	0.000
s	1.116	12.967	0.000	0.686	13.815	0.000	0.415	8.474	0.000
h	-0.246	-2.470	0.014	0.070	1.213	0.227	0.771	13.610	0.000
r	-0.185	-4.077	0.000	0.123	4.689	0.000	0.089	3.431	0.001
c	0.024	0.252	0.802	0.162	2.894	0.004	0.186	3.355	0.001
Residual standard error	0.049			0.028			0.028		
adj. R^2	0.579			0.716			0.798		
F Value	60.738			110.616			172.857		
p value	0.000			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.010	4.301	0.000	0.009	3.309	0.001	0.009	4.007	0.000
b	0.588	9.622	0.000	1.246	17.318	0.000	0.399	7.078	0.000
s	0.072	1.362	0.175	-0.021	-0.333	0.739	-0.415	-8.474	0.000
h	-0.011	-0.172	0.863	-0.098	-1.361	0.175	1.229	21.694	0.000
r	0.043	1.517	0.131	0.015	0.439	0.661	-0.089	-3.431	0.001
c	0.045	0.744	0.458	-0.020	-0.289	0.772	-0.186	-3.355	0.001
Residual standard error	0.030			0.035			0.028		
adj. R^2	0.536			0.712			0.812		
F Value	51.185			108.126			188.471		
p value	0.000			0.000			0.000		

Table 7.36: Regression Statistics of 6 Operating Income Portfolios - Software and Computer Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.004	-0.910	0.364	-0.005	-2.117	0.035	-0.003	-0.928	0.354
b	-0.331	-3.321	0.001	-0.333	-5.182	0.000	-0.537	-5.820	0.000
s	1.101	12.688	0.000	0.777	13.906	0.000	1.243	15.516	0.000
h	-0.127	-1.269	0.206	0.108	1.671	0.096	0.095	1.027	0.306
r	-0.574	-12.521	0.000	0.153	5.174	0.000	0.822	19.426	0.000
c	-0.001	-0.014	0.989	0.123	1.956	0.052	-0.045	-0.497	0.619
Residual standard error	0.049			0.032			0.045		
adj. R^2	0.702			0.675			0.751		
F Value	103.071			91.117			131.602		
p value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.012	2.684	0.008	0.004	1.141	0.255	0.012	5.408	0.000
b	0.701	5.832	0.000	0.553	6.947	0.000	0.906	15.441	0.000
s	0.031	0.296	0.768	0.258	3.732	0.000	-0.112	-2.195	0.029
h	0.175	1.453	0.148	0.216	2.695	0.008	-0.047	-0.797	0.426
r	-0.555	-10.070	0.000	-0.025	-0.680	0.497	0.049	1.805	0.073
c	0.105	0.888	0.375	-0.212	-2.711	0.007	0.148	2.576	0.011
Residual standard error	0.059			0.039			0.029		
adj. R^2	0.548			0.526			0.682		
F Value	53.540			49.085			93.930		
p value	0.000			0.000			0.000		

Table7.37: Regression Statistics of 6 Investment Portfolios -Software and Computer Services, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.006	-2.470	0.014	-0.003	-1.125	0.262	0.000	-0.029	0.977
b	-0.492	-7.517	0.000	-0.118	-1.657	0.099	-0.279	-3.538	0.000
s	0.390	6.848	0.000	0.781	12.648	0.000	0.986	14.375	0.000
h	-0.034	-0.513	0.608	0.130	1.817	0.071	0.151	1.902	0.058
r	-0.004	-0.133	0.895	0.069	2.117	0.035	0.016	0.433	0.666
c	1.031	16.056	0.000	-0.104	-1.493	0.137	-0.240	-3.105	0.002
Residual standard error	0.032			0.035			0.039		
adj. R^2	0.755			0.624			0.628		
F Value	135.065			73.071			74.363		
p value	0.000			0.000			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.006	2.470	0.014	0.010	4.396	0.000	0.007	2.075	0.039
b	0.492	7.517	0.000	0.879	14.290	0.000	0.795	9.258	0.000
s	-0.390	-6.848	0.000	-0.012	-0.225	0.822	0.259	3.475	0.001
h	0.034	0.513	0.608	-0.013	-0.211	0.833	0.029	0.337	0.736
r	0.004	0.133	0.895	0.006	0.202	0.840	-0.027	-0.695	0.488
c	0.969	15.094	0.000	-0.040	-0.660	0.510	-0.081	-0.961	0.338
Residual standard error	0.032			0.030			0.042		
adj. R^2	0.722			0.640			0.576		
F Value	113.963			78.068			60.030		
p value	0.000			0.000			0.000		

Table 7.38: Regression Statistics of 6 Value Portfolios -Technology Hardware and Equipment, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Low			Small Neutral, Book to Market Value			Small High		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.010	1.870	0.063	-0.001	-0.295	0.768	-0.011	-2.854	0.005
b	-0.146	-1.985	0.049	-0.094	-2.225	0.027	-0.220	-4.139	0.000
s	0.687	6.912	0.000	0.618	10.867	0.000	0.504	7.008	0.000
h	-0.100	-1.182	0.238	0.041	0.847	0.398	0.685	11.178	0.000
r	-0.092	-1.221	0.224	0.117	2.704	0.007	0.081	1.488	0.138
c	0.095	1.039	0.300	0.085	1.620	0.107	-0.066	-0.994	0.321
Residual standard error	0.073			0.042			0.053		
adj. R^2	0.346			0.580			0.671		
F Value	22.265			56.627			82.972		
p value	0.059			0.000			0.000		
	Big Low			**Big Neutral, Book to Market Value**			**Big High**		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.018	4.685	0.000	-0.002	-0.370	0.711	0.011	2.854	0.005
b	0.459	8.797	0.000	0.413	6.005	0.000	0.220	4.139	0.000
s	0.257	3.651	0.000	0.483	5.197	0.000	-0.504	-7.008	0.000
h	-0.076	-1.270	0.205	0.153	1.938	0.054	1.315	21.453	0.000
r	-0.004	-0.076	0.940	0.139	1.966	0.051	-0.081	-1.488	0.138
c	0.052	0.808	0.420	0.169	1.982	0.049	0.066	0.994	0.321
Residual standard error	0.052			0.068			0.053		
adj. R^2	0.491			0.571			0.777		
F Value	39.775			54.526			141.158		
p value	0.000			0.000			0.000		

Table 7.39: Regression Statistics of 6 Operating Income Portfolios - Technology Hardware and Equipment, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient.

	Small Weak			Small Neutral, Operating Profit			Small Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.009	-1.946	0.053	0.004	1.418	0.158	0.000	-0.017	0.987
b	-0.005	-0.081	0.935	-0.202	-5.065	0.000	-0.127	-2.725	0.007
s	0.655	7.566	0.000	0.511	9.490	0.000	0.795	12.626	0.000
h	-0.017	-0.228	0.820	0.229	4.980	0.000	0.132	2.456	0.015
r	-0.549	-8.352	0.000	0.190	4.644	0.000	0.422	8.827	0.000
c	0.113	1.424	0.156	0.024	0.487	0.627	0.079	1.367	0.173
Residual standard error	0.063			0.039			0.046		
adj. R^2	0.646			0.569			0.661		
F Value	74.468			54.060			79.276		
p value	0.000			0.000			0.000		

	Big Weak			Big Neutral, Operating Profit			Big Robust		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.016	2.920	0.004	0.006	1.288	0.199	0.007	2.983	0.003
b	0.769	10.384	0.000	0.304	4.654	0.000	0.891	28.840	0.000
s	0.188	1.882	0.061	0.358	4.070	0.000	0.048	1.151	0.251
h	0.067	0.792	0.429	0.216	2.874	0.004	-0.081	-2.283	0.024
r	-0.907	-11.942	0.000	0.106	1.587	0.114	0.121	3.833	0.000
c	0.064	0.701	0.484	0.243	2.998	0.003	0.099	2.573	0.011
Residual standard error	0.073			0.064			0.030		
adj. R^2	0.691			0.550			0.877		
F Value	91.096			50.061			288.740		
p value	0.000			0.000			0.000		

Table 7.40: Regression Statistics of 6 Investment Portfolios -Technology Hardware and Equipment, in time 2003 - 2023. α is the intercept term and b, s, h, r and c are the coefficients for each factor. VIF stands for Variance Inflation Factor. coef. stands for coefficient. coef. stands for coefficient.

	Small Conservative			Small Neutral, Investment			Small Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	-0.015	-4.062	0.000	0.011	3.654	0.000	-0.009	-1.791	0.075
b	-0.304	-6.367	0.000	-0.186	-4.409	0.000	-0.024	-0.381	0.704
s	0.571	8.856	0.000	0.574	10.106	0.000	0.761	8.786	0.000
h	-0.286	-5.195	0.000	0.275	5.684	0.000	0.099	1.343	0.181
r	0.145	2.956	0.003	0.069	1.589	0.114	0.133	2.023	0.044
c	0.929	15.667	0.000	-0.124	-2.372	0.019	-0.151	-1.902	0.059
Residual standard error	0.047			0.042			0.063		
adj. R^2	0.764			0.579			0.418		
F Value	130.972			56.204			29.910		
p value	0.000			0.003			0.000		

	Big Conservative			Big Neutral, Investment			Big Aggressive		
		t value	coef. p value		t value	coef. p value		t value	coef. p value
α	0.015	4.062	0.000	-0.001	-0.365	0.715	0.014	3.287	0.001
b	0.304	6.367	0.000	0.495	10.366	0.000	0.285	4.998	0.000
s	-0.571	-8.856	0.000	0.389	6.038	0.000	0.623	8.086	0.000
h	0.286	5.195	0.000	-0.120	-2.180	0.030	0.221	3.359	0.001
r	-0.145	-2.956	0.003	0.093	1.905	0.058	-0.048	-0.823	0.411
c	1.071	18.044	0.000	0.059	0.992	0.323	-0.337	-4.762	0.000
Residual standard error	0.047			0.047			0.056		
adj. R^2	0.805			0.618			0.540		
F Value	166.542			65.987			48.262		
p value	0.000			0.000			0.000		