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The relationship of equity risk factors and the business cycle

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The relationship of equity risk factors and the business cycle

έχει συγγραφεί από εμένα αποκλειστικά και στο σύνολό της. Δεν έχει υποβληθεί ούτε έχει εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού προγράμματος ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό, ούτε είναι εργασία ή τμήμα εργασίας ακαδημαϊκού ή επαγγελματικού χαρακτήρα.

Δηλώνω επίσης υπεύθυνα ότι οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης εργασίας, αναφέρονται στο σύνολό τους, κάνοντας πλήρη αναφορά στους συγγραφείς, τον εκδοτικό οίκο ή το περιοδικό, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο. Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου».

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Abstract

The scope of the present study is to examine the validity of the five factor model of Fama and French for the case of the United States of America for the period 1966 - 2017. As Gross Domestic Product (GDP) growth presents many fluctuations through the years, which were split to sub-periods based on significant economic milestones like oil crisis, financial crisis and currency change in Europe, in accordance with the business cycle too.

The regressions that were conducted were not only based on the five factor model of Fama and French, but also on their three factor model. One and two factor regressions have been also reviewed.

The risk factors of the five factor model of Fama and French are related to the value (HML), size (SMB), profitability (RMW) and investment (CMA). The fifth factor is the market risk premium.

The results are, as expected, affected by changes in the general economic environment. There are a couple of common observations for all years. However, the rest of the factors present extreme pattern when significant changes in the economic environment are observed.

All above mentioned fluctuations and outcomes can be explained by the business cycle. The business cycle describes the rise and fall in production output of goods and services in an economy. Business cycles are generally measured using the rise and fall in the real gross domestic product (GDP).

The conclusion is that the changes of the general economic environment significantly affect the ability of the model to predict sufficiently GDP growth. However, there are common patterns related to this. In addition, based on the regressions, the five factor model of Fama and French gives a more representative overview of the risk factors that may be used to predict GDP, than the rest of the models.

Title: The relationship of equity risk factors and the business cycle

Key words: Fama French factors; GDP growth; Business Cycle

Credits / Thanks

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Contents

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Acronyms and Abbreviations

GDP	Gross Domestic Product
HML	High minus Low
SMB	Small minus Big
CMA	Conservative minus Aggressive
RMW	Robust minus Weak
CAPM	Capital Asset Pricing Model
FF	Fama and French
USA	United States of America
NBER	National Bureau of Economic Research

1. Introduction

Based on literature and past empirical findings there are variables that could predict macroeconomic growth. The scope of this diploma thesis is limited to the United States macroeconomic growth. Gross Domestic Product (GDP) is the most important macroeconomic growth variable and is the monetary measure of market value. GDP is often measured quarterly and can be split per industry, sector or country.

There is evidence that there is a relationship between equity returns and future economic activities. The methodology used was the five factor model proposed by Fama and French, based on which, macroeconomic growth is related to equity risk factors which are characterized based on their size, value, profitability and investment. In parallel, additional regressions with less than five equity risk factors have been performed for comparison reasons. The variables that were reviewed were the market risk factor, the return to a portfolio that is long in high-book-to-market stocks and short in low-book-to-market stocks (the so-called value effect or HML), the return to a portfolio that is long on small stocks and short on big stocks (the so-called size effect or SMB), the difference between the returns on diversified portfolios of stocks with robust and weak profitability (the so-called profitability effect or RMW), and the difference between the returns on diversified portfolios of the stocks of low and high investment firms (the so-called investment effect or CMA). Following equation shows the five factor model proposed by Fama and French which includes the above mentioned variables and their relationship with the macroeconomic growth (GDP).

$$GDP = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB + h_i HML + r_i RMW + c_i CMA + e_i$$

The a, b, s, h, r and c are the coefficients that have been calculated using simple and multiple factors regressions.

To be more specific, the initial form of this equation proposed by Fama and French, was with three factors. RMW and CMA were missing. In the beginning the first three factors were enough to predict macroeconomic growth, but in the meantime, it seems that profitability and investment factors are significant too, to improve the results during GDP prediction. Before the three factor model of Fama and French, the Capital Asset Pricing Model (CAPM) was the one used. Over time, it was proved to be inefficient as

this model suggests that beta alone can describe the cross-section of expected stock returns. This model in fact predicts the relationship between risk and expected return during a risky project.

The available data that will be used to build the equation lie between 1966 and 2017 and they are captured quarterly. All these variables are highly depended from the general economic situation of each country. For this reason, the period of 50 years has been split in sub-periods according to significant economic milestones, in order to gain a more representative perspective on the relationship of macroeconomic growth with equity returns.

The purpose of this study is not only to confirm the applicability of five factor model, but also to find similarities on variables' trends during different time periods. To be more specific, the scope is to review the extent to which the risk factors SMB, HML, CMA and RMW can, next to market factor, be related to future macroeconomic growth in terms of gross domestic product (GDP) in the United States of America.

The point that is also interesting here is that the behavior of the above mentioned equity risk factors is strongly related to the business cycle (which is an indication of GDP trend too). Depending on the stage of the cycle (the expansion, the peak, the recession, the depression, the trough or the recovery) they present a different behavior which, as a result, affects their contribution on the prediction of the future macroeconomic growth.

The structure of the present diploma thesis is as follows. Caption 2 presents a review of related literature. Caption 3 describes the research methods used for the scope of this study. Caption 4 describes the findings and results of the present study. In caption 5 there is a summary of the conclusions of the study and suggestions for future research.

2. Literature Review

The relationship between growth and future gross domestic product and inclusive domestic product has been widely reviewed and studied. At the same time, the performance of small stocks minus big stocks (SMB) and high book-to-market stocks minus low book-to-market stocks (HML). The results show that Capital Asset Pricing Model (CAPM) is inefficient as the model suggests that beta alone is sufficient to describe the cross-section of expected stock returns. This model mainly predicts the relationship between risk and expected return during a risky project. Further research shows that average returns are related to more factors like size, earnings/price ratio, cash flow to price, book-to-market equity, past sales growth, long term past returns and short term past returns. So Fama and French during 1992 suggested the three factor model (market excess return, SMB, HML) which results that small and high book-to-market equity firms have big returns.

Regarding CAPM, it is up to now, the most widely used model in asset pricing. However, this model cannot explain cross-sectional variation of asset returns. On the other hand, CAPM is based mainly on assumptions. This is the basic reason why there is significant research on creation of more advanced pricing models. After that, the so called three factor model of Fama and French has been created to overcome these difficulties and explain a significant percentage of cross-sectional variations. This model has been built to predict macroeconomic growth based on already sorted by book-to-market and size, average return portfolios. [3]

In general, book-to-market ratio, like other accounting ratios are in line with economic growth expectations. This specific ratio represents scales prices with respect to the future. To build up on this, macroeconomic growth in terms of GDP is strongly related to equity returns, which are mainly affected by factor returns and economic activity. This relationship is shown in the below simplified graph. [3]

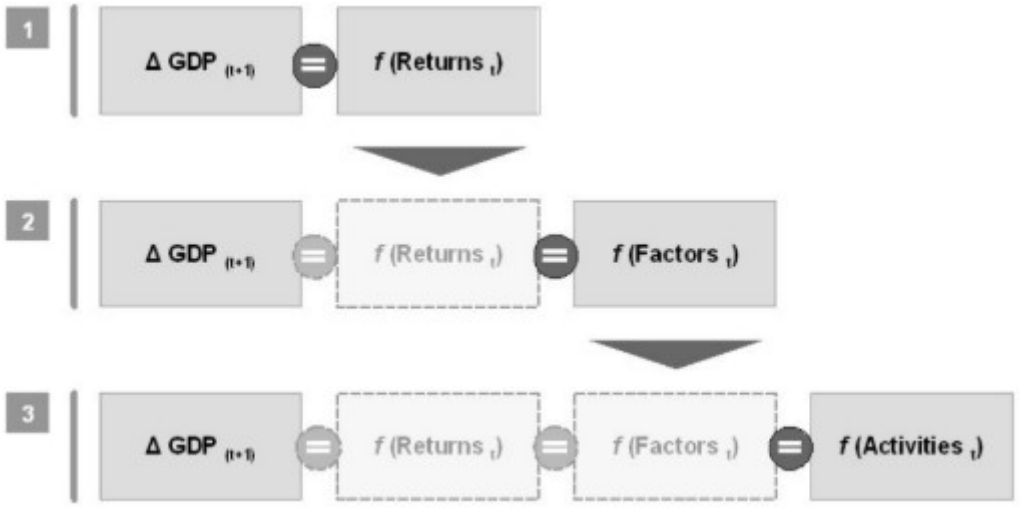


Figure 1: “Relationship of GDP to equity returns”

The book-to-market equity is the cumulative book value of net contributions by shareholders plus retained earnings minus the book value of preference shares divided by the total market value of the common stock. [1]

Following this relationship, Liew and Vassalou did the practical application of this relationship to various countries. Their outcome was that HML and SMB can help to forecast future rates of economic growth. However, this specific study was mainly conducted for European countries, so the results may be biased towards this. [3]

Past studies have also shown that when the research is based on industries it is difficult to be conducted and the formation of portfolios is really valuable as there are industries which are sensitive to changes in the business cycle and other that are not. The main driver for this is the nature of the industry, for example if it is an oil or telecommunications industry is different than being a retail industry. The latter is more sensitive to fluctuations of economic activities. [3]

After that, profitability (RMW) and investment (CMA) factors were added to the three factor model of Fama and French, to foresee several average-return anomalies. Positive exposures to RMW and CMA have profitable firms that invest conservatively, and based on the five factor model they have high average returns, low market β, share repurchases and low stock volatility. On the contrary, unprofitable firms that invest aggressively, has low average returns, high β, large share issues and highly volatile returns.[2]

Accruals, net share issues, momentum, and volatility are some examples related to the anomalies that are attributed to the three factor model of Fama and French. There is also long-standing evidence that the relation between average return and market β is flatter than predicted by the CAPM. The goal of the study is to examine whether the five factor model and models that use subsets of its factors capture average returns from sorts on these variables and whether portfolios that signal model problems have exposures to the size, profitability, and investment factors typical of stocks that cause problems for the five factor model in many sorts in FF (2015). [2]

The bottom line from our tests is that the list of anomalies shrinks when we use the five-factor model, in part because anomaly returns become less anomalous and in part because the returns for different anomalies have similar five-factor exposures (regression slopes) that suggest they are related phenomena. With two exceptions, accruals and momentum, the five-factor model shrinks anomaly average returns left unexplained by the FF three-factor model. Moreover, the successes and failures of the model are linked to patterns in the slopes for RMWt and CMAt that are common to the sorts on β, net share issues, and volatility. The high average returns associated with low β, share repurchases, and low volatility that are left unexplained by the three-factor model are absorbed by positive five-factor exposures to RMWt and CMAt, typical of profitable firms that invest conservatively. At the other extreme, the low average returns associated with high β, large share issues, and high return volatility that are left unexplained by the three-factor model are substantially captured by negative five-factor exposures to RMWt and CMAt, typical of less profitable firms that invest aggressively. [2]

In the sorts on net share issues and volatility, the portfolios that cause the most serious problems for the five-factor model are in the smaller Size quintiles and the highest quintiles of share issues and volatility. These portfolios have negative exposures to RMWt and CMAt that lower estimates of their expected returns, but not enough to explain their low average returns. Most interesting, the common patterns in the five-factor slopes for these portfolios suggest they share the lethal traits - small stocks whose returns behave like those of relatively unprofitable firms that invest aggressively - that plague the five-factor model in FF (2015). [2]

Accruals pose special problems. For other anomalies, the five-factor model improves the description of average returns of the FF three-factor model. For accruals the five-

factor model does worse. The problem is that in the sorts on accruals, portfolios in the smallest Size quintile (microcaps) have negative RMWt slopes but they do not have the predicted low average returns. Hou, Xue, and Zhang (2015) also find that sorts on accruals produce average returns that escape explanation by a model similar to ours. [2]

For the anomalies discussed above, adding a momentum factor to the five-factor model has little effect on performance, simply because the sorts do not produce portfolios with large momentum tilts. For portfolios formed on momentum, however, the five-factor model does poorly, with regression intercepts about as disperse as average returns on the portfolios. Adding a momentum factor improves model performance, but leaves nontrivial unexplained momentum returns among small stocks. [2]

Industry portfolios cannot be priced using either the conventional CAPM or Fama and French three factor model while some industries are more sensitive to business cycle movements than others. This is related to the demand of each product. When it is permanent, like the cases of telecommunications, oil or gas, industries are immune to business cycle movements. On the contrary, industries with durable consumer goods for example are more sensitive to fluctuations. In this paper they used multi-factor regressions to include various risk factors. [3]

It has been calculated that when at a specific time the stock of two firms have the same expected dividends but different prices, the stock with a lower price has a higher expected return. [4]

Empirical results show that there is considerable evidence of movements in stock prices leading the business cycle both in terms of pre-dating peaks and troughs. It is widely known that policy decisions are not the only factor that can affect aggregate output. Stock prices are systematically affected by any factor that bears on the expected future profitability of firms and may therefore have advantages over interest rate based predictive variables that respond primarily to fiscal and monetary policies. But the relationship between stock market and output was assumed to be non-linear. The findings show that there exist significant non-linear “bounce-back” effects where economies recover strongly following recessions and that stock returns contain information that assists in the prediction of aggregate output only when economies are in recession. [5]

Various studies have shown that although SMB and HML contain information about default risk, it is not the main reason why they are significant in explaining equity returns. On the contrary, size and book-to-market are related to default risk. Expected returns on common stocks appear to vary within the business cycle and the consumption aggregate wealth ratio proxies for investors' expectations of future returns on the market portfolio. The investors want to maintain a flat consumption path over time and will attempt to smooth their future consumption. [7]

Based on one research, three-factor and five-factor models were compared and found that they perform poorly compared to empirical asset pricing models.[8]

The dynamic linkage between stock prices and economic fundamentals throughout 20 years (1990-2009) for major European and US countries has been studied, using the rolling-sample cointegration technique and VAR specifications. This period includes pre- and post-Euro periods. Furthermore, the impact of consumer expectations on stock prices. The stock market could be characterized as a predictor of economic activity and the firm's earnings. A dividend is the discounted expected cash flow, with which the fundamental value of a firm's stock should be equal. These expected dividends should reflect real economic activity, as measured by GDP or industrial production. Nevertheless, more parameters can influence stock prices, like market interest rates or inflation. However, after the 1990s, the movements of stock prices could not be explained with the common models. It seems that the firm's stock fundamental value is simply related in line with the expected earnings and dividends or economic fundamentals.

The method took monthly data for national stock market indexes, economic activity, short term interest rates and consumer price indexes (sources OECD and FRED). All except interest rates was transformed either in natural logarithms or in rates of return (growth rates) depending on the part of the analysis. To convert a value into real magnitude, the rate of inflation should be subtracting from its return form, which is obtained by the rate of return in the consumer price index of each country. The country's industrial production index is collected monthly, but the GDP is collected quarterly. We could split the period before and after the Euro introduction no matter if the country is directly affected to assess if foreign factors are responsible for economic convergence of the Euro.

To measure economic activity, the volume of retail trade could be measured for each country (subset of “Production, Order and Sales” of the “Key Economic Indicators” category in the OECD's database and the crude oil prices for US government. In addition, indicators regarding the consumer perceptions has been collected. One is the consumers’ beliefs on the future tendency of the economic situation, the second is the tendency in consumer prices (inflation) and the third is the composite confidence indicator, which is expressed as the (weighted) balance of positive over negative results.

After placing the stock prices and industrial production on graphs for each country, they tried to find common trends for the sub-periods (before and after Euro). They used the unit-root analysis (to identify if series are stationary or not) and one cointegration approach. Afterwards, they proceed with the main empirical model with the vector autoregressive (VAR) model in the absence of cointegration, and/or the vector error-correction model (VECM) in the presence of cointegration. The results of this research showed that there is a connection between the stock prices and many economic variables like retail trade or energy prices. [9]

There are also studies where the Carhart (1997) model is reviewed, which is mainly an extension of the three factor model of Fama and French, incorporating as a fourth factor the return on a portfolio that is long in past winner stocks and short in past loser stocks (WML or winner minus loser stocks). However, based on various studies, the factor WML does not present a clear pattern for the relation of this factor and the future GDP growth. It appears that WML is either country or industry specific or that the return to this portfolio strategy has limited, if at all any, ability to explain future macroeconomic growth. One explanation for the low level of information content might be that investors tend to mistakenly project a continuation of abnormal profit levels long periods into the future. This, however, is not in accordance with real economic activity and firms’ fundamentals. Successful firms become overvalued and unsuccessful ones become undervalued and the market reacts inefficiently. The market develops a false belief that a few positive or negative events cause a run that will persist for long periods into the future. The market is wrong as past success is not able to project prolonged future success. Consequently, no clear traceable pattern between WML and future real economic activity may be detected. [3]

There are also studies describing the relationship of the business cycle and the equity risk factors. Decomposing a complete business cycle into four phases (expansion,

slowdown, recession and recovery), K. Liang and C. Yen (2014) found the different stock market behaviors in each cyclical phase: − in the expansion phase, the growth rate of the economy is high, with booming investment activities and inflation pressure. Even the stock market would be bullish with huge profit, though it usually peaks at the end of this stage, as increases in interest rates are likely to have an unfavorable effect on stock prices; in the slowdown phase, inflation remains high at the beginning of this stage and growth rate starts to deteriorate from its highest level. Profit margins of corporations shrink as economic growth slows down, making the stock market bearish; − in the recession phase, low inflation rates keep interest rates low and the bond market bullish. However, when nearing the end of this stage, the fall in interest rates helps the stock market, and if the customary early upturn in profits also occurs, investor optimism in stocks is doubly justified even though business activity is still depressed and sliding downward; − in the recovery phase, stock markets are still bullish, due to improvement of profit and low interest rates. In sum, the peaks (troughs) of the stock market usually occur at the end of expansion (end of recession phases), which all lead the turning points of the business cycle (Liang, Yen, 2014).

Trading in the financial market the main aim of investors is to reduce the investment risk and to ascertain the high returns from their investment portfolio. The decision making of rational investors is mostly based on the historical data monitoring and the accumulation of investment experience, share prices future forecasting, evaluation of investment risk and the formation of investment portfolio. Various software products and technical analysis nowadays help investors to make the investment decisions and faster trading, but the assessment of only the non-objective technical information sometimes can distort the share prices. The investor‘s decision making also can be influenced by emotions and many other psychological factors that are often contrary to human rationality. So, understanding the macroeconomic and specific factors of particular companies that influence the share prices allows to manage the investment portfolio risk more effectively and to reduce the probability of loss. The ability to analyze the stock market environment allows to understand the nature of unstable periods and to predict how the share prices will change in future periods. [13]

These findings reveal several other things. For example, periods with high risk premia are associated with periods of very low correlation between money and output, suggesting that a negative correlation between money and output shocks coincide with more risky stock market returns. At the end of recessions, and shortly after, the risk

premium tends to decline, implying more favorable economic conditions that make the stock market less risky.

Various studies have concluded that macroeconomic shocks are significantly priced in equity markets and that identified demand and supply shocks have very different effects on the equity premium. In contrast to the pioneering work of Schwert and later purely empirically-based approaches, including simple correlation analysis, our analysis was conducted within an explicit no-arbitrage framework of the relation between returns and their volatility based on several models of asset pricing involving stochastic discount factors. This enabled us to derive a formal relation between returns and the business cycle via the equity risk premium. This model is capable of encompassing a number of different asset-pricing theories, including the CAPM. An advantage of this model is that we can then relate the equity risk premium to the business cycle. We are also able to investigate the potential effects of other macroeconomic variables such as inflation and money growth. The results support the use of two priced macroeconomic factors: output and inflation. [14]

The robustness test confirms that the three-factor model captures the time-series variations in stock returns across the three sub-periods (pre-, during-, and post-crisis), six risk regimes (portfolios' risk profile), and across three different portfolio construction methodologies (baskets of stocks). However, the significance and coefficients vary over time, across risk-profile of the portfolio, and across portfolio construction methodology. The three-factor model performs better in the post-crisis period. [15]

During times of recession number of available projects is already low because of the unfavorable demand conditions. Firms are expected to be more adversely affected from credit conditions during recessions or when the recessionary periods are expected in the near future. I therefore expect sensitivity to changes in credit conditions to increase during such times.

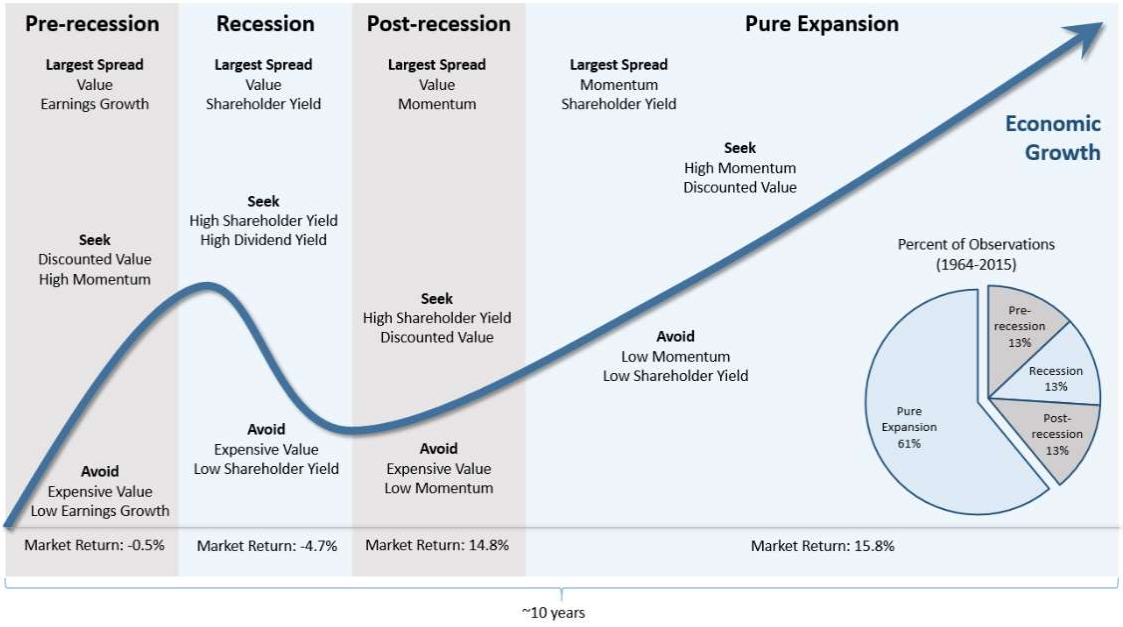


Figure 2: “Description of business cycle”

Though unpredictable, the economic cycle has significant implications for investors. Given the vast amount of evidence that certain themes consistently outperform, and underperform, throughout the cycle, an allocation to passive market cap-weighted indexes seems almost naive.

The information presented here supports an assertion that active management is, at the least, more likely to outperform during turbulent times when factor spreads are wide. Though, that investing in public equities is largely a zero-sum game, less transaction costs. For every active manager that takes advantage of wide factor spreads to their own benefit, another is investing in the wrong end of the spectrum to their clients' detriment. Whether any associated outperformance is based on luck or skill is up for debate. In either case, differentiation based on fundamental factor themes has been historically rewarded in a non-linear fashion over the economic cycle. Spread compression in certain environments (pure expansion) suggests that generating excess return may be more difficult, while spread expansion in other environments (pre-recession, recession, and post-recession) suggests greater opportunities for excess return.

Unfortunately, it just so happens that investors tend to emotionally drawdown equity allocations in the periods when high-low spreads are highest, and pile into equities when the spreads are compressing. Rather than attempt to time allocations based on economic indicators that are often outdated, volatile, and revision-prone, it seems

diversifying equity exposure to multiple key selection factors and staying invested throughout the economic cycle may be the most prudent course of action.

Realistically though, not every investor can allocate to the high decile of Value, Momentum, or Yield while avoiding low Earnings Quality, Financial Strength, and Earnings Growth. Large asset aggregators have recognized this problem in their attempts to build scalable highly-liquid products that are broadly accessible. In an era of continued fee compression, product sponsors sacrifice potential alpha for scale. The result is usually a neutered implementation of true factor-based investing that uses factor tilting instead of factor concentration. [16]

3. Methodology

The model that was used to assess the relationship of equity returns with macroeconomic growth was the five factor model of Fama and French. This model, on top of what the three factor model of Fama and French is taking into consideration, includes equity returns that are characterized based on their size, value, profitability and investment, as follows:

$$GDP = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB + h_i HML + r_i RMW + c_i CMA + e_i$$

The first factor represents the market risk premium which in fact is the difference between the expected return on a market portfolio and the risk-free rate.

The second factor is the return to a portfolio that is long in high book-to-market stocks and short in low book-to-market stocks (the so-called value effect or HML). The acronym is “High minus Low”. The book-to-market ratio compares the book value and the market value. The book value is calculated based on historical data and the market value is determined based on the share price in the stock market and the number of shares outstanding. When the book-to-market ratio is high, it is an indicator that the company is basically cheap. However, it is still a risk measure. The differentiation of these portfolios based on the book-to-market ratio is of great importance to get representative results during analysis.

The third factor is the return to a portfolio that is long on small stocks and short on big stocks (the so-called size effect or SMB). In fact, this variable shows the differences in terms of economic behavior between industries that are small or big. The acronym is “Small minus Big”.

The fourth factor is the difference between the returns on diversified portfolios of stocks with robust and weak profitability (RMW). The acronym is “Robust minus Weak” in terms of industries or countries operating profitability. In fact, this factor measures operating profit (OP) of firms minus interest expense.

The fifth factor is the difference between the returns on diversified portfolios of stocks of low and high investment firms (CMA). This factor measures investment in assets, by taking the ratio of growth of total assets in the previous year divided by total assets in the previous year.

It seems that the addition of these two new risk factors (RMW and CMA) on the three factor model of Fama and French, makes the factor HML to be less significant and can be excluded from the equation without any big impact. However, their three factor model has been also tested, as long as simpler one and two factor models.

The data was referring to the US. The equity risk factors were retrieved from Kenneth R. French database [17] and the GDP data from OECD [18]. The method that was used to find the coefficients and the statistical significance of the variables was the regression method of Microsoft Excel.

The available data has already been differentiated to portfolios, in order the differences to be calculated and used as an input for the present study. Each factor has its own background related to the way that it has been set up.

Regarding the SMB factor (small minus big), the first step was to calculate the average market value of each sample of stocks. The second step is to compare this value with each real market value of each stock and characterize as “Small Capitalization” the stocks whose market value is lower than the average one, and as “Big Capitalization” the rest ones. The difference between these two sets of data for a specific period (for example for each quarter) represents the SMB factor of Fama and French.

Regarding the HML factor (high book-to-market value minus low book-to-market value), this is a factor that represents the risk premium which is required from investors in order to keep the possession of high book-to-market ratio stocks. Again, the first step was to calculate the average book-to-market ratio of each sample of stocks, which is calculated by dividing the book value per share with the market value per share. The next step is to compare this value with each real book-to-market value of each stock and characterize as “low book-to-market” the stocks whose book-to-market ratio is lower than the average one, and as “high book-to-market” the rest ones. The difference between these two sets of data for a specific period (for example for each quarter) represents the HML factor of Fama and French.

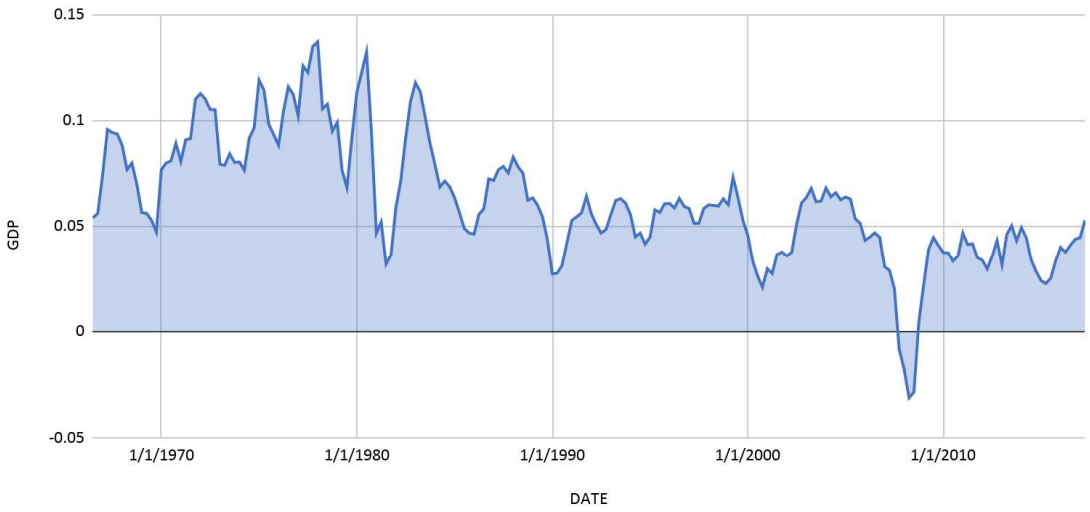
The RMW factor (Robust minus Weak) is the average return on robust operating profitability portfolios minus the average return on weak operating profitability portfolios.

The CMA (Conservative minus Aggressive) is the average return on conservative investment portfolios minus the average return on aggressive investment portfolios.

Regarding the market risk premium factor, it is calculated by subtracting the risk free rate (Rf) from market premium (Rm). Market premium is the average quarterly equity return. Risk free rate is given for every quarter.

In this way, using the above mentioned factors the study is based on representative data as they are mainly calculated based on average values.

In the below graph, the trend of GDP per quarter for US from 1966 to 2017 is shown, where it is obvious the periods of significant drop of GDP which is highly affected by important events of the general economic and social situation of the United States of America.



Graph 1: “GDP related to time”

The equity returns are considered as independent variables and GDP is regressed in multiple steps to ensure that Fama and French five factor model is sufficient. The available data are dated in quarters between 1966 and 2017. In order to get more representative results, the period has been divided into sub-periods based on milestones that have a significant impact on macroeconomic growth. The dates that

have been considered as of great significance for the macroeconomic growth are the entry of Euro in Europe in 2002, the oil crisis in 1973, the economic crisis in 1982 and 2008 and the “Internet bubble” of 1990. The main purpose is to find common trends between periods that are characterized by different economic conditions, based on which, the GDP of each period can be predicted. An equation that can predict GDP based on equity returns for the entire US, there is evidence regarding the integration of equity markets throughout the US.

The analysis started with a simple regression of future GDP growth throughout the entire set of data (from 1966 to 2017) with each one of the risk factors. In this way, the effect on future macroeconomic growth of each factor can be explained. The expectation is that market risk premium; HML and SMB are positively related to future economic growth and as a result to GDP.

$$GDP = a_i + \beta_i Factor + e_i$$

After the simple regressions, multiple regressions should be used in order to evaluate the impact of the additional risk factors to future economic growth. The risk is mainly included to the general market risk premium, so these additional variables show the additional risk apart from that included in market risk premium. The first step is to compare all these variables one by one with market risk premium and run two factor regressions.

$$GDP = a_i + b_i MRF + \gamma_i Factor + e_i$$

The expectation is that all coefficients will remain positive showing positive relationship with economic growth and of course the R^2 to be higher than that of the univariate analysis.

The next step is to review the three factor and five factor models of Fama and French, incorporating more variables in the same equation.

$$GDP = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB + h_i HML + e_i$$

$$GDP = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB + h_i HML + r_i RMW + c_i CMA + e_i$$

Using the same rational, R^2 is expected to be increased as more variables are added in this equation.

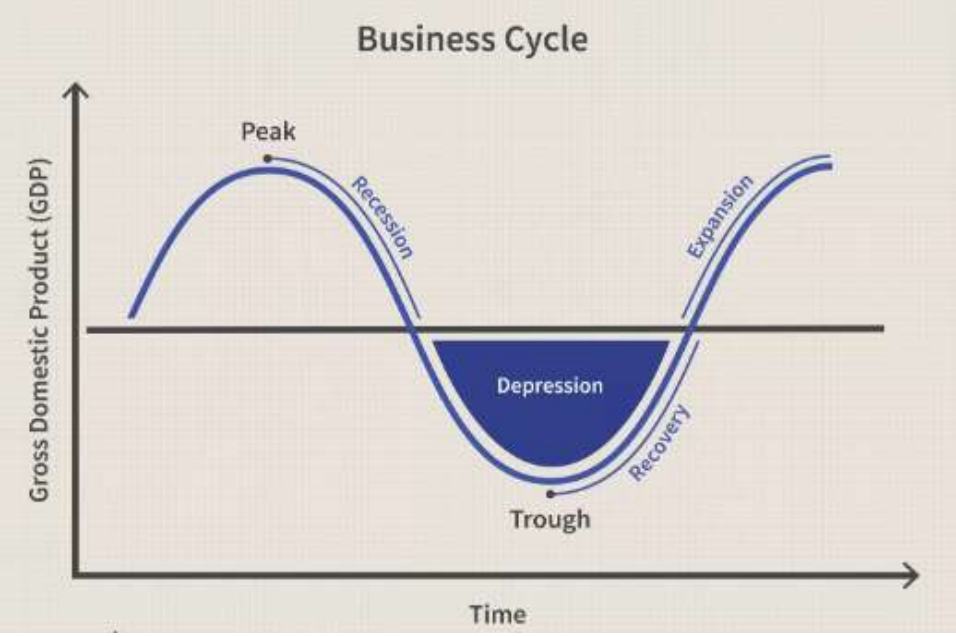
In addition, standard deviations for all risk factors have been calculated in order to review how sensitive are these variables to the changes of the economy. The results are shown in the below table.

Table 1: "General statistic indicators for all variables"

Value	GDP	Mkt-RF	SMB	HML	CMA	RMW
Mean	0.062	0.060	0.030	0.042	0.037	0.033
Median	0.059	0.096	0.027	0.040	0.033	0.029
Standard Deviation	0.029	0.171	0.117	0.124	0.086	0.095

Based on these data, it seems that the available data are neither reproducible nor centered. One important reason for this variation is the important and economic milestones of US economy, which had a great impact on various aspects of equities. However, in the scope of this study, the aim is to find the relationship between these variables in terms of coefficients in a common equation, as proposed by Fama and French.

The way the sub-periods were divided is not so random, it is based on the business cycle. The business cycle describes the rise and fall in production output of goods and services in an economy. Business cycles are generally measured using the rise and fall in the real gross domestic product (GDP) or the GDP adjusted for inflation. Below, a visual overview of such a cycle is presented.



Graph 2: “Business cycle stages”

The business cycle is characterized by 6 stages:

1. Expansion

This is the first stage. When the expansion occurs, there is an increase in employment, incomes, production, and sales. People generally pay their debts on time. The economy has a steady flow in the money supply and investment is booming.

2. Peak

The second stage is a peak when the economy hits a snag, having reached the maximum level of growth. Prices hit their highest level, and economic indicators stop growing. Many people start to restructure as the economy's growth starts to reverse.

3. Recession

These are periods of contraction. During a recession, unemployment rises, production slows down, sales start to drop because of a decline in demand, and incomes become stagnant or decline.

4. Depression

Economic growth continues to drop while unemployment rises and production plummets. Consumers and businesses find it hard to secure credit, trade is reduced, and bankruptcies start to increase. Consumer confidence and investment levels also drop.

5. Trough

This period marks the end of the depression, leading an economy into the next step: recovery.

6. Recovery

In this stage, the economy starts to turn around. Low prices spur an increase in demand, employment and production start to rise, and lenders start to open up their credit coffers. This stage marks the end of one business cycle.

According to the National Bureau of Economic Research (NBER), the average expansion lasted 58 months while the average contraction lasted 11 months since 1945. After the 1990s, the NBER estimates the average expansion lasted 95 months, while the average contraction remained the same.

For example, one recession began in December 2007 and lasted 18 months, making it the longest downturn recession since World War II. The longest post-war recessions were those of 1973 to 1975 and 1981 to 1982, both of which lasted 16 months. Above mentioned findings are in line with the differentiation that has been followed in the scope of the present study.

Inversion	State of the Economy
September 1966 to February 1967	Economic slowdown 1967
December 1968 to February 1970	Recession December 1969
June 1973 to November 1974	Recession November 1973
November 1978 to May 1980	Recession January 1980
October 1980 to September 1981	Recession July 1981
May 1989 to August 1989	Recession July 1990
July 2000 to January 2001	Recession March 2001
January 2006 to August 2007	Recession December 2007

Figure 3: “States of economy of USA”

Following a recession, there is the ‘Early Stage’. These are the 24 months following the end of the NBER recession. There was only a 12 month gap between the recession started January 1980, and the recession that started in July 1981. As a result, for this

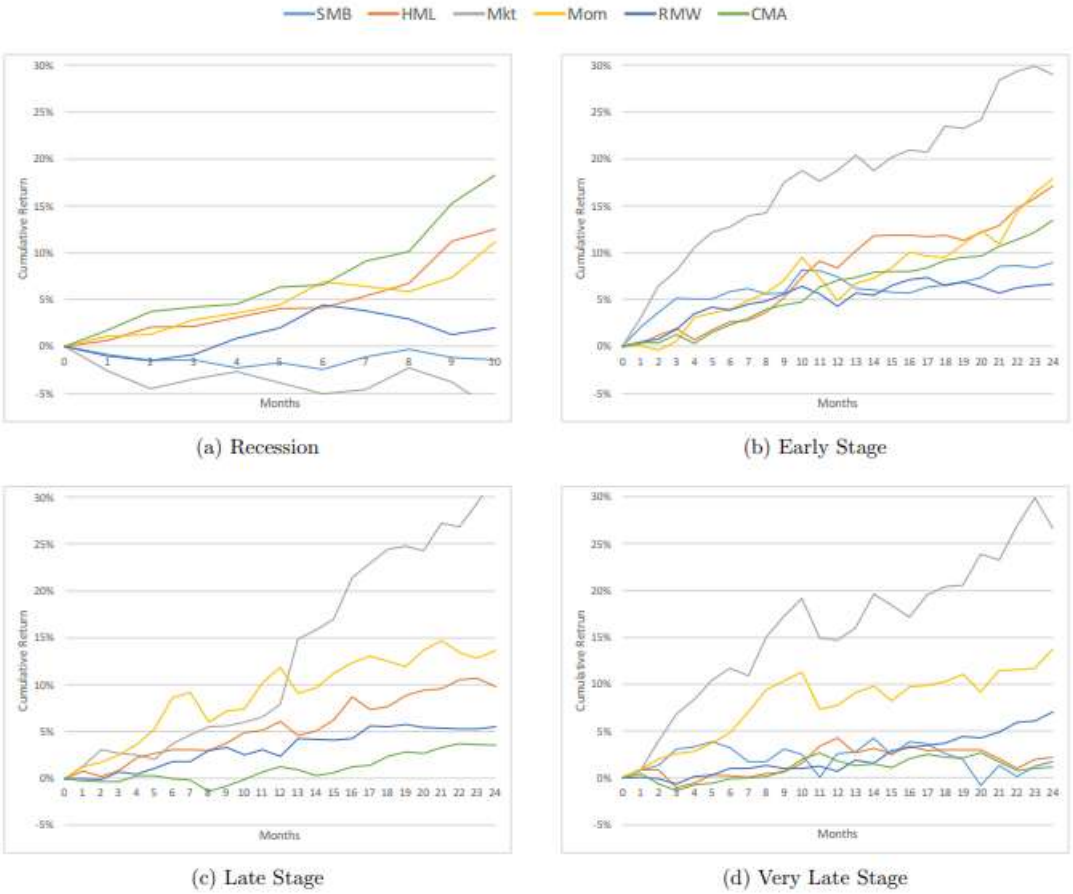
recession only, the 'Early Stage' overlaps with the 'Recession' stage. However, since there were a total of 7 recessions, there are a total of 7 early stage periods. As we take the average values across all seven of the periods, we allow for this overlap. Following the 'Early Stage', we have the 'Late Stage'. The 'Late Stage' is as many months as are possible following the 'Early Stage' up to 24 months, or until the next 'Recession' starts.

Market underperforms in a recession, but outperforms all the other factors in each of the other three stages by delivering outsized cumulative returns in comparison. [12]

At this point, the connection of all variables described above to the business cycle could be conducted. Based on literature, SMB is mostly related to innovations in default spread and HML is mostly related to innovations in term spread. Both business cycle variables clearly represent business cycle risks. To be more specific, based on literature, size effect is related to default spread because the small firms are expected to be more sensitive to credit market conditions. Relative to large firms, small firms probably lack collateral for loans and do not have established credit lines which will affect their business more negatively during adverse credit market conditions. The increased riskiness due to adverse credit conditions argument is expected to hold for all firms but this will be especially true for the smaller firms. The increases in default spread increases riskiness of returns through its effect on credit lines of the firms. When default spread increases firms will forego otherwise positive-NPV projects because the increase in cost of financing, and this will adversely affect the future cash flows, therefore the stock price. During times of recession number of available projects are already low because of the unfavorable demand conditions.

It is expected that during recession periods small firms, relative to large firms, become more sensitive to credit market conditions, proxied here by the default spread. During recessions or when recession periods are expected in the near future, credit conditions likely become the more critical issue for the small firms whose lack of collateral makes it harder for them to finance their projects. Since financing projects are likely to be the binding constraint for such firms during periods, also considering the overall reduction in available projects due to low expected demand. Given that small firms are often more leveraged and are in the habit of financing a higher percentage of their new projects via the debt markets, small firms are expected to be more sensitive to changes in default spread during these times, compared to large firms, during the recession times.

In the present research, cumulative returns have also been reviewed. In the below graph, there is the behavior of the review equity risk factors behavior during every business cycle. This is something that will be also confirm in the scope of the present study.



Graph 3: “Variables related to stages on business cycle - Generic”

It is obvious that the best performer in a recession is CMA, the investment factor.. Firms that invest conservatively outperform firms that invest aggressively in a recession, a logical finding. This performance did not last, however, as the cumulative returns for these firms deteriorate moving through the stages. The second-best performer in a recession was HML, the value factor. Value firms outperform growth firms, perhaps a surprising finding (although markets are forward-looking). The value factor’s performance in recessions is exceeded by its results in early stage recovery, and then its performance tapers off. [11]

4. Regression Results

In this session, the results of the regressions, both simple and multiple, between risk factors and future macroeconomic growth (GDP). The first analysis for all regressions is the entire period from 1966 to 2017 and then, the sub-periods based on significant economic milestones, like the oil crisis in 1973, the financial crisis of 1981, the "Internet bubble" in 1990, the entry of Euro in Europe in 2002 and the financial crisis in 2008.

During one factor regressions, the results are as anticipated. There is a positive relation between risk factors and GDP. In the following table, the coefficients, the p-value and the R^2 are summarized for every one-factor regression.

Table 2: "Results of one factor regressions"

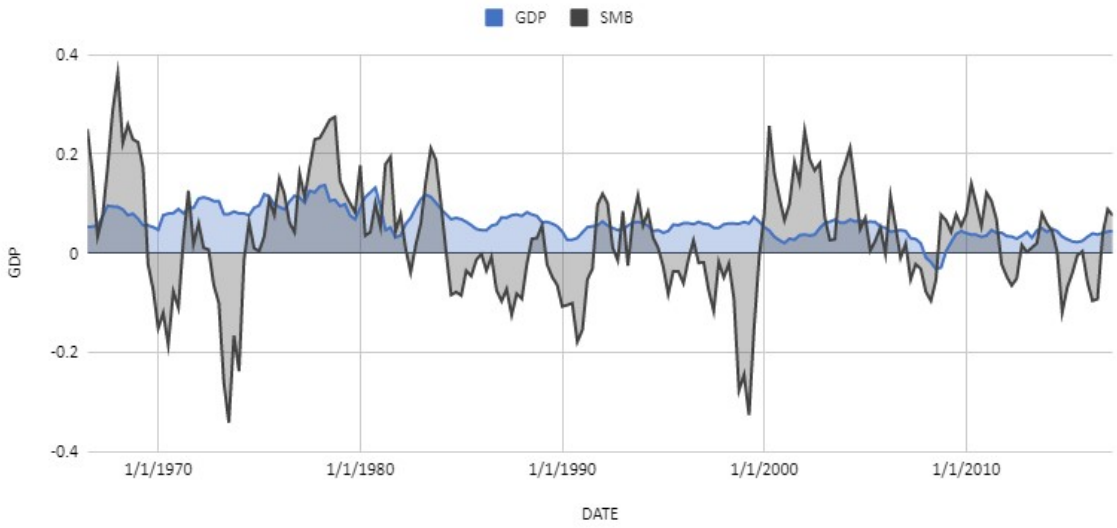
Time	Coefficients				
	Mkt-RF	**SMB**	**HML**	**RMW**	**CMA**
1966-2017	**0.0215**	**0.0563**	**0.0213**	**-0.0709**	**0.0198**
1966-1972	0.0662	-0.0009	-0.0831	0.1520	-0.0490
1973-1980	0.0190	0.0696	-0.0453	0.0600	-0.0399
1981-1989	0.0265	0.0669	-0.0084	-0.1324	0.1744
1990-2001	0.0537	-0.0288	-0.0186	-0.0293	-0.0680
2002-2007	0.0138	0.0986	0.0917	-0.0252	0.0383
2008-2017	0.0626	0.0746	0.0645	-0.1677	0.1139
Time	**P-Values**				
	Mkt-RF	**SMB**	**HML**	**RMW**	**CMA**
1966-2017	**0.0678**	**0.0010**	**0.1901**	**0.0007**	**0.4045**
1966-1972	0.0068	0.9731	0.0817	0.0154	0.2897
1973-1980	0.2840	0.0014	0.1120	0.3369	0.2990
1981-1989	0.1866	0.0782	0.8017	0.0527	0.0016
1990-2001	2.07E-07	0.0543	0.0704	0.0226	7.72E-06
2002-2007	0.6003	0.0283	0.0641	0.4161	0.3868
2008-2017	5.91E-05	0.1135	0.0751	0.0001	0.0569
Time	**R-square**				
	Mkt-RF	**SMB**	**HML**	**RMW**	**CMA**
1966-2017	**0.0163**	**0.0517**	**0.0084**	**0.0549**	**0.0034**
1966-1972	0.2581	4.64E-05	0.1163	0.2129	0.0447
1973-1980	0.0382	0.2937	0.0820	0.0308	0.0359
1981-1989	0.0507	0.0884	0.0019	0.1060	0.2568
1990-2001	0.4469	0.0781	0.0694	0.1080	0.3556

2002-2007	0.0127	0.2003	0.1473	0.0303	0.0342
2008-2017	0.3650	0.0681	0.0854	0.3459	0.0971

After one factor regressions, it is obvious that the R^2 is too low for all combinations which is an indication that one factor alone cannot explain future macroeconomic growth satisfactorily.

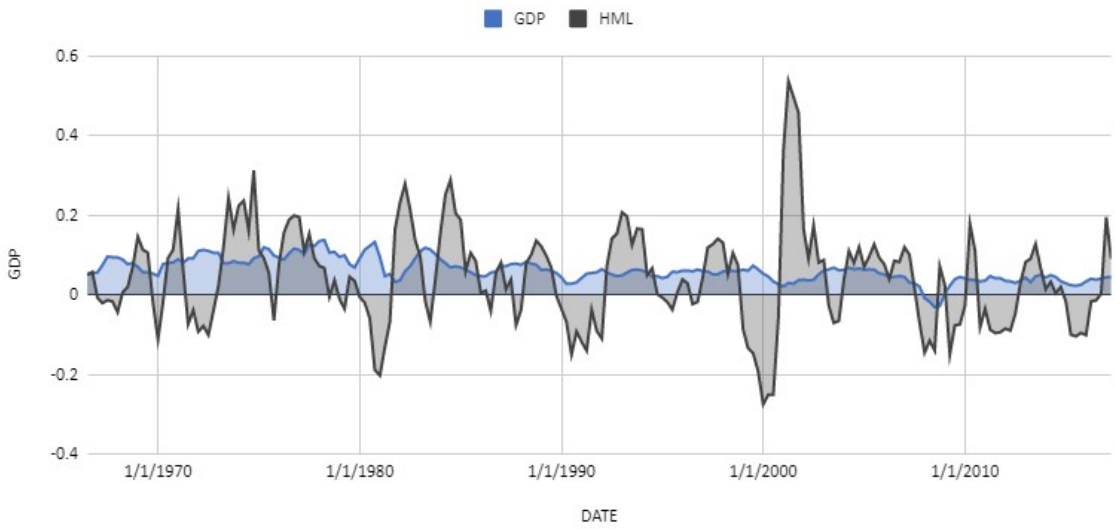
However, there are cases where some factors present a very low p-value which is basically the indication of whether a variable is statistically significant or not. There are variables which are presented as statistically significant even using a single regression, but a common pattern cannot be observed. One observation is that both market risk premium and SMB present positive correlation towards GDP for most of the years.

To make the correlations more visual, below are presented the graphs between GDP and every one of the risk factors. This first graph shows the SMB which is an indication of size. It seems that the higher fluctuations are presented just before the oil crisis of 1973 and the introduction of an integrated currency in Europe.



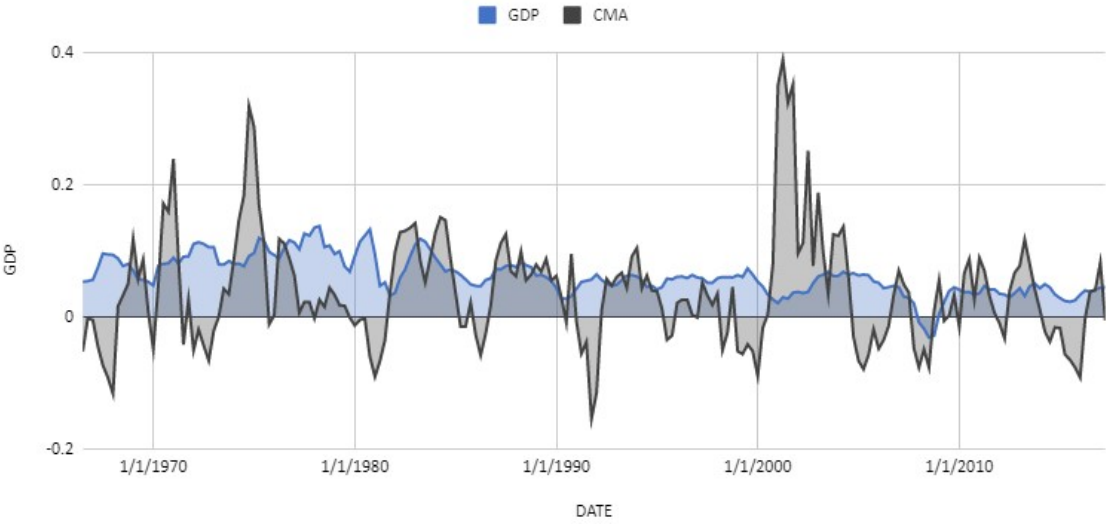
Graph 4: “GDP relationship with SMB”

The next graph is about the HML, which is related to the value. This variable seems to be more sensitive, as it was expected based on literature, to the changes of the general economic environment, than SMB.



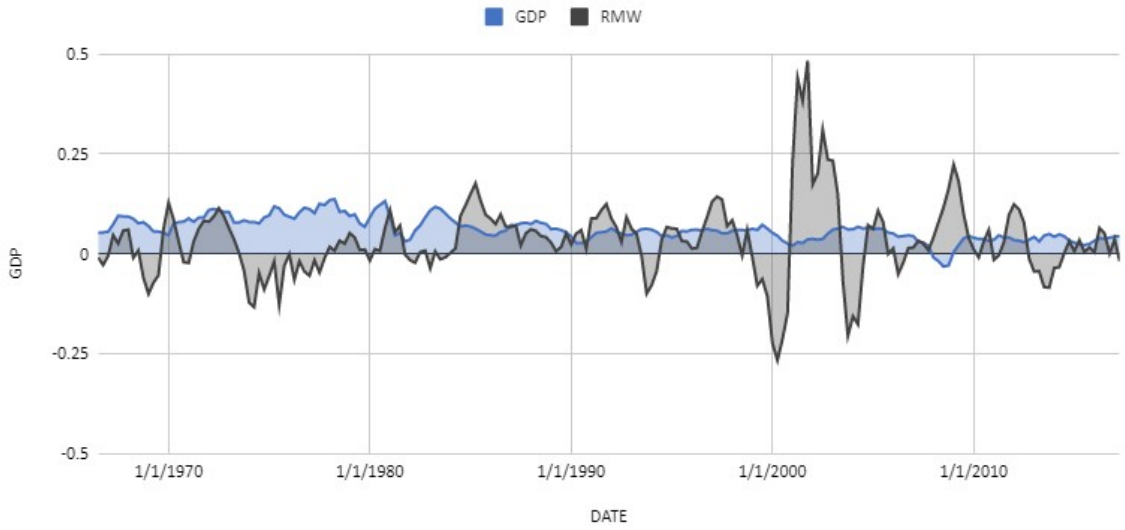
Graph 5: “GDP relationship with HML”

This third graph shows the fluctuations of CMA during these 50 years of available data. This factor is related to the investment and as SMB, the higher fluctuations are observed around 2002 (introduction of Euro) and 1973 (oil crisis). A couple of more drops are also observed during the rest of the financial milestones that have been chosen during the beginning of this study.



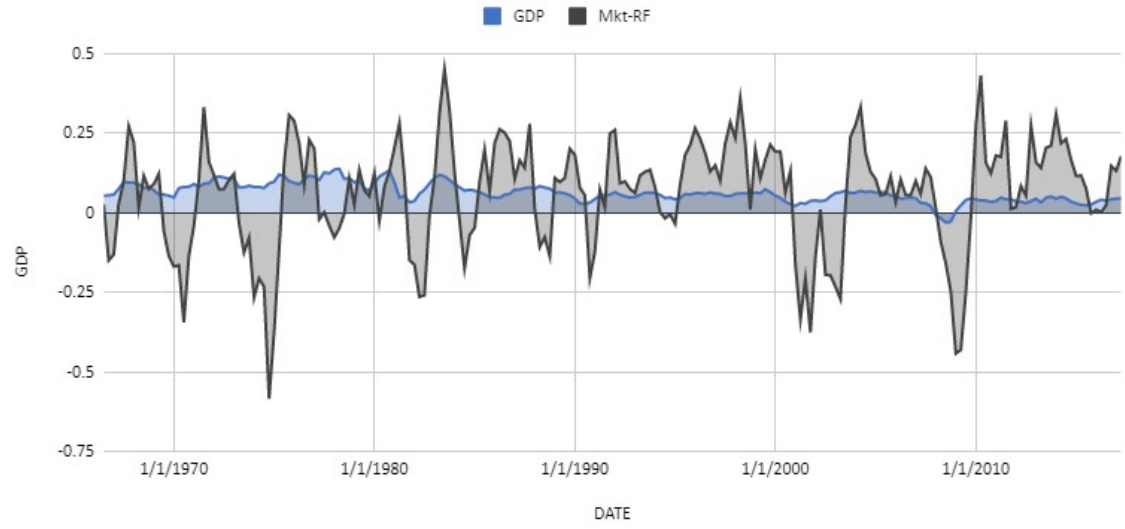
Graph 6: “GDP relationship with CMA”

The fourth graph shows the behavior of CMA, which is a factor related to investments. It seems to be more stable than other variables, but still its higher fluctuation is observed during 2002.



Graph 7: “GDP relationship with RMW”

The fifth graph shows the behaviour of market risk premium. Unfortunately, this variable presents a lot of fluctuations. For sure, the biggest ones could be attributed to significant events of the general financial environment, but the rest do not seem reproducible.



Graph 8: “GDP relationship with Market risk premium”

One common characteristic of all graphs is that during 2002, when Europe obtained an integrated currency, all risk factors present a significant fluctuation; they gave a too low value and a very high value afterwards, before they achieve logical levels.

Regarding the two-factor regressions, used to review the additional impact of each risk factor the the market risk factor, in the next table, the results of this regression are shown.

Table 3: “Results of two factor regressions”

Time	Coefficients (Mkt-RF and one more risk factor)			
	SMB	**HML**	**CMA**	**RMW**
1966-2017	0.0526	0.0355	0.0485	-0.0653
1966-1972	-0.0655	-0.0537	0.0100	0.1364
1973-1980	0.0695	-0.0402	-0.0221	0.0407
1981-1989	0.0573	0.0756	0.2615	-0.1384
1990-2001	-0.0170	0.0078	-0.0221	0.0095
2002-2007	0.0970	0.0937	0.0472	-0.0415
2008-2017	0.0426	0.0106	0.0664	-0.0807
Time	**P-Values**			
	SMB	**HML**	**CMA**	**RMW**
1966-2017	0.0023	0.0383	0.0645	0.0032
1966-1972	0.0177	0.2248	0.8308	0.0135
1973-1980	0.0030	0.2345	0.6760	0.5472
1981-1989	0.1446	0.1690	3.23E-06	0.0401
1990-2001	0.1417	0.3922	0.2697	0.4389
2002-2007	0.0357	0.0631	0.3084	0.4934
2008-2017	0.2774	0.7467	0.1873	0.2288
Time	**R-square**			
	SMB	**HML**	**CMA**	**RMW**
1966-2017	0.0606	0.0371	0.0329	0.0578
1966-1972	0.4159	0.3031	0.2595	0.4277
1973-1980	0.2937	0.0847	0.0440	0.0503
1981-1989	0.1109	0.1044	0.5124	0.1661
1990-2001	0.4731	0.4559	0.4618	0.4543
2002-2007	0.2037	0.1657	0.0614	0.0350
2008-2017	0.3863	0.3669	0.3962	0.3911

The results of two factor regressions are better than that of the one factor, in terms of R^2 mainly during the sub-periods, not during the entire 50-years period.

Regarding the p-values, the opposite is observed. They are all low enough to determine that these variables are statistically significant, but this is observed for the entire period more obviously than during the sub-periods. Using the output of both single and double regressions, it is observed that the point is not that one variable is

not statistically significant (as single regressions show), but this variable cannot stand alone to predict future macroeconomic growth.

The next regressions are the three factor model of Fama and French, to consider market risk premium, SMB and HML as independent variables for the prediction of macroeconomic growth.

Table 4: "Results of three factor model of Fama and French"

Time	Coefficients		
	Mkt-RF	**SMB**	**HML**
1966-2017	0.0238	0.0491	0.0299
1966-1972	0.0980	-0.0608	-0.0343
1973-1980	-0.0051	0.0662	-0.0186
1981-1989	0.0549	0.0568	0.0748
1990-2001	0.0574	-0.0200	0.0111
2002-2007	0.0106	0.0762	0.0654
2008-2017	0.0601	0.0438	-0.0028
Time	**P-Values**		
	Mkt-RF	**SMB**	**HML**
1966-2017	0.0556	0.0045	0.0772
1966-1972	0.0016	0.0309	0.4074
1973-1980	0.7861	0.0062	0.5440
1981-1989	0.1010	0.1429	0.1661
1990-2001	9.74E-07	0.0907	0.2260
2002-2007	0.6597	0.1075	0.1947
2008-2017	0.0004	0.3054	0.9361
Time	**R-square**		
1966-2017	0.0751		
1966-1972	0.4334		
1973-1980	0.3030		
1981-1989	0.1634		
1990-2001	0.4906		
2002-2007	0.2694		
2008-2017	0.3864		

Based on the outcome of the three factor model of Fama and French, the values of R^2 seem to be improved, which is in fact an indication that the prediction is better for the case of five factors. This is an important indication that the model is strong enough to predict GDP with three factors. However, regarding the statistical significance, both

HML and SMB are observed to be less significant than they were during two factor regressions.

The next, and last, regressions are the five factor model of Fama and French, to consider all factors as independent variables to the prediction of macroeconomic growth.

Table 5: “Results of five factor model of Fama and French”

Time	Coefficients				
	Mkt-RF	**SMB**	**HML**	**CMA**	**RMW**
1966-2017	0.0132	0.0465	0.0378	0.0006	-0.0705
1966-1972	0.0825	0.0080	0.0108	0.1071	0.2323
1973-1980	-0.0140	0.0700	-0.0140	-0.0392	-0.0274
1981-1989	0.0405	0.1221	-0.0570	0.4099	0.2048
1990-2001	0.0145	-0.0150	0.0632	-0.1141	-0.0221
2002-2007	-0.1131	0.1041	0.1497	-0.0548	-0.1612
2008-2017	0.0379	0.0285	-0.0291	0.0699	-0.0800
Time	**P-Values**				
	Mkt-RF	**SMB**	**HML**	**CMA**	**RMW**
1966-2017	0.3210	0.0063	0.0905	0.9868	0.0013
1966-1972	0.0073	0.8473	0.9206	0.2041	0.0935
1973-1980	0.5583	0.0069	0.7446	0.5293	0.7574
1981-1989	0.0582	0.0003	0.1439	1.60E-07	0.0040
1990-2001	0.3641	0.1723	0.0015	0.0013	0.1746
2002-2007	0.0320	0.0610	0.0108	0.2812	0.0131
2008-2017	0.1305	0.5233	0.4688	0.2808	0.2429
Time	**R-square**				
1966-2017	0.1225				
1966-1972	0.5340				
1973-1980	0.3138				
1981-1989	0.6914				
1990-2001	0.6030				
2002-2007	0.4923				
2008-2017	0.4327				

Based on the above mentioned results of the various regressions, it seems that there is for sure a relationship between risk factor variables and macroeconomic growth. The issue is that this relationship is significantly affected by the general economic situation.

To be more specific, the first regression of each equation that was tested, is referring to the entire period from 1966 until 2017. As it was anticipated, R^2 is low for all these regressions. However, it is observed that SMB and RMW are statistically significant values as their p-value is lower than the threshold, which is equal to 0.05. In addition, it seems that RMW is the only factor which is negatively related to GDP. But this observation is only for the entire period, which may not be so representative, as the RMW itself is also significantly affected by the general economic condition.

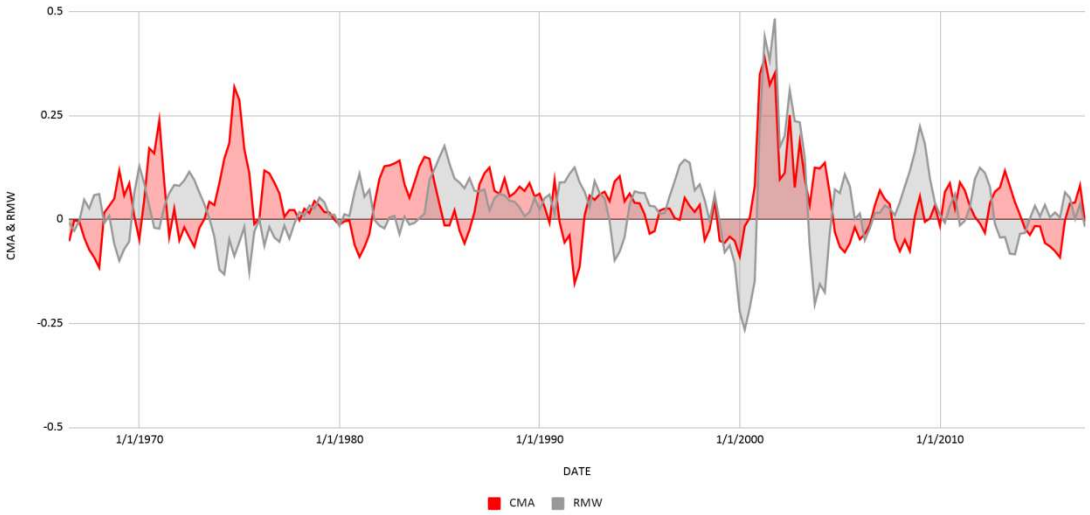
In addition, based on the R^2 values of each regression, it is observed that higher values are achieved using the five factor model. For sure this is not the case for all time periods, but for most of them. It is common in all regressions that the period which is better predicted is the 1990-2001, just before the entry of Euro in Europe.

Regarding SMB, in most of the cases it is statistically significant, so it is one of the variables which contains the most robust information with respect to future macroeconomic growth. Regarding the coefficients of SMB, they are mainly positive so this variable is not only strongly but also positively related to GDP.

As far as HML is concerned, it is not so clear whether it is positively or negatively related to GDP. However, based on related literature this variable, HML, is sensitive to changes in the general economic environment. This variable could be characterized as less significant and could be excluded from next regressions or be replaced with a similar more significant variable.

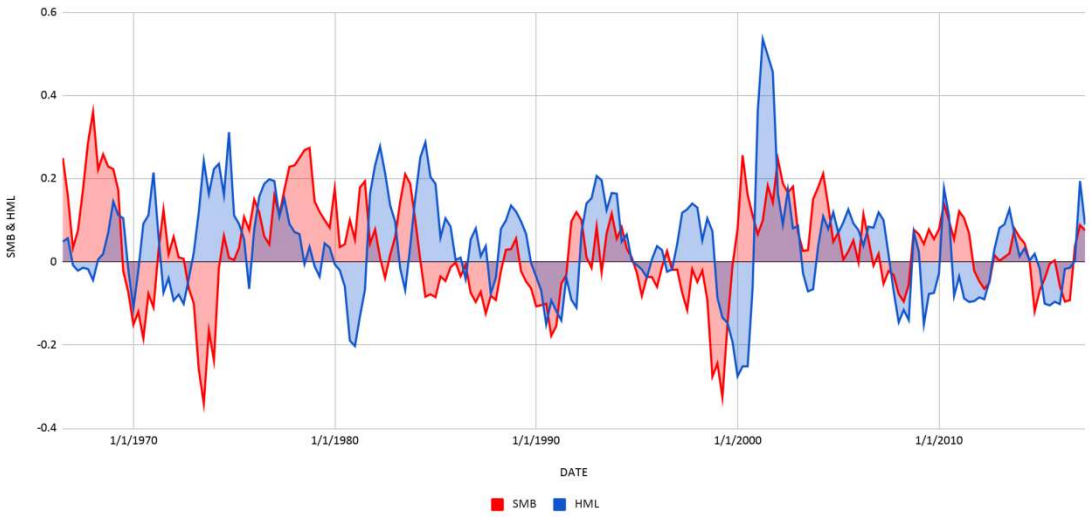
Regarding CMA and RMW, most of the times, they are both statistically significant, but their slope is differentiated based on the time period. To be more specific, when the slope of these two variables is negative, the GDP of this respective period does not have significant drops. CMA and RMW are the factors that are related to profitability and investment.

In the below graph it is shown that the variables CMA and RMW depending on the time. It is observed that in most of the cases, they are two variables which are mainly negatively related to one another. When one increases, the other decreases. There are a couple of exceptions, mainly slightly before and after Euro entry in Europe (2002), but this could be attributed to the general re-configuration of the economic situation.



Graph 9: “Relationship of CMA and RMW”

In the below graph it is shown that the variables SMB and HML depending on the time. It is observed that they both present big variations during the chosen periods of significant macroeconomic changes. During the rest of the years, they are more or less moving towards the same direction.



Graph 10: “Relationship of SMB and HML”

Regarding the comparison of Fama and French models, the three and five factor models, is that the two additional factors are related to profitability and investment which are two variables with significant value on the general macroeconomic growth of a country or an industry sector. As a conclusion, the five factor model can be used to

get more representative results than the three factor model as it has a more representative view of the economy situation.

The source of the below table is not liked to any of the models. It is an overview of five factor Fama and French model from which the HML factor has been removed.

Table 6: "Regression results of five factor model of Fama and French w/o HML"

Time	Coefficients			
	Mkt-RF	**SMB**	**CMA**	**RMW**
1966-2017	0.0135	0.0474	0.0385	-0.0636
1966-1972	0.0830	0.0075	0.1120	0.2233
1973-1980	-0.0130	0.0721	-0.0437	-0.0133
1981-1989	0.0633	0.1134	0.3662	0.1776
1990-2001	0.0464	-0.0124	-0.0246	0.0147
2002-2007	-0.0472	0.1304	-0.0385	-0.0643
2008-2017	0.0358	0.0235	0.0481	-0.0737
Time	**P-Values**			
	Mkt-RF	**SMB**	**CMA**	**RMW**
1966-2017	0.3149	0.0055	0.1313	0.0033
1966-1972	0.0053	0.8526	0.0943	0.0281
1973-1980	0.5779	0.0035	0.4646	0.8615
1981-1989	9.34E-05	0.0007	1.36E-07	0.0097
1990-2001	0.0021	0.3100	0.2769	0.2672
2002-2007	0.3582	0.0427	0.5108	0.2635
2008-2017	0.1462	0.5914	0.3960	0.2741
Time	**R-square**			
1966-2017	0.3312			
1966-1972	0.5338			
1973-1980	0.3110			
1981-1989	0.6682			
1990-2001	0.4940			
2002-2007	0.2643			
2008-2017	0.4232			

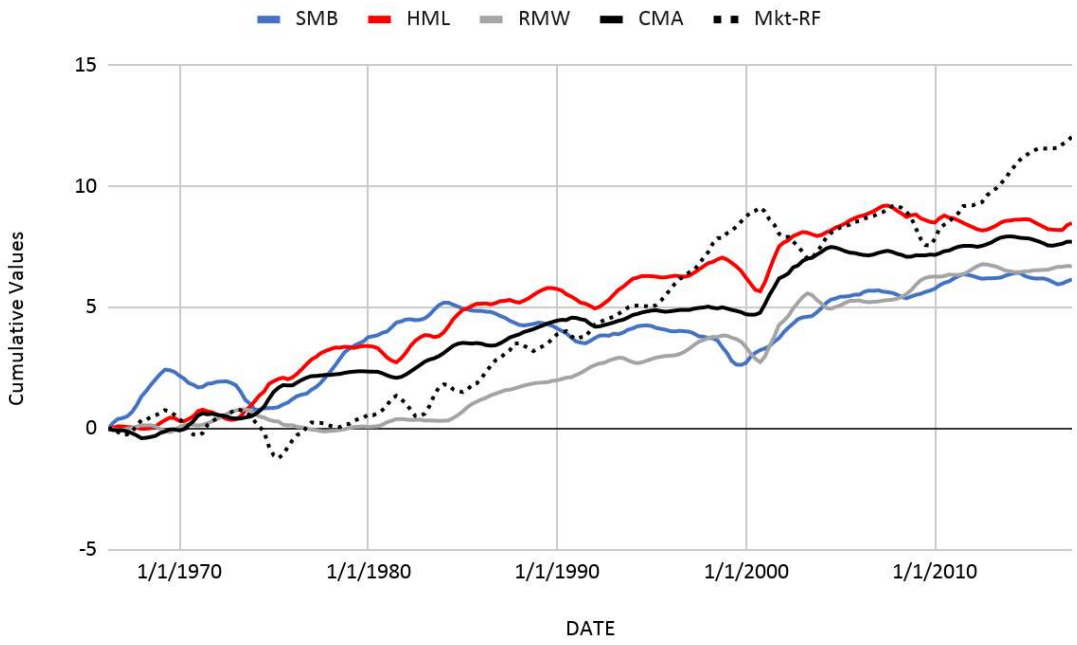
This version of the model seems to behave excellent during 1981-1989 when all the variables are statistically significant and the R^2 is high too.

As an overview of the results, we are in line with Liew and Vassalou. Based on their research, during periods of low economic growth, investors would rather hold big capitalization stocks with low book to market ratios since their returns are more stable

over time, which results in a lower return premium for small firms over big firms. In other words, high book to market firms and small capitalization stocks are better able to prosper during periods of high economic growth and the reverse occurs during periods of low economic growth.

Most probably, due to the fact that the available data are concerning only United States of America, the results and outcomes are sample-specific and should be combined with results from other countries too, in order to gain a better overview.

The graph of the cumulative equity risk factors returns are presented, based on the date.



Graph 11: “Cumulative values of all variables”

The results are in line with what it is already described in the methodology.

Market risk premium underperforms in a recession, but outperforms all the other factors in each of the other three stages by delivering outsized cumulative returns in comparison. The best performer in a recession is CMA and the next best performer in a recession is HML.

5. Conclusion

The scope of this study was to review the extent to which the risk factors SMB, HML, CMA and RMW can, next to market factor, be related to future macroeconomic growth in terms of gross domestic product (GDP) in the United States of America. The study was based on the model that was developed by Fama and French as an improvement of the CAPM model, which has been agreed that presents poor results when trying to predict macroeconomic growth.

Based on the results, there is a relationship between these risk factors and macroeconomic growth. The data that was available for the scope of this study lie between 1966 and 2017 and has been split to sub-periods based on significant economic milestones during these 50 years. This has been decided in order to get more representative results as all factors of the model are strongly linked to possible changes of the general economic environment. So the data has been regressed, using Microsoft Excel, both for the entire period and the sub-periods.

The sub-periods are mainly related to the change of currency in Europe in 2002, the oil crisis in 1973, the economic crisis in 1982 and 2008 and the “Internet bubble” in 1990. All these events seem to have a significant impact on both the individual risk factor and their general relationship with GDP growth.

Regarding the models that were used, both the three and the five factor model of Fama and French have been reviewed. In addition, simple one and two factor regressions have been conducted in order to determine the effect of each separate factor on the future macroeconomic growth. As expected, the outcome was that the five factor model of Fama and French is the one that better explains the relationship between risk factors and GDP.

In addition, some similarities on the behavior of each risk factor have also been observed. First of all, it seems that SMB contains strong and robust information concerning GDP. Their relationship is mainly positive as expected based on past studies’ results. This is the indication of size, in terms of capitalization, and the positive relationship with GDP shows that small capitalization firms or stocks are able to thrive when high economic growth is expected, than the big ones.
On the other hand, the risk factor HML does not present so robust information related to macroeconomic growth. In most of the cases, mainly when the five factor model is

used, this factor presents high p-values which are an indication that this variable is not statistically significant. Basically it seems that is very sensitive to changes of the general macroeconomic environment.

To be more specific, the changes in the general macroeconomic environment are better described in the business cycle. There are seven periods of recession during the available 50-year data, when we observed logical patterns in terms of equity risk factors movements. The business cycle represents indirectly the meaning of GDP.

Finally, it seems that indeed there is a relationship between risk factor and the GDP, for sure it is not the same for each period but it has common characteristics.

Regarding future research, the equity risk factors of US could be differentiated based on the state and industry sector, in order to reach to more clear and justifiable results related to the prediction of macroeconomic growth. The data can then be split to company portfolios according to their size, value, profitability and investment to determine the factors that affect the pattern of these variables first and then determine their relationship with future macroeconomic growth, and finally to recognize common patterns between the six stages of business cycle and the GDP prediction.

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