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THE EFFECTS OF COMMON MACROECONOMICS FACTORS ON U.S. STOCK RETURNS*

Ortak Makroekonomi Faktörlerinin ABD Hisse Senedi Getirileri Üzerindeki Etkileri

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Key Words:
Stock Return, Fama French, CAPM, Macroeconomic Factors, Principal Component Analysis

JEL Codes:
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Abstract

In this study, the explanatory power of the macro variables in relation to the variation of stock returns has been discussed in terms of the economy of the USA. To make an analysis of the cross-section of the stock returns, 131 Macroeconomic variables between 1964 and 2007 have been put into use. Summing up the information in 131 monthly series, dynamic factor analysis is used to take out 8 potential factors. So that the pragmatic presentation of the factor model can be measured, Fama-Macbeth's test procedure of two phases is applied. In addition to the variables included in the literature such as market risk factor, size factor, value factor, and momentum factors, it is found that the macro factors are highly influential on the explanation of the common variation in U.S stock returns. The tests stated above have been performed by means of Fama French 49 industry portfolios, apart from Fama French 100 portfolios that have been formed on size and book. Furthermore, the factor model is established and intended for certain periods of boom and recession. The relations established between latent factors and stock returns appear to be unimportant during the downturn periods.

Anahtar Kelimeler:
Hisse Senedi Getirisi, Fama French, KVFM, Makroekonomik Faktörler, Temel Bileşen Analizi

JEL Kodları:
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Öz

Bu çalışmada, makro değişkenlerin hisse senedi getirilerindeki değişimi açıklama gücü ABD ekonomisi açısından ele alınmıştır. Hisse senedi getirilerinin yatay kesiti üzerinde bir analiz yapmak için 1964-2007 yılları arasındaki 131 makroekonomik değişken kullanılmıştır. Aylık 131 serideki bilgileri toplayarak, 8 potansiyel faktörü çıkarmak için dinamik faktör analizi kullanılmıştır. Faktör modelinin pragmatik sunumunun ölçülebilmesi için Fama-Macbeth'in iki aşamalı test prosedürü uygulanmıştır. Piyasa riski faktörü, büyüklük faktörü, değer faktörü ve momentum faktörü gibi literatürde yer alan değişkenlere ek olarak, makro faktörlerin ABD hisse senedi getirilerindeki ortak varyasyonun açıklanmasında oldukça etkili olduğu tespit edilmiştir. Yukarıda belirtilen testler, büyüklük ve deftere göre oluşturulan Fama French 100 portföylerinin yanı sıra Fama French 49 endüstri portföyleri aracılığıyla gerçekleştirilmiştir. Ayrıca, faktör modeli oluşturulmuş ve belirli patlama ve durgunluk dönemleri için tasarlanmıştır. Gizli faktörler ile hisse senedi getirileri arasında kurulan ilişkilerin gerileme dönemlerinde önemsiz olduğu görülmektedir.

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1. Introduction

In last few decades, a common wondering issue is the relationship between the economy and the financial sector (e.g. Chen et al., 1986; Cheung and Ng, 1998; Altay, 2003). The behind idea of this curiosity is to find the effects of macroeconomic factors on the global financial crises. Although there are so many works in the literature to investigate the relationship, so few have a close interest the interrelations between the macroeconomic factors and the financial variables. Moreover, the main difference of this study is to use 131 macroeconomic variables which are higher than all relative works.

According to much research, there are significant effects of macroeconomic factors such as inflation, interest rate, etc. on stock returns (Fama, 1981; Chung and Tai, 1999; Christopher et al., 2006). The most known model to analyze the interactions between the macroeconomic variables and the stock returns is the arbitrage pricing theory called APT. This theory was developed by Ross (1976) where various factors which created the risk factor can be used to explain the stock return. The first study with the APT model in the literature was done by Gehr (1975). Such macroeconomic variables are used to explain the stock return in the U.S. stock market by Chen et al. (1986). Their work was also the first empirical analysis of APT which is considered as a macroeconomic approach. They found that there are some variables such as the production or change in risk premiums which have positive effects, although some others such as the expected or unexpected inflation rate have adverse effects on the expected stock returns.

There are different models besides, APT, such as Capital Asset Pricing Model (CAPM) or Modern Portfolio Theory (MPT) to show the relationship between the stock return and the macroeconomic factors. And some authors designed their fact models according to the aim of the model. For instance, Fama and French (1992) included some microeconomic variables such as firm size or book to market equity to present the fundamental factor model. A different example can be seen in the study of Chen et al. (1986). They also included consumption and oil prices as macroeconomic variables to make an economic factor model. The APT can be considered as the extension version of the other models.

Bodurtha et al. (1989) expanded the study of Chen et al. (1986) by adding such global factors to the model. First, they repeated the same analysis with the same macroeconomic factors and smaller sample data however, the only significant factor is the production of the industry. Then, they added the five global factors besides the local factors and the expanded model gave better results that some insignificant factors became significant.

By Martinez et al. (2005) or Poon and Taylor (1991), the relative studies were done for the UK and Spanish stocks market. They could not find any close relationship of the variables. Moreover, Gunsel and Cukur (2007) revised the study for the London Stock Exchange while Rjoub et al. (2009) made it for Istanbul Stock Exchange. In both studies, they found that the variables have effects, probative or negative, on the different individual and industry portfolios.

This paper examines how the macroeconomic variables work for explaining the cross section of the US share of earnings. It is put forward by the classical economic theory that the financial sector and macro economy have some aspects in common. Not just a particular theory has prevailed in this study. Instead, various studies that associate asset prices and returns with macro variables have been used. When it comes to the practice, deciding on the establishment of a corresponding link between the macro variables and asset prices becomes more difficult. The analysis covered in this study reveals an empirical attempt to establish and support this link.

To examine the cross section of stock returns, the papers written in this regard gave place to a small number of variables. On the other hand, this paper presents 131 macroeconomic variables of the U.S. economy in relation to the dynamic factor analysis with the aim of extracting common macro factors. This introduces some advantages and disadvantages. Considering a great number of factors, it becomes obvious that certain errors related to measurement will not be that important compared to a few numbers of factors, because these factors will substantially vary. Besides, a single macro series may not be a priced factor; however, the combination of tens of them may become a priced factor.

The key distinction and most significant contribution of this study to the existing body of work and literature is its experimental endeavor to establish a general linkage between macroeconomic factors and stock returns, rather than relying on existing theories. Additionally, it is the first study that uses both individual and industry portfolios at the same time. Also, this paper explores the transformation of latent macro factors when applied to Fama French 100 portfolios categorized by size and book value. These latent factors undergo a significant shift in becoming priced risk factors. Additionally, certain latent macro factors demonstrate a remarkable capacity to offer explanations that extend well beyond the scope of the CAPM and the Fama French 3-factor model, even when the momentum factor is incorporated into the Fama French model. The research encompasses a variety of portfolio structures, including references to 49 industry portfolios, to ensure its reliability. Another noteworthy aspect involves assessing the effectiveness of certain latent factors in explaining the collective movement of industry portfolios. Furthermore, separate tests were conducted for periods of economic growth and contraction. On one hand, the excluded factors failed to account for priced risk factors during recessionary periods. On the other hand, some of the latent factors appeared to have little significance during periods of economic expansion.

2. Literature Review

Examining the relationship between risk and return requires the factor models. Furthermore, there is an allegation on their part that the systematic risk is completely under the control of the factors. What the factors that have been set out in a factor model explain is the reason why some group of stocks' returns is inclined to act together. Also, they are needed to explain the variations of the stock returns in detail.

The two most widely used and popular theories in relation to the asset pricing literature, are the CAPM and Arbitrage Pricing Theory (APT). In the CAPM, systematic risk is the unique factor to explain the variations in stock returns. As it gets larger, the return is expected to be larger to the same extent. Regarding this, the CAPM brings up the idea that there is a linear relationship between the expected return and the systematic risk.

The model was constructed and introduced by Jack Treynor (1961), William Sharpe (1964), John Lintner (1965), Jan Mossin (1966) separately, and it is mostly based on the previous works conducted by Harry Markowitz, MPT, drawn up in 1950's. The CAPM is deemed valid along with some assumptions which are; (i) Investors come to an agreement about the return distribution, (ii) Investment horizon is fixed for each investor, (iii) Investors make use of the efficient portfolios that establish a connection between the CAPM and MPT, (iv) Borrow and lending can be done at risk-free rate, (v) There is an equilibrium in the stock market, (vi) Investors avoid taking risks and also act rationally, (vii) There is a perfect information

The experimental studies conducted by, Reinganum (1981), Gibbons (1982), and Coggin and Hunter (1985) all point out that the CAPM does not work efficiently. To compensate for the drawbacks of the CAPM model, Ross (1976) developed the APT. The APT offers predictions on the relationship between an asset return and risk premiums of the different factors. As a difference between the theories included in this study so far, the APT does not put forward equilibrium, unlike the CAPM. The CAPM can be regarded as a special case within the scope of the APT. Therefore, it does not determine the factors. Moreover, the APT comes up with softer presumptions which are; (i) A factor model can describe all common variations, (ii) No arbitrage opportunities are available, (iii) The idiosyncratic risk can be diversifiable.

The factors are required for the APT. Since they are not set out in the theory, some models or analysis techniques are required to extract the factors. In the macroeconomic models, there is a comparison between stock returns and the macroeconomic variables such as interest rate, inflation, or production. Certain macroeconomic factors have been used by Chen et al. (1986) to provide an explanation for the stock returns.

The second way to extract the factors is through econometric models. The most known type of econometric model in this sense is Principal Component Analysis which is explained in the methodology section.

Another method is data mining which enables the determination of the correct portfolios, the returns of which can be proxy variables for the factors. Fama and French state that there are two factors which are value and size besides the systematic risk and these factors have great explanatory power for the stock returns. Post and Levy (2005) found that the firms that have small market capitalization (counted as small firms) have positive abnormal returns around 2-4% per year while the big firms that have large market capitalization have negative abnormal returns. Post and Levy (2005) concluded a result about the value effect that value stock has positive abnormal returns approximately 4 and 6 percent in a year. This model of Fama French was extended by Carhart (1997) who adds a momentum factor. Post and Levy (2005) state that the momentum effect is more important than size and value effect so that it has a significant effect to determine the stock returns. Especially for the small firms which are categorized according to the size factor, the momentum effect became more significant.

Chan et al. (1985) researched separately the size effect on the stock return for a small number of firms that have high average returns and different sizes. They constructed a data set for 20 firms and their macroeconomic factors were the growth of production, change in the risk premium, inflation, etc. They took the difference between two portfolios which are the smallest and the biggest to determine which factors are important. They found that the change in risk premium is the most deterministic factor for the stock returns of firms that have different sizes.

Roll and Ross (1980) extended the first research which was done by Gehr (1975) by increasing the data set to find the significance of the test for the stock returns. They implied this factor model for the New York Stock Exchange between 1962 and 1972. They concluded that the test that was made for the five factors model gave weak results for the expected stock returns. Dhrymes et al. (1984) tried to find the problems in the analysis of Roll and Ross (1980). The first one is that the number of risk factors that were identified increased with the number of securities positively. The other one is that there was a complication in diagnosing the factors that generate the stock returns.

Some information about the study of Chen et al. (1986) was given before but some more details should be discussed in this section since their work is the closest one to this study. They decided to use a different factor model which contains the macroeconomic variables (in 1980s), to find the significant factors for the asset returns. They used the Fama Macbeth two-pass regression model to forecast the relationship between the macroeconomic variables and the stock returns. Their main purpose was to find the estimated risk premium for every factor used in the model and then to make a test to check their significance. They obtained that four of the factors, risk premium, industry production, interest rate, and unexpected inflation, have mixed significance effects to explain the stock returns.

Poon and Taylor (1991) used the same model as Chen et al. (1986) to determine the stock returns for the UK stock market. However, unlike Chen et al. (1986), they could not find any effects of the macroeconomic factors on the stock returns. Martinez et al. (2005) also did the same analysis for the Spanish stock market; they could not obtain any meaningful relationship between the stock returns and the used factors, too. On the other hand, Hamao (1988) repeated the same framework for the Japanese stock market and according to his study, anticipated inflation, risk premium, and interest rate have significant effects on stock returns.

Cauchie et al. (2003) researched the effects of macroeconomic variables on the returns of stocks that were taken from the Swiss stock market by using the APT model. They extracted the macroeconomic factors via the principal component analysis and the significance of four variables for stock returns was confirmed by using 17 years of monthly data. Gunsel and Cukur (2007) used a portfolio model to explain the stock returns for the London Stock Exchange and they found that all independent variables which are eight macroeconomic variables have significant effects on the stock returns.

3. Methodology

In the methodology part, firstly the principal component analysis and then the methods of the research for the asset pricing will be explained. The determined latent factors will be extracted by the principal component analysis. This work and the two-stage Fama Macbeth regressions of the latent factor portfolios will be employed.

3.1. Principal Component Analysis

Principal Component Analysis is a model used to find correlations in the data. The PCA sets out the use of principal components which are reduced as its main objective to indicate the original variables.

The principal component analysis functions for resolving the problems related to the measurement error in the data series. This analysis expects a great number of macro series to be explained by a few potential factors. Stock and Watson (2002) and Bai and Ng (2002) pointed out that the PCA can be used to extract the latent factors. Stock and Watson (2006) employed the analysis in different estimation methods and discussed its certain advantages and disadvantages. They seek to make a comparison between the performances of estimation methods for the industrial production in the U.S. To convey their statement in this regard, "the dynamic factor analysis allows us to turn dimensionality from a curse into a blessing". Ludvigson and Ng (2007) also employed the model to take factors out to explain the excess return of stock market.

As stated above, the PCA is a common method to make a prediction about the factors. This paper will handle this analysis model to determine the potential factors and then to test their significance.

3.2. Constructing the Factor Model

According to the literature review, the following equation for r_{it}, will be most appropriate in return time t.

$$r_{it} = a_i + \sum_{i=1}^{N} b_{ij} * I_j + e_{it} \quad (1)$$

$$\mathrm{E}(e_{it}) = 0; \ \ \mathrm{cov}(e_{it} I_j) = 0$$

r_{it} represents the actual return, a_i signifies the constant term or intercept, b_{ij} denotes the slope coefficient, I_j represents the factor, and e_{it} stands for the error term.

After adding the basic econometric assumptions that the error terms are not correlated to each other (cov(e_{it}, e_{jt}) = 0) in order to get rid of the autocorrelation problem, the model above transforms a factor model. Another important assumption is that an error term of the return of an asset is not correlated to each other. The final assumption about the above equation is that the residuals are not correlated with the independent variables.

After constructing the factor model, all the factors should be derived specifically. There are three different strategies that can be used to determine the factors in the literature. These three methods, using the economic variables, econometric models, and data mining, are discussed in the literature review section.

3.3. Determining the Factors

Using macroeconomic variables is so useful to examine the variation in U.S stock returns. In this direction, the variable, I_{jt}, is added to the model to show all macroeconomic variables. Implying the factor model may conclude some measurement errors because the data which is used is so huge. To get rid of the problems, I_{jt} needs to be defined as a regression model specifically,

$$I_{jt} = \lambda_i^{\,T} f_t + e_{it} \quad (2)$$

where $I_t = (I_{1t}, I_{2t}, \ldots \ldots, I_{nt})$ and $\lambda_i = (\lambda_1, \lambda_2, \ldots \ldots, \lambda_n)$. In the equation, f_t represents the factors, λ_i represents the factor loadings and e_{it} represents residuals. After estimating the factors by PCA, the sum of square of errors should be minimized.

3.4. Two Stage Regression Procedure

The next step, after the construction of the factor model, is to evaluate the performances of the factors. The best way to measure the performance in APT is Fama-MacBeth model. Fama-MacBeth (1973) is a commonly used method to determine the estimated values of APT variables. The process has two stages: the first one is to conduct the time regression. In this regression, the estimated slope coefficients are determined and then these estimated values will be used to realize the second step of the regression to measure the risk premiums. To estimate the slope coefficients, the following regression model is used.

$$r_{it} = \bar{r}_i + b_1 f_{1t} + b_2 f_{2t} + b_3 f_{3t} + b_4 f_{4t} + b_5 f_{5t} + b_6 f_{6t} + b_7 f_{7t} + b_8 f_{8t} + e_{it} \quad (3)$$

$$r_{it} - \bar{r}_i = b_1 f_{1t} + b_2 f_{2t} + b_3 f_{3t} + b_4 f_{4t} + b_5 f_{5t} + b_6 f_{6t} + b_7 f_{7t} + b_8 f_{8t} + e_{it} \quad (4)$$

In the above regression model, the risk factors are represented by the latent macroeconomic factors. The regressions will be repeated by adding the market risk factor, size, value and momentum factors.

Combining the latent factors and the market risk factor gives the following equation:

$$r_{it} = \bar{r}_i + b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i (r_{mt} - r_{ft}) + e_{it} \quad (5)$$

$$r_{it} - \bar{r}_i = b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i (r_{mt} - r_{ft}) + e_{it} \quad (6)$$

Adding the size & value factor to the existed factors gives the following equation:

$$r_{it} = \bar{r}_i + b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i \left(r_{mt} - r_{ft}\right) + s_i SMB_t + h_i HML_t + e_{it} \quad (7)$$

$$r_{it} - \bar{r}_i = b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i \left(r_{mt} - r_{ft}\right) + + s_i SMB_t + h_i HML_t + e_{it} \quad (8)$$

Finally, inclusion of the momentum factors to the above regression equation gives the following:

$$r_{it} = \bar{r}_i + b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i \left(r_{mt} - r_{ft}\right) + s_i SMB_t + h_i HML_t + \ m_i WML_t + e_{it} \quad (9)$$

$$r_{it} - \bar{r}_i = b_1 f_{1t} + \cdots + b_8 f_{8t} + \beta_i \left(r_{mt} - r_{ft}\right) + + s_i SMB_t + h_i HML_t + m_i WML_t + e_{it} \quad (10)$$

In financial modeling and asset pricing, various factors play crucial roles. Market risk factor (β_i) assesses the exposure to overall market fluctuations, with market return (r_m) reflecting the performance of the market, and the risk-free rate (r_f) representing the baseline return without risk. Additionally, size factor (s_i), value factor (h_i), and momentum factor (m_i) contribute to understanding asset performance. These factors interact with size risk premium (SMB_t), value risk premium (HML_t), and momentum risk premium (WML_t) over time to shape investment outcomes and asset pricing dynamics.

The second stage of the regression is to estimate the factor premiums with the following regression equation for just latent factors and lambda shows the risk premium factor.

$$r_i = \lambda_0 + \ \hat{b}_{i1}\lambda_1 + \hat{b}_{i2}\lambda_2 + \hat{b}_{i3}\lambda_3 + \hat{b}_{i4}\lambda_4 + \hat{b}_{i5}\lambda_5 + \hat{b}_{i6}\lambda_6 + \hat{b}_{i7}\lambda_7 + \hat{b}_{i8}\lambda_8 + e_i \quad (11)$$

i= (1,……….N) for each t = (1,……..T)

All portfolio returns is regressed separately in each period on the estimated betas that are found in the first stage in order to examine the risk premiums. The above equation will be revised by adding the factors which are same before to analyze their effects.

$$r_i = \lambda_0 + \hat{b}_{i1}\lambda_1 + \hat{b}_{i2}\lambda_2 + \cdots + \hat{b}_{i8}\lambda_8 + \hat{\beta}_i\lambda_{capm} + e_i \quad (12)$$

The following equation shows the inclusion of CAPM to the previous one.

The following equation shows the inclusion of size and value factors to the previous one.

$$r_i = \lambda_0 + \hat{b}_{i1}\lambda_1 + \hat{b}_{i2}\lambda_2 + \cdots + \hat{b}_{i8}\lambda_8 + \hat{\beta}_i\lambda_{capm} + \hat{s}_i\lambda_{SMB} + \hat{h}_i\lambda_{HML} + e_i \quad (13)$$

The following equation shows the inclusion of momentum factors to the previous one.

$$r_i = \lambda_0 + \hat{b}_{i1}\lambda_1 + \hat{b}_{i2}\lambda_2 + \cdots + \hat{b}_{i8}\lambda_8 + \hat{\beta}_i\lambda_{capm} + \hat{s}_i\lambda_{SMB} + \hat{h}_i\lambda_{HML} + \hat{m}_i\lambda_{WML} + e_i \quad (14)$$

where the signal of hat shows the estimated coefficients.

The null hypothesis of the test for the lambdas is that the average of the lambdas for each factor are equal to zero against the alternative hypothesis that it is significantly different from zero.

4. Data and Factors

4.1. Information about the Data for Stock Return

Kenneth R. French’s website provides access to Fama French Data Library, from where the data on stock returns and supplementary factors were obtained. Two different data sets are used for the stock returns: The first one is 100 portfolios formed on size and book and the second one is 49 industry portfolios. About testing the constructed factor model, using portfolios rather than individual shares has more benefits. The betas gained thanks to the use of portfolios create less trouble than individual shares which make Fama-Machbeth test model more efficient in relation the downturns. The two different sets of data are, per month, value-based, limited to the timeframe during 1964 - 2007.

As stated before, the factor model is formed for boom and recession periods. The web site of NBER is the provider of the data about the periods. It is possible to observe higher average returns of growth periods when portfolio statistics of growth and recession periods are compared, and this is an expected result. Furthermore, in recession periods, there are larger standard errors for the stock returns. This can be shown as a proof to the asymmetric volatility.

4.2. Macro Series and Corresponding Factors

Ludvingson provides the whole data set about the macro series between the desired dates on his website. The same data was used in the analysis of Ludvingson and Ng (2009b). The main purpose of using this set of data is to examine the relationship between the macro series and the excess bond returns. Furthermore, Stock and Watson (2005) used almost the same data set with and Ludvingson and Ng (2009a) to analyze the effects of macro series on the bond yields. There is just one macro variable in Stock and Watson (2005) which was not used in Ludvingson and Ng (2009a) because there is no data about this macro factor in the dates which are used in their study. Different standardization methods were used for all series to promote stationary. The standard normalization technique was used in this study before implying the PCA.

131 macroeconomic series are gathered into eight groups. The series between 1 and 20 is called output & income. 1th Group defined as “Output and Income”, 2nd Group defined as “Labor Market”, 3rd Group defined as “Housing”, 4th Group defined as “Consumption”, 5th Group defined as “Money and Credit”, 6th Group defined as “Bond and Exchange rates”, 7th Group defined as “Prices”, 8th Group defined as “Stock Market”

Table 1. Summary Statistics for Estimated Factors

i	AR(1)	R2
1	0.77	0.17
2	0.75	0.24
3	-0.24	0.30
4	0.46	0.35
5	0.36	0.40
6	0.42	0.43
7	-0.11	0.46
8	0.23	0.49

Table 1 shows the correlation of the factors with the macro data series. AR1 column shows that there are many fluctuations among the factors. In other words, the factors are not fixed when looking at the separately, they change from -0.24 to 0.77. R square shows the total variations that can be explained by the independent variables. With this result, whole factors have 49% explanatory powers when they come together. The table shows that the first factor discloses the most important one because it can explain %17 of the total variation alone. The second one and the rest have lower importance because their explanatory power decreases.

5. Results

In model construction of this work, it is necessary to determine the factors which are useful besides the eight factors. CAPM coefficient (market risk factor), Fama French coefficients (size, value) and momentum factor will be added to the basic model to show the models differences.

The first model is constructed with only 8 latent factors to find whether there is a relationship between these factors and stock returns. The second model is constructed with 8 latent factors and CAPM coefficient to show whether the explanatory power of the latent factors increases with the market risk factor. The third model is constructed with 8 latent factors and Fama French 3 factors. It is used to result the changes in the model when size and value factors are added to the model. Specifically, the changes in the significance of the latent factors will be researched. The final model is constructed by adding the momentum factor to the previous model to investigate the effects of this factor on the explanatory power of the latent factors.

To realize the regression of these four different models, Fama MacBeth two stage regression is used. For this method, four different data is set to show the differences between the independent variables and the models. Individual portfolios (100 units), industrial portfolios (49 units) and the recession & boom periods of the individual portfolios are used to estimate the regression.

It is possible to see the beta parameter assessments of risk factors for individual portfolios in Table 2. The table also indicates the rate of portfolios that include significant beta estimation. F test demonstrates the importance of the regression formula in general sense. In conclusion, the table also reveals the average level of the R squared. Examining the F significance levels, it is revealed that 100% of time series regressions have substantial F test at three different critical levels.

Moreover, we can deduct from Table 2 that the inclusion of the factor for market risk with eight latent factors has brought a substantial increase from 0.276 to 0.643 in the average R squared. Adding the Fama French factors (size and value) increase the R squared. Inclusion of the momentum factor as a final one has a little raise in the explained part of the total variation.

Furthermore, in the first regression model which is constructed with only latent factors, two of them do not seem significant, Factor 3 (price) and 7 (money and credit). The interpretation of this insignificancy is that the macro series about the price and money & credit have no effect on the individual portfolios. On the other hand, the stock market (Factor 8) and the labour market (Factor 2) have the largest significance level in all models.

In conclusion, without taking the insignificant factors (3 and 7) into consideration, the explanatory power of the factors has fallen by adding the extra factors, CAPM coefficient, size and value and momentum factor although the average R squared of the regression models have increased.

Table 2. Time Series Regression of Individual Portfolios

Models	Sig.	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F Test	Av. R2
Latent Factors	1%	42%	100%	0%	42%	83%	50%	2%	100%	100%	0.276
	5%	68%	100%	1%	67%	96%	76%	13%	100%	100%	
	10%	80%	100%	3%	75%	100%	80%	17%	100%	100%	
Latent Factors & Market Risk Factor Beta	1%	2%	29%	1%	4%	13%	10%	2%	53%	100%	0.643
	5%	17%	44%	5%	13%	32%	33%	7%	66%	100%	
	10%	35%	57%	12%	21%	40%	48%	19%	68%	100%	
Latent Factors & Market Risk, Size and Value Factors of FF3	1%	4%	13%	6%	0%	3%	1%	4%	6%	100%	0.783
	5%	20%	22%	16%	6%	12%	6%	16%	14%	100%	
	10%	31%	27%	24%	12%	28%	11%	23%	19%	100%	
Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4	1%	4%	14%	5%	0%	3%	0%	4%	6%	100%	0.786
	5%	21%	23%	17%	7%	14%	6%	14%	14%	100%	
	10%	34%	27%	28%	13%	28%	14%	25%	19%	100%	

Notes: F-1: Factor 1, F-2: Factor 2, F-3: Factor 3, F-4: Factor 4, F-5: Factor 5, F-6: Factor 6, F-7: Factor 7, F-8: Factor 8. Av. R2: Average R squared.

In the Table 3, the regression results of the estimated beta for Industry Portfolios are shown. According to the results, F statistic is significant for the industry portfolios which are 100%. Moreover, average R square has an increasing trend rising with the number of the explanatory variables. The average R square can give an idea about the comparison between two factor models which are with individual and industrial portfolios which have lower value. In details, there is no change in the situations of the third and seventh factors, but the significance level of the other factors are more in this model than the previous one. However, their significance level has a decreasing trend by expanding the model with additional factors.

Table 3. Time Series Regression of Industry Portfolios

Models	Sig.	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F Test	Av. R2
Latent Factors	1%	33%	100%	4%	35%	59%	20%	10%	100%	100%	0.213
	5%	57%	100%	6%	61%	80%	37%	27%	100%	100%	
	10%	69%	100%	6%	71%	88%	57%	35%	100%	100%	
Latent Factors & Market Risk Factor Beta	1%	14%	14%	8%	10%	2%	4%	10%	29%	100%	0.538
	5%	35%	27%	14%	14%	12%	10%	27%	39%	100%	
	10%	39%	35%	24%	20%	14%	22%	29%	47%	100%	
Latent Factors & Market Risk, Size and Value Factors of FF3	1%	14%	6%	8%	8%	4%	2%	14%	4%	100%	0.579
	5%	33%	18%	18%	18%	8%	10%	27%	18%	100%	
	10%	41%	27%	27%	24%	14%	18%	37%	27%	100%	
Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4	1%	16%	6%	8%	6%	4%	0%	14%	4%	100%	0.582
	5%	33%	18%	18%	18%	8%	12%	29%	18%	100%	
	10%	39%	27%	27%	24%	14%	16%	35%	27%	100%	

Notes: F-1: Factor 1, F-2: Factor 2, F-3: Factor 3, F-4: Factor 4, F-5: Factor 5, F-6: Factor 6, F-7: Factor 7, F-8: Factor 8. Av. R2: Average R squared.

To clarify the difference between the behavior of stock returns in boom and recession periods, two factor models are implemented. The results of time series regression for boom and recession periods of individual portfolios are showed in Table 4 and 5, respectively. The main difference between the periods can be concluded that most of the factors are insignificant in recession periods. Moreover, the significance of the coefficients is getting to decrease by adding of one more variable boom and recession periods.

Another important indicator of the Table 4 and Table 5 about the difference between the recession and the boom periods is that the average R square is relatively higher for the contraction periods. It means that the explanatory power of the factors in the contraction period is relatively higher than in the expansion periods. To understand the overall significance level of models, F statistics give the right information, and, in both periods, the F statistics are high enough.

Table 4. Time Series Regression of Individual Portfolios in Expansion Periods

Models	Sig.	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F Test	Av. R2
Latent Factors	1%	13%	100%	0%	9%	50%	46%	0%	100%	100%	0.231
	5%	35%	100%	0%	30%	73%	72%	3%	100%	100%	
	10%	57%	100%	1%	46%	88%	83%	14%	100%	100%	
Latent Factors & Market Risk Factor Beta	1%	1%	27%	0%	3%	4%	4%	1%	50%	100%	0.605
	5%	9%	45%	5%	16%	16%	13%	6%	61%	100%	
	10%	161%	54%	9%	212%	21%	25%	15%	67%	100%	
Latent Factors & Market Risk, Size and Value Factors of FF3	1%	4%	10%	5%	1%	1%	3%	1%	7%	100%	0.757
	5%	16%	22%	14%	9%	9%	10%	8%	15%	100%	
	10%	21%	27%	22%	16%	16%	15%	14%	22%	100%	
Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4	1%	4%	9%	6%	1%	1%	3%	1%	6%	100%	0.762
	5%	19%	21%	18%	9%	9%	11%	9%	15%	100%	
	10%	27%	29%	27%	16%	16%	18%	19%	20%	100%	

Note: F-1: Factor 1, F-2: Factor 2, F-3: Factor 3, F-4: Factor 4, F-5: Factor 5, F-6: Factor 6, F-7: Factor 7, F-8: Factor 8. Av. R2: Average R squared.

Table 5. Time Series Regression of Individual Portfolios in Recession Periods

Models	Sig.	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F Test	Av. R2
Latent Factors	1%	0%	91%	0%	0%	6%	0%	0%	91%	98%	0.372
	5%	0%	96%	0%	1%	47%	0%	0%	96%	99%	
	10%	1%	100%	0%	6%	76%	0%	0%	96%	99%	
Latent Factors & Market Risk Factor Beta	1%	0%	0%	0%	1%	0%	0%	0%	0%	100%	0.743
	5%	3%	0%	0%	2%	2%	4%	1%	8%	100%	
	10%	10%	6%	0%	4%	4%	12%	3%	22%	100%	
Latent Factors & Market Risk, Size and Value Factors of FF3	1%	1%	2%	0%	1%	1%	1%	2%	0%	100%	0.863
	5%	6%	9%	3%	5%	4%	6%	11%	0%	100%	
	10%	16%	14%	6%	9%	8%	14%	13%	7%	100%	
Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4	1%	2%	1%	0%	2%	0%	1%	1%	0%	100%	0.865
	5%	6%	12%	2%	6%	3%	6%	6%	0%	100%	
	10%	16%	20%	8%	10%	6%	13%	10%	8%	100%	

Notes: F-1: Factor 1, F-2: Factor 2, F-3: Factor 3, F-4: Factor 4, F-5: Factor 5, F-6: Factor 6, F-7: Factor 7, F-8: Factor 8. Av. R2: Average R squared.

After completing the estimation of beta coefficients, it is the right time to use them to estimate the lambdas with the cross-sectional regressions which are conducted monthly. Then to test the performance of the lambdas, t test is used on the average of the series by taking the averages of the estimated lambdas.

There is a summary of the statistical values of the lambdas that correspond to the latent factors of the individual portfolio model in Table 6. The details of the table are when the model is constructed by just eight latent factors; there is no insignificant lambda at the 10% critical level.

When one more factor, market risk, value, or size factor, added to the model, the significance of the independent variables is getting to fall according to the t statistics. According to the Table 6, it gives an important result for the study that the financial sector, consumption series, money and credit sector data, and stock market data have significant effects on the model which is constructed with individual portfolios when adding the CAPM coefficient to the model. Additionally, it is so clear to see the adverse effects of the additional factors on the significance of the latent macroeconomic factors to explain the total variation in the individual portfolios model.

Table 6. Cross Sectional Regression of Individual Portfolios

		Latent Factors	Latent Factors & Market Risk Factor Beta	Latent Factors & Market Risk, Size and Value Factors of FF3	Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4
λ1	Average	-0.339	0.084	0.050	0.083
	Std. Dev.	3.958	3.354	3.183	3.201
	t-stat	-1.970**	0.577	0.361	0.593
λ2	Average	0.687	0.260	0.110	0.177
	Std. Dev.	4.023	3.264	3.522	3.576
	t-stat	3.927***	1.834*	0.718	1.135
λ3	Average	0.476	0.057	0.003	-0.070
	Std. Dev.	3.995	3.327	3.183	3.232
	t-stat	2.736***	0.393	0.022	-0.498
λ4	Average	0.242	0.379	0.396	0.283
	Std. Dev.	3.101	3.304	2.870	2.745
	t-stat	1.790*	2.636***	3.167***	2.365**
λ5	Average	0.514	0.098	0.044	0.023
	Std. Dev.	4.225	3.262	2.985	2.964
	t-stat	2.798***	0.692	0.337	0.181
λ6	Average	-0.231	-0.138	-0.146	-0.228
	Std. Dev.	3.071	3.144	3.109	3.123
	t-stat	-1.731*	-1.010	-1.078	-1.681*
λ7	Average	-0.220	-0.213	-0.180	-0.18
	Std. Dev.	2.950	2.962	2.860	2.861
	t-stat	-1.714*	-1.656*	-1.447	-1.446
λ8	Average	0.230	-0.221	-0.050	-0.122
	Std. Dev.	3.042	2.716	2.362	2.328
	t-stat	1.738*	-1.871*	-0.488	-1.207
λcapm	Average		-0.294	-0.654	-0.199
	Std. Dev.		7.550	7.783	8.354
	t-stat		-0.895	-1.930*	-0.547
λsmb	Average			0.212	0.190
	Std. Dev.			3.132	3.130
	t-stat			1.552	1.394
λhml	Average			0.334	0.161
	Std. Dev.			3.538	3.654
	t-stat			2.170**	1.014
λwml	Average				1.060
	Std. Dev.				8.148
	t-stat				2.989***

Note: *, ** and *** show that the factors are significant at 10%, 5% and 1%, respectively.

Table 7 is about the cross-sectional regression which is conducted with the Industry Portfolios of Fama French model. Unlike the regression with individual portfolios, in this model (industrial portfolio model) the latent factors do not have significant effects on the stock returns. In this analysis, which utilizes industry portfolios, it may be surprising that significant findings are absent beyond the FF3 and momentum models, considering that in the general literature, particularly, the influence of exchange rates and credit channels is acknowledged. There are just two significant factors, 1 and 8, for the returns if additional factors, market risk, value, and size, are included in the model besides the latent factors. The situation becomes worse when the momentum factor is added to the model so that only factor 1 has a significant effect on the stock returns. It is anticipated that the addition of momentum renders the 8th factor insignificant, as stock markets do not inherently incorporate momentum. They can vary depending on market conditions.

Table 7. Cross Sectional Regression of Industry Portfolios

		Latent Factors	Latent Factors & Market Risk Factor Beta	Latent Factors & Market Risk, Size and Value Factors of FF3	Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4
λ1	Average	0.274	0.277	0.340	0.361
	Std. Dev.	3.958	4.012	4.010	4.023
	t-stat	1.591	1.586	1.948*	2.061**
λ2	Average	-0.192	-0.181	-0.177	-0.115
	Std. Dev.	3.963	3.944	4.110	3.939
	t-stat	-1.114	-1.043	-0.987	-0.669
λ3	Average	0.069	0.069	0.191	0.176
	Std. Dev.	4.599	4.601	4.044	4.126
	t-stat	0.344	0.343	1.087	0.98
λ4	Average	0.128	0.133	0.078	-0.066
	Std. Dev.	4.135	4.013	4.113	4.152
	t-stat	0.713	0.760	0.438	-0.365
λ5	Average	-0.239	-0.257	-0.116	-0.141
	Std. Dev.	4.778	4.669	4.837	4.817
	t-stat	-1.149	-1.267	-0.552	-0.674
λ6	Average	0.097	0.108	0.142	0.135
	Std. Dev.	4.800	4.821	4.507	4.492
	t-stat	0.465	0.517	0.724	0.691
λ7	Average	-0.088	-0.070	-0.015	0.005
	Std. Dev.	3.401	3.148	3.078	3.082
	t-stat	-0.594	-0.513	-0.115	0.037
λ8	Average	-0.083	-0.051	-0.244	-0.224
	Std. Dev.	2.945	3.045	3.401	3.397
	t-stat	-0.650	-0.382	-1.648*	-1.512
λcapm	Average		-0.023	0.283	0.501
	Std. Dev.		7.173	7.555	7.589
	t-stat		-0.075	0.860	1.517
λsmb	Average			-0.143	-0.186
	Std. Dev.			3.909	3.891
	t-stat			-0.840	-1.101
λhml	Average			-0.088	-0.242
	Std. Dev.			4.479	4.514
	t-stat			-0.453	-1.234
λwml	Average				0.963
	Std. Dev.				11.767
	t-stat				1.881*

Note: *, ** and *** show that the factors are significant at 10%, 5% and 1%, respectively.

Table 8 and Table 9, the separation of the boom and the recession periods for the cross-sectional regressions can be interpreted for the individual portfolios. In contraction periods, the latent macroeconomic factors have no significant effect to explain the variation in stock returns. There is only one significant factor, 8, when the model is constructed with only latent factors. However, there are more significant latent factors for the portfolio return in the boom periods.

In the expansion periods, most companies benefit, by increasing their earnings, which contributes positively to the index. However, during recession periods, large companies that inherently have crisis-resistant structures may not be significantly affected, and as a result, may not exert a negative impact on the index. Therefore, the results align with expectations.

Table 8. Cross Sectional Regression of Individual Portfolios in Expansion Periods

		Latent Factors	Latent Factors & Market Risk Factor Beta	Latent Factors & Market Risk, Size and Value Factors of FF3	Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4
λ1	Average	-0.059	0.101	0.072	0.083
	Std. Dev.	2.010	1.854	1.842	1.855
	t-stat	-0.629	1.170	0.830	0.954
λ2	Average	0.496	0.220	0.058	0.038
	Std. Dev.	3.116	2.418	2.259	2.260
	t-stat	3.405***	1.941*	0.546	0.362
λ3	Average	0.304	0.072	0.002	-0.030
	Std. Dev.	3.639	3.391	3.378	3.413
	t-stat	1.784*	0.454	0.010	-0.188
λ4	Average	0.137	0.184	0.252	0.112
	Std. Dev.	2.579	2.641	2.367	2.254
	t-stat	1.139	1.489	2.275***	1.064
λ5	Average	1.123	-0.081	-0.203	-0.162
	Std. Dev.	2.975	2.696	2.652	2.655
	t-stat	0.885	-0.641	-1.640	-1.304
λ6	Average	-0.476	-0.319	-0.347	-0.316
	Std. Dev.	2.959	2.816	2.772	2.755
	t-stat	-3.436***	-2.421**	-2.674***	-2.449**
λ7	Average	-0.213	-0.081	-0.037	0.000
	Std. Dev.	2.277	2.392	2.143	2.136
	t-stat	-2.000**	-0.721	-0.366	2.002
λ8	Average	-2.025	-0.280	-0.049	-0.164
	Std. Dev.	2.778	2.483	2.364	2.215
	t-stat	-0.192	-2.408**	-0.444	-1.586
λcapm	Average		-0.086	-0.812	-0.378
	Std. Dev.		7.672	7.070	7.183
	t-stat		-0.239	-2.455**	-1.124
λsmb	Average			0.242	0.223
	Std. Dev.			3.008	3.009
	t-stat			1.722*	1.587
λhml	Average			0.302	0.079
	Std. Dev.			3.582	3.627
	t-stat			1.801*	0.464
λwml	Average				1.145
	Std. Dev.				7.343
	t-stat				3.334***

Note: *, ** and *** show that the factors are significant at 10%, 5% and 1%, respectively.

Table 9. Cross Sectional Regression of Individual Portfolios in Recession Periods

		Latent Factors	Latent Factors & Market Risk Factor Beta	Latent Factors & Market Risk, Size and Value Factors of FF3	Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4
λ1	Average	-0.202	-0.145	-0.064	-0.100
	Std. Dev.	1.646	1.639	1.588	1.484
	t-stat	-1.036	-0.746	-0.341	-0.566
λ2	Average	-0.030	0.090	0.249	0.219
	Std. Dev.	-2.443	2.572	2.425	2.354
	t-stat	-0.104	0.297	0.865	0.784
λ3	Average	-0.182	0.081	-0.012	-0.012
	Std. Dev.	-1.930	1.940	1.599	1.598
	t-stat	0.793	0.354	-0.064	-0.065
λ4	Average	-0.107	0.016	-0.010	0.006
	Std. Dev.	2.406	2.272	2.252	2.266
	t-stat	-0.375	0.058	-0.039	0.021
λ5	Average	0.451	0.485	0.342	0.371
	Std. Dev.	2.495	2.490	2.219	2.258
	t-stat	1.524	1.641	1.300	1.386
λ6	Average	0.341	0.295	0.200	0.240
	Std. Dev.	2.126	2.120	1.826	1.797
	t-stat	1.351	1.173	0.922	1.127
λ7	Average	-0.081	-0.192	-0.256	-0.224
	Std. Dev.	3.118	2.884	2.661	2.681
	t-stat	-0.220	-0.560	-0.811	-0.703
λ8	Average	0.520	0.336	0.110	0.089
	Std. Dev.	2.267	2.310	1.955	1.968
	t-stat	1.932*	1.225	0.475	0.381
λcapm	Average		-1.314	-0.700	-0.758
	Std. Dev.		7.748	7.302	7.256
	t-stat		-1.429	-0.808	-0.880
λsmb	Average			-0.089	-0.071
	Std. Dev.			3.966	3.960
	t-stat			-0.190	-0.151
λhml	Average			0.677	0.676
	Std. Dev.			3.337	3.330
	t-stat			1.709*	1.710*
λwml	Average				-0.039
	Std. Dev.				6.458
	t-stat				-0.051

Note: *, ** and *** show that the factors are significant at 10%, 5% and 1%, respectively.

Table 10 shows the average and the adjusted average R squares. According to the table, 25% to 54% of the cross-sectional variation can be explained by the factors differently for each model. The R square is getting to increase by adding each additional Fama French three model or momentum factors. The adjusted R square values are almost same with the R square; the only difference is that adjusted one has smaller increments because the degrees of freedom are considered in calculation of the adjusted R square. Besides the interpretation of the R squares, there is another important indicator of Table 10 that the explained parts of the stock returns are higher in the contraction periods than the boom periods.

Table 10. Comparison of Cross-Sectional Regressions

Independent Variable	**R2**	**Latent Factors**	**Latent Factors & Market Risk Factor Beta**	**Latent Factors & Market Risk, Size and Value Factors of FF3**	**Latent Factors & Market Risk, Size, Value and Momentum Factors of FF4**
100 Portfolios Formed on Size and Book	Av. R2	0.310	0.355	0.401	0.412
	Adj. Av. R2	0.249	0.291	0.326	0.331
100 Portfolios Formed on Size and Book for Expansion Periods	Av. R2	0.312	0.339	0.388	0.400
	Adj. Av. R2	0.252	0.272	0.312	0.317
100 Portfolios Formed on Size and Book for Contraction Periods	Av. R2	0.402	0.451	0.521	0.542
	Adj. Av. R2	0.349	0.396	0.461	0.479
49 Industry Portfolios	Av. R2	0.385	0.411	0.467	0.499
	Adj. Av. R2	0.262	0.274	0.307	0.331

6. Conclusion

As global financial crises become the major issue on the agenda over last few decades, there are various studies about the relationship between the macroeconomic variables and the stock returns. Poon and Taylor (1991) and Martinez et al. (2005) analyzed the relationship between the macroeconomic variables with the stock returns that were taken by UK and Spanish stocks market, respectively. And they could not have found any significant effects of the variables. This study and many others in the literature found important relationships between the macroeconomic variables and the stock returns. Gunsel and Cukur (2007) or Rjoub et al. (2009) have found the close relationships for many macroeconomic variables in London Stock Exchange and Istanbul Stock Exchange, respectively. In this study, it is founded that some macroeconomic variables have a significant influence on stock returns which are based on the US stock market.

Post and Levy (2005) state that size and value factors have a significant effect in explaining the stock returns and the momentum factor is stronger than the size and value factors to determine the expected stock returns. Also, Chen et al. (1995) concluded that the size factor matters in explaining the stock returns. However, in our study, although the size, value, and momentum factors have some effects to increase the R square of the models, but this increase is less than the expectations.

Almost all research has found the different macroeconomic variables to have significant effects on stock returns, but the common variables are industrial production, the inflation rates (expected and unexpected), the term structure of the risk premium, interest rate, and the oil prices (Chen et al, 1986; Hamao, 1998; Cauchie et al., 2003). In our study, the factors in group 2 (labor market) and group 8 (stock market) are commonly significant factors for the stock returns in almost all models.

The main result of this study is that the latent factors which are subtracted by the principal component analysis from the macroeconomic data have a significant relationship with the stock returns in the US. With this result, this study joins the previous research which found the significant effects of the macroeconomic factors on the stock returns.

If a model is constructed with only latent factors that are derived from the macroeconomic series, these factors are accepted to be priced as risk factors. In the study, three more different models are constructed by adding the CAPM coefficient or market risk factor, value, and size factors, and the momentum factor to find the best model that explains the higher variation of the stock returns. Some of these potential factors keep being important but some of them turn into minor risk factors. This demonstrates that these additional factors have the capacity to explain the cross section of stock returns as much as the extracted latent factors. The results tremendously differ when various portfolios are used. The study includes two different portfolios to create the structure of the data, individual portfolios, and industrial portfolios. When certain types of portfolios like industry portfolios are evaluated, the latent factors are no longer assessed as risk factors. Finally, it is figured out that latent factors do not function in a similar way to the cross-sectional variation for boom and recession time of periods. As to recession periods, almost all the latent factors lack an explanatory power. The reason might be due to the short downturn periods and unusual rise and fall in the returns. In other respects, for the growth periods, a part of latent factors remains important.

This study makes two key contributions to the literature on the relationship between macroeconomic factors and stock returns. First, it empirically examines this relationship, rather than relying on existing theories. Second, it is the first study to use both individual and industry portfolios. The study finds that latent macroeconomic factors can be transformed into priced risk factors when applied to Fama-French 100 portfolios categorized by size and book value. These latent factors can explain stock returns beyond what is captured by the CAPM and the Fama-French 3-factor model, even when the momentum factor is included. The study also finds that the effectiveness of latent factors in explaining stock returns varies depending on the economic environment. In recessionary periods, the excluded factors fail to account for priced risk factors. However, in periods of economic expansion, some of the latent factors appear to have little significance. Overall, the study provides new evidence on the relationship between macroeconomic factors and stock returns. It suggests that latent macroeconomic factors can be a valuable tool for explaining stock returns, especially in periods of economic expansion.

The study's findings have important implications for investors. They suggest that macroeconomic factors can be a valuable tool for explaining stock returns, especially in periods of economic expansion. However, the study also shows that the effectiveness of macroeconomic factors in explaining stock returns can vary depending on the economic environment. Investors should therefore carefully consider the economic environment when making investment decisions. The stock returns at a specific point in time are not only affected by the variables at that time, but also by the events that happened in the past. This means that stock returns are volatile and can be difficult to predict. Economic indicators can be used to explain the behavior of the stock market, but they are not always accurate.

This paper can be improved with different patterns for further research. The analysis can be repeated by adding some other assets, bonds, etc. to analyze the relationship between the macroeconomic variables and some other dependent variables, not just stock returns. Moreover, this analysis can be done for other countries' stock markets or other markets to reveal the effects of the latent factors. The use of some other techniques from the principal component analysis to find the factors could be more attractive.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
I am a single author of this paper. My contribution is 100%.

Declaration of Researcher's Conflict of Interest
There is no potential conflicts of interest in this study.

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