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MASTER THESIS

The Macroeconomic Factors and The Returns of Stock

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Author:

Yan Li

Supervisors

Hossein Asgharian

Björn Hansson

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Abstract

This paper uses three different models Fama-French three-factor model, a Macroeconomic factor model and a combined model to examine the efficiency of the macroeconomic factors in estimating expected returns. The inflation rate and short-term interest rate are chosen as macroeconomic factors. Six European countries, Denmark, Finland, Hungary, Norway, Spain and Sweden, are selected to represent different economies. The combined model has a better performance than the other two models. From the results of combined model, the inflation rates and short-term interest rates have indeed complementary effects on the two size variables. The inflation rate is positively related to return which coincides with the theory. However, short-term interest rate shows some spurious results. Through the check using J-test and HJ-bound, most of the SDF are valid in the GMM/SDF method. A comparison among the different economies shows that the Economic and Monetary Union of the European Union is better in making monetary policies. Further researches should focus on the proxy problem of two state variables, HML and SMB, in Fama-French three-factor model, and the omission of other macroeconomic factors in both Macroeconomic factor model and combined model.

Key Words: Stock Return, Fama-French three-factor model, Macroeconomic factor model, Inflation rate, Short-term interest rate

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1. Introduction

1.1 Background

With the growth of equity markets, the investors focus more and more on this asset class. In the traditional capital asset pricing model (CAPM), there is only one factor, the market risk premium, which determines an asset's risk premium. Furthermore, CAPM is a one-period model. In order to reduce the one-period limitation of CAPM, the intertemporal capital asset pricing model (ICAPM) is developed for maximizing expected utility over several periods. Models such as the three-factor model of Fama-French (1993) and Ross' arbitrage pricing theory (APT) (1973) could be considered as being based on ICAPM. In the Fama-French three-factor model two state variables are added besides the market portfolio: firm size (SMB) and book-to-market ratio (HML). These state variables may increase the explanatory power of this model compared CAPM. Even if Fama-French three-factor model is widely used in empirical research, there still lacks an empirical motivation to these two state variables. Therefore, more and more economists pay attention to what these factors may be proxies for. An advantage of the Arbitrage Pricing Theory (APT) is its openness considering both the categories of the factors as well as their number. Thus, this model may contain macroeconomic factors. However, APT is more of a theoretical model than an empirical model, and it is not widely used by the investors.

In order to hedge various risks, people have demands for distinguishing these risks. The risk premiums of the stocks may contain some macroeconomic risks. Therefore the specific effect of the macroeconomic factors, such as inflation and interest rate, on the returns attracts economists' attentions. Since different countries have different monetary policies and economic structure, these effects may be very different. Choudhry (2001) found that in some high inflation countries there exists a Fisher effect. The Fisher effect, also named the Fisher hypothesis, shows that the inflation has a positive relation with stock returns. Under the Fisher Hypothesis, stock return can be considered as a hedge against the inflation. However, most researchers have

found that inflation has a negative influence on stock return. Some found that the spurious relation between inflation rates and returns can be explained by the monetary policies. For most countries, the government uses the short term interest rate as a main instrument for monetary policy. The reason is that the interest rate affects the allocation between savings and investments. When the interest rates increase, the capital flows to banks. This leads to a lack of capital in the capital market. Therefore the interest rates negatively influence the returns.

1.2 Purpose of the study

Both the Fama-French three factor model and APT are models describe the returns. The differences between them are the different explanatory variables they contain. In this paper, the state variables, SMB and HML, are used to estimate the returns according to the theory in the Fama-French three factor model. With the purpose of illustrating more explicit and authentic relationships between the macroeconomic factors and returns, the Macroeconomic factor model is also applied. Earlier empirical research has found a negative correlation between inflation and stock returns, which is seemed as spurious. On the other hand, based on the theory of the monetary policies, there is a negative relationship between interest rate and returns. Furthermore, in order to verify the complementary relationships between the size variables and the macroeconomic factors, a combined model would be estimated as well. I will use GMM/SDF approach to estimate and verify these parameters. As we all know that different countries have different inflation rates and interest rates, thus the reflections of the factors are various among six countries. I would compare the results between different countries, for instance the Scandinavian countries and countries in Euro zone. The main question of this paper is that "How do the macroeconomic factors and state variables affect the expected returns through three alternative models in different countries?" The Fama-French three factor model illustrates the influence of state variables, HML and SMB, on the returns, while the results of both Macroeconomic factor model confirms the effects of macroeconomic factors on the returns. In term of

the synergy effects of state variable and the macroeconomic factors on returns are demonstrated by the combined model. I analyze the different performance of these explanatory variables. They partly explain the efficiency of the monetary policies in each country.

1.3 Method and data

In this paper, I would use three alternative pricing models to examine the effects of the macroeconomic factors or market indices among different European countries. The first one is Fama-French three-factor model. In Fama-French three-factor model, the two basic size variables, HML and SMB, are applied. The second one is a model with macroeconomic factors, which is named Macroeconomic factor model in this paper. I choose inflation and interest rate as representatives of the macroeconomic factors to estimate the returns. The last model is a combined model. It contains the state variables, HML and SMB, and the macroeconomic factors, inflation and interest rate. I apply the GMM/SDF approach to estimate the models.

I use the latest monthly data from January 2000 to December 2010 to verify the relations. The Harmonized Index of Consumer Prices (HICP) instead of normal consumer price index (CPI) is used to calculate inflation rate. The HICP is a special CPI, which is balanced over the European Union countries. I choose six European countries, Denmark, Finland, Hungary, Norway, Spain and Sweden as samples. Some of them, such as Hungary, have relative high inflation rates, while others have more stable inflation rates. On the other hand, I select short-term interest rates to explore the relationship between the interest rates and returns. The reason is that the short-term interest rates reflect the monetary policies more immediately. The stationarity of all data is tested by the Augmented Dickey-Fuller test. Since the correlations between the explanatory variables are examined and the results are not obvious, the multicollinearity problem does not hurt the results of models.

1.4 Results and Limitations

Both of the state variables, HML and SMB, play a positive role in Fama-French three factor model mostly. The results in Macroeconomic factor model show that short-term interest rates and inflation rates have significant influences on the returns. The short-term interest rates have a negative effect on returns for all six countries. According to Fisher hypothesis, all six countries have positive linkages between inflation rates and returns. In the combined model, because of the complementary effects of HML and SMB, the influences of the short-term interest rates on the returns change in Norway and Spain. The good performance of inflation rates and short-term interest rates in Spain and Hungary shows the efficient monetary policies for the emerging market. The functions of European Central Bank are more efficient than other countries' governments or central banks, given that inflation rates and short-term interest rates work well in Finland and Spain. Therefore the results of this research reveal the effects of the monetary policies on the returns.

However, there are many more macroeconomic factors and other theoretical market indices having impacts on the returns. The further researches should incorporate them into the model and explore the effects of them as well. Moreover, the obscure proxy problem of HML and SMB in Fama-French three-factor model needs to be solved in future.

1.5 Outline of the study

The paper is organized as follows. Section 2 illustrates the previous researches about the effects of the macroeconomic factors on the returns. Section 3 demonstrates the three models which are used in this paper and the GMM/SDF method. The data of six countries are introduced in Section 3 also. In Section 4, the empirical results of three models and some tests are stated. The results are further analyzed in Section 5, in order to find the relationship between the monetary policies and returns. At last, Section 6 is the conclusion.

2. Literature Review

The capital asset pricing model (CAPM) is a traditional theoretical approach to estimate the expected returns of assets. It uses a single factor, the market risk premium, to calculate the asset return. The market risk is considered as the systematic risk which is not diversified. But CAPM have many unrealistic assumptions, for example the investors only care about returns in one period. These assumptions limit the application of CAPM. Fama and French (1993) established a three-factor model to extend the CAPM. Fama and French added two state variables into the model which are capital size variable and book-to-market ratio variable. Even if these two variables are not state variables themselves, they reflect some implicit state factors. Fama and French (1993) explained the size and book-to-market ratio variables as a distress premium. The new model increases the explanatory ability of the factors. In addition, the size variable, the book-to-market ratio variable and the market risk premium capture most of the variance of the returns, which cannot be solved in CAPM. The model predicts the reversal future returns in long term well. However, Jegadeesh and Titman (1993) stated that the Fama-French three-factor model cannot explain the continuation of the short-term returns. Since there are some common factors affecting the returns, the pricing model can use the common factors to predict the returns. Fama and French (1995) found that the state variables have relations with the profitability in long term. Although the model is widely used, it have less theoretical base. The economists wonder what the state variables are proxies for. The explanatory of distress premium causes the biased data problem, because that the data overstate the survive stocks rather than the distressed stocks. Nguyen (2009) used data of Australian equity market to examine the relation between the state variables and GDP growth. The result is that the two state variables are not proxies for GDP growth. Therefore the system risks do not include GDP growth in Fama-French three-factor model, and GDP growth does not have significant effects on the returns. However, the size and book-to-market variables are not the concern of the investors. The investors care about the specific risks in the market. The further researches are exploring the

system risks of Fama-French three-factor model.

Unlike CAPM and Fama-French three-factor model, arbitrage pricing theory (APT) does not identify the factors clearly. Both the macroeconomic factors and the theoretical market indices can be contained in the APT. Therefore APT gives an explanatory model rather than a statistical model of the returns. Additionally, the APT has less strict and more plausible assumptions, thus it is a more attractive model than CAPM from both theoretical and empirical aspects. Chen, Roll and Ross (1986) investigated the effects of a series of macroeconomic factors on the returns. These macroeconomic factors are seemed as state variables to explain the system risks. The inflation, the industrial production index, changes in risk premium and changes in yield curve have significant influence on the returns. Nevertheless, the value-weighted New York Stock Exchange index, the consumption variable and oil price index are insignificant in the model. Dhrymes (1984) discovered that the number of the factors, which have significant effect on returns, depends on the scale of the group of stocks. If the APT deals with more stocks, the model would found more economic factors. Another problem is that APT cannot examine the specific effect of individual factor, due to APT uses the F-test and Chi-square test to test the significance of all factors. However, due to there is no restriction of the factors in APT, the model does not define the explicit factors which should be right in estimating returns. Both the type and the number of variables vary over time periods and areas. When the researchers change the target length of time period or the areas with different economic structures, the economic state variables show different effects on the returns. The APT does not give a universal model for expected returns. This character of APT provides motivation of researchers to detect specific factors for particular situation, but this also causes the prediction and comparison problems.

The macroeconomic risks play an important part in determining returns of the equities. Lettau (2006) found that from 1990s the expected price of the stock had increased.

The reason is that the macroeconomic environment is more stable than before. Therefore both the equity risk premium and the expected stock return declined with the decrease of the macroeconomic risks. However, there are so many macroeconomic factors which have different effects on the returns of equities.

Many economists researched the relationship between the return of equity and the changes of inflation rate. Fisher (1930) proposed a hypothesis that the real interest rate is independent of the inflation. The nominal interest rate would change with the inflation one by one. Under Fisher hypothesis, the ex ante returns have a positive relation with the inflation. When the ex post returns of stock also move positively with the inflation, it means that the returns of stock can offset the changes of inflation. Under such situation, the return of stock can be defined as a good hedge against inflation. Boudoukh and Richardson (1993) found that in long-term both ex ante returns and ex post returns move positively with the inflation. Choudhry (2001) examined the Fisher hypothesis through using data from four high inflation countries of Central and Latin America during 1980s and 1990s. The result is that only Argentina and Chile shows a Fisher effect of the nominal returns. However most of the empirical evidences show that there is a negative relation between the return of stock and the inflation. Due to most previous researches before 1983 showed that the stock returns are poor hedges against inflation in US market, Gultekin (1983) used 26 countries data to examine the Fisher hypothesis. The research indicated that although most returns negatively correspond to the inflation, the stocks have higher returns in higher inflation countries.

Fama (1981) asserted that the negative relation in post-1953 period is a spurious relation. Fama thought that the prediction of the relevant real variables can explain the return of stocks better. Therefore the negative relationship is the linkage between the real activities and the inflation rate in fact. He assumed the real activity is that the growth of the money. The proxy effects of these data causes this spurious negative

relation. When the models contain variables reflecting real activities, the inflation negative effects even its explanatory ability diminish. In 1992, Ely made a further research about the anomalistic negative relation between the real stock return and unexpected inflation. They controlled the real output growth at first, and then identified the debt growth impacts. Unfortunately, they found that debt monetization cannot explicate the negative relation. On the contrary, Lintner (1975) stated that there is a possibility of the negative relation existing between the real stock return and inflation. Choudhry (2001) also found that the past inflation contain more information than the future inflation. Therefore both one-period lagged inflation and current inflation have negative effects on the real returns. Sharpe (2000) explained the negative relation in two aspects. One is that the growth of the expected real earnings would decrease with the inflation increase. The other one is that a rise in expected inflation causes higher required real returns. Since either positive or negative relationship exists, the inflation has a definite relation with the real return. The signs of the relationship could be determined by the time scale of the estimation. In a short term, the negative relationship is clearly observed. With the time scale increase, Fisher hypothesis replaces the negative relation. Boudoukh and Richardson (1993) found that the long-term returns are positively related with the inflation, but the results would be reversal in short time horizon. However, according to Fisher hypothesis, the return of stock can hedge the inflation only when the real returns do not depend on the inflation. Therefore the return of stock could not be a hedge against the inflation in a short term.

During Asia financial crisis, the stock markets of different countries show various reflection to the shock. Poon and Tong (2009) asserted that this financial crisis provide enough evidence for the negative relationship between inflation and returns. The governments make use of monetary policies to control the inflation, because high inflation means high risks for the investors. Patelis (1997) stated that the returns vary basing on a business cycle. Since the returns reflect the changes of monetary policies

immediately, there is no lagged effect on the returns. Even the results found that there exists relationships between inflation effects and monetary policies, the monetary policies cannot explain all the returns. The previous research of Geske and Roll (1983) explained the negative relation as an adverse choice of the investors. When the inflation changes, it would initiate a set of adjustments of monetary policies. These changes of monetary policies offer the investors different signals of the market. Therefore, followed these signals, the short-term returns would modify.

Most countries use adjusting interest rate as a monetary policy to control the investments. Because that the interest rate is the cost of the borrowers for borrowing money, the changes of interest rate would cause the movement of the capital. When the interest rate increases, the capital would flow into the banks. This leads the decrease of the demand of the stocks, thus the prices of stocks decline. Under such situation, if a corporation wants to lend money, it should provide a higher expected return than the interest rate. However, high profitable investments are limited. Thereby, high interest rates eliminate or delay low profitable investments. That is to say interest rate is another important macroeconomic factor on the returns of stocks. If the governments want to use this monetary policy correctly, they have to know the relationship between interest rate and return of stock at first. Economists found that the short term interest rates have significant effects on the returns of stocks. Because financial institutions such as banks have the function of allocating the capital, the returns of them are more sensitive to the interest rate. The reason is that the mismatched maturity of the borrowers and the lenders. The borrowers always prefer long-term loans, while the lenders want to have the right of withdrawing their deposits from banks arbitrarily or at a short notice. The gaps of the mismatched maturity lead the two sides of the financial institutions' balance sheet changes differently. Thereby the equities of the financial institutions reflect the changes of the term structure. On the other hand, Dinenis (1998) investigated the UK equity market. He found that the returns of both the financial institution and the nonfinancial institution are negative

correlated with the interest rate, and the volatility of the interest rate has a positive relation with these returns. Czaja (2010) verified that the exposure of the interest rate risks has been contained in the return of stocks. Since the same return reflect the same risks, even the specific exposure is individually constructed, it would earn the same return. The result also indicated that the financial institutions have larger exposure of the interest rate risks. Furthermore, León (2008) found that the conditional market returns is negatively correlated with the short term interest rates. On the contrary, the conditional variance of stocks, which means volatility, has a positive relation with short term interest rate. Moreover, Hou (2009) made a further research about the relationship between the short term interest rate and the returns of stocks in EMU market. The results explicate that there are asymmetric effects of the changes of interest rate on the returns. For both returns of stocks and volatility of stocks, the increase of the interest rates has a more significant impact than the decrease of the interest rates. Additionally when the market is bear market, the effects of interest rate on both returns and volatility of stocks would be stronger than the effects in the bull market.

3. Methodology

3.1 Theories

3.1.1 Fama-French three-factor model and Asset Pricing Theory

The traditional method to evaluate the expected return of equity is capital asset pricing model (CAPM). This one factor method is over simply, because that the only factor cannot explain all the risks clearly. The CAPM omits other variables which describe various risks. But the bias of the beta would cause the failure of the model. Fama and French (1993) raised a three-factor model to represent the risks. The two more variables are the size variables which describe the size of capital and the book-to-market ratio. One is “SMB (Small Minus Big) is the average return on the three small portfolios minus the average return on the three big portfolios”. The other one is “HML (High Minus Low) is the average return on the two value portfolios

minus the average return on the two growth portfolios". This model raises the explanatory ability of the model. But there is a weakness of Fama-French three-factor model which is the investors cannot use this model to hedge specific risks. The main question of Fama-French three-factor model is that what risks are these two additional size variables proxies for.

$$E[r] - r_f = \alpha + \beta_1(E[r_m] - r_f) + \beta_2 SMB + \beta_3 HML$$

Bartholdy and Peare (2005) found that both CAPM and Fama-French Model cannot estimate the expected return of equity well. As we all know there are many macroeconomic risks such as changes of inflation rate, changes of interest rate. These macroeconomic risks also affect the returns of the equities. Asset Pricing Theory (APT) is a linear model with explicit factors. Compared to CAPM, APT has fewer restrictions of the assumptions. Researchers can construct the specific factors from the macroeconomic risks and other market indices for APT.

$$E[r] = r_f + \beta_1 F_1 + \beta_2 F_2 + \cdots + \beta_n F_n$$

3.1.2 GMM

There are many restrictions of the traditional ordinary least squares (OLS) method, especially the distribution of the error term should be known as normal distribution. The independent and identically distributed variables cannot describe the characters of the real returns. In this paper, I would use the generalized method of moments (GMM) instead of OLS. The reason is that GMM has no requirement of the distribution of data. When the parameters are finite but the distributions of data are unknown, GMM would work better than OLS. By using GMM, a certain number of moment conditions are constructed as functions of the parameters and the data. The expected values of the functions are zero when the parameters reach the true values. These moment conditions were specified for The GMM method. The GMM is such a method which minimizes the moment conditions in order to get the true parameters.

The models in this paper, Fama-French three-factor model, APT and combined model,

would be used to calculate the stochastic discount factor (SDF) at first. For the SDF model, the basic theory is that the consumers want to maximize their intertemporal utilities. As we all know that the consumers are impatient, therefore the utility function contains a discount factor for the utility of future consumption. Under such situation, the price of the equity would be discounted by this factor. When the market reaches the equilibrium, the SDF is $m = \beta * \frac{U'(C_{t+1})}{U'(C_t)}$. The SDF contains various information of the financial market. Both the current inflation rate and the short-term interest rate would be considered into the models. In Macroeconomic factor model, the macroeconomic factors are the pricing factors of the returns. Unlike Macroeconomic factor model, these macroeconomic factors cannot directly be estimated in the Fama-French three-factor model. In Fama-French three-factor model, SMB and HML would be used instead of specific macroeconomic factors. At last, all parameters would be used in the combined model. The next step is that using the SDF to calculate the returns. The price of the equity is calculated by the function as

$$P_t = E[m_t * x_t], \text{ where the x are the payoffs in future}$$

As a consequence, the return of the equity is

$$1 = E[m_t * R_t]$$

The coefficients of the regression can be estimated by GMM. Due to the number of orthogonality conditions is always larger than the number of parameters in the model, GMM have a problem of over-identification. In order to examine the specification of the model, I would use the J-test for the results.

3.2 The models

At first, I use two basic models and one combined model to estimate the SDF. In the Fama-French three-factor model, the two size variables, SMB and HML, are used according to the original model.

$$m = \alpha + \beta_1(r_m - r_f) + \beta_2 SMB + \beta_3 HML \qquad (1)$$

In the Macroeconomic factor model, the macroeconomic factors and other market indices are indentified. As a result both the inflation rate and the short term interest

rate would be used directly in the regression to estimate the SDF. I would select current inflation rate and short term interest rate in Macroeconomic factor model. I also add market risk premium into the model to find the relationship between them and the SDF, even the returns.

$$m = \alpha + \beta_1 (r_m - r_f) + \beta_2 IR + \beta_3 Inf \qquad (2)$$

In the combined model, both the size variables in Fama-French three-factor model and the two macroeconomic factors in Macroeconomic factor model would be included in a single model. This model can indicate the effects of each factor on the returns. Furthermore, the non-explanatory of returns in Fama-French three-factor model could be explained by the two additional macroeconomic factors.

$$m = \alpha + \beta_1 (r_m - r_f) + \beta_2 SMB + \beta_3 HML + \beta_4 IR + \beta_5 Inf \qquad (3)$$

3.3 The data

3.3.1 The selection of data

In this paper, six European countries, which are Denmark, Finland, Hungary, Norway, Spain and Sweden, are selected as samples. The monthly industrial indices from January 2000 to December 2010 are used to calculate the industrial returns. These industrial returns simulate the portfolio returns. I apply the criteria of Datastream industrial index. Basic Mats, Industrials, Consumer Gds, Consumer Svs, Financials and Technology are picked as the representations of the various industrial indices. The market price index is used to compute the market returns as well. Unlike previous researches, I choose Harmonized Index of Consumer Prices (HICP) instead of traditional consumer price index (CPI) to estimate the inflation rates. The 3-months inter-bank rate or 90-days treasury bills represent the short-term interest rates. The factors data of SMB and HML in Fama-French three-factor model are obtained from the data library of French website. Additionally, I use the one-month Treasury bill rate to represent the risk-free rates. These factors data also can be applied in estimate other national or regional asset returns besides asset returns in US.

3.3.2 The tests of data

I use Augmented Dickey-Fuller test to check the stationarity of data. I select the exogenous factors include constant and linear Trend. The number of lags based on SIC is chosen as twelve. From the Table 3.3.2-1 in Appendix, we know that the short-term interest rates are not stationary. However, I use the pricing models to estimate the coefficients, thus the explanatory variables do not need to be stable. By making use of short-term interest rates directly, I can find the efficiency of the ordinary pricing models. The reason is that these models do not apply the difference of interest rates over periods.

The results of Table 3.3.2-2 to 3.3.2-7 in Appendix describe the correlations between the explanatory variables in all six countries. Since all explanatory variables have unapparent relations with each other, the multicollinearity problems do not hamper the models from the correct estimations.

4. Empirical Result

4.1 Hypotheses

Hypothesis 1

Based on the theories, the coefficients of the short term interest rate should be negative.

Because that the interest rates are used as a main monetary policy by the government, the returns of equities are negatively influenced by the interest rates. In this SDF regression, the interest rate is used to establish the SDF. Thereby the relation between the short term interest rates and the discount factors would be negative as well.

Hypothesis 2

Based on the theories, the coefficients of the inflation rate should be positive.

The Fisher effect says that the returns are hedges against the inflation. Thus the inflation rate would have a positive effect on the returns. Because that I use inflation

rate to calculate the discount factors at first, the relationship between the inflation rates and the discount factors would also be positive.

Hypothesis 3

In countries with higher inflation rates, the returns are higher.

As previous researches results, countries with the higher inflation have higher asset returns. This comparison is across countries. I would calculate the average of the time series returns for each country. At the same time, the average of the inflation rates is computed also. For the countries with higher inflation rates, the industrial returns even the market returns should be higher.

4.2 Results

At first, I compare the inflation rates of these countries. Due to all the countries are European countries, the inflation rates are calculated by the Harmonized Index of Consumer Prices (HICP). From Table 1 we can find that the inflation rates of Spain and Hungary are higher than others. The Graph 1 shows the monthly inflation rates of six countries during 2000 to 2010. Before 2005, the inflation rates of Hungary are even higher than ones in Spain. During 2005 to 2007, all inflation rates of six countries tend to stable and comparably lower. However, there is a big financial crisis, which is caused by US subprime mortgage crisis, sweeping the European countries in 2008. This disaster attacked some countries' weak economy. Therefore after 2008, the inflation rates become unstable, especially the inflation rates of Spain turn to highest. However, Norway, the only Scandinavian country does not join European Union, always has a relatively volatile inflation rates than other three Scandinavian countries. Table 2 indicates that the inflation rates in Hungary, Norway and Spain are more volatile than others. Hungary has the highest short-term interest rates as well as the most unstable interest rates. It is notable that the two members of Economic and Monetary Union (EMU), Finland and Spain have the lowest market returns. Additionally, the market returns of Finland are most volatile.

Table 1 The average of R_f, R_m, Short-term interest rate and Inflation in six countries

Mean			
	Rm	Short term IR	Inflation
Denmark	6.208E-03	3.140E-02	1.655E-03
Finland	2.630E-04	2.966E-02	1.538E-03
Hungary	6.642E-03	**7.526E-02**[1]	**4.683E-03**[2]
Norway	6.898E-03	4.403E-02	1.666E-03
Spain	7.810E-04	2.966E-02	2.437E-03
Sweden	3.878E-03	2.689E-02	1.593E-03

Table 2 The variance of R_f, R_m, Short-term interest rate and Inflation in six countries

Variance			
	Rm	Short term IR	Inflation
Denmark	3.228E-03	2.027E-04	1.442E-05
Finland	8.807E-03	1.767E-04	1.538E-05
Hungary	5.514E-03	**1.358E-03**[3]	2.863E-05
Norway	4.648E-03	4.255E-04	2.592E-05
Spain	3.092E-03	1.767E-04	**3.433E-05**[4]
Sweden	4.684E-03	1.860E-04	1.787E-05

In order to estimate the models through GMM, I build the moment conditions for all models in advance. I use equation (1) in Fama-French three factor model to calculate the SDF, while the equation (2) and equation (3) are applied in APT and the combined model separately.

$$m = \alpha + \beta_1(r_m - r_f) + \beta_2 SMB + \beta_3 HML \qquad (1)$$

$$m = \alpha + \beta_1 (r_m - r_f) + \beta_2 IR + \beta_3 Inf \qquad (2)$$

$$m = \alpha + \beta_1 (r_m - r_f) + \beta_2 SMB + \beta_3 HML + \beta_4 IR + \beta_5 Inf \qquad (3)$$

Because that the excess returns are used in GMM, the moment conditions are

$$0 = E[m_t * R_t^e]$$

[1] Hungary has the highest short-term interest rates

[2] Hungary has the highest inflation rates

[3] Hungary has the most volatile short-term interest rates

[4] Spain has the most volatile inflation rates

In all three models, there are seven moment conditions. Since the numbers of moment conditions are more than the numbers of the parameters in all models, there emerging the problem of overestimation. I will explain this problem in following part.

Table 3 shows the results of Fama-French three-factor model in six countries. The results indicate that all the coefficients of the size variables are not zero. Either positive or negative relationship between SMB/HML and returns are found. That is to say in Fama-French three-factor model, the effects of SMB and HML are uncertain, even the two variables are well indentified in the model. On the other hand, Table 4 illustrates the coefficients of the parameters in Macroeconomic factor model. The coefficients of the macroeconomic factors and market risk premium are non-zero. It means that both short-term interest rates and inflation indeed have direct influences on the returns. Moreover, the combined model is established by containing all two size variables, two macroeconomic factors and market risk premium in a single model. Because that SMB and HML cannot represent macroeconomic factors completely, the macroeconomic factors have influence on the returns as well as size variables. Additionally, Hypothesis 1 and Hypothesis 2 assumed that all countries have the same relationships between the macroeconomic factors and returns. Hypothesis 4 indicates the non-negativity of the coefficients of the short-term interest rates, while Hypothesis 2 describes the negative relationships between the inflation rates and the SDF. However, some of the results reveal particular features, which do not obey the common assumptions.

In Fama-French three-factor model, the market risk premium, SMB and HML are the direct factors affecting the returns. For both SMB and HML, the effects on the returns are uncertain based on the theory. The coefficients of HML and SMB are almost positive in the model, while the coefficient of SMB for Spain is negative. The results demonstrate that SMB and HML have explanatory power on the returns, since both positive and negative relationships between state variables and returns can correctly

exist.

Table 3 The results of Fama-French three-factor Model

Fama-French three-factor Model							
		Denmark	Finland	Hungary	Norway	Spain	Sweden
Intercept	α	-15.309	3.710	-12.040	1.538	15.478	0.343
R_m	β_1	-48.785	39.280	-39.505	19.407	70.014	17.037
SMB	β_2	667.155	180.019	269.761	332.665	**-306.010**[5]	112.111
HML	β_3	488.902	720.370	852.656	302.931	220.699	350.695

In contrast to Fama-French three-factor model, Macroeconomic factor model can check the direct effects of the macroeconomic factors and market indices on the returns. The short-term interest rates, which follow the theories, have significant negative influence on the returns. The inflation rates positively move with returns. The good performance of the coefficients of the inflation rates explains the Fisher effects well, which is to say that the returns can be a hedge against inflation in all six countries.

Table 4 The results of Macroeconomic factor model

Macroeconomic factor model							
		Denmark	Finland	Hungary	Norway	Spain	Sweden
Intercept	α	28.087	30.200	35.592	29.814	15.581	34.419
R_m	β_1	-40.770	48.985	32.912	7.407	92.076	17.948
Short-term IR	β_2	-1141.307	-664.270	-518.441	-637.214	-227.291	-1114.342
Inflation	β_3	521.299	42.311	2449.998	101.101	4380.499	197.022

In order to find the complementary effects of the macroeconomic factors on the size variables in Fama-French three-factor model, a combined model is built. Due to the mutual influence of SMB and HML, the effects of short-term interest rates and inflation rates are different from Macroeconomic factor model. From Table 5, we know that the coefficients of short-term interest rates for Norway and Spain are positive in the combined model. These two coefficients are contrary to the theories. In addition,

[5] Only Spain has the negative effect of SMB

the coefficient of SMB for Finland turn to be negative, even though we cannot say the change is incorrect. Thus the combined model distorts the effects of some factors. In the combined model, the effects of inflation rates on returns are still positive in six countries. The Fisher effects are verified by the combined model as well as the Macroeconomic factor model.

Table 5 The results of combined model

The combined model							
		Denmark	Finland	Hungary	Norway	Spain	Sweden
Intercept	α	3.988	35.984	26.744	-41.178	-14.400	30.732
R_m	β_1	-78.288	44.584	-9.597	104.628	151.517	-43.834
SMB	β_2	561.866	**-446.460**[6]	283.780	379.603	**-171.439**[7]	126.270
HML	β_3	420.154	269.673	886.842	519.359	293.986	320.122
Short-term IR	β_4	-793.556	-861.127	-573.131	1139.624[8]	1307.207[9]	-1573.364
Inflation	β_5	192.436	187.873	1768.847	4597.520	2892.526	415.112

However, neither Fama-French three-factor model nor Macroeconomic factor model can be applied validly in any situation. The two models possibly fail to work in some countries. Due to I use the GMM/SDF method to estimate the returns, there exists an over-indentified problem. As we known, the J-test always comes along with the GMM/SDF estimation, with the aim of inspecting over-identified problem. Table 6 demonstrates the results of J-test for the six countries in Fama-French three-factor model, Macroeconomic factor model and the combined model. Denmark, Finland, Hungary and Norway do not have the over-indentified problem in Fama-French three-factor model, whilst in Macroeconomic factor model only Hungary and Spain do not have the problem as well. The results of other countries reject the null hypothesis of J-test. That is to say the J-test loses its power of examining the validity of the models. Compared with the relative poor performance of Fama-French three-factor model and Macroeconomic factor model, the combined model works well without the

[6] Finland turn to have the negative effect of SMB

[7] Spain still negative effect of SMB

[8] Norway has the positive effect of short-term interest rates which disagree with the theories

[9] Spain has the positive effect of short-term interest rates which disagree with the theories

over-identified problem in most countries expect Sweden. Hansen and Jagannathan (1991) raised a minimum bound, HJ-bound, of the standard deviation of SDF in the mean-standard deviation space. All the valid SDF should be above or on the bound. Lettau (2002) found that the SDF cannot pass the HJ-bound when the SDF contains some distinctive risks. Kan and Zhou also pointed out that the factors determining SDF should be highly related to the returns. Because of the invalidation of J-tests in some situation, the efficiency of the SDF generated from these data is uncertain. From the Graphs in Appendix, the SDF in Macroeconomic factor model for Finland and the SDF in Fama-French three-factor model for Sweden are under the HJ-bound. The results consist with the results of J-test. Other SDF are above the HJ-bound, which means they are valid SDF.

Table 6 The results of J-test[10]

J-test						
	Fama-French		Macroeconomic factor model		Combined model	
	Statistic	P-value	Statistic	P-value	Statistic	P-value
Denmark	1.826	0.609	13.983	0.003	0.775	0.379
Finland	1.402	0.705	7.949	0.047	1.236	0.266
Hungary	4.103	0.251	2.469	0.481	0.001	0.970
Norway	6.052	0.109	12.867	0.005	0.827	0.363
Spain	8.498	0.037	3.998	0.262	0.277	0.598
Sweden	19.777	0.000	9.409	0.024	4.173	0.041

Since the models cannot explain the effects of the macroeconomic factors on the returns well all the time, I compare the returns and inflation rates directly. The results in Table 7 describe the averages of the industrial returns, the market returns and the inflation rates. Because that, even in the same countries, the industries have different speed of development, the industrial returns would be dissimilar. I put focus on the main comparison between the market returns and the inflation rates. As the outcomes shown, the Scandinavian countries such as Denmark, Finland, Norway and Sweden

[10] The red P-values are less than 5%, which means these regressions reject the null hypothesis of J-test

obey the assumption of hypothesis 3. Norway has the highest inflation rates, so it has the highest market returns. The second highest one is Denmark. The market returns and inflation rates of Sweden and Finland are the relative lower than them. Hungary and Spain have much higher inflation rates, but the market returns are not the highest. Especially the returns of Spain are just a little bit higher than ones of Finland. These results are abnormal which needs deeper researches.

Table 7 The comparison of returns and inflation rates in six countries

Returns and Inflation rates									
	Basic Mats	Industrials	Consumer Gds	Consumer Svs	Financials	Technology	Market		Inflation
Denmark	0.00385	0.00711	0.01330	0.01178	0.00832	0.01027	0.00621		0.00165
Finland	0.00283	0.01153	0.01598	0.00445	0.00600	-0.00342	0.00026		0.00154
Hungary	0.00298	0.00173	0.00157	0.00707	0.01722	0.00055	0.00664		0.00468
Norway	0.01138	0.00347	0.00784	0.00972	0.00917	0.00584	0.00690		0.00167
Spain	0.00636	0.00359	0.00654	0.00290	0.00093	-0.00555	0.00078		0.00244
Sweden	0.00897	0.00960	0.00895	0.00586	0.00536	0.00037	0.00388		0.00159

5. Analysis

Due to the research objectives are six European countries, I use Harmonized Index of Consumer Prices (HICP) replaced CPI to calculate the inflation rates. The reason is that HICP is an important indicator for European Central Bank to measure and control the inflation rates across European countries. There are two main differences between HICP and the traditional US CPI. The first one is that HICP tries to include the rural consumers into the sample partly, while CPI only considers the urban consumers. The other one is that HICP takes the consumptions on owner-occupied housing as a kind of investment, which should be removed from the index. The distinct features of HICP might cause slight changes of the effects of inflation on returns.

Norway is the only non-European Union (EU) member in this sample. The central bank of Norway does not have any long-term target of the monetary policies. In addition the central bank of Norway does not have the rights of making monetary

policies independently. The central bank needs to follow the economic policies made by the government. Even if the central bank has some special decisions, it has to report the decisions to the Ministry of Finance. This system lacks of clear delegation of monetary policies for the central bank. The Ministry of Finance would balance the various policies in order to ensure the growth of economy. Therefore there are much more restrictions of making monetary policies for Norwegian central bank, for example the interest rates cannot be adjusted by the central bank properly. However, Norway has a good fiscal status that it does not worry about the inflation. Allen (2006) stated that the inflation rates have a stable relationship with interest rates in Norway. Other Scandinavian countries as EU members are influenced by the economic policies from EU. In particular, Finland is the only one adopting Euro as currency. Therefore the central bank of Finland loses the rights to make monetary policies. The European Central Bank has the responsibility of setting the proper monetary policies for all the 17 EU Eurozone members. In the sample of this paper, another Eurozone member country is Spain. Spain took a lot of efforts to change its domestic macroeconomic policies, with the purpose of preparing to join EMU. After joined Economic and Monetary Union (EMU), Spain adjusts its high inflation rates to the lower European inflation rates. Hungary, the eastern European country, is called as the emerging market economy. Its economy is undergoing a transition to a market based economy. Even though the development of Hungary's economy is relative stable, it should consider what have to do when it become an EU member and even will be an EMU member. At first, it has to increase the output per capita to reach the EU basic level. At the same time, the central bank and government need to keep an eye on the inflation rates, which should be as low as possible. Hungary could opt for the inflation targeting to control the inflation rates. The reason is that emerging market economy like Hungary has little confidence of keeping a stable low inflation rates. In order to set a proper inflation rate, the government or the central bank need to understand the "core inflation" at first. The "core inflation" is a necessary inflation rate driven by demand. Because that other monetary policies such as interest rates and exchange

rates would be trade-off the inflation rates, the inflation rates would be driven by many other factors of macroeconomic environment. More important is that the target is not only decreasing the inflation rates but also increasing the output per capita. The results show that Hungary makes use of inflation targeting well to accomplish its economic objectives.

The inflation rates and short-term interest rates are the main monetary policies. Both the ex ante interest rates and the ex post interest rates are used to adjust the monetary policies. Due to the government or the central bank can use the monetary policies to control the inflation rates and short-term interest rates, the monetary policies have impacts on the returns as well. In the OECD countries, the decline of the short-term interest rates actually boosts the economies. Decreasing short-term interest rates is an expansionary monetary policy. When the investors find that the discount rates are reduced, the investments turn to be more and more since the future cash flows can raise. It is worthy to note that there is no standard reiteration of the monetary policies. Every country has its specific approaches to control the short-term interest rates, inflation rates and so on to facilitate stabilizing the economy. For instance, Sweden currently adopts the inflation targeting method, while the EMU implement the two pillar strategy.

Furthermore, no matter which method the country chooses, the trade-off relationship between nominal interest rates and inflation rates should be considered. The Taylor rule states a principle a good economy need to abide by. It says that the nominal interest rates increase more than one percentage necessarily, when the inflation rates rise one percentage. Crowder (1996) found that the nominal interest rates contain some information of the future changes of the inflation rates. Therefore the inflation rates are partly incorporated into the nominal interest rates. What's more the returns are affected by the trade-off of interest rates and inflation rates. Although both Fisher Hypothesis and Taylor Rule think that the interest rates have relation with inflation

rates. In practice, the interest rates indeed have information about the future inflation rates, so that the changes of interest rates can explain part of changes of inflation rates. Particularly, the nominal interest rates integrate portion of inflation rates in setting prices. But Mishkin (1992) discovered that the short-term interest rates do not have positive relation with inflation rates, even there might be no connection between them. There is no short-term Fisher effect, but the long-term Fisher effect works well.

6. Conclusion

In this paper, I use Fama-French three-factor model, Macroeconomic factor model and a combined model to estimate the expected returns in six European countries. The GMM/SDF method is selected to replace the traditional OLS method. The results show that the macroeconomic factors such as short-term interest rates and inflation rates definitely have influences on the returns. In terms of the over-identification problem of GMM, the Macroeconomic factor model has more serious problem than other two models. The Fama-French three-factor model merely uses two size variables to increase the explanatory ability of model. However, the two size variables do not have empirical motivations of prediction for the investors. Based on the theories, macroeconomic factors have influence on the returns. The Macroeconomic factor model directly reflects the relation between returns and the macroeconomic factors. From the results, not only short-term interest rates but also inflation rates verify the theories well in Macroeconomic factor model across the countries. The short-term interest rates have a negative relation with returns for all six countries. Additionally, all six countries have positive linkages between inflation rates and returns, which follow the Fisher hypothesis. In the combined model, the complementary effects of HML and SMB distort the influence of the short-term interest rates on the returns in Macroeconomic factor model for Norway and Spain.

On the other hand, the country with higher inflation rates has higher returns in Scandinavian area. Spain and Hungary, as the representatives of emerging market

economies, need to make sure the fast growth of the economies. The transition to market-based economy or the preparation of being European Monetary Union (EMU) member require them to raise the return per capita, as well as keep the inflation rates as low as possible. The inflation targeting method is recommended to these emerging market economies. The good performance of inflation rates and short-term interest rates in Spain and Hungary points out the efficient monetary policies for the emerging market. Through both Macroeconomic factor model and combined model, the good performance of Finland and Spain indicates that the functions of European Central Bank is more efficient than other countries' governments or central banks. The reason is that the function of the European Central Bank is managing the monetary policies for all the member countries in Eurozone. The monetary policies definitely are balanced across the member countries. Therefore the common policies can works efficiently both in Spain and Finland. Harmonized Index of Consumer Prices (HICP) and Euro Interbank Offered Rate (Euribor) are the two main indicators of reflecting and managing the inflation rates and interest rates across the member countries of Eurozone. In this paper, I use HICP to calculate the inflation rates and use the 3-month interbank rates to represent the short-term interest rates. Therefore the results of this research reveal the effects of the monetary policies on the returns in some extent.

However, Lee (1992) asserted that there is no causal relationship between inflation rates and returns. Thus neither the positive relation nor the negative relation between inflation rates and returns, which is used to predict the returns, would be spurious. Furthermore there are more other macroeconomic factors and theoretical market indices such as exchange rates and GDP growth rates also have significant influences on the returns. Therefore the sufficiency and the efficiency of the short-term interest rates and inflation rates for both Macroeconomic factor model and combined model is a big problem in my research. Owing to the inherent linkage of interest rates and inflation rates, the governments and central banks use various monetary policies to

adjust them. For instance, the short-term interest rates forced to decrease in order to stimulate the growth of economy. Thus the observed data might contain the bias produced by these compulsory readjustments and controls from governments. In the combined model, SMB and HML might change the influence of short-term interest rates and inflation rates on the returns. In regard to the proxy problem of the HML and SMB in Fama-French three-factor model, we cannot assert that the changes are improvements or distortions. The inexplicit proxy problem also restrains the further researches of other macroeconomic factors and theoretical market indices for Fama-French three-factor model. This question should be further discussed and resolved in future.

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Appendix

Table 3.3.2-1 The stationarity of short-term interest rates

Augmented Dickey-Fuller test statistic		
	Level	
	t-Statistic	Prob.[11]
Denmark	-2.299571	0.4308
Filand	-2.105957	0.5373
Hungary	-3.087419	0.1139
Norway	-2.096142	0.5427
Spain	-2.105957	0.5373
Sweden	-2.776371	0.2088

Table 3.3.2-2 The correlations between the explanatory variables in Denmark

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	0.03623344	1			
HML	0.25093724	-0.381706	1		
Short term IR	0.12864314	0.0044983	0.1237777	1	
Inflation	0.14016814	-0.064757	0.0355206	0.05653954	1

Table 3.3.2-3 The correlations between the explanatory variables in Finland

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	0.0453593	1			
HML	0.0348469	-0.3817064	1		
Short term IR	0.1082157	-0.0807943	0.1925133	1	
Inflation	0.0408135	-0.0041933	0.0252506	0.084354798	1

Table 3.3.2-4 The correlations between the explanatory variables in Hungary

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	0.1408812	1			
HML	0.0291534	-0.3817064	1		
Short term IR	-0.1258977	0.0593118	0.0940192	1	
Inflation	0.10589	0.016578	0.0951355	-0.028190021	1

[11] MacKinnon (1996) one-sided p-values

Table 3.3.2-5 The correlations between the explanatory variables in Norway

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	0.1079559	1			
HML	0.1170944	-0.3817064	1		
Short term IR	0.0323548	-0.1384431	0.1327356	1	
Inflation	0.0212942	0.0786087	0.0115304	0.128074066	1

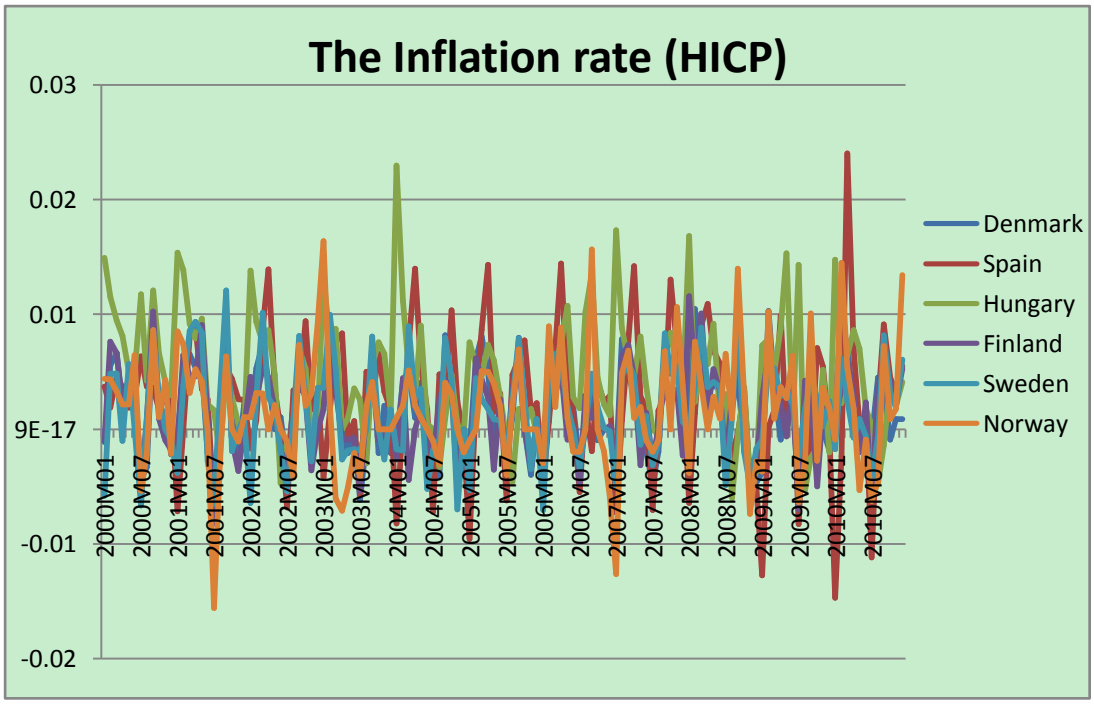
Table 3.3.2-6 The correlations between the explanatory variables in Spain

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	-0.0326116	1			
HML	0.1838732	-0.3817064	1		
Short term IR	0.1926555	-0.0807943	0.1925133	1	
Inflation	0.0288743	-0.028381	0.0415492	0.251866953	1

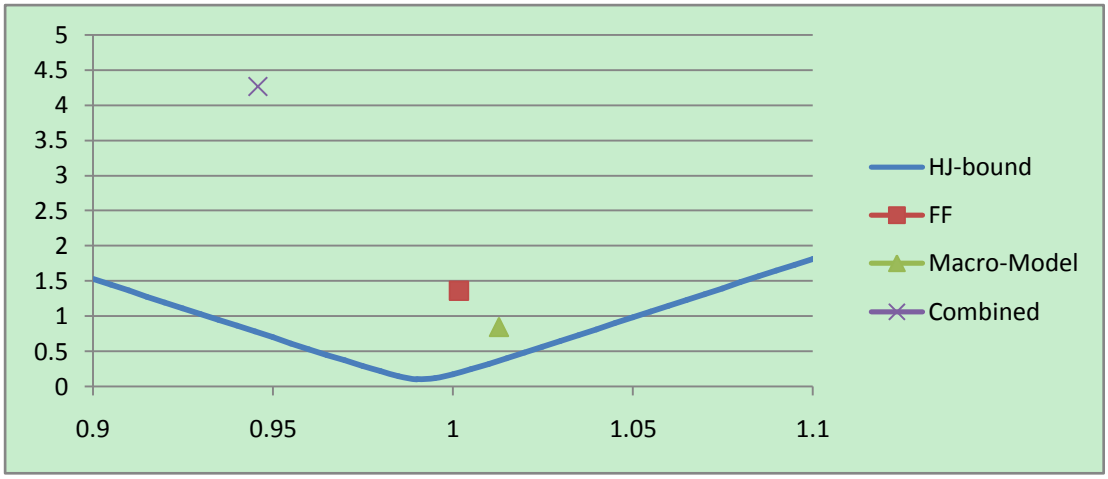
Table 3.3.2-7 The correlations between the explanatory variables in Sweden

	Rm-Rf	SMB	HML	Short term IR	Inflation
Rm-Rf	1				
SMB	0.0726855	1			
HML	0.1461204	-0.3817064	1		
Short term IR	0.2418765	0.0378559	0.1646446	1	
Inflation	0.0432011	-0.0679557	0.0152951	0.06268202	1

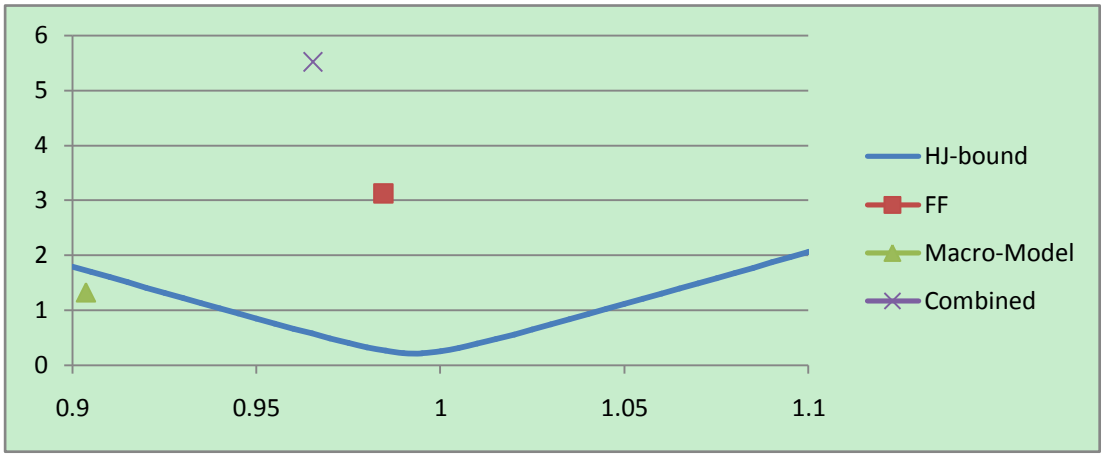
Graph 1 The inflation rates of six countries



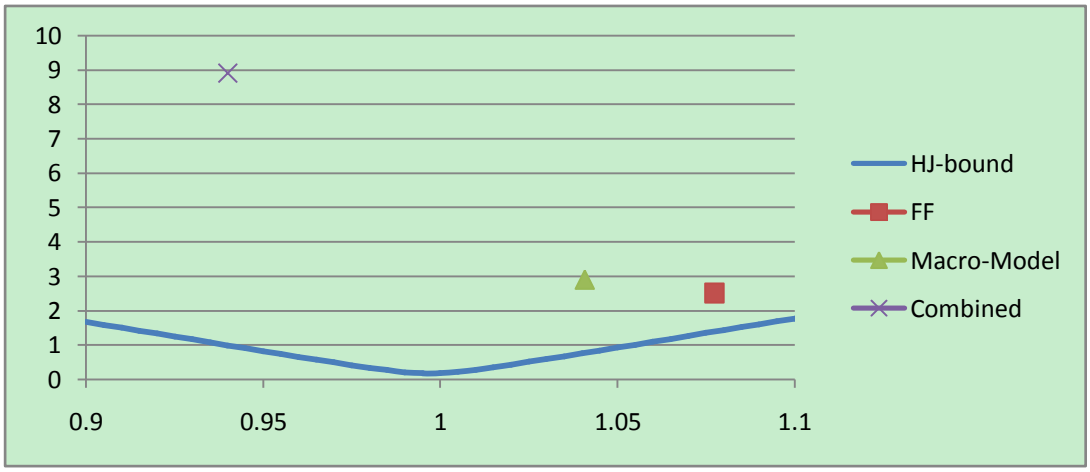
Graph 2 The HJ-Bound of Denmark



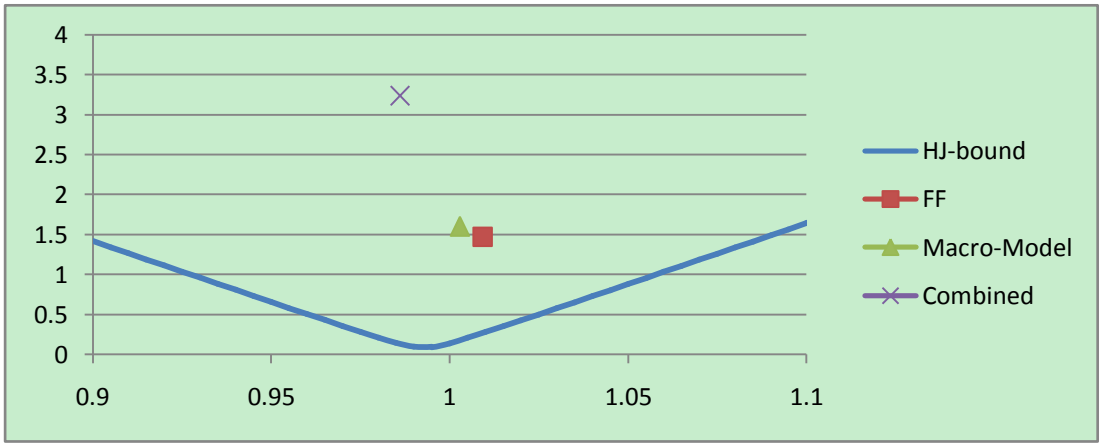
Graph 3 The HJ-Bound of Finland



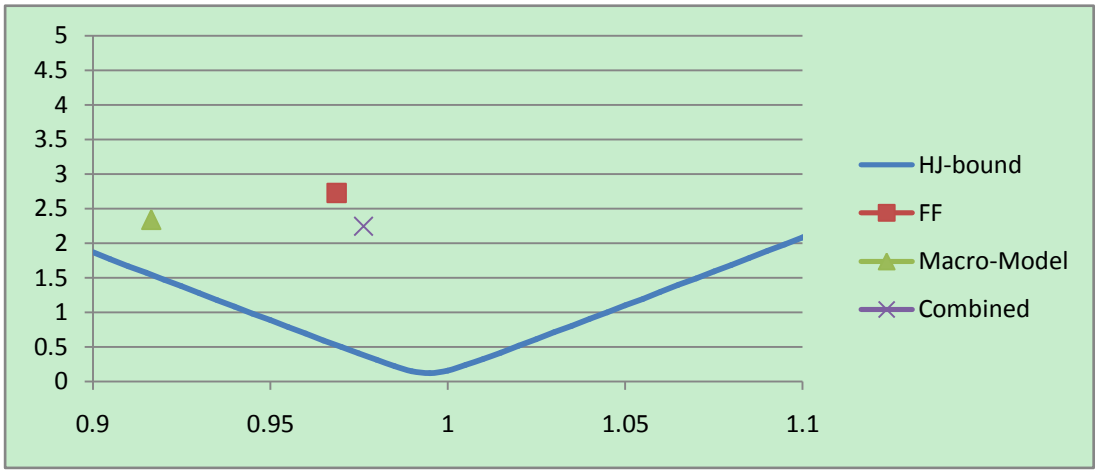
Graph 4 The HJ-Bound of Hungary



Graph 5 The HJ-Bound of Norway



Graph 6 The HJ-Bound of Spain



Graph 7 The HJ-Bound of Sweden