

# “The use of CAPM and Fama and French Three Factor Model: portfolios selection”

## AUTHORS

Belen Blanco

## ARTICLE INFO

Belen Blanco (2012). The use of CAPM and Fama and French Three Factor Model: portfolios selection. *Public and Municipal Finance*, 1(2)

## RELEASED ON

Tuesday, 27 November 2012

## JOURNAL

"Public and Municipal Finance"

## FOUNDER

LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

0



NUMBER OF FIGURES

0



NUMBER OF TABLES

0

© The author(s) 2021. This publication is an open access article.

Belen Blanco (Spain)

## The use of CAPM and Fama and French Three Factor Model: portfolios selection

### Abstract

This work tests the American NYSE market, the expected returns of a portfolios selection according to the CAPM and Fama and French Three Factor Model. The portfolios have been constructed according to the size and BV/MV. The author employs a database based on expected returns and factors related to each model, from July 1926 to January 2006. Empirical results point out that Fama and French Three Factor Model is better than CAPM according to the goal of explaining the expected returns of the portfolios. However, the paper shows that the results vary depending on how the portfolios are formed.

**Keywords:** CAPM, Fama and French, portfolios.

**JEL Classification:** G11, G12.

### Introduction

There is a concern in Financial Economics on how estimating assets' returns. There are two main alternatives available for this purpose; the first one is a single factor model (or Capital Asset Pricing Model [CAPM]) by Sharpe (1964) and Lintner (1965), and the second one is the Three Factor Model suggested by Fama and French (1992).

CAPM is an economic model that explains stock returns as a function of market return. The main alternative to CAPM is the Three Factor Model suggested by Fama and French (1992). In this model, size and book to market factors are included, in addition to a market index, as explanatory variables.

A huge amount of criticisms of CAPM have emerged over the time, and many authors propose alternative models to improve it. There exist several examples of these CAPM modifications models; Merton (1973) develops the intertemporal capital asset pricing model (ICAPM) to capture the multi-period aspect of financial market equilibrium. In a different way, Ross (1976a, 1976b) proposes the Arbitrage Pricing Theory (APT). Breeden (1979) proposes the consumption-based model.

A lot of CAPM contradictions have been showed over time. If I look at the empirical test, Basu (1977) and Basu (1983) show that CAPM empirical failures by showing that stocks with high earnings/price ratios (or low P/E ratios) earned significantly higher returns than stocks with low earnings/price ratios, and this effect is not just observed among small capitalization stocks. Basu's studies are confirmed by Jaffe, Keim and Westerfield (1989). They show how this effect appears not only in January. The existence of this effect makes CAPM failure because the beta should be all that matters, and it's not.

Another contradiction is found by Banz (1981). In his paper, he finds that the stocks of firms with low market capitalizations have higher average returns than large capitalization stocks. These two contradictions are not connecting and small firms tend to have higher returns, even after controlling for E/P.

One more contradiction comes from the tendency of returns to reverse over long horizons. In this context, DeBondt and Thaler (1985) find that those stocks that have had poor returns over the past three to five years have much higher average returns than "winners" over the next three to five years. Chopra, Lakonishok and Ritter (1992) show that beta cannot account for this difference in average returns. And there is not exist such beta able to justify the return difference and so the CAPM.

Chan, Hamao and Lakonishok (1991) find that BtM (book-to-market equity) has a direct relationship with the expected returns. This finding is consistent with that of Rosenberg, Reid and Lanstein (1985), who find that BtM produces dispersion in average returns.

One more contradiction in the CAPM comes from Bhandari (1988), which includes the leverage variable, as a function of average returns, apart from size and beta. High leverage increases the riskness of a firm's equity, but this increased risk should be reflected in a higher beta coefficient.

Another CAPM contradiction comes from the momentum. Jegadeesh (1990) finds that stock returns tend to exhibit short-term momentum. A study by Jegadeesh and Titman (1993) confirms these results. Their study also indicates that the momentum is stronger for firms that have had poor recent performance.

Due to lack of consistency of CAPM, Fama and French (1992) propose a model which controls for size, leverage, E/P, BtM, and beta in a single cross-sectional study. Their results are controversial. First, they find that the previously documented positive

relation between beta and average return is due to the negative correlation between firm size and beta. When this correlation is accounted for, the relation between beta and return disappears. The positive relation between return and beta is highly linear, as predicted by the CAPM. Based on this evidence, it appears that the CAPM nicely explains the higher returns that small firms have earned. But when beta is allowed to vary without controlling for size, the positive, linear beta-return relation disappears. This result contradicts the central prediction of the single-period CAPM.

However, taking all these variables (size, leverage, E/P, BtM, and beta) in the model doesn't seem to solve the CAPM problems. When they run cross-sectional regressions from 1963 to 1990, it seems that BtM and size are the variables that have the strongest relation to returns. The explanatory power of the other variables vanishes when these two variables are included in the regressions. The cross-section of average stock returns can be nicely described by two variables.

The main objective of this paper is to compare the performance of the Three Factor Model of Fama & French with that of CAPM for portfolios formed on different way, for North American Market, with monthly data from July 1926 to January 2006. I can construct different portfolios on different manner. Could I have different results if I choose different way to form the portfolios? It seems from prior literature that results are different depending on how the portfolios are formed (among others, Chordia and Shivakumar, 2006; Petkova, 2006; Core et al., 2008), but as far as I know, there is no previous literature driving this issue directly.

The results obtained show empirical evidence in favor of Fama and French Three Factor Model, in respect to the CAPM. So, there exists evidence of how the characteristics related to the size and the BE/ME ratio, explain the assets returns. I also find that results vary depending on how the portfolios are formed.

The remainder of the paper is organized as follows. In section 1, various issues associated with estimation of expected return based on CAPM are discussed and Fama and French Three Factor Model is presented. A description of the data used for analysis is provided in section 2. In section 3 the results obtained from estimation based on CAPM are presented and those from estimation based on Fama and French. Finally, the last section concludes the paper.

## 1. CAPM vs. Fama and French Three Factor Model

The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between risk and expected returns. The weak point in the CAPM is the existence of simplifying assumptions, which is going to create problems in the empirical test.

**1.1. Development of the CAPM.** Markowitz (1952, 1959) states the "mean-variance-model", which tries to minimize the variance according to a given expected return or maximize the expected return according to a given variance.

The assumptions behind the model developed by Sharpe (1964) and Lintner (1965) are:

- ◆ It is a static model (one period).
- ◆ There exists fixed asset supply.
- ◆ There exists a zero net supply risk free asset (borrowing and lending at same rate  $r$ ).
- ◆ The returns follow a normal distribution.
- ◆ There are homogeneous expectations about investment opportunities set.
- ◆ The financial markets are competitive markets.
- ◆ There no transaction costs (taxes, frictions, and so on).

From these assumptions it is easy to see that it is going to be the following equation:

$$E(R_i) = E(R_{zM}) - (E(R_M) - E(R_{zM}))\beta_{iM}, i = 1, \dots, N$$

is the Minimum Variance Condition for market portfolio in the CAPM Black version. The CAPM assumptions imply that the market portfolio  $M$  must be on the minimum variance frontier if the asset market is to clear. This means that the algebraic relation that holds for any minimum variance portfolio must hold for the market portfolio. If there are  $N$  risky assets, I can derive the above formula, where  $E(R_{zM})$  is the expected return on assets that have market betas equal to zero, and the second term is the risk premium.

In this equation,  $E(R_i)$  is the expected return on asset  $i$  and  $\beta_{iM}$ , the market beta of asset  $i$ , is the covariance of its return with the market return divided by the variance of the market return. The equation is the following:

$$\beta_{iM} = \frac{\text{cov}(R_i, R_M)}{\sigma^2(R_M)}$$

The last step is to include the risk-free borrowing and lending assumption,  $E(R_i) = R_f + (E(R_M) - R_f)\beta_{iM}$ ,  $i = 1, \dots, N$ . This is the Sharpe-Lintner CAPM equation.

Black, Jensen and Scholes (1972) and Black (1972) keep out the risk-free borrowing and lending assumption and include unrestricted short sales of risky assets. So the market portfolio is efficient because it is made of efficient portfolios, and it is the expected return-risk relation of the Black CAPM.

From the above explanations it can be stated the differences between Black and Sharpe-Lintner versions. The Black version states that the expected return on assets uncorrelated with the market must be less than the expected market return, so the premium for beta is positive; but in the Sharpe-Lintner version, the expected return on assets uncorrelated with the market, must be the risk-free interest rate and the premium per unit of beta risk is the difference between the expected market return and the risk free assets.

The CAPM is based on unrealistic simplifications and it is necessary to test it in order to validate the model.

**1.2. Testing CAPM.** *1.2.1. Early test.* The implications are three: (1) expected returns on all assets are linearly related to their betas and they are the unique explanatory variables; (2) the beta premium is positive; (3) in the Sharpe-Lintner model assets uncorrelated with the market have expected returns equal to the risk-free interest rate and the beta premium is the expected market return minus the risk-free rate.

### *1.2.2. Tests on risk premia.*

#### 1. Cross-section regression.

The cross-section regression tests focus on the Sharpe-Lintner's model predictions about the intercept and the slope in the relation between expected return and market beta.

The intercept is the risk free interest rate and the coefficient on beta is the expected return on the market in excess of the risk-free rate.

But this test involves two problems: (1) imprecise estimated individual betas prevent to explain average returns; and (2) regression residuals have common sources of variation.

One possible solution to the first problem is working with portfolios; however, doing portfolios reduces the statistical power, so researchers sort securities on beta when forming portfolios. For the second problem, Fama and Macbeth (1973) propose to estimate month by month cross-section regressions of monthly return on betas, as the effect of residual correlations are captured via repeated sampling of the regression coefficients.

#### 2. Time series regression.

Jensen (1968) was the first to note that the Sharpe-Lintner version of the relation between expected return and market beta also implies a time series regression test.

He states that the "Jensen's Alpha", in other words, the intercept, is zero for each asset.

$$R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \varepsilon_{it}.$$

Both, the cross-section tests and the time series tests confirm that the relation between beta and average return is too flat.

Although the observed premium per unit of beta is lower than the one predicted by Sharpe-Lintner model, the relation between average returns and beta is roughly linear. This is consistent with the Black version of the CAPM, which predicts that the beta premium is positive.

*1.2.3. Testing whether market betas explain expected returns.* If the market portfolio is mean-variance efficient, the differences in market betas are the only variables responsible for the differences in expected returns.

#### 1. Cross-section regression.

The trick in cross-section regression is to choose specific additional variables to solve problems of the CAPM.

#### 2. Time series regression.

The trick here is to form a portfolio in a way to solve CAPM deficiencies. To test if the portfolios solve these problems, Gibbons, Ross, and Shaken (1989) propose a statistic tests to see whether the market proxy is the tangency portfolio in the set of portfolios that can be constructed by combining the market portfolio with the specific assets used as dependent variables in the time series regressions.

According to the above mentioned we can make the following conclusion. Time series and cross section regressions do not test the CAPM. The goal of these tests is whether a specific proxy for the market portfolio is efficient in the set of portfolios that can be formed.

CAPM can not be tested because: (1) the set of left-hand-side assets does not include all marketable assets; and (2) the data for the true market portfolio of all assets are likely beyond reach.

Black's model predicts that betas are sufficient to explain the expected returns, but a more specific prediction of the Sharpe-Lintner CAPM of that the premium per unit of beta is the expected market return minus the risk-free interest rate, is consistently rejected.



**1.3. Recent tests.** Fama and French (1992) prove the empirical failures of the CAPM, using the cross-section they confirm that size, earning-price, debt-equity, and book-to-market ratios add to the explanation of expected stocks returns provided by market beta.

If betas do not suffice to explain expected returns, the market portfolio is not efficient, and the CAPM is not fulfilled. This problem can be spurious, but the empirical evidence suggests that the contradictions of the CAPM associated with price ratios are not sample specific.

*1.3.1. Explanations: irrational pricing or risk.* Behavioralists' view is based on evidence that stocks with high ratios of book value to price are typically firms that have fallen on bad times, while low B/M ratios are associated with growth firms.

The other reason for empirical contradictions in CAPM is that the CAPM is based on many unrealistic assumptions.

Merton's (1973) intertemporal capital asset pricing model is a natural extension of the CAPM, but the ICAPM takes into account future state variables. Optimal portfolios are "multifactor efficient", which means they have the largest possible expected returns, given variances and the covariances of their returns with the relevant state variables.

Fama and French (1995) show similar patterns in size and book to market in the covariation of fundamentals like earnings and sales. Fama and French (1993, 1996) propose the following three-factor model:

$$E(R_{it}) - R_{ft} = \beta_{iM}(E(R_{Mt}) - R_{ft}) + \beta_{is}E(SMB_t) + \beta_{ih}E(HML_t).$$

In this equation,  $SMB_t$  (small minus big) is the difference between the returns on diversified portfolios of small and big stocks, and  $HML_t$  (high minus low) is the difference between the returns on diversified portfolios of high and low B/M stocks.

Applied to time regressions:

$$R_{it} - R_{ft} = \alpha_i + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}SMB_t - \beta_{ih}HML_t - \varepsilon_{it}.$$

This model is better than the CAPM to estimate expected returns, and captures in a better way the variation in average returns for portfolios formed on size, book to market, and the others factors, for which CAPM is not efficient.

From a theoretical perspective, the main shortcoming of the three factor model is its empirical motivation, as the SMB and HML explanatory returns are not motivated by predictions about state variables of concern to investors.

Adding diversified portfolios that capture covariation in returns and variation in average returns left unexplained by the market is essential in ICAPM and APT.

Fama (1970) emphasizes that the hypothesis that the prices properly reflect available information must be tested in the context of a model of expected returns, like CAPM. The principal problem for the three factor model is the "momentum effect" of Jegadeesh and Titman (1993). This effect is distinct from the value effect captured by book-to-market equity and other price ratios, and it is not explained by the Three Factor Model, neither by the CAPM, but this problem is short-lived, so it is irrelevant for estimating the cost of equity capital.

To sum up, when the relation between cash flows and expected returns is unexplained by the CAPM or by the Three Factor Model, one cannot tell whether it is the result of irrational pricing (behavioral approach) or a mis-specified asset pricing model.

*1.3.2. The market proxy problem.* Roll (1997) argues that the CAPM has never been tested and probably will not be. The problem is that the market portfolio is theoretically and empirically elusive, and it is necessary to use proxies.

The limitation comes from the fact that researchers have not uncovered a reasonable market proxy that is close to the minimum variance frontier, or in other words, an efficient one.

The major problem for the CAPM is that portfolios formed by sorting stocks on price ratios produce a wide range of average returns, but the average returns are not positively related to market betas, and it is unlikely that alternative proxies for the market portfolio will produce betas and a market premium that can explain the average returns on these portfolios. If a market proxy does not work in tests of the CAPM, it does not work in applications.

The first version of the CAPM developed by Sharpe-Lintner has never been empirical success, it was modified by Black (1972) but it was not good enough. It is necessary to introduce new variables to be able to compute the average returns provided by beta. These challenges take place in 1970. Jensen measures abnormal performance introducing the intercept, or Jensen's alpha, in the time series regression; others complicated models as ICAPM from Merton (1973) have not solved the problems. So despite of the CAPM simplicity, its empirical problems invalidate the application.

## 2. Data

**2.1. Sample description.** In this paper I have worked with monthly returns from July 1926 to January 2006, thus makes a total of 955 observations. The methodology used to test the models is time series regressions.

The explanation of the sample is going to be based on two basic items: (1) expected returns; (2) description of Fama/French Factors.

**2.2. Expected returns.** To get the expected returns for the portfolios, the solution implies to rebalance annually these portfolios using two independent sorts, on size (market equity, ME) and book-to-market (the ratio of book equity to market equity, BE/ME).

To form the portfolios, first, the firms are divided into two groups according to the size. First, the firms are divided taking into account the median of NYSE to divide the firms into big (B) and small (S) firms. Then, the firms are divided into three groups according to the BE/ME ratio. Thus the 30% of the firms with a lower value are grouped in a portfolio (L), the 40% with a medium ratio in a (M) portfolio, and the other 30% related to the higher ratio in the (H) portfolio. The decision of dividing the portfolios into three groups according to the BE/ME ratio, and into two portfolios according to stock market exchange, is related to the most favorable evidence to this ratio obtained in the cross-section regressions and in time series regressions.

Using the possible two portfolios intersections according to the size and the three portfolios to BE/ME ratio, Fama and French build six portfolios which are defined as S/L, S/M, S/H, B/L, B/M, B/H, and represent the portfolios with lower stocks which at the same time are part of the lower BE/ME ratio group, S/L, those smaller firms with medium ratio (S/M) and so on.

The assets related to each of the six portfolios get a different weight depending on the stock exchange market. This classification is kept over the whole year, so in the following year, at the end of June, the classification process is going to be repeated.

**2.3. Description of Fama/French factors.** The Fama/French factors,  $R_m$ , SMB, and HML, are constructed from six size/book-to-market portfolios that do not include hold ranges and do not incur transaction costs.

$R_m$  is the excess return on the market, is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates), this Treasury bill rate is going to be the risk premium ( $R_f$ ).

SMB (Small minus Big) is the average return on three small portfolios minus the average return on

three big portfolios,  $SMB = 1/3$  (Small Value + Small Neutral + Small Growth) –  $1/3$  (Big Value + Big Neutral + Big Growth).

HML (High minus Low) is the average return on two value portfolios minus the average return on two growth portfolios,  $HML = 1/2$  (Small Value + Big Value) –  $1/2$  (Small Growth + Big Growth).

## 3. Empirical evidence: CAPM versus Fama and French Three Factor Model

The following tables present the results obtained from the CAPM and Fama and French Three Factor Model. These tables show the estimators related to each model, the significance statistics and the  $R^2$  coefficient, that means, which is the percentage of the dependent variable, explained by the independent variables. The sample period is wide enough, and I can observe important volatilities in war and North American crisis periods, these situations can influence in an indirect way the contrasts results (see the Appendix).

The independent variable is defined as the reference portfolio return, which is computed by Fama and French for the American market according to the size and the BE/ME ratio.

The three Fama and French factors, are the reference monthly factors found out by the authors. The market index is the NYSE value and the bill's monthly rentability is taken as the risk-free rate.

The table is divided according to six different kinds of portfolios, which are characterized taken into account the size and the BE/ME ratio.

Table 1. CAPM for six different kinds of portfolios

	$\hat{\alpha}_i$	$\hat{\beta}_i$	$\bar{R}^2$
BL	42,52	0,94	0,83
	(7,93)	(69,67)	
BM	66,38	0,86	0,73
	(9,98)	(51,19)	
BH	112,20	0,76	0,53
	(12,08)	(32,75)	
SL	127,80	0,76	0,48
	(12,67)	(29,92)	
SM	103,90	0,76	0,55
	(11,74)	(34,45)	
SH	137,17	0,70	0,45
	(13,73)	(27,95)	

Note: t-statistics are presented in parentheses.

Table 2. Fama and French Three Factor Model for six different kinds of portfolios

	$\hat{\alpha}_i$	$\hat{\beta}_{M}$	$\hat{\beta}_{S}$	$\hat{\beta}_{B}$	$\bar{R}^2$
BL	74,54	0,94	-0,02	-0,08	0,84
	(9,61)	(69,62)	(-1,45)	(-5,82)	
BM	39,85	0,86	-0,02	0,10	0,74
	(4,14)	(51,29)	(-138)	(5,70)	

Table 2 (cont.). Fama and French Three Factor Model for six different kinds of portfolios

	$\hat{a}_i$	$\hat{\beta}_M$	$\hat{\beta}_{S}$	$\hat{\beta}_n$	$\bar{R}^2$
BH	58,08	0,78	-0,05	0,22	0,56
	(4,41)	(33,92)	(-2,06)	(8,49)	
SL	63,97	0,69	0,36	-0,06	0,56
	(4,50)	(29,23)	(13,31)	(-2,40)	
SM	23,40	0,71	0,31	0,02	0,62
	(0,95)	(34,11)	(13,09)	(1,19)	
SH	33,32	0,66	0,27	0,13	0,51
	(2,41)	(27,31)	(9,80)	(5,05)	

Note: t-statistics are presented in parentheses.

It is easy to see how the CAPM does not show empirical evidence in its favor. The Jensen's alpha should be zero, but in the test this coefficient is too high and statistically significant, independently of the portfolio analyzed. Because of the significance of this parameter, if I only take as independent variable the expected market portfolio return to compute the portfolio return, a big percentage of the dependent variable return is not explained anymore.

I can observe that the Fama and French Three Factor Model works empirically better than the CAPM for the selected sample.

This is the reason to apply the Fama and French Three Factors Model, to explain the portfolio expected return. The results vary according to the chosen portfolio characteristics. I can observe in a clear way, that the expected market return is an independent variable to explain all the portfolios expected returns.

If I focus on the size, I can observe how the parameters significance depends on the chosen portfolio. Thus, I can see that in big firms, the size cannot be considered as independent variable to determine the expected portfolio return, independently of the BE/ME ratio. However, in smaller firms, this variable gets a high significance when I compute the expected returns. Moreover, I can see that in this market, in this period of time small firms have higher returns than big firms.

If I focus now on the BE/ME value ratio I can observe that in this case the parameters significance vary depending on the chosen portfolio. So, for example, the firms with a low ratio show in a significant way, an indirect relationship with the portfolio expected returns.

I observe that in medium ratio firms, this variable does not explain the expected return. High ratio firms show a direct relationship with the expected return in a significant way.

The perfect fitness in Fama and French Three Factor Model has made me thinking about the latent relationship between the Fama and French Factors and

the dependent variable. This relationship appears due to the way in which the portfolios are built, so I have defined a correlation table explaining all the correlations related to all the model's terms.

Table 3. Correlations between Fama and French Factors

	B/L	B/M	B/H	S/L	S/M	S/H
Risk premium	<b>0,98</b>	<b>0,95</b>	<b>0,86</b>	<b>0,83</b>	<b>0,87</b>	<b>0,79</b>
SMB	0,25	0,23	0,24	<b>0,49</b>	<b>0,49</b>	<b>0,42</b>
HML	0,06	<b>0,36</b>	<b>0,46</b>	0,10	0,29	<b>0,38</b>

I can observe too high correlation between the Fama and French factors and the variable I want to study, thus the shadowed values show the highest correlations, and these values match in a perfect way with the values which made me thinking about a deterministic relationship. I believe that building the portfolios in other way will destroy the Fama and French Three Factor Model empirical evidence.

If I form portfolios according to the dividend yield, for the same period of time and for the same market, I can construct four different portfolios: those which got dividend yield equal to zero, then another portfolio built with the 30% of firms which had a low dividend yield, the third portfolio was constructed with the 40% of firms which got medium dividend yield and the last portfolio was formed using the 30% of firms with high dividend yield.

I have tested CAPM and Fama and French Three Factor Model for these portfolios, and the results are the following.

Table 4. CAPM

	$\hat{a}_i$	$\hat{\beta}_i$
Dividend yield 0	1,2227	-0,0005
	(2,7565)	(-0,3220)
Bottom 30%	0,934	0,000
	(2,5724)	(0,0220)
Middle 40%	1,1987	-0,0006
	(3,6023)	(-0,7685)
Top 30%	1,5852	-0,0014
	(4,2237)	(-1,4873)

Notes: t-statistics are presented in parentheses.  $R^2$  is always close to zero, so I submit the corresponding column.

Table 5. Fama and French Three Factor Model

	$\hat{a}_i$	$\hat{\beta}_M$	$\hat{\beta}_S$	$\hat{\beta}_n$
Dividend yield 0	0,8787	-0,006	0,0012	0,0002
	(1,0508)	(-0,4422)	(0,6854)	(0,1536)
Bottom 30%	1,4054	0,0003	-0,0016	-0,0004
	(2,6269)	(0,2873)	(-1,443)	(-0,3478)
Middle 40%	1,4090	-0,0005	-0,0011	0,0001
	(2,8722)	(-0,5443)	(-1,0890)	(0,1354)
Top 30%	1,3714	-0,0014	0,0002	0,0005
	(2,4883)	(-14854)	(0,2032)	(0,4915)

Note: t-statistics are presented in parentheses.  $R^2$  is always close to zero, so I submit the corresponding column.

At this point, I can see in the CAPM that the market risk premium is not statistically significant, although the Jensen's alpha is still positive and statistically significant. This fact should be the result of parameters model (betas) change over the time depending on a state variable related to the economic cycles.

On the other hand, in Fama and French Three Factor Model, the betas related to the Fama and French's factors are not significant anymore.

If I see a correlation table explaining all the correlations related to all the model's terms, I have the following one.

Table 6. Correlation

	Dividend yield 0	Bottom 30%	Middle 40%	Top 30%
Risk premium	-0,0047	0,0181	0,0040	-0,0319
SMB	0,0004	-0,0338	-0,0031	0,0225
HML	-0,0002	0,0364	-0,0054	-0,0282

I have created portfolios in two different ways, and I have proved that the CAPM is poor explaining the portfolios returns, moreover in Fama and French Three Factor Model I have checked that the size and book-to-market ratio, do not succeed as portfolios returns explanatory variables.

The study is novel as it proposes a different way to test CAPM and Fama and French Three Factor Model, choosing portfolios which is going to allow me to get the expected returns, using two independent sorts, on size (market equity, ME) and book-to-market (the ratio of book equity to market equity, BE/ME). I have showed a century without empirical evidence both CAPM and Fama and French Three Factor Model, because of I have shown the false cause which makes working the model. If I build portfolios in another way, different from Fama and French suggestions, I believe I am going to obtain results radically different from the expected ones; this is the novelty of the paper. A rational investor will not always form portfolios following these criteria. Thus if I want Fama and French works, I should assume that the investor is going to create portfolios in this way. If I do not make this assumption, the model does not look to get better empirical evidence than the CAPM.

There exists empirical evidence which shows how the parameters model (betas) change over the time

## References

1. Banz, Rolf W. (1981). "The Relationship Between Return and Market Value of Common Stocks", *Journal of Financial Economics*, 9, pp. 3-18.
2. Basu, Sanjoy (1977). "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis", *Journal of Finance*, 32, pp. 663-682.
3. Basu, Sanjoy (1983). "The Relationship between Earnings Yield, Market Value and Return for NYSE Common Stocks: Further Evidence", *Journal of Financial Economics*, 12, pp. 129-156.

depending on a state variable related to the economic cycles. A large enough periods, used in this study for the American case, is going to catch the economic variations. In order to improve the results proposed in this study, and due to the parameters model (betas) change over the time depending on a state variable related to the economic cycles, I should study the conditional models. Moreover, I should do a psychological study taking a representative investors sample, in order to see the factors for which the investors choose a given portfolio, and then test if these two models fit with the data.

## Conclusion

This study wants to go into the new alternatives in depth, in order to solve the CAPM empirical failure, coming to the Fama and French Three Factor Model.

I have studied the American market, from July 1926 to January 2006, the empirical behavior related to the two classical models in the financial literature, the CAPM and the Fama and French Three Factor Model (1992).

The results obtained show empirical evidence in favor of Fama and French Three Factor Model, respect to the CAPM. I can say that for the sample period and the market analyzed, there exist evidence of how the characteristics related to the size and the BE/ME ratio, explain the assets returns. But these results are due to the way the portfolios are formed. As far as I know, there is no previous literature driving this issue directly, and these models should be used with caution, as I find that depending on how I create the portfolios, the results change.

The study proposed here can be considered as a source of future researches. Other alternative ways to create portfolios could change the results obtained here.

## Acknowledgements

I appreciate the comments and suggestions contributed by Mikel Tapia and Rosa Rodriguez, and seminar participants at the Universidad Carlos III de Madrid. I acknowledge financial assistance from the Spanish Ministry of Innovation and Science (ECO2010-19314, ECO2008-06238-C02-01/ECON, ECO2009-10796).



4. Bhandari, Laxmi Chand (1988). "Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence", *Journal of Finance*, 43, pp. 507-528.
5. Black, Fischer (1972). "Capital Market Equilibrium with Restricted Borrowing", *Journal of Business*, 45, pp. 444-455.
6. Black Fischer, Jensen Michael C. and Scholes Myron (1972). "The Capital Asset Pricing Model: Some Empirical Tests", *Studies in the Theory of Capital Markets*, ed. Jensen M. C., Praeger, New York, pp. 79-121.
7. Breeden, Douglas (1979). "An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities", *Journal of Financial Economics*, 7, pp. 265-296.
8. Core, John, Guay, Wayne and Verdi, Rodrigo (2008). "Is accruals quality a priced risk factor?" *Journal of Accounting and Economics*, 46, pp. 2-22.
9. Chan, Louis K.C., Yasushi Hamao, and Josef Lakonishok (1991). "Fundamentals and Stock Returns in Japan", *Journal of Finance*, 46, pp. 1739-1789.
10. Chopra, Navin, Josef Lakonishok, and Jay R. Ritter (1992). "Measuring Abnormal Performance: Do Stocks Overreact", *Journal of Financial Economics*, 31, pp. 235-268.
11. Chordia, Tarun and Shivakumar, Lakshmanan (2006). "Earnings and price momentum", *Journal of Financial Economics*, 80, pp. 627-656.
12. DeBondt, Werner F.M., and Richard H. Thaler (1985). "Does the Stock Market Overreact", *Journal of Finance*, 40, pp. 557-581.
13. Fama, Eugene F. (1970). "Efficient capital markets: A review of theory and empirical work", *Journal of Finance*, 25, pp. 383-417.
14. Fama, Eugene F., and Kenneth R. French (1992). "The Cross-Section of Expected Stock Returns", *Journal of Finance*, 47, pp. 427-465.
15. Fama, Eugene F., and Kenneth R. French (1993). "Common Risk Factors in the Returns on Stocks and Bonds", *Journal of Financial Economics*, 33, pp. 3-56.
16. Fama, Eugene F., and Kenneth R. French (1995). "Size and Book-to-Market Factors in Earnings and Returns", *Journal of Finance*, 50, pp. 131-155.
17. Fama, Eugene F., and Kenneth R. French (1996). "Multifactor Explanations of Asset Pricing Anomalies", *Journal of Finance*, 51, pp. 55-84.
18. Fama, Eugene F., and James D. MacBeth (1973). "Risk, Return and Equilibrium: Empirical Tests", *Journal of Political Economy*, 81, pp. 607-636.
19. Gibbons, Michael R.; Ross Stephen A. and Shanken Jay (1989). "A test of the efficiency of a given portfolio", *Econometrica*, 57, pp. 1121-1152.
20. Jaffe, Jeffrey, Donald B. Keim, and Randolph Westerfield (1989). "Earnings Yields, Market Values, and Stock Returns", *Journal of Finance*, 44, pp. 135-148.
21. Jegadeesh, Narasimhan (1990). "Evidence of Predictable Behaviour of Security Returns", *Journal of Finance*, 45, pp. 881-898.
22. Jegadeesh, Narasimhan, and Sheridan Titman (1993). "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency", *Journal of Finance*, 48, pp. 65-91.
23. Jensen, Michael C. (1968). "The Performance of Mutual Funds in the Period 1945-1964", *Journal of Finance*, 23, pp. 389-416.
24. Lintner, John (1965). "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", *Review of Economics and Statistics*, 47, pp. 13-37.
25. Markowitz, Harry (1952). "Portfolio Selection", *Journal of Finance*, 7, pp. 77-91.
26. Markowitz, Harry (1959). "*Portfolio Selection: Efficient Diversification of Investment*", New York: John Wiley and Sons.
27. Merton, Robert C. (1973). "An Intertemporal Capital Asset Pricing Model", *Econometrica*, 41, pp. 867-887.
28. Petkova, Ralitsa (2006). "Do the Fama-French factors proxy for innovations in predictive variables?" *The Journal of Finance*, 61, pp. 581-612.
29. Roll, Richard (1997). "A Critique of the Asset Pricing Theory's Tests' Part I: On Past and Potential Testability of the Theory", *Journal of Financial Economics*, 4 (2), pp. 129-176.
30. Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein (1985). "Persuasive Evidence of Market Inefficiency", *Journal of Portfolio Management*, 11, pp. 9-17.
31. Ross, Stephen A. (1976a). "The Arbitrage Theory of Capital Asset Pricing", *Journal of Economic Theory*, 13, pp. 341-360.
32. Ross, Stephen A. (1976b). "Risk, Return, and Arbitrage", In *Risk and Return in Finance*, edited by Irwin Friend and James Bicksler, 189-218. Cambridge, Mass.: Ballinger.
33. Sharpe, William F. (1964). "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance*, 19, pp. 425-442.

Appendix. Returns for the different portfolios over time

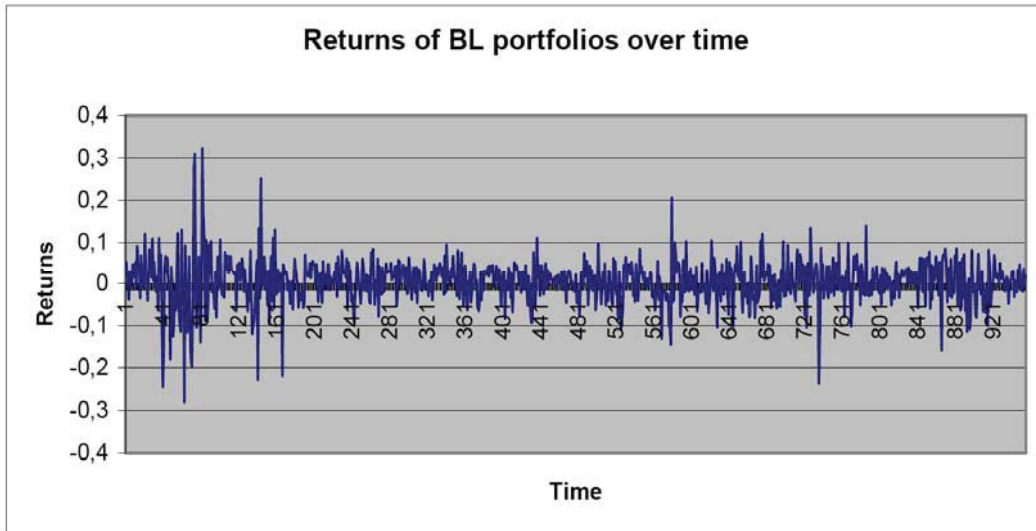


Fig. 1. Returns of BL portfolios over time

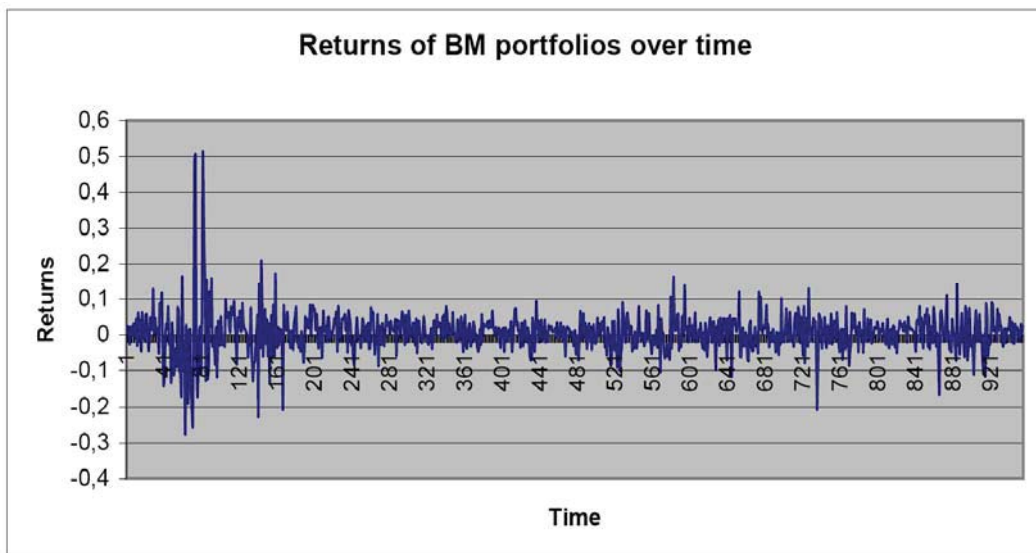


Fig. 2. Returns of BM portfolios over time

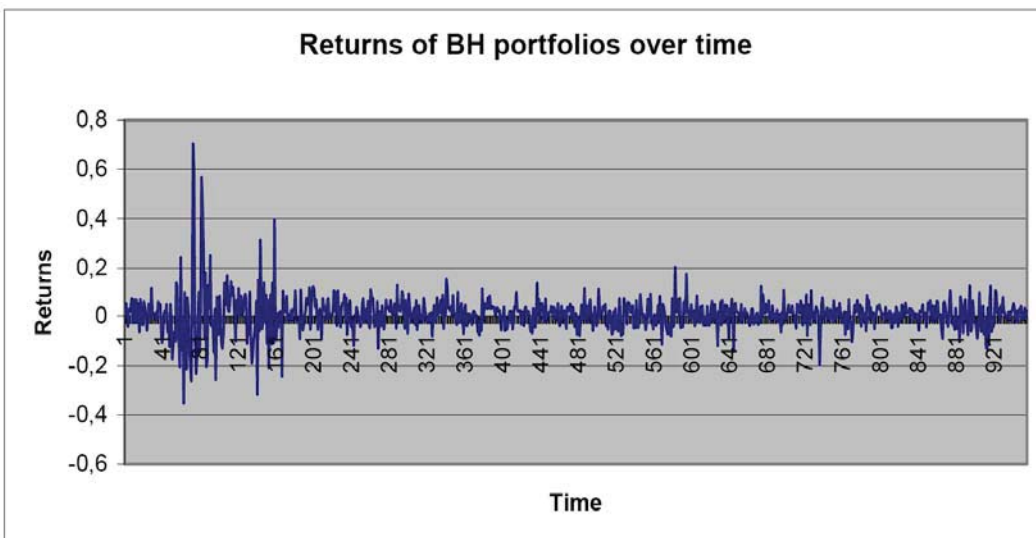


Fig. 3. Returns of BH portfolios over time

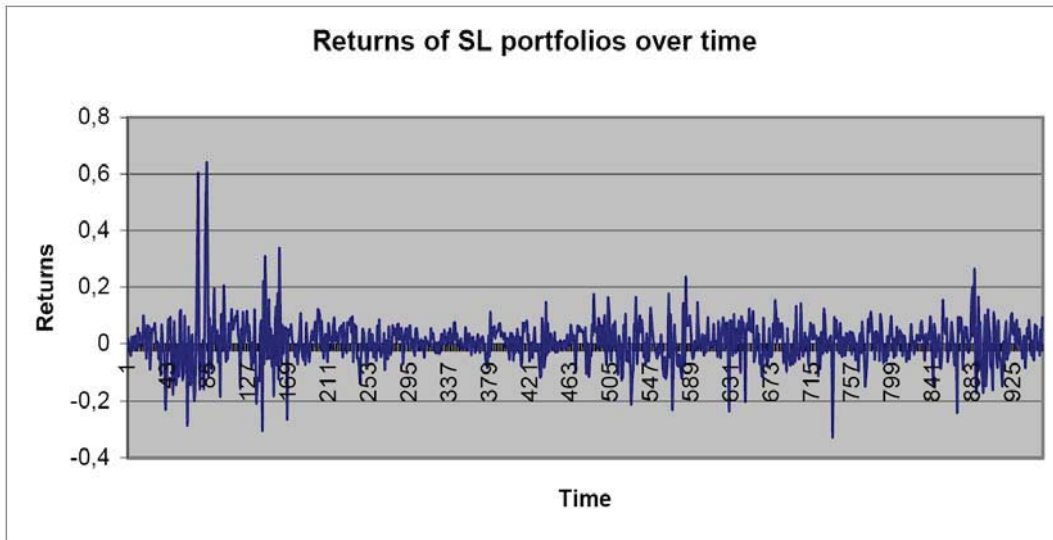


Fig. 4. Returns of SL portfolios over time

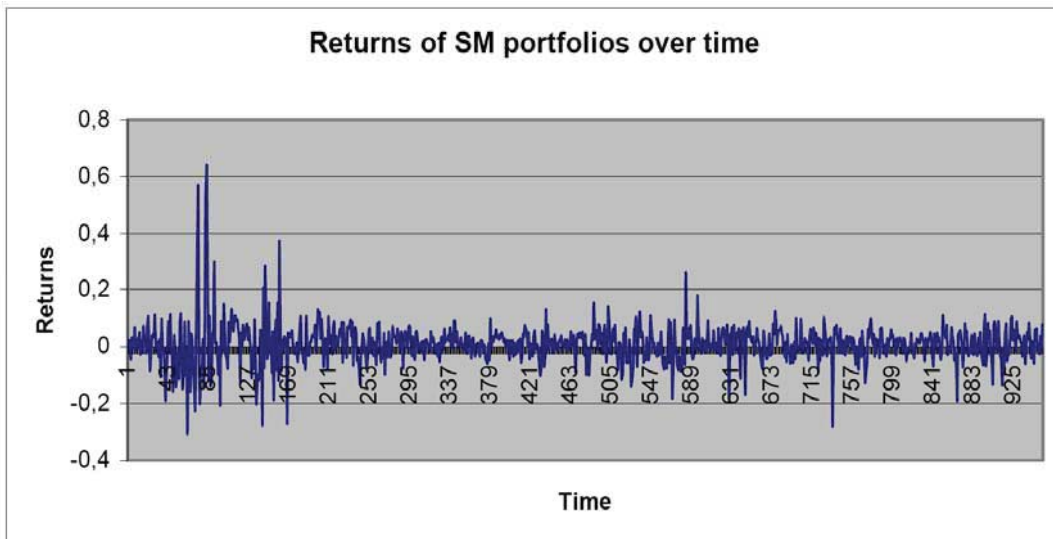


Fig. 5. Returns of SM portfolios over time

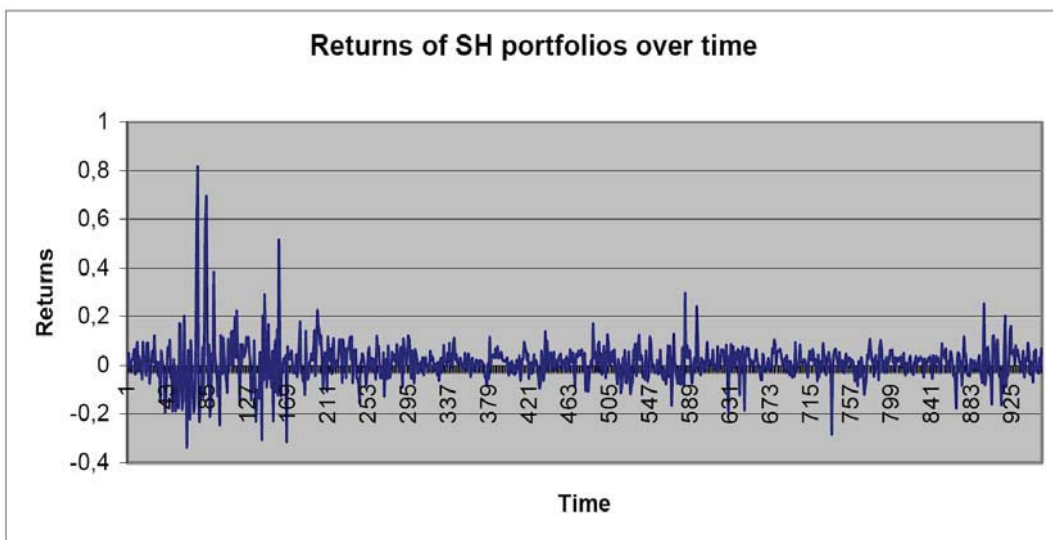


Fig. 6. Returns of SH portfolios over time

Graphically, I can see in a clear way, that there exist homocedasticity, but if I explain the returns conditioned to the time, there exists heteroscedasticity evidence, but it will not be a problem to fit the models, moreover I can guess the existence of economic cycles.