An Empirical Investigation of the Italian Stock Market Based on the Augmented Fama and French Three-Factor Pricing Model

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Abstract:

The aim of this paper is to identify the pricing factor structure of Italian equity returns. The Italian Stock Market is characterized mainly by small quoted firms. Small stocks have higher beta but beta differences are not enough to explain returns differences. We investigate how these differences can be explained by other factors like size, value and momentum. A two step empirical analysis is provided where first we estimate an unrestricted multi-factor model to test if there is any evidence of mispecification. Secondly, we estimate the restricted model, with pricing errors equal to zero, through the Generalized Methods of Moments (GMM). In accordance with the main literature (see e.g. Fama and French 1992, 1993) we find that the size premium for stocks is confirmed for a domestic Italian investor. On the contrary the value premium is statistically weakly different from zero. Finally, augmenting the model with a momentum factor does not improve its performance.

1 Introduction

In 1992 Fama and French (hereafter FF) published a landmark paper in which it was shown - with a cross-sectional analysis - strong evidence of explanatory power by size and book to market factors, compared with a little or no capacity by the beta to explain equity returns differences. After them, a large body of literature came out with evidence of little explanatory power by beta for explaining asset returns. Empirical works have mostly used US data and most of them reject beta and CAPM model (see, for example, Grinold, 1993).

In another paper, Fama and French (1993) - using a time-series approach - found basically the same evidence. Despite the fact that this model is a landmark in the asset pricing theory, little evidence has been published concerning markets other than US, with some exceptions for Japan (Chan et al.,

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1991, Daniel et al., 2001 and Charitou and Constantinidis, 2004) and the UK (Fletcher, 1997, Strong and Xu, 1997, Gregory et al., 2001, Levis and Liodakis, 2001 and Daniel et al, 2004). Regarding small markets, only recently a few papers have been published[3]. Concerning the Italian Stock Market, some results have been recently produced on the empirical relevance of the Fama and French three factors model (Aleati, Gottardo and Murgia, 2000 and Beltratti and Di Tria, 2002), on the source of momentum and contrarian strategies (Mengoli, 2004) and on the relation between equity returns and macroeconomic forces (Panetta, 2002). Following Fama and French (1993) we investigate the factor structure of the Italian Stock Market, through a GMM test of the Fama and French model augmented by a momentum effect from 1986 to 2002. Our empirical analysis shed further light on the relevance of different factors than the beta - as size, book-to-market value and momentum effect - to explain equity returns differences. Using a GMM procedure, we find that the size factor adds to the beta a positive contribution in the explanation of stock returns in Italy. On the contrary, the value premium appears to be statistically weakly different from zero while we do not find any statistical significance with reference to the momentum factor.

The paper is organized as follows: in section 2, we review the main theoretical and empirical contributions identifying the factor structure of equity returns. In section 3, we describe the data used for the empirical analysis and we explain the procedure adopted to construct the portfolios and the mimicking portfolios for the explanatory factors. Section 4 presents the results while section 5 concludes.

2 The theory of the factor structure determining equity returns

Even if the CAPM by Sharpe (1964), Lintner (1965) and Black (1972) (hereafter SLB) has been extensively studied and accepted, there is strong evidence in the literature rejecting its validity (see, for example, Grinold, 1993 and Fama and French, 1996b). Many attempts have been made to extend the one-factor model by SLB to multifactor models in order to explain better average returns. This approach is based on the empirical evidence that the intercept of the linear function of the CAPM is statistically different from zero: *i.e.* the beta does not explain alone the stock average returns.

The seminal work by Fama and French (1992) shows how the stock returns' differences are better explained by other factors than the market, as instead postulated by the classical theory of SLB. In particular, they find that the strongest consistency in explaining the average stock returns is represented by size and book-to-market value. Book-to-market value can equally be approximated by the earning-price ratio, by the cash-price ratio or by the dividend-price ratio[4].

[3]See, for example, L'Her et al., 2004 for Canada; Asgharian and Hansoon, 2002 for Sweden; Faff, 2001 for Australia.

[4]As suggested by Lakonishok, Shleifer and Vishny [1994, p. 1547] "B/M is not a *clean* variable uniquely associated with economically interpretable characteristics of the firms"; however

Unlike in past literature on the Arbitrage Pricing Theory[5], FF (1992) suggest that adding more factors than two does not improve the estimates obtained by their model on stock returns[6]. However, after FF some authors find evidence in favour of a third pricing factor known as the momentum factor (see, for example, Jegadeesh and Titman, 1993). Coherent with our econometric investigation in the next two subsections, we review the main theoretical and empirical works on the different pricing factors as size, book-to-market value and momentum in a national asset pricing perspective.

2.1 Literature review

2.1.1 The FF thesis

As discussed in FF (1992) some critics of the standard SLB model emergerd just in the eighties: for example, Banz (1981) shows that the firm size improves the estimation of the stock average return; Bhandari (1988) notes a positive relation between the firm leverage and the stock average return; Stattman (1980) and Roseberg, Reid and Lanstein (1985) find that the U.S. stock average returns are positively linked to the book-market value ratio; Basu (1983) shows that the earning-price ratio improves the estimation of the U.S. stock cross-section average returns when in the statistical test the firm size and the market β is considered at the same time.

What FF (1992) add to the previous literature is the joint role of market β, size, earning-price ratio, leverage and book-to-market ratio with reference to NYSE, AMEX and NASDAQ stock returns. In their seminal work they show that the SLB model does not work in the U.S. market for the entire period between 1941-1990. In particular, they show that the univariate relation between

they can be succesfully proxied by the market's expectations of future growth and the past growth of the firms involved. The expected growth can be proxied by various measures of profitability to price that according to Gordon's formula are: dividend-to-price ratio (D/P), cash-to-price ratio (C/P) and earning-to-price ratio (E/P). An alternative way to classify stocks is based on past growth rather than on expectations of future growth. In this case past growth is measured by growth in sales since sales are less volatile than either cash flow or earnings. The above analysis supported empirically by Lakonishok, Shleifer and Vishny [1994] and by Fama and French [1998] implies that to estimate stocks value we can choose among our regressors the ratios B/M, D/P, E/P and C/P indifferently. This is the reason why - without any loss of generality - in our following econometric analysis we use the ratio E/P instead of B/M. Another way to proxy the B/M ratio is through the Tobin's Q, which is in turn a measure of future investment opportunities. We thank an anonimous referee to have helped us to clarify this point.

[5]See Ross, 1976, Roll and Ross, 1980, Chen et al., 1986 and Asprem, 1989.

[6]In a augmented FF model augmented by macro factors - as industrial production growth, consumer prices, both expected and unexpected, risk premiums, interest term structure, the federal funds rate, housing starts, the producer index and an idiosyncratic return proxy - Merville et al. (2001) find that the most significant factors for an individual common stock can be associated to: i) the market return - beta; ii) the market capitalization - size; and iii) the investment opportunity set - value. Higher-order factors can be uniquely associated with macroeconomic variables that, however, add little explanatory power to the standard three FF model.

average return and size, leverage, E/P, and book-to-market equity are strong. In multivariate tests, the negative relation between size and average returns is robust to the inclusion of other variables. The positive relation between book-to-market equity and average returns also persists in competition with other variables.

Moreover, FF (1992) show that, even if the size factor has attracted more attention among the researchers, the book-to-market equity has a consistently stronger role in average returns.

The FF (1992) analysis finally implies that, first the SLB market β is not so useful to understand the cross-section of average stock returns in U.S. and second the combination of size and book-to-market equity seems to absorb the roles of leverage and E/P in average stock returns. In other terms, the main conclusion of FF (1992) is that stock risks are multidimensional: one dimension of risk is proxied by size, the other one is proxied by the ratio of the book value of common equity to its market value. In this way, FF (1992) confute the role of β in the explanation of the stock returns; in other terms, if there is a role for β in average returns, it has to be found in a multi-factor model.

2.1.2 The critics of the FF model

Even if the pioneer works by FF (FF, 1992 and FF, 1993) have given origin to a new and rich stream of literature, their results are not immune to criticism. Critics (see, for example, De Bondt and Thaler [1985], Lakonishok, Shleifer and Vishny [1994], Haugen, [1995], MacKinlay [1995] and Knez and Ready [1997]) is mainly based on the observation that the violations of the SLB model are not simply linked to missing risk factors as in FF but to the existence of market imperfections, to the presence of irrational investors and to the inclusion of biases in the empirical methodology.

On the one hand, De Bondt and Thaler [1985], Lakonishok, Shleifer and Vishny [1994] and Haugen, [1995] argue that the so called "value" strategies - small market capitalization and high book-to-market equity stocks - yield higher returns than "glamour" strategies - large market capitalization and low book-to-market equity stock - because of investor overreaction rather than compensation for risk bearing. They argue that investors systematically overreact to recent corporate news, unrealistically extrapolating high or low growth into the future. This, in turn, leads to underpricing of "value" and the overpricing of "glamour" stocks. The value strategies produce higher returns because these strategies exploit the suboptimal behavior of the typical investor and not because these strategies are fundamentally riskier.

Unlike FF, Lakonishok, Shleifer and Vishny [1994] with reference to the US stock market (NYSE and AMEX) from April 1968 to April 1990 find little support for the view that value strategies are fundamentally riskier than glamour strategies.

So the reason for the controversy is not the fact that value strategies perform better than glamour strategies - on which there is at least some consensus with reference to US markets[7] - but the reason why this happens. According to Lakonishok, Shleifer and Vishny [1994] the reason has to be found in the irrational behavior of investors[8].

On the other hand, MacKinlay [1995] and Knez and Ready [1997] base their arguments on the empirical methodology. MacKinlay [1995] evaluates the plausibility of multifactors models *à la* FF using *ex ante* analysis instead of *ex post* analysis. They show that, *ex ante*, CAPM deviations due to missing risk factors will be very difficult to be empirically detected, whereas deviations resulting from non risk-based sources are easily detectable. They finally conclude that multifactor pricing models alone do not entirely resolve CAPM deviations. The empirical test of the FF multifactor model conducted by Knez and Ready [1997] suggests that the "size" effect is completely driven by sample extreme observations that represent less than 1% of each month's data. The Least Trimmed Squares (LTS) regression used instead of the OLS regression of FF implies that most small firms actually do worse than larger firms. In fact, the LTS regression implies a positive relation between firm size and average return that is exactly the opposite of what FF obtained in their study. The result obtained by Knez and Ready [1997] could be particularly relevant for the Italian Stock Market made up mostly by small firms. However, further empirical analysis would be useful to accept such a result as an economic regularity rather than a sampling error. Concerning this point many authors (see, for example, Ferson, Sarkissian and Simin [1999]) caution against using empirical regularities as "explanatory risk factors". According to this line of criticism, Black [1993] argues that FF results are strongly biased by a sort of "data mining", *i.e.* the way to do a study including various combinations of explanatory factors, various periods and various models. For example, with reference to the size-effect Black [1993, p. 9] criticizes the fact that FF results hold for the entire period analyzed (1963-1990) but not for the eighties (1981-1990). In this sense, their results cannot be considered robust and suffer from "data mining". On the other side, FF find that the value premium holds for both halves of the period and that gives a right prediction of subsequent firm's accounting performance - a low book-to-market value predicts a high subsequent accounting performance[9]. Both these reasons do not seem, however, to Black [1993] enough to eliminate "data mining" from FF analysis. Black [1993, p. 10] suggests that these results can be better connected to market inefficiencies than to "priced factors". For these reasons Black [1993] asserts that the analysis conducted by FF is not enough to say that the CAPM is dead. However, also from Black's studies there emerges a misalignment between the theoretical CAPM prediction and the empirical estimates that in Black's analysis can be connected mainly to two reasons: i) the existence of borrowing restrictions; and ii) to the mis-measurement of the

[7]In fact concerning the Italian Stock Market the value premium does not hold at all for the entire period considered (January 1980-April 2002). See section 5.

[8]For further developments on this point see, for example, Shefrin [2001].

[9]That a low book-to-market value predicts high future growth prospects compared with the value of assets in place is strongly supported by other authors. See, for example, Chan, Karcescki and Lakonishok (2003).

market portfolio due to the neglect of foreign stocks. “World capital markets are becoming more integrated all the time. In a fully integrated capital market, what counts is a stock’s beta with the world market portfolio, not its beta with the issuer country market portfolio. This may cause low beta stocks to seem consistently underpriced. If investors can buy foreign stocks without penalty, they should do so; if they cannot, stocks with low betas on their domestic market may partly substitute for foreign stocks. If this is the reason the line is flat, they may also want to emphasize stocks that have high betas with the world market portfolio” (Black, p. 11). According to this observation one way to test the empirical validity of both the CAPM and the FF three factors model could be to use international data.

2.1.3 International factors

An extension of the multifactors model to an international framework is advanced by Fama and French [1998]. They argue that an international CAPM *à la* SLB cannot explain the difference between value stock returns and glamour stock returns. After having observed that there is evidence of an existing value premium in twelve markets outside the U.S. during the 1975-1995 period, FF (1998) show that an international three-factor model that includes a risk factor for relative distress seems to capture the value premiun in the returns for major markets. This result holds also for emerging markets.

However, they do not compare the world factor model to country-specific models. Griffin (2002) compares the world factor model to country specific models and finds that the domestic models explain more time-series variation and generally provide more accurate pricing than the world model. Moreover, he does not find any benefits from the extension of the FF three factors model to a global context. Even if from a statistical point of view the world model seems more significant than a country model, from an economic point of view it implies a small increase in explanatory power. In fact, the country-specific three factor model has lower in-sample and out-of-sample pricing errors than models that include foreign factors. In summary, there are no benefits to extending the three-factor model to an international context[10].

2.1.4 The momentum effect

The Fama and French (1992, 1993) three-factor pricing model captures most market anomalies except the momentum anomaly. The momentum anomaly takes origin from the investor capacity to extrapolate from the previous stock prices the right market value of future stock prices. With reference to the US market Jegadeesh and Titman (1993, 2001) show that strategies that involve taking a long (short) position in well (poorly) performing stocks on the basis of past performance over the previous 3-12 months tend to produce significantly positive abnormal returns of about 1% per month for the following year. These

[10]For more developments on the international multifactors models see, among others, Korajczyk and Viallet (1989), Bansal, Hsieh and Viswanathan (1993), Stulz (1995),

return continuation strategies - momentum return in individual stocks - would not be justified if markets were efficient, but a large and growing body of evidence suggests otherwise both with reference to US market (Jegadeesh and Titman, 1993, 2001), to European markets (see Rouwenhorst, 1998), to Asian markets (Chui et al., 2000) and to minor markets like Canada (L'Her, Masmoudi and Suret, 2004) and Italy (Mengoli, 2004). According to the literature the momentum effect usually develops over a medium horizon: three months to a year. In the medium term, stock prices exhibit momentum - continuation in a price direction. So, for these horizons, what goes up tends to keep rising and vice versa.

Two reasons can justify this result. One reason can be found in the fundamentals variability. When earning growth exceeds expectations or when consensus forecasts of future earnings are revised upward, an "earning momentum" is observed (Chan, Jegadeesh and Lakonishok, 1999). Thus, the profits from a price momentum strategy may reflect underlying changes in fundamentals that are captured by earnings momentum.

Another reason can be connected to the fact that strategies based on price momentum and earnings momentum may be profitable because they exploit market underreaction to different pieces of information. For instance - as suggested by Chan, Jegadeesh and Lakonishok, 1999 - earnings momentum strategies may exploit underreaction to information about the short-term prospects of companies that will ultimately be manifested in near-term earnings. Price momentum strategies may exploit slow reaction to a broader set of value-relevant information, including the long-term information and the long-term prospects of companies that have not been fully captured by near-term earning forecsats or past earning growth. If both these explanations are true, then a strategy based on past returns and on earning momentum in combination should lead to higher profits than either strategy individually.

3 Data and methodology

3.1 Data

The data used to test the multi-factor model are derived from the close price of the entire Italian Stock Market for the period between the 1-Jan-1986 and 1-Apr-2002. The total number of assets included is 598 and the frequency is monthly. We included 296 stocks from Datastream MIBTEL Index of which 40 stocks from Datastream NUMTEL Index and 302 stocks from the Datastream Italy DEAD-STOCK Index to avoid possible survivor biases[11].

We compute the return on a single asset as:

[11]This means that our dataset considers only survivor stocks for all the period considered. The dead-stock index quotes all the stocks just for the period for which the stocks survived. They are eliminated from their death to the end of our sample period. On the survivor bias problem see, among others, Banz and Breen (1986) and Fama and French (1998).

[1] $R_t = \frac{p_t - p_{t-1}}{p_{t-1}} + dy_t$

where:
p_t = price at time t;
dy_t= estimated monthly dividend yield at time t.

In order to estimate the monthly dividend yields, we spread the correspondent annual dividend yields supplied by Datastream so that, compounding the monthly dividends gives back exactly the annual dividends. The risk-free rate used in our empirical tests is the Italian interbank rate[12].

3.2 Methodology

The aim of this section is to explain the methodology adopted to test the Fama and French Three Factor Model [FF, 1992 and FF, 1993] on the the Italian Stock Market.

The theoretical *ex-ante* Fama and French model can be expressed as follows:

[2] $E\left(ExR_i\right) = \beta_i E\left(ExRm\right) + \gamma_i E\left(SMB\right) + \delta_i E\left(HML\right);$

where:
ExR_i = is the excess return on asset i, $(R_i - R_f)$ where $i = 1, ..., N$;
ExR_m = is the excess return on market portfolio, $(R_m - R_f)$;
SMB = Small Minus Big is the return on the mimicking portfolio for the size factor;
HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor;
R_f = is the return on a risk-free asset.

If the market determines the investment price at the beginning of each period following the above law, and given the hypothesis of rational expectations for the CAPM, the investment return observed *ex-post* for every period will respect the following expression:

[3] $R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \gamma_i\left(SMB_t\right) + \delta_i\left(HML_t\right) + \varepsilon_{it}.$

where ε_{it} is the error term characterised by:

$E(\varepsilon_{it}) = 0$; $Var(\varepsilon_{it}) = const$; $Cov(\varepsilon_{it}, \varepsilon_{it-1}) = 0$ and $Cov(\varepsilon_{it}, \varepsilon_{jt}) = 0$.

It follows that, given the stationarity of the returns distributions, the average *ex-post* return on investment tends to be exclusively a function of the parameters

[12] As a good proxy of the Italian interbank rate we use for the entire sample - from 1-Jan-1986 to 1-Apr-2002 - the ITALY EURO-LIRE 1 MONT (LDN:FT) - MIDDLE RATE quoted on the London Interbank Market and published by Datastream. It has been computed as a mean between OFFERED and BID RATES.

of the estimated model since the relevance of the error term is decreasing. If the above hypothesis holds - *i.e.* error terms follow a Normal distribution - we can use the OLS method to estimate the parameters of the model.

However, if the Normality does not work we need an alternative method of estimation that leaves aside the normality: the Generalized Least Squares (GLS) or the Generalized Methods of Moments (GMM). In the first case (GLS) we can leave aside the hypothesis of variance stationarity while in the second one (GMM) we can also leave aside the hypothesis of non-correlation between the explicative variables and the error terms.

To estimate the above equation [3] we perform a two step test:

i) As a preliminary analysis we first test the unrestricted model with the classical OLS method to find the consistency of the model and if the pricing errors (alpha) are not significantly different from zero. In fact, comparing the equations [2] and [3], it appears obvious that the model has one important implication: the intercept term (alpha) in a time-series regression should be zero. Given this implication we use the Black, Jensen and Scholes [1972] approach to evaluate this assumption: basically we run a time-series regression for each portfolio of assets to be tested and then we use the standard OLS t-statistics to test if the pricing errors (alpha) are zero.

ii) As a second more accurate analysis we test the restricted FF Model (alpha = 0) using a GMM test. The basic idea of the GMM procedure is to choose the parameters to be estimated so as to match the moments of the model itself with the empirical moments of the data. The main advantage of the GMM procedure is that the statistical assumptions required are very weak.

The restricted model to be estimated is:

$$[4] \qquad R_{it}-R_{ft} = \beta_i \left(R_{mt} - R_{ft}\right)+\gamma_i \left(SMB_t\right)+\delta_i \left(HML_t\right)+\varepsilon_{it} \qquad [i = 1...N]$$

with 4N sample moment condition for each portfolio and 3N parameters to be estimated. We can test the N over-identifying restrictions using the GMM-statistic that is the minimized value of the objective function.

We compute the GMM-statistic as:

$$[5] \qquad GMM = m\left(\theta\right)^{'} S^{-1} m\left(\theta\right)$$

where:

$m(\theta)$ = empirical vector of moment conditions;

S = weighting matrix used for estimating the parameters.

Under the null hypothesis that the overidentifying restrictions are satisfied, the GMM-statistic times the number of regression observations is asymptotically χ^2 with degrees of freedom equal to the number of overidentifying restrictions. Finally for calculating the standard errors of our estimated parametrs we use the Newey and West [1987] variance-covariance estimator.

3.3 Construction of the four factors

In order to obtain the mimicking portfolios for the factors, we construct three groups of assets based on Size tertiles and three groups of assets based on the Price-Earnings ratio (P/E) tertiles. By the intersection of these groups we obtain nine portfolios named as R1V, R2V, R3V, R1M, R2M, R3M, R1G, R2G, R3G; where 1, 2, 3 mean respectively small, medium and big firms, while V, M and G mean respectively value, medium and growth firms, so that for example R3G is the portfolio containing the firms with an high Market Value (big firms) and an high P/E ratio (growth firms). On those portfolios we calculate the value weighted returns. Each portfolio is rebalanced every year.

The next step is to construct the risk factors:

i) Market Factor (MKT): index constructed by calculating the averaged weighted value return of all the assets listed. The risk factor is calculated by substracting the risk free rate[13].

ii) Size Factor (SMB): mimicking portfolio constructed by calculating the difference between the simple mean of the returns on the "small firms" portfolios and the return on the "big firms" portfolios:

$$[6] \qquad SMB_t = \sum_{i=V,M,G} \tfrac{1}{3} Ri1_t - \sum_{i=V,M,G} \tfrac{1}{3} Ri3_t.$$

iii) P/E Factor (HML): mimicking portfolio constructed by calculating the difference between the simple mean of the returns on the "value firms" portfolios and the return on the "growth firms" portfolios[14]:

$$[7] \qquad HML_t = \sum_{i=1}^{3} \tfrac{1}{3} RiV_t - \sum_{i=1}^{3} \tfrac{1}{3} RiG_t.$$

iv) Since in our empirical analysis we'll improve the model by the estimation of a four factor, the momentum effect, we proceed to the construction of another mimicking portfolio based on the difference between the stock with the highest past year's average returns and the stock with the lowest past year's average returns. In practice we construct three groups of assets based on size tertiles and three groups of assets based on the past year's returns tertiles. By the intersection of these groups we obtain nine portfolios named as R1W, R2W, R3W, R1WL, R2WL, R3WL, R1LS, R2LS, R3LS; where, as above, 1, 2 and 3 mean small, medium and big firms while W, WL and LS mean, respectively, winner, winner-loser and loser so that, for example, R3W is the portfolio containing the "winners" with a high Market Value.

[13] To confirm the correctness of our methodology we calculate the correlation between the Market Factor and the Morgan Stanley Capital International Index (MSCI ITALY). The result is more than comforting: 98% on the entire sample period.

[14] We use the Price-Earning ratio (P/E) instead of the Book-to-Market ratio used by Fama and French for two main reasons. First of all our choice is due to the avaiability of the data for the Italian Market; second because the P/E ratio is well accepted in literature as proxy to identify a firm as a "value" or as a "growth" firm. See also footnote 5.

The mimicking portfolio associated to the momentum factor WML - Winners Minus Losers is constructed by calculating the difference between the simple mean of the returns on the "winners" portfolios and the return on the "losers" portfolios:

[8] $$WML_t = \sum_{i=1}^{3} \frac{1}{3} RiW_t - \sum_{i=1}^{3} \frac{1}{3} RiLS_t.$$

The new restricted model to be estimated is:

[9] $$R_{it} - R_{ft} = \beta_i (R_{mt} - R_{ft}) + \gamma_i (SMB_t) + \delta_i (HML_t) + \eta_i (WML_t) + \varepsilon_{it} \qquad [i = 1...N]$$

with 5N sample moment condition for each portfolio and 4N parameters to be estimated. Hence we get again N over-identifying restrictions.

The last step before starting the empirical tests is to construct the portfolios of which the returns has to be explained in the Three/Four Factors Model. To obtain the dependent variables of our time-series regression we construct sixteen portfolios based on "value-growth" ranking and on "size" ranking of the firms.

If we identify two distinct set of assets as GV (four groups of assets based on P/E ratio quartiles) and SZ (four groups of assets based on Market Value quartiles), we can obtain, from the intersection of GV and SZ, sixteen portofolios and we can calculate the value weighted returns as the returns calculated for the mimicking portfolios (see above in this section).

4 Results

4.1 Summary statistics and preliminary OLS results

As expected, Table 1 shows that the correlations between the three factors are low and in two cases are not statistically different from zero. This result is consitent with the FF model and allows us to use the three series to test the model.

[Insert Table 1&2]

As shown in Table 2 all the mimicking portfolios series show a consistent evidence of non normality in the monthly returns. This is consistent with the existing literature (see for example Fama [1965, 1976] or Blattemberg and Gonedes [1974]).

This evidence suggests the absence of normality in the series and as explained above in this case it is advisable to abandon OLS to pass to the GMM procedure with the guarantee of more consistent results. Generally speaking all the constructed portfolios show annualized returns statistically significant and, going deeper in our analysis, it is possible to show some characteristics of the Italian Market. As shown in Table 2, the annualized return on the "size" mimicking portfolio (SMB) is about 13%, with a 20% volatility and appears to be statistically significant. This is consistent with the theory of a risk premium for the small firms.

On the contrary the annualized return of the "value-growth" mimicking portfolio (HML) is about 7.5% with a volatility of 18% and it appears to be statistically weakly different from zero. The annual excess return of the Market index (MKT) is about 11% with a volatility of about 26% and, hence, consistent with the assumption of risk aversion[15]. Finally, the annual excess return on the momentum mimicking portfolio (WML) is about -1.5% with a volatility of about 20% and it is not statistically significant. This preliminary descriptive analysis seems to suggest the absence of momentum effect in the Italian Stock Market.

Table 3 reports as a preliminary analysis the OLS results to test if the pricing errors (alpha) are different from zero. In fiftheen portfolios the intercept term is not statistically significant. Looking at the classical OLS statistics, we can reject the null hypothesis (5% confidence level) of alpha=0 only in portfolio R44. In this case the composition of the portofolio is based on only few assets for the first observations due to lack of data. This characteristic can lead to reject the null hypothesis because, in practice, we are testing with the same regression two totally different "assets": a single stock at the beginning of the sample and a diversified portolio in the remaining period.

[Insert table 3]

4.2 GMM test of the restricted Fama and French model

Table 4 reports the results for the GMM analysis to test the restricted Three Factors Model developed by FF applied to the Italian Stock Market. The results seem to support the model; we find an R^2 range between 0.39 for the R14 portfolio and 0.89 for the portfolio R44 and, in nine out of 16 portfolios, the null hypothesis cannot be rejected, as shown by the GMM statistics, with a 5% confidence level. We reject the null hypothesis that the overidentifying restrictions are satisfied in seven out of 16 portfolios: R12, R21, R32, R33, R41, R43 and R44.

[Insert table 4]

[15] Considering the sample period 1-Jan-1986 to 1-Apr-2002, the t-stat. of the annual excess return on the market index is 1.77 and seems to be statistically weakly different from zero. But, on the other hand, if we consider a longer sample period, from 1-Jan-1980 to 1-Apr-2002, we find an annual excess return of 17% with a volatility of about 27% and a t-stat. of 2.56.

To understand the motivation behind the rejection of the null hypothesis in seven out of 16 portfolios, we investigate if there are other factors that can be used in the model to explain portfolio returns. In order to do that, first of all, we estimate the unrestricted model (see equation 3) with a GMM procedure to investigate if the model is characterized by some pricing errors[16]. We find that in all these portfolios the constant term is significantly different from zero.

[Insert Table 5]

Even if the previous descriptive analysis does not support a momentum effect for the Italian market we investigated, it could represent a possible explanation of the rejection of our model in seven out of sixteen portfolios. So we test a GMM restricted Fama and French model augmented by a momentum effect. As shown in Table 6, for all the seven portfolios consideded we reject the null hypothesis that the overidentifying restrictions are satisfied. This result confirms the preliminary descriptive statistic that there is no momentum effect in the Italian Stock Market.

[Insert Table 6]

5 Conclusions

In this paper we have investigated a multi-factor model applied to the Italian Stock Market. Overall, we found that the size premium is confirmed for a domestic Italian investor; on the other hand, the value premium is statistically weakly different from zero for the Italian Market. Then the pricing errors appear to be not different from zero in most of the portfolios; when they are not it is probably due to the composition of the portolios that, being formed by only a few assets at the beginning, may present a bigger variance of the disturbance term that can affect the model specification.

Then the GMM test of the Three Factors Model appears to support the FF Model applied to the Italian Stock Market with an R^2 range between 0.39 and 0.89. In nine out of 16 portofolios the GMM-statistics show a p-value that leads us to conclude that the null hypothesis that the overidentifying restrictions are satisfied, cannot be rejected.

Finally we investigate if there is some evidence of momentum effect but we have found no evidence of it in the Italian Stock Market.

Further research could come from the inclusion in the model of other explaining factors. In particular it would be interesting to investigate how the anomaly of a high risk free rate during the 80's in Italy as well as other factors related with the yield curve can explain the Italian stock returns. A further development can moreover derive from the inclusion among the explicative factors

[16]In this case we use GMM procedure to estimate the unrestricted model to avoid possible biases given to the distribution assumptions.

of the exchange rate variability with the aim to undestand if the start of the European Monetary Union has produced some significant effects on the Italian stock performance.

Table 1 - Correlations between Fama and French Factors			
Correlation	MKT[a]	SMB[b]	HML[c]
MKT	1,0000	-	-
SMB	-0,0598	1,0000	-
HML	0,0337	0,3196	1,0000
t-stat			
SMB-HML	4,699		
SMB-MKT	-0,835		
HML-MKT	0,469		

Note: **(a)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(b)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(c)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor.

Monthly data 1-Jan-86 to 1-Apr 2002

Table 2 - Basic descriptive statistics				
	MKT[a]	SMB[b]	HML[c]	WML[d]
Mean	0,0090	0,0109	0,0060	0,0070
Median	-0,0039	0,0076	0,0010	0,0025
Maximum	0,2747	0,3741	0,4178	0,3578
Minimum	-0,1618	-0,1272	-0,2685	-0,2575
Std. Dev.	0,0743	0,0577	0,0517	0,0551
Skewness	0,7072	1,5781	2,0697	2,0712
Kurtosis	4,0580	11,0095	26,4809	23,4509
Jarque-Bera	25,3497	599,0821	4595,2510	4591,351
Probability	0,0000	0,0000	0,0000	0,0000
Annualized return	0,1135	0,1389	0,0744	-0,01489
Annualized volatility	0,2574	0,1999	0,1791	0,1998
t-stat	1,7641	2,7804	1,6622	0,6871

Note: **(a)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(b)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(c)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(d)** WML = Winners Minus Losers is the return on the mimicking portfolio for the momentum factor.

Monthly data 1-Jan-86 to 1-Apr-2002

Table 3 - OLS preliminary estimation of the unrestricted Fama and French Model for the Italian Stock Market

Dependent variable[a]	CONS[b]	SMB[b, c]	HML[b, d]	MKT[b, e]	F(3,188)[f]	R^2	Adj-R^2
R11	0.0019	0,3519*	0,2119**	0,7737	88,31	0,5824	0,5758
	(0.48)	*(5.00)*	*(2.70)*	*(14.97)*	*(0.00)*		
R12	0,0026	0,3831*	0,0804	0,7944*	89,62	0,5859	0,5794
	(-0.67)	*(-5,47)*	*(1,03)*	*(-15,43)*	*(0.00)*		
R13	0,0066	0,2236*	-0,1127	0,8675*	87,71	0,5807	0,5741
	(1,62)	*(3,05)*	*(-1,38)*	*(16,11)*	*(0.00)*		
R14	0,0025	0,5783*	-0,2759**	0,6695*	41,2	0,3941	0,3846
	(0,47)	*(6,15)*	*(-2,63)*	*(9,69)*	*(0.00)*		
R21	-0,0026	0,4035*	0,3067	0,8224*	155,05	0,71	0,7054
	(-0,81)	*(6,94)*	*(4,73)*	*(19,25)*	*(0.00)*		
R22	-0,0008	0,2637*	0,0714	0,6797*	66,06	0,5105	0,5028
	(-0,22)	*(3,85)*	*(0,93)*	*(13,51)*	*(0.00)*		
R23	-0,0015	0,2247*	-0,0351*	0,659*	67,68	0,5166	0,5089
	(-0,41)	*(3,5)*	*(-0,49)*	*(13,99)*	*(0.00)*		
R24	0,002	0,4832*	-0,4813*	0,8168*	138,48	0,6862	0,6812
	(0,6)	*(8,15)*	*(-7,27)*	*(18,74)*	*(0.00)*		
R31	0,0042	0,1502*	0,3201*	0,9112*	115,76	0,6464	0,6408
	(1,06)	*(2,15)*	*(4,1)*	*(17,73)*	*(0.00)*		
R32	-0,0021	0,4061*	-0,0442	0,8892*	137,77	0,6851	0,6801
	(-0,59)	*(6,56)*	*(-0,64)*	*(19,55)*	*(0.00)*		
R33	-0,0005	0,2364*	0,0169	0,7972*	159,63	0,716	0,7115
	(-0,17)	*(4,69)*	*(0,3)*	*(21,5)*	*(0.00)*		
R34	-0,002	0,3938*	-0,2713*	1,017*	116,63	0,6481	0,6425
	(-0,46)	*(5,2)*	*(-3,21)*	*(18,28)*	*(0.00)*		
R41	-0,0056	-0,2225*	0,4408*	0,9319*	176,99	0,7365	0,7323
	(-1,7)	*(-3,76)*	*(6,68)*	*(21,44)*	*(0.00)*		
R42	0,0017	-0,2022*	0,2445*	0,8426*	257,98	0,8029	0,7998
	(0,7)	*(-4,69)*	*(5,08)*	*(26,59)*	*(0.00)*		
R43	-0,0023	-0,0502*	0,0361	0,9502*	253,59	0,8002	0,797
	(-0,88)	*(-1,06)*	*(0,68)*	*(27,38)*	*(0.00)*		
R44	-0,0051*	0,051	-0,1915*	1,0784*	693,02	0,9163	0,9149
	(-2,84)	*(1,58)*	*(-5,31)*	*(45,42)*	*(0.00)*		

Note: **(*)** = statistically significant at the 5% level; **(**)** = statistically sifnificant at the 10%. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portofolios. **(b)** the associated t-statistic is contained in parentheses below the coefficient estimate. **(c)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(d)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(e)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(f)** The *p*-value is contained in parentheses below the *F*-stat.

Monthly data: 1-Jan-1986 to 1-Apr 2002.

Table 4 - GMM Tests of the restricted Fama and French Model

Dependent variable[a]	SMB[b, c]	HML[b, d]	MKT[b, e]	GMM-stat[f]	R^2	Adj-R^2
R11	0,3710*	0,1589	0,7921*	0,9626	0,5755	0,5710
	(2,7166)	*(1,0564)*	*(9,1061)*	*(0,3265)*		
R12	0,3149*	0,0816	0,7695*	4,6707*	0,5728	0,5683
	(2,0660)	*(0,5195)*	*(8,3490)*	*(0,0307)*		
R13	0,2224	-0,0984	0,8615*	0,0519	0,5798	0,5754
	(1,6129)	*(-0,5693)*	*(10,8332)*	*(0,8197)*		
R14	0,6216*	-0,3257	0,6577*	0,4379	0,3875	0,3811
	(4,1782)	*(-1,5997)*	*(7,0772)*	*(0,5082)*		
R21	0,4052*	0,2086**	0,8339*	5,6966*	0,6921	0,6889
	(4,2933)	*(1,8613)*	*(10,3219)*	*(0,0169)*		
R22	0,2250*	0,0675	0,6398*	2,5412	0,4997	0,4945
	(2,1147)	*(0,5887)*	*(7,5184)*	*(0,1109)*		
R23	0,2065	-0,1065	0,6767*	3,6476**	0,4991	0,4939
	(1,2652)	*(-0,6137)*	*(6,0078)*	*(0,0561)*		
R24	0,4615*	-0,4838*	0,8134*	0,9202	0,6828	0,6795
	(6,7513)	*(-5,2103)*	*(12,7483)*	*(0,3374)*		
R31	0,1180	0,3546**	0,9078*	0,1842	0,6476	0,6440
	(0,9995)	*(1,8447)*	*(12,9085)*	*(0,6678)*		
R32	0,3581*	-0,1788**	0,8980*	5,1482*	0,6661	0,6627
	(3,1290)	*(-1,8345)*	*(9,9058)*	*(0,0233)*		
R33	0,2098**	-0,0342	0,7817*	4,5537*	0,7066	0,7035
	(1,9112)	*(-0,2676)*	*(9,6225)*	*(0,0328)*		
R34	0,3458*	-0,3064*	1,0576*	3,6086**	0,6376	0,6338
	(2,1214)	*(-3,0618)*	*(9,3725)*	*(0,0575)*		
R41	-0,3833*	0,4782*	0,9634*	8,0599*	0,7078	0,7048
	(-3,6759)	*(4,2284)*	*(15,1285)*	*(0,0045)*		
R42	-0,2233*	0,2087*	0,8743*	2,1232	0,7940	0,7918
	(-3,5041)	*(2,6015)*	*(14,2658)*	*(0,1451)*		
R43	-0,2274*	0,13	0,9455*	7,7432*	0,7812	0,7789
	(-2,4981)	*-1,1855*	*(17,1812)*	*(0,0054)*		
R44	0,0342	-0,1785*	1,0126*	16,3914*	0,8961	0,8950
	(0,7322)	*(-3,0948)*	*(28,0421)*	*(0,0001)*		

Note: **(*)** = statistically significant at the 5% level; **(**)** = statistically sifnificant at the 10%. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portofolios. **(b)** the associated t-statistic is contained in parentheses below the coefficient estimate. **(c)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(d)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(e)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(f)** The generalized method of moments test statistic (GMM) testing the three-factor model holds, is distributed as a chi-square with N degrees of freedom. The statistic has had the small adjustment applied following MacKinlay and Richardson (1991). The associated p-value is contained in parentheses below the GMM-stat.

Monthly data: 1-Jan-1986 to 1-Apr-2002.

Table 5 - GMM Tests of the unrestricted Fama and French Model

Dependent variable[a]	CONS[b]	SMB[b, c]	HML[b, d]	MKT[b, e]	GMM-stat[f]	R^2	Adj-R^2
R12	-0,0083*	0,3767*	0,0888	0,7899*	0,0000	0,5833	0,5767
	(-2,3154)	*(2,4210)*	*(0,5460)*	*(8,7235)*	*(1,0000)*		
R21	-0,0083*	0,3971*	0,3151*	0,8178*	0,0000	0,7062	0,7016
	(-2,7835)	(4,2839)	*(3,0122)*	*(10,9051)*	*(1,0000)*		
R32	-0,0077*	0,3997*	-0,0358	0,8846*	0,0000	0,6830	0,6780
	(-2,6996)	*(2,9462)*	*(-0,2934)*	*(9,3278)*	*(1,0000)*		
R33	-0,0061*	0,2300*	0,0253	0,7927*	0,0000	0,7154	0,7109
	(-2,3338)	*(2,1763)*	*(0,2055)*	*(10,1571)*	*(1,0000)*		
R41	-0,01127*	-0,228868**	0,449145*	0,927391*	0,0000	0,732525	0,728302
	(-3,38686)	*(-1,8695)*	*(3,3691)*	*(15,3782)*	*(1,0000)*		
R43	-0,008*	-0,0566	0,0444	0,9456*	0,0000	0,8025	0,7994
	(-3,2382)	*(-0,5275)*	*(0,3853)*	*(15,4695)*	*(1,0000)*		
R44	-0,010777*	0,044599	-0,183155*	1,073835*	0,0000	0,913824	0,912463
	(-5,46589)	*(0,94901)*	*(-3,02507)*	*(29,1551)*	*(1,0000)*		

Note: **(*)** = statistically significant at the 5% level; **(**)** = statistically sifnificant at the 10%. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portofolios. **(b)** the associated t-statistic is contained in parentheses below the coefficient estimate. **(c)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(d)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(e)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(f)** The generalized method of moments test statistic (GMM) testing the three-factor model holds, is distributed as a chi-square with N degrees of freedom. The statistic has had the small adjustment applied following MacKinlay and Richardson (1991). The associated p-value is contained in parentheses below the GMM-stat.

Monthly data: 1-Jan-1986 to 1-Apr-2002.

Table 6 - GMM Tests of the restricted Fama and French Model augmented with the momentum factor

Dependent variable[a]	SMB[b, c]	HML[b, d]	MKT[b, e]	WML[b, f]	GMM-stat[g]	R^2	Adj-R^2
R12	0,3349*	0,0877	0,7803*	-0,0512	4,9340	0,5745	0,5678
	(2,2838)	*(0,5899)*	*(8,6657)*	*(-0,8227)*	*(0,0263)*		
R21	0,4081*	0,2202*	0,8393*	-0,0561	6,1880	0,6970	0,6922
	(4,6425)	*(2,1733)*	*(10,8926)*	*(-1,0540)*	*(0,0128)*		
R32	0,364**	-0,1751*	0,9030*	-0,0241	5,2960	0,6675	0,6623
	(3,1916)	*(-1,8452)*	*(10,0364)*	*(-0,5756)*	*(0,0213)*		
R33	0,2163*	-0,0321	0,7855*	-0,0226	4,7830	0,7091	0,7045
	(2,0226)	*(-0,32585)*	*(9,9058)*	*(-0,4912)*	*(0,0287)*		
R41	-0,3849*	0,4880*	0,9651*	-0,0112	8,1370	0,7080	0,7034
	(-3,6885)	*(4,6759)*	*(15,2373)*	*(-0,3869)*	*(0,0043)*		
R43	-0,2314*	0,1310	0,9494*	-0,0238	7,976	0,7822	0,7788
	(-2,583)	*(1,2036)*	*(18,0714)*	*(-0,8502)*	*(0,0047)*		
R44	0,0347	-0,1685*	1,0074*	0,0379*	16,1320	0,8992	0,8976
	(0,8303)	*(-3,5316)*	*(28,0336)*	*(3,1318)*	*(0,0000)*		

Note: **(*)** = statistically significant at the 5% level; **(**)** = statistically significant at the 10%. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portofolios. **(b)** the associated t-statistic is contained in parentheses below the coefficient estimate. **(c)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(d)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(e)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(f)** WML = Winners Minus Losers is the return on the mimicking portfolio for the **(g)** The generalized method of moments test statistic (GMM) testing the three-factor model holds, is distributed as a chi-square with N degrees of freedom. The statistic has had the small adjustment applied following MacKinlay and Richardson (1991). The associated p-value is contained in parentheses below the GMM-stat.

Monthly data: 1-Jan-1986 to 1-Apr- 2002.

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