This paper follows one main purpose: approaching classical models from a behavioral point of view. And two secondary objectives: First, providing behaviorally based tools to study efficiency in investment funds markets. Second, proposing a new methodological approach in order to disentangle randomness from ability in investment fund’s performance.

We reach two main theoretical proposals:

To set the fourth order moment of our Sharpe’s ratio differences based indicator as a market efficiency measure.

To take the statistical comparison of the probability distribution of the fund’s Net selectivity with a $N(0, \sigma_p)$ distribution, as an indicator of luck/skill in investment funds performance measurement.

In order to illustrate these proposals, we take a randomly chosen sample of investment funds investing in four sectors: energy, financial, industrial and technology. We analyze: First, the cross sectional level of activity/efficiency in the market. And second, whether the individual results of each fund are ability or randomness caused.

**Keywords:** Market Efficiency, Investment Funds Performance, Randoness versus Ability.

**Jel Classification:** G.01
Introduction

Efficiency in financial markets and portfolio performance are two specific topics that have been specially shaken by the recent financial crisis. The reason for this impact might be explained by the fact that either market efficiency theories or performance evaluation measures are based on the Efficient Markets Hypothesis and the CAPM model. Until now the gap between efficient market hypothesis (EMH) and real financial markets has been quite successfully justified by allowing a certain level of inefficiency in the market in change of liquidity, so the existence of a certain level of inefficiency is assumed as desirable in order to make financial markets work. The EMH approach has been criticised for its rigidity, and according to Lo (2004) markets should be studied from a more evolutionary point of view in which organisms (managers) might be optimizing a utility function whose main aim is not to maximize value but to survive.

In this paper we take a behavioural approach by observing how professional fund managers act. These managers know how everyday markets work and are used to these inefficiencies, and some of these professional managers undertake active strategies so we can infer that they believe they are able to beat the market. According to the EMH these managers do not have any reason to act such, but they do, and indeed sometimes they beat the market. Of course, this can be easily explained by EMH theorists as a coincidence of punctual inefficiency and a punctually lucky manager.

According to this explanation, we do not see managers that beat the market systematically in the long run, and if we consider a long enough period of time we should see that luck does not exist in the long run in a given market, so the quality of a manager cannot be persistent over time.

Classical theoretical models are grounded in the rational election paradigm so they don’t consider limited rationality or irrationality to explain the way markets work. In this sense we would like to approach these models from a behavioral point of view in order to be able to develop new tools that might: first, determine how efficient these markets are, and second, analyze investment funds performance according to the fact that it is, of course, influenced by the level of efficiency in the market, but mostly determined by the investment decisions undertaken by managers.

This paper follows two objectives. First, to set a proper theoretical background to analyze investment funds markets according to a behavioral point of view. Second, to provide a new methodological approach, in order to
disentangle luck from skill in investment fund’s performance.

These objectives are closely related to the two main issues that might be considered when evaluating investment funds performance. On one hand, the framework market in which we measure this performance, on the other hand, the specific behavior of individual managers.

Regarding the first point, we must assume that performance, according to its own definition, cannot be an absolute measure but it must be a relative one, so the benchmark that is used to set this performance might affect the validity of it. According to this, our proposal assumes that investment funds should be previously grouped according to the market they invest in, in order to be able to properly measure their performance.

This is the reason why setting an appropriate benchmark framework is so important in portfolio performance measurement.

It might seem a paradox that willing to study some behavioral aspects of investment funds markets we shall take a classical theory as the efficient market hypothesis and so the CAPM as theoretical background but, as it has been said, what we aim in this paper is not to set a new theory but to approach the current one from a behavioral point of view.

**Performance and market efficiency**

This paper is based on the CAPM theoretical framework and given that we are trying to evaluate investment funds performance, the proper risk measure to be taken under consideration is, $\sigma_p$, the standard deviation of the random variable $\tilde{R}_p$ which indicates the return of portfolio $p$.

A widely used performance measure according to these characteristics is the Sharpe ratio that indicates the slope of the Portfolio Possibility Line for each portfolio $p$.

By comparing portfolio’s $p$ Sharpe’s ratio with the slope of the CML we can determine how good the fund performed comparing with the market the fund is investing in.

As it can be seen in figure 1, portfolio $p$ is performing better than portfolio $k$. This fact can be measured by comparing the slopes of the two Portfolio Possibility Lines, which means comparing the Sharpe’s ratios of both portfolios.
The Sharpe ratio allows us to easily order performance from a given group of funds investing in the same market, but we don’t obtain any information about how efficiently these funds are performing or how active the management strategies they undertake are.

When we approach investment funds performance from a behavioral point of view the juxtaposition between active and passive strategies comes into play. It is a manager’s decision to undertake an active strategy so he might have the possibility to beat the market or to just follow the model and undertake a passive strategy in which case he would be on the Capital Market Line.

According to this, while wanting to measure active management, it is necessary to set a suitable passive portfolio in order to have a benchmark for comparison. Once this passive portfolio is set it will be possible to identify successful or unsuccessful active strategies.

The CAPM model assumes that the optimal passive strategy for an investor consists in combining the free risk asset with the market portfolio, so a suitable passive strategy for a given group of funds would be a combination of bonds and the reference market index. This is equivalent to any position on the CML.

By calculating the Sharpe ratio from this portfolio, we obtain a passive benchmark for each fund group that will allow us to later develop a measure that might determine the level of efficiency and activity for each market.
Once the group passive benchmark is set it is possible to measure the dispersion around this benchmark. This dispersion measure provides the first approach to measuring the level of activity, meaning that the more dispersion that is observed, the more active strategies are being undertaken by managers. So we define Group Dispersion Indicator as follows:

\[
\text{GE}_g = \frac{\sum_{p=1}^{N} (S_p - S_{pp})^4}{(N)GD^4}
\]

Where \(S_p\) is the Sharpe ratio of a portfolio of a given group of funds, \(S_{pp}\) is the Sharpe ratio of the passive portfolio and \(N\) is the number of funds in the group.

In a deeper analysis, the fourth order moment appears as a better method to measure the level of activity in a certain group of funds. Given that in a fully efficient market, the best strategy a manager can set is a passive strategy, we must assume that a certain level of inefficiency incentivizes fund managers to undertake active management in order to beat the market. In highly efficient markets with highly passive strategies we are supposed to find a “peaky” shape in the Sharpe ratio distribution of probabilities. This would be coherent with the lack of opportunities to beat the market; in consequence all managers in the market are incentivized to undertake passive strategies. Nonetheless a flat distribution could be associated with a more inefficient market where managers may have the opportunity to beat the passive benchmark by implementing higher activity strategies.

These arguments lead us to suggest as an active strategies measure the following fourth order moment indicator as Group Efficiency Indicator:

\[
\text{GE}_g = \frac{\sum_{p=1}^{N} (S_p - S_{pp})^4}{(N)GD^4}
\]

We must observe that this indicator will have a higher value while managers in a given market are closer to the passive strategy which might be related to the lack of incentives to beat the market due to a high level of market efficiency. Further, we should find a lower value of this indicator when the number of managers that are undertaking active strategies is higher as a consequence of increased opportunities to outperform the market associated with a less efficient market.

Figure 2 shows how this fourth order moment might indicate efficiency in a given market according to the probability distribution of the Sharpe Ratios.
differences.

![Efficiency indicator and portfolio strategies activity](image)

**Figure 2:** Efficiency indicator and portfolio strategies activity

According to the previous reasoning, in a less than perfectly efficient market, managers are more willing to set active strategies, but according to our theoretical background this inefficiency might not necessarily imply an increase in performance. In fact, in a highly efficient market, managers who dare to undertake an active strategy should have a worse performance than the passive strategy portfolio, so in an extreme case of perfect efficiency there would not be any observation above $S_{pp}$. We could then detect group management performance by measuring the distribution’s skewness from the. Having a positive skewness would mean that managers, by mean, are performing positively so they beat the market. On the contrary, negative skewness is an indicator of less than average management performance.

We propose a management performance measure for a certain group of funds, based on a third order moment, the following Group Management success indicator:

$$GMS_g = \frac{\sum_{p=1}^{n}(S_p - S_{pp})^3}{(N)GD^3_g}$$

This indicator will have positive sign if managers, in the same framework market, surpass, on average, the output of the passive strategy and would be negative if they are underperforming it.

In figure 3 we can observe a Sharpe’s differences positively skewed distribution (green), meaning that managers in that market outperform the passive strategy and a negatively skewed distribution (red) that might indicate
that managers in that given market are not able to beat the passive strategy.

![Figure 3: Success and skewness](image)

### About luck and skill

The second objective of this paper is to break down performance into luck and skill for individual funds. Therefore, we propose a performance measure that would allow us to order asset funds controlling for the market in which they invest. A manager will be considered a good performer if he succeeds at out performing the market, so we propose as a measure of performance the indicator that Fama (1972) named Net Selectivity. The Net Selectivity measures the difference between the return effectively achieved by a fund and the theoretical profitability that would have been obtained according to the CML by undertaking the same level of risk.

\[
NS_p = R'_p - \left[ i + \frac{R_{pp} - i}{\sigma_{pp}} \right] \sigma_p
\]

Where \( R'_p \) is the return from the portfolio \( p \), \( i \) is the free risk asset rate, \( R_{pp} \) is the return of the passive portfolio, \( \sigma_{pp} \) is the standard deviation of the passive portfolio's return and \( \sigma_p \) is the standard deviation of the portfolio \( p \)'s return.

In figure 4 we show the net selectivity’s graphical representation of portfolios \( p \) and \( k \), as it can be seen the net selectivity measures the distance...
between the effective return of each portfolio and the return that could have been achieved, assuming the same level of risk, investing on the CML which means undertaking a passive strategy. Portfolio $p$ is outperforming the passive strategy so $NS_p$ has a positive value that indicates a good performance, on the other hand, portfolio $k$ is underperforming the CML so it’s net selectivity $k$ has a negative value indicating a poor performance.

![Image of Figure 4: Net selectivity]

It is interesting to observe that the group indicators previously defined are based on the same idea of excess return on the passive strategy, in fact GMSg and GEG are the third and fourth order moments of the net selectivity defined by Fama for a group of funds, in the present section we use the same approach to evaluate individual performance.

We can easily identify good managers from bad ones using this individual measure. A positive value of the Net Selectivity means a good performance, beating the passive portfolio, and a negative value may indicate a lower performance than the benchmark.

According to the we can rank successful managers in a proper way but we still cannot identify skilled managers from lucky ones.

As we base our analysis on the CAPM model but from a behavioral point of view, we approach managerial skill identification as follows: Given that CML can be taken as an explanatory model of portfolio returns, we can assume that values are the residual values of the following model:
\[
\tilde{R}_p' = i + \frac{\tilde{R}_{pp} - i}{\sigma_{pp}} \sigma_p + \varepsilon_{NS}
\]

Where \(\tilde{R}_p'\) is the portfolio's return random variable, and \(\tilde{R}_{pp}\) is the passive portfolio return random variable and \(\varepsilon_{NS}\) is the random residual corresponding to the Net Selectivity.

According to the assumptions of the CAPM, the expected value of this residual should equal zero and have a Gaussian distribution. Therefore if good performers can be identified by finding mean values different from zero, according to the EMH we could be observing an insufficiently long data series so the explanation may be randomness or luck. However, if we reject the null hypothesis that a given data sample belongs to a normally distributed population then we may infer some managing skills as a good explanation of abnormal success. In other words, we could determine if they are just lucky or if they have some managing skills by examining the probability that the sample belongs to a Gaussian distributed population or not. So we propose the Shapiro-Wilk test p-results in order to identify skill in high performing managers.

If we cannot discard the fund from belonging to a \(N(0, \sigma_p^p)\) distribution of probabilities we infer that good performance was due to randomness, if the Shapiro-Wilk test states that the sample has a low probability of belonging to a \(N(0, \sigma_p^p)\) distributed population, then we can infer skill as the cause of this good performance.

![Figure 5: Net selectivity normality test](image-url)
In figure 5 we can see the NS probability distribution of fund A which has a positive mean value and a probability distribution very close to $N(\mu, \sigma_p)$. Figure 5 also shows the probability distribution of fund B which has the same positive mean value but with a lower probability to be normally distributed.

The mean positive value of $NS_A$ could be consequence of randomness and that if we had a wider observation series the NS mean value would tent to zero, so we cannot discard fund A’s success to be caused by luck. Fund B’s NS distribution has a lower probability to be normally distributed, so its mean positive value is more likely to have been caused by some kind of managerial skill.

**Empirical illustration**

In order to illustrate the theoretical results we reach in part two and three, we take a randomly determined sample of thirteen mutual funds investing in the U.S.A. market.

We collect daily market value from June 2005 to June 2012.

Funds can be classified in four different groups regarding the economical sector they invest in, being: Energy, Financial, Industry and Technology.

As passive benchmark portfolios we take the sectorial Dow Jones corresponding indexes: Dow Jones US energy, Dow Jones USA Financial Service, SPDR Dow Jones industrial, and Dow Jones U.S. Technology Index (^DJUSTC)

As a risk free asset proxy we take the ten years US bond yield.

**Groupal results**

As an indicator of group performance we take the GMSg (equation 3) indicator that is a passive portfolio based skewness measure. This measure shows if the funds in a certain group beat, by mean, the passive strategy portfolio, in this case the sectorial market index.

In Graph 1 we show a plot of the GMSg for each group of funds along the period of study. We cannot observe significant out or underperforming groups, so the only conclusion we reach is that there are no differences in level of success or failure in the long run, depending on the sector the funds invest in.
Level of activity/market efficiency measurement

We calculate the G&Eg (equation 2) for the four sector groups. Given that we have a small sample of funds, this measurement might not be a significative market’s efficiency measure, but it might properly indicate the level of activity/passivity in strategies undertaken by managers in each market.

In Graph 2 we plot the G&Eg indicator for the four groups. It can be observed that the level of activity in the Technological sector is significantly lower than in the other three, being the Industrial sector the one in which managers undertake more active strategies.
Randomness or ability as cause of individual managerial results.

We take the NS for each fund in the sample and test it to be distributed as a random residual by making the Shapiro-Wilk test.

The following table shows the funds in the sample classified by name, sector group, success/failure indicator and the source of these results according to the Shapiro-Wilk test.

<table>
<thead>
<tr>
<th>NAME</th>
<th>SECTOR GROUP</th>
<th>NS average</th>
<th>P-value</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanguard Energy Fund Admiral</td>
<td>Energy</td>
<td>4,85E-05</td>
<td>p&gt; 0.100</td>
<td>RANDOMNESS</td>
</tr>
<tr>
<td>Balckrock energy &amp; res</td>
<td>Energy</td>
<td>-1,01E-04</td>
<td>p&lt; 0.010</td>
<td>No success</td>
</tr>
<tr>
<td>Fidelity adv Energy Fund T</td>
<td>Energy</td>
<td>1,24E-04</td>
<td>p&gt; 0.100</td>
<td>RANDOMNESS</td>
</tr>
<tr>
<td>Russell GI Real State Sec-C</td>
<td>Financial</td>
<td>2,61E-04</td>
<td>p=0.036</td>
<td>ABILITY</td>
</tr>
<tr>
<td>Fidelity Adv Financial SVC-T</td>
<td>Financial</td>
<td>-1,02E-04</td>
<td>p&lt; 0.010</td>
<td>No success</td>
</tr>
<tr>
<td>Financial Select Sector SPDR</td>
<td>Financial</td>
<td>-8,89E-05</td>
<td>p&lt; 0.010</td>
<td>No success</td>
</tr>
<tr>
<td>Fidelity Adv Industrial FD-A</td>
<td>Industrial</td>
<td>-2,06E-05</td>
<td>p&gt; 0.100</td>
<td>No success</td>
</tr>
<tr>
<td>Icon Industrials Fund-S</td>
<td>Industrial</td>
<td>-2,32E-04</td>
<td>p=0.047</td>
<td>No success</td>
</tr>
<tr>
<td>Ishares DJ US Industrial SEC</td>
<td>Industrial</td>
<td>-1,67E-04</td>
<td>p=0.08</td>
<td>No success</td>
</tr>
<tr>
<td>Columbia Selig Comm&amp;Inf-RS</td>
<td>Technology</td>
<td>8,69E-04</td>
<td>p&gt; 0.100</td>
<td>RANDOMNESS</td>
</tr>
<tr>
<td>Ishares DJ US Technology SEC</td>
<td>Technology</td>
<td>2,60E-05</td>
<td>p&lt; 0.010</td>
<td>ABILITY</td>
</tr>
<tr>
<td>Vanguard INF Tech Idx-Adm</td>
<td>Technology</td>
<td>1,32E-05</td>
<td>p&lt; 0.010</td>
<td>ABILITY</td>
</tr>
<tr>
<td>Fidelity Select Electronics</td>
<td>Technology</td>
<td>-2,52E-04</td>
<td>p&gt; 0.100</td>
<td>No success</td>
</tr>
</tbody>
</table>
Conclusions

In this paper we have approached the classical capital markets theoretical models from a behavioral point of view in order to improve investment funds performance evaluation.

We propose to base investment fund performance measurement in the difference between the fund’s portfolio Sharpe’s ratio and the Sharpe’s ratio of a portfolio that is investing in the same market but undertaking a pure passive strategy.

This proposal leads us to study the probability distribution of this distance measure, in order to analyze market efficiency and groupal performance.

We propose as a market efficiency indicator the fourth order moment of the distance measure according to the EMH based assumption that in a highly efficient market managers have no incentives to deviate from the passive strategy, so if the probability distribution of the distance measure is “peaky” shaped we infer a high level of efficiency and if this distribution is flat we might assume a lower level of efficiency given that managers do have higher incentives to intend beating the market by undertaking active strategies.

When applying this measure to our sample we find differences in the level of activity according to the economical sector the funds are investing in. We also observe that the third order moment of the distance measure is a good indicator of groupal success and taken for individual funds allow us to improve performance measurement by including in the function to be optimized not only maximization of return and minimization of volatility but also maximization of skewness.

Our sample shows that, even though there are differences in behavior between groups, positive and negative skewness get compensated in the long run which is coherent with the Efficient Markets Hypothesis.

By taking the CML as an explanatory model of portfolio’s return, we consider the Net Selectivity of a given fund as a random residual. By considering randomness as a cause of managers’ results, we test for normality of the NS assuming it to behave as a random residual to show that a random-caused managerial result might have a probability distribution that cannot be discarded to be normal, so we can only infer ability from those managers that do not have a normal distribution of their Net Selectivity.

By looking at classical models with behavioral eye we can improve markets efficiency measurement, we set the basis for three dimensional...
performance evaluation and bring some new light into the difficult task of disentangling randomness from ability in investment funds managerial behavior.

References