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GRADO EN ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS Y ECONOMÍA INTERNACIONAL

RETURN PERSISTENCE IN THE SPANISH MUTUAL FUNDS

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ABSTRACT

In this bachelor's thesis, we are going to analyse the existence of performance persistence on a sample of European Equity Funds (RVE), International Equity Funds (RVI) and Guaranteed Equity Funds (GRV) for the period covering 2009-2014. Data has been obtained from the "Comisión Nacional del Mercado de Valores" database and Banco de España database. In order to test performance persistence we use Pearson's correlation coefficient, Cross-product ratio and Chi-squared test and results have been classified into 4 different categories. The results suggest the presence of diseconomies of scale in the mutual fund industry. Moreover, mutual funds are under no efficient information allowing companies to adopt opportunistic behaviours by charging higher fees that do not match with their obtained results. Finally we also conclude that when fees are charged over results, there is a greater alignment of objectives between managers and participants.

KEY WORDS

Mutual funds, persistence, performance, RVE, RVI, GRV.

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1. INTRODUCTION

During the last years, Mutual Funds have experienced a boom, which have boosted this product as one of the most popular products for saving due to their risk to reward ratio and because they allow investors to enjoy economies of scale by accessing to diversified portfolios. Many Spanish families and small savers have them as its preferred choice due to their high liquidity and especially for their information transparency, since funds managers are required to daily report the net asset value of most of the funds. Managers are also required to inform about the characteristics of each fund with an explanatory prospectus on the date of their release.[1]

In Spain, these kind of financial products date from 1964 when the royal decree of 30 April authorized Mutual Funds and Real Estate Investment Funds. However, it was not until February of 1966 when the first ones appeared receiving the names of NUVOFONDO and CRECINCO which were managed by GESFONDO and HISPANIBEC respectively. Despite appearing in the 60s, mutual funds popularity was quite low until the 80s when these products started to be marketed on a large scale, coinciding with the enactment of the Law of 26 December 1984 that regulates definitively the operation of collective investment institutions.[2]

The sector has experienced its greater dynamism since the earliest 90s until today, becoming a solid alternative to traditional savings. Their success is due to a deep and effective legislative action and the strength of our financial markets that result from a combination of factors such as orthodox fiscal policies, low inflation, low interest rates and privatizations. These factors have allowed Spain to be placed among the group of countries with the greatest number of assets invested in funds in the world.[3] In 2005, Spanish mutual funds had nearly 8.5 million of participants and the total assets under these funds reached a 30% of the Spanish GDP according to the Comisión Nacional del Mercado de Valores, from now onwards CNMV. Ten years later, the number of participants has reached 9.7 million and the total assets managed by these funds amount 373.090 million of euros.[4]

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[1] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp.120-121). New York: McGraw-Hill/Irwin.

[2] Blanco Mendialdua, A., & Soldevilla García, E. (1999). *La gestión de fondos de inversión en activos de renta fija*. Bilbao: [s.n.].

[3] Garcia Clavel, J. & Yélamos Castro, M. (2004). *Evolución de los fondos de inversión comercializados en España en la década de los noventa*. Lecture, León.

[4] INVERCO. (2016). Las instituciones de inversión colectiva y los fondos de pensiones. *Informe 2015 y perspectivas 2016* (pp. 7-8).

INVERCO is the Spanish association of Collective Investment Institutions and Pension Funds and represents Spanish Investment, the Spanish pension funds, the institutions of foreign collective investment registered on the CNMV for distributing them in Spain, as well as several Associate Members.[5] This association defines mutual funds as "separated assets without legal personality, which belong to a variety of investors, including other collective investment institutions among them, whose management and representation corresponds to a management company who exercises the powers of domain without being the owner of the fund with the assistance of a depositary and whose aim is raising funds, goods or rights in order to manage and invest them in assets, rights, securities or other financial instruments, establishing the return of the investor on the base of the collective results"[6]

1.1 KEY CONCEPTS

Once we have introduced mutual funds, it is time to go a little bit more into detail in order to develop a better understanding. In order to do so, we will proceed to discuss several aspects of relevance.

- Managing company and depository

They are two of the most important elements of mutual funds. By managing company we understand those companies that are in charge of managing collective investment institutions by developing activities such as informing investors, valuating the net asset value, subscriptions and redemptions. Moreover, these companies manage fund's assets by deciding the investment policy to follow.

The depository mission is to ensure the fund securities, cash and overall assets and to monitor the collective investment institution management and their managers. Each fund has a single depositary and this should be: a bank, a savings bank, a credit union or stock companies and agencies.

- Types of Mutual funds[7]

[5] *INVERCO*. (2016). *Inverco.es*. Retrieved 20 April 2016, from http://www.inverco.es/en/
[6] *INVERCO*. (2016). *Inverco.es*. Retrieved 20 April 2016, from http://www.inverco.es/20/0/133
[7] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 124-126). New York: McGraw-Hill/Irwin.

Depending on the investment policy that a fund follows, we can classify it among 8 different categories. These are: Money Market funds, Equity funds, Sector funds, Bond funds, International funds, Balanced funds, Asset Allocation and Flexible funds and Index Funds.

Money Market funds are those funds that invest in different money market securities as could be commercial paper, certificates of deposit or repurchase agreements. They are in general safer investments and consequently offer a lower potential return.

Equity funds refer to those funds that mainly invest in stock; however, they may hold fixed-income assets or other securities. These kinds of funds commonly hold a small percentage of their total assets in money market securities so that they have liquidity to meet redemption of shares.

By Sector funds we understand those funds which concentrate their investment solely on a particular industry or sector of the economy.

Bond funds are those funds that invest in the fixed-income sector, however within this sector we can identify several assets such as corporate bonds, treasury bonds, mortgage-backed securities or even municipal bonds. Moreover, there exists room for further specialization as could be by maturity (short, intermediate or long term) or credit risk (very safe to junk bonds).

International funds are defined as those funds that have international focus. For example International funds invest in worldwide securities outside the United States while Global funds invest in worldwide securities including the United States. We can also find Regional funds which focus on a particular part of the world or Emerging Market funds that invest in companies from developing countries.

Balanced funds are funds which hold both stock and fixed-income securities in reasonably stable proportion. These funds exhibit different proportions of stocks and bonds depending on their aggressive or conservative orientation.

By Asset Allocation and Flexible Funds we identify those funds that are similar to balanced funds in what refers to holding fixed and variable assets; however their allocation can vary according to the manager's forecast.

Last but not least we can Index fund, which are those funds that try to match their performance to the performance of a broader index by buying securities in the proportion of each security's representation in the index selected.

- Rate of Return[8]

The rate of return is the increase or decrease that the net asset of a fund experience plus the income distributions in form of dividends or distributions of capital gains with respect to the net asset value at the beginning (subscription price). It is important to have in mind that mutual funds are priced once a day depending on the value of their underlying assets. We have to bear in mind that the following rate of return formula ignores any fees paid, however it is affected by expenses since they are subtracted from the portfolio of assets.

$$Rate\ of\ Return_t{}^{9} = \frac{Net\ Asset\ Value_t - Net\ Asset\ Value_{t-1} + Income\ and\ Capital\ gain\ distributions}{Net\ Asset\ Value_{t-1}}$$

Using the fund daily market price of the unit of participation/share P_t we can also compute the daily return as follows:

$$R_t = ln\frac{P_t}{P_{t-1}}$$

- Costs associated with investing in Funds

While choosing a fund, investors should not only have into consideration the fund's investment policy and performance, it is really important to gather some information about the different fees and expenses that they might charge since they vary across funds. Some of these fees and expenses are:

Operating expenses are the costs incurred by fund while performing (management fees, administrative expenses, audit fees…). Moreover, we can identify some fees related with marketing and distribution costs. Management fees can be variable, fixed or a mix of both, depending on if they are based on assets under management or on the fund results. Operating expenses are automatically daily deducted from the net asset value of the fund therefore; the returns published already take into account these fees.

[8] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 129-131). New York: McGraw-Hill/Irwin.
[9] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 129). New York: McGraw-Hill/Irwin.

Deposit fee is the commission charged by the depositary for its work. As the operating expenses, this fee is charged daily as a percentage of the fund's net assets.

Front-End load is the commission charged when the shares are purchased and it is primarily related with paying the brokers who sell the shares.

Back-End load is the commission charged when the investor sell its shares and it is also know more formally as *contingent deferred sales charges*.

There are annual marketing or distribution fees charged in order to pay for distribution costs (advertising, promotional literature, fees to pay brokers, 12b-1 Charges in the US context). It may be charged instead or in addition to, Front-End loads and are not clearly billed since they are deducted from the net assets.

- Variables to analyse before selecting a fund

Mutual funds are classified as safe products, nevertheless it is well know that some risk is associated to these kinds of products and it varies depending on the investment policy of each of the funds. By operating with funds, investors spread their exposure to firm-specific risk, also known as diversifiable risk. However all assets are exposed to the common macroeconomic factors so, even after an extensive diversification, there exists the possibility of having losses.[10]

The two main elements that determine risk are volatility and duration, meaning that if one, or both, of the two factors increase, the risk associated to the fund also increases. Volatility refers to the change that has experienced the net asset value of a fund. A very volatile fund carries a higher risk since it not possible to predict whether the net asset value will rise or fall. On the other hand, duration provides a measure of the interest rate sensitivity of a fund and it is related with fixed income assets and their response to changes in interest rates. The relationship between funds and duration is the following: the longer a fund's duration, the more sensitive it is to the shifts in interest rates.

That is the reason why before selecting a fund, investors should check the following:

- Risk profile and investment policy of the fund. Investors should consider their risk tolerance in order to enter low, moderate or high risk funds. There is a close relationship between risk and return

[10] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 225). New York: McGraw-Hill/Irwin.

- Charges and fees that mutual funds apply, it is important to understand which of them are going to be applied.
- Research the historical returns of the mutual fund, bearing in mind that the past performance of a fund is not a guarantee of future results.

The rest of the study is structured as follows. In section 2 there is a brief revision of previous literature and in section 3 the main objectives of this bachelor's thesis are described. In section 4 we have the presentation of the database and in section 5 we can find a descriptive analysis of the results obtained. In sections 6 and 7 the main the performance and persistence measures are presented respectively. Section 8 display the results for the source of persistence using raw returns, style-adjusted returns, risk-adjusted returns and risk-adjusted returns split by funds size and according to their size and level of fees. In the section 9 some limitations of the study are presented. Finally, section 10 summarizes the main conclusions that can be drawn from this study.

2. PREVIOUS LITERATURE

Due to the weight that Mutual Funds have on the industrialized countries' GDP, the literature about this kind of product has risen exponentially during the last years. The topics covered by the different studies realized are very diverse; however the main three topics of discussion had been the followings:

1. Analysis of the presence of persistence on the results of a variety of different mutual funds.
2. Analysis of the reasons that lead an investor to choose a mutual fund and particularly, if it is based on past performance information.
3. Analysis of the investors' capability to predict future mutual funds results. Hypothesis known as *"the smart money effect"*.

This bachelor's thesis is going to focus on the study of the first point. In particular, with this thesis we want to discover whether there exists a tendency on Spanish mutual funds to persist in their returns during consecutive periods of time. The literature has already covered the topic and it has defined as "hot hands" effect to those funds that outperform the market during consecutive periods of time and as "cold hands" effect to those funds that obtain lower returns that the average during consecutive periods of time.

Kahn and Rudd (1995)[11] perfectly introduced the main idea in their FAJ paper: *"Who will be next year's winners? Conventional wisdom in the investment industry is that the first place to look in trying to predict the future performance of mutual funds is past performance. But does it help to know last year's winners? Do winners repeat?*

The idea that winners repeat is so obvious and popular, it has spawned an entire mini-industry devoted to documenting past winners. Mutual fund performance reviews regularly appear in publications from Barrons to Business Week to Consumer Reports. Services such as Morningstar and Lipper exist to publish mutual funds rankings. Pension plan consultants closely examine past performance before recommending managers, and successful managers proudly document their past performance. All this activity demonstrates that everyone choosing active managers, from pension plan sponsors to individual investors, is acting as if past performance predicts future performance. But does it?" (pp. 43)

As we have said before, several authors have studied the topic since performance persistence is a recurring theme in the mutual fund literature and we are able find studies starting in the 1960s. However, these numerous authors have obtained differences in their results and conclusions as it is stated in their published papers. One of the main reasons behind these differences is that some of them used funds' raw returns while others employed funds' risk-adjusted returns or funds' style adjusted returns.

For example, Sharpe (1966)[12] stated that the persistence in beating the market is not very probable since choosing the best portfolio in terms of efficiency is quite easy. However, both Sharpe and Jensen (1968)[13] reported underperformance persistence of mutual funds with respect to the market due to the high cost incurred in finding undervalued assets with the aim of beating the market. In this second case, persistence would be justified by poor active management that entails high transaction costs and little ability to predict market movements.

Focusing our attention on more recent studies, especially those from the last 20-30 years, we can classify the results into 5 different groups[14]:

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[11] Kahn, R. & Rudd, A. (1995). Does historical performance predict future performance?. *Financial Analyst Journal*, *51*(6), 43.

[12] Sharpe, W.F. (1966), "Mutual Funds Performance", *Journal of Business, 39*, 119-138.

[13] Jensen, M.C. (1968), "The performance of Mutual Funds in the Period 1945-1964", *Journal of Finance, 23*, 389-416.

[14] This summary has been done thanks to the previous work of Abinzano, I., Muga, L., & Santamaria, R. (2010). Do Managerial Skills Vary Across Fund Managers? Results Using European Mutual Funds. *Journal Of Financial Services Research*, *38*(1), 41-67. http://dx.doi.org/10.1007/s10693-009-0080-9 and Ruíz Martín, M., 2007. Los fondos de inversión. Performance y persistencia. *Monografía CNMV, 26*

- Positive results persistence in short-run

Hedricks, Patel and Zeckhauster (1993), Goetzmann and Ibbotson (1994), Ferruz and Vargas (2004) or Toledo and Marco (2006) are some of the authors that shown the existence of positive and significant performance persistence of mutual funds during consecutive periods. All of them concluded attributed this to the "hot hands" effect or to common investment strategies.

- Positive results persistence in the long-run

Elton, Gruber, Das and Hlavka (1993) or Elton, Gruber, Das and Blake (1996) defended the existence of positive performance persistence but only in the long-run. These authors attributed it to managers' stock-picking ability.

- Negative results persistence in the short-run

Carhart (1997) admits the existence of negative short-term persistence but pointed out management cost and the "momentum effect" as the main causes of it, ie, the accidental tenure of last year's winning titles due to the tendency to buy those securities that were winners in the past.

- Negative results persistence in the long-run

Carhart (1992) concluded that those mutual funds that perform below the market are more likely to continue this behaviour in the future. The author attributed it to the persistence in fees/commissions and expenses.

- No existence of persistence

Jensen (1967), Kritzman (1983) or Menéndez and Álvarez (2000) are authors which exhibit that there is no persistence in mutual funds' results. Jensen used alpha estimates for a sample of mutual funds concluding that most managers had no ability to predict assets prices and that if any fund outperformed the market, it was by pure chance. Menéndez and Álvarez stated, referring to the Spanish environment, that there is no persistence on equity investment's results, except in the case of the less profitable funds as they tend to persist if underperformance is found.

- Performance persistence in the short and long-run

Ciriaco and Santamaría (2005) found performance persistence in the Spanish mutual funds, both in short and long-run, although most of this persistence was due to the behaviour of lees profitable funds. As these authors asserted, it is not clear if the results were due to difference in fees or differences in management skills, because both reasons can explain the results obtained.

In any case, it is important to take into account that Carhart, Carpenter, Lynch and Musto (2000) found that "survival bias" weakened the results on the existence of persistence. Funds that disappear are those that underperform for several years, not those that only do it for one year. Therefore, the failure to take into account these funds that have negative results persistently weakens the persistence tests' results.

3. OBJECTIVE

The main objective of this bachelor's thesis is to study the behaviour of mutual funds in order to discover if there exists performance persistence in their results. Basically, we are going to analyse the presence of persistence in the performance of three different types of mutual funds that operated in Spain for the period covering 2009-2014. The mutual funds' classes that have been selected are European equity funds, International equity funds and Guaranteed Equity funds. In particular, we are going to investigate if returns of fund *i* during period *t* show a systematic relationship with the funds returns in period *t-1*. In the case that past performance is a good indicator of future performance, this will indicate us that there exists predictability, meaning that there exists information in past results that helps us in predicting future ones.

Firstly, in order to quantify this, we are going to analyse persistence over the raw returns of the different types of mutual funds selected. This will be done by classifying them by type an individually analysing the presence of persistence for every of the three types of funds selected. We will also collectively analyse the whole funds, but adjusting each class of fund by style, that is by taking into account the yearly median of each class of fund while analysing persistence.

Secondly and since returns do not take into account risk, we will continue our study by doing an empiric analysis that will take into account and indicator that relates returns with the risk associated to a portfolio.

Thirdly, and here is where we are going to study something different with respect to the previous studies, we will analyse in depth this risk-adjusted analysis taking into account fund characteristics by splitting mutual funds according to their size (below 30^{th} percentile, between 30^{th} and 70^{th} percentile and over 70^{th} percentile) and also according to the level of fees (below 30^{th} percentile, between 30^{th} and 70^{th} percentile and over 70^{th} percentile) and type of management fees that they charge (over results or over assets under management).

By studying funds according to their size we will try to discover if size matters in what refers to performance persistence. The results obtained with this study will allow us to infer the possible presence of economies or diseconomies of scale in the mutual funds industry.

The research related with the level of fees attempts to test the hypothesis of efficient information; under this null we suppose that investors have the ability of distinguish results across different mutual funds. In this case, managing companies will charge higher level of fees in order to signalize that they obtain better returns to their possible investors. If the results allow us to reject this null, we will be under the case of no efficient information meaning that investors can't distinguish across funds and that managing companies will adopt opportunistic behaviours by charging higher fees that do not match with their obtained results.

Last but not least we will study also performance persistence by splitting funds according to the type of management fees that they charge. On the one hand we will have those funds where fees are charged over results and on the other hand those funds where fees are charged over assets under management by the fund. The hypothesis behind funds charging fees over net assets suggests that funds goal is not to outperform a competitor or benchmark, but rather perform well enough to keep their assets under management and at the same time try to increase them. On the other hand, the assumption behind funds charging fees over results suggests an alignment between managers and investors objectives since management compensation depends on funds' performance.

4. THE DATABASE

In order to realize this research, we have used CNMV public database on collective investment schemes statistics on a quarterly basis. However, in order to gather information annually, we have selected the fourth quarter report of every year between 2009 and 2014 (six years) since they provide the accumulated values of each year.

CNMV's report provides information about mutual funds, guaranteed funds, real estate investment funds, foreign collective investment institutions trading in Spain, assets and number of investors of collective investment institutions sorted by financial groups and managing companies of collective investment institutions.

From all the information provided, we have gathered the one related with mutual funds investing in European equities, International equities and Guaranteed equity funds. The characteristics of these funds are the followings:

- European Equity Funds (RVE): These funds invest more that 75% of their assets in equities and Spanish ones cannot exceed three quarters of these. Of the whole portfolio, at least 70% of the assets must be denominated in euros and those denominated in other currencies may reach a maximum of 30% of the portfolio.
- International Equity Funds (RVI): These funds invest more than 75% of their assets in equities, and more than 30% of the portfolio must be denominated in non-euro currencies.
- Guaranteed Equity Funds (GRV)[15]: These funds guarantee the capital initially invested plus a return linked (wholly or partially) to the evolution of stocks, stock indices, currencies or other mutual funds. If markets do not evolve as expected or do not meet certain conditions described in the explanatory prospectus, investor may not get any return on their investment.

Once the funds with which we were going to work were selected, we decided to create a panel database with the help of Microsoft Excel including the following information for each of the funds:

- Name of the fund
- Financial Group to which the fund belongs
- Managing Company

[15] ACTIVO BANK,. *Manual de Fondos de Inversión* (pp. 23-38).

- International Securities Identification Numbering System (ISIN) code
- Investment policy and fund age
- Volatility
- Last year return
- Last 3 years return
- Total Expense Ratio or TER (total expenses/net assets)
- Participants in the funds
- Net assets
- Management fees over net assets (fixed)
- Management fees over results (variable)
- Deposit fee

5. DESCRIPTIVE ANALYSIS

Before entering into the main topic of discussion, we are going to realize a descriptive analysis of the three different kinds of funds studied in other to gain some knowledge about them.

On Figure 1 we can clearly see how the total number of funds of the different categories selected has been reducing. The years covered in this study have coincided with the world financial crisis that in Spain has caused an important restructuration of the banking sector. The direct consequence of this restructuration of the sector can be appreciated in the remarkable reduction in the number of existing mutual funds as a result of the multiple mergers and acquisitions that banks have experienced. It is important to bear in mind that the number of Spanish banks has dropped from 55 to 14 since the 2008 financial crisis.[16] Referring to the creation of European equity funds, International equity funds and Guaranteed equity funds, it is clear that the worst years were 2012 and 2013but on the other hand in 2010, 2011 and 2014 the creation of funds moved in a close range between 55 and 60 funds.

[16] Aguado, J. (2015). Downsize me further - More Spanish banks to be swallowed up. Reuters. Retrieved from *http://uk.reuters.com/article/uk-spain-banks-m-a-idUKKCN0PT04C20150719*

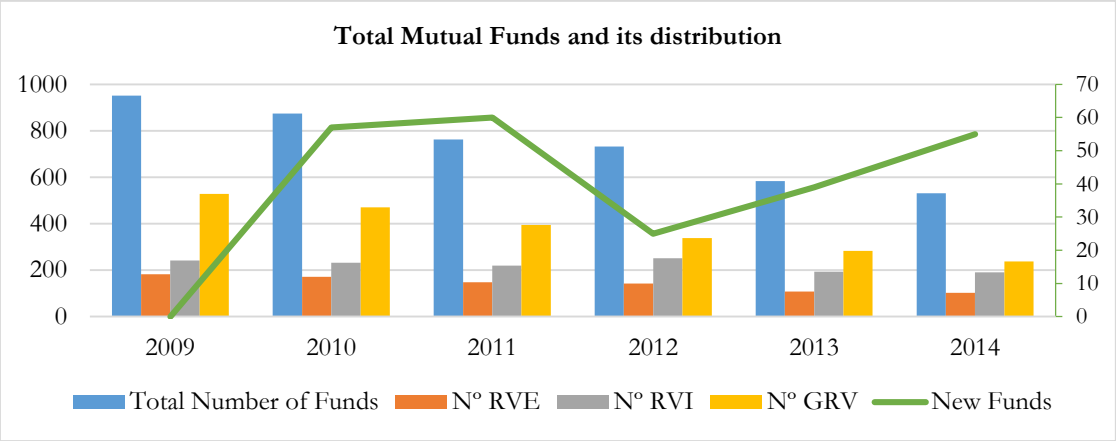

Fig.1 Source: Own compilation from CNMV database. The graph has two vertical axes. The left axe measures the following variables Total Number of Funds, Nº RVE, Nº RVI and Nº GRV. The right axe measures the New Funds.

Another aspect that we found interesting to highlight is the net assets controlled by the funds and the average assets of each of them. On figure 2 we can see that from 2009 and 2012 the total net of assets declined. However, since 2013 it seems that the total net assets controlled by these three types of funds started to increase as can be seen on figure 2.

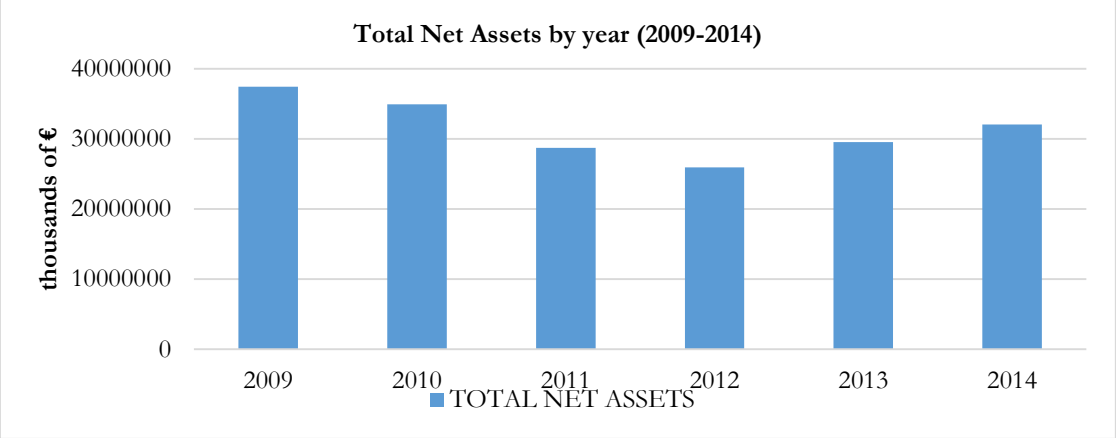

Fig.2 Source: Own compilation from CNMV database

Figure 3 shows the average net assets per fund of the funds' sample during the 6 years covered in this study. Between 2009 and 2010 the average net assets increased by 0.11% while from 2010 to 2011 they decreased by 10.42%. However, 2011 was an inflexion point due to the fact that since then, the average net assets increased from year to year. Between 2011 and 2012 they increased by 0.84% and from 2012 to 2013 by 29.05%. Finally, from 2013 to 2014 they increased by 16.17%.

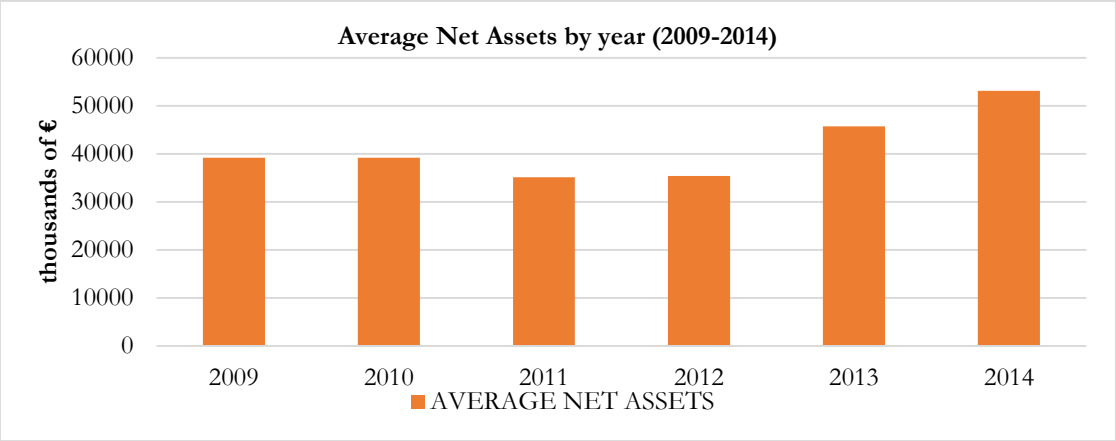

Fig.3 Source: Own compilation from CNMV database

When we put these three figures together we can appreciate the existence of two different trends. While the number of funds and total net assets controlled by these funds has been reduced, the average values of net assets managed by the funds that have remained have increased.

The next aspect that we would like to analyse is the variable number of participants. Between 2009 and 2014 the number of participants declined from 1.935.268 to 1.338.497, meaning a 30.84% decrease. However, since 2013 the number of participants seems to start recovering and in 2014 they reached 1.617.704 participants, 84% of the participants of 2009. The average number of participants per fund for the years covered in this study has been 2.110, being the highest 2.683 in 2014 and the lowest 1.829 in year 2012.

	2009	2010	2011	2012	2013	2014	Average
Number of Participants	1.935.268	1.820.582	1.588.437	1.338.497	1.349.550	1.617.704	1.608.340
Average Number of Participants	2.033	2.083	1.944	1.829	2.089	2.683	2.110

Table 1 Source: Own compilation from CNMV database

Finally, the last element that we have considered in this descriptive analysis is the last year's return. The maximum and minimum values provide information about the range on which the returns moved. On table 2 we can clearly identify that for the years covered in this study, the maximum return achieved was 100.46% in 2009 and the minimum was -77.44% in 2014. We can also appreciate that the broadest ranges of values took place in year 2012, 2013 and 2014. The standard deviation informs about the standard quantity that the values differ from the mean and by observing table 2 we can see that the greater dispersion took place in the year 2009 and the lowest in 2014. The average dispersion for the entire period was 0,1089.

	2009	2010	2011	2012	2013	2014	Average
Maximum	100,46%	27,89%	11,88%	158%	74,93%	32,94%	67,68%
Minimum	-9,25%	-23,63%	-54,5%	-7,64%	-74,61%	-77,44%	-41,18%
Standard Deviation	0,1793	0,0943	0,0864	0,0862	0,1307	0,0764	0,1089

Table 2 Source: Own compilation from CNMV database

Figure 2 shows the yearly average return of the funds selected in this study from years 2009 to 2014. The worst period for these kinds of mutual funds has been 2011 since the average return reached -5.88% and although it is somewhat shocking, the best year was 2009 with an average return of 15.74%.

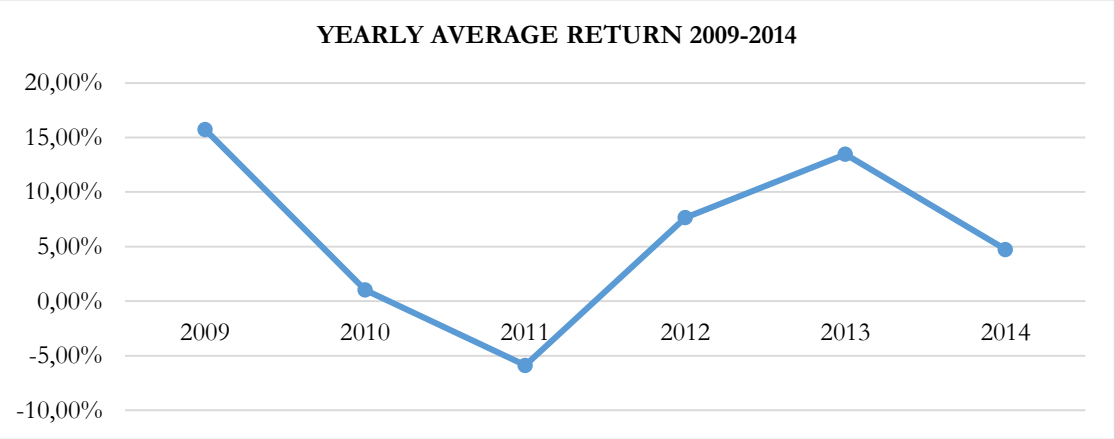

Fig.4 Source: Own compilation from CNMV database

6. PERFORMANCE MEASURES

Among the traditional measures of performance, the most outstanding are: the Jensen's alpha, Treynor's ratio and Sharpe's ratio. Sharpe's ratio takes into account both the returns and risks of the funds without taking into account any market index. On the other hand, Jensen's alpha and Treynor's ratio take into account a market index. While Jensen's alpha is an absolute measure, both Treynor's and Sharpe's ratios are relative measures of performance.[17]

- Jensen's alpha[18]

According to Jensen (1967), the concept of performance of a portfolio has two different dimensions: one of these dimensions is the ability that a manager has to increase the

[17] Ruíz Martín, M., 2007. Los fondos de inversión. Performance y persistencia. *Monografía CNMV, 26*, 13
[18] Ruíz Martín, M., 2007. Los fondos de inversión. Performance y persistencia. *Monografía CNMV, 26*, 13-14

returns thanks to his ability to predict the liquidity values and the other dimension is his ability to reduce the portfolio's risk trough proper portfolio diversification. Jensen's alpha only refers to the first of these two dimensions.

So Jensen's alpha is an estimation of the returns that a manager is able to achieve thanks to his ability to predict liquidity value's evolution. Within the CAPM (Capital Asset Pricing Model), Jensen's alpha is given by the estimation of the constant of the model. Thus, the alpha provides information on the excess return that the manager is able to get over which one would expect given the level of risk of the managed fund.

This measure is an indicator of absolute performance, that is, besides being able to establish a ranking of funds by the alpha associated with each of them, it provides an absolute assessment of whether the fund is doing well or not.

Jensen equation[19]:

$$\alpha_p = r_p - [r_f - \beta_p(r_m - r_f)]$$

Where r_p is the return of the mutual fund p, r_f is the return of the risk-free asset, r_m is the market return and β_p is the beta of the mutual fund p.

Jensen's measure provides the average return of the portfolio over and above the one predicted by the CAPM model. If the alpha is bigger than 0, it means that the fund has beaten those returns predicted by the model and that the manager have "some ability" to select assets in which invest.

- Treynor's Ratio[20]

Another measure of performance is the one introduced by Treynor (1965). It is a relative measure since it measures the excess return obtained with respect to risk-free assets per unit of systematic risk (beta) assumed.

Treynor had the hypothesis that the assets are properly valued and all a manager has to do is to diversify the portfolio according to the risk level chosen. Therefore, it does not take into account the additional return that the manager can get because of his forecasting and researching skills for undervalued assets.

[19] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 850). New York: McGraw-Hill/Irwin.
[20] Ruíz Martín, M., 2007. Los fondos de inversión. Performance y persistencia. *Monografía CNMV, 26*, 14

Treynor's measure[21]:

$$T = \frac{(r_p - r_f)}{\beta_p}$$

Where r_p is the return of the mutual fund p, r_f is the return of the risk-free asset and β_p is the beta of the mutual fund p.

- Sharpe's Ratio[22]

The ratio introduced by William F. Sharpe in 1966 was called originally *reward to variability ratio*. The ratio relates the mean and standard deviation of the fund's performance in comparison with the risk-free assets, so that it indicates the additional return obtained per unit of total risk assumed.

Sharpe rejected Treynor's hypothesis, so for him there exits the possibility that the portfolio is not well diversified. Therefore, the ratio may indicate that the fund it is not doing as well as the market. This would be justified by the existence of diversifiable or systematic risk in the portfolio.

Sharpe's ratio is more universal because it considers the total risk borne by the portfolio, both specific and systematic. The formula is the following:

$$Sharpe's\ ratio^{23} = \frac{(r_p - r_f)}{\sigma_p}$$

Where r_p is the return of the mutual fund p, r_f is the return of the risk-free asset and σ_p is the fund's standard deviation.

If the ratio is below 0, it means that the performance of the fund has been lower than that of the risk-free asset and inferior to the risk assumed.

- Performance Measure selected

After having carefully analysed these three measures, Sharpe's ratio was the one selected. The main reason behind this decision is that both Treynor's and Jensen's indicators require the computation of the β_p. This β_p is the coefficient that measures the volatility or

[21] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 850). New York: McGraw-Hill/Irwin.
[22] Ruíz Martín, M., 2007. Los fondos de inversión. Performance y persistencia. *Monografía CNMV, 26*, 14)
[23] Bodie, Z., Kane, A., & Marcus, A. (2011). *Investments and portfolio management* (9th ed., pp. 850). New York: McGraw-Hill/Irwin.

systematic risk of a mutual fund in comparison to the whole market. Our database only includes annual data for 6 different years and in order to calculate β_p we need a much larger time series with more information available, otherwise we would obtain a weak β_p estimator.

Sharpe ratio is a widely used method in what risk-adjusted return calculation refers. However we had to select a proxy for the risk-free asset and due to the complexity of the information we are going to continue this part the study just on European equity funds. As this proxy for the risk-free asset we have selected the average return of the interbank treasury bills' market with a maturity of 34 and 94 days, this statistic has been obtained from the bulletin published by the Bank of Spain.[24]

7. PERSISTENCE MEASURES

This section covers the three different alternatives selected in order to measure persistence. The first alternative is the most common measure of correlation in statistical science, Pearson correlation coefficient. The second alternative is the CPR statistic and the third one is the Carpenter and Lynch chi-squared test. These last two options are used in order to test the persistence of two consecutive years and they have the characteristic of being nonparametric tests, which means that they are more robust than the traditional self-correlation test and moreover provide information about the possible source of persistence.[25] Since our database has information about European equity funds (RVE), International equity funds (RVI) and Guaranteed equity funds (GRV), we will apply these three measures to all of them, to the set of all these funds adjusted respectively by Style and to Sharpe's ratio.

- Pearson Correlation Coefficient

This parametric test was developed by Pearson from an original idea of Francis Galton. It measures the association degree or strength between two sets of quantitative variables that had a joint bivariate normal distribution. In other words, this coefficient identifies the degree of lineal dependence between two variables with causal independence. The results

[24] This database can be accessed on the following link: *http://www.bde.es/webbde/es/estadis/infoest/series/be19.zip*
[25] Ciriaco A., Santamaría R. (2005). Persistencia de resultados en los fondos de inversión españoles. *Investigaciones Económicas, 29(3)*, 525-573. (p.534)

of this test range between 1 and -1, where 1 means total positive correlation, 0 means the nonexistence of correlation and -1 means a total negative correlation.

The coefficient is defined by the following formula:

$$\rho_{x,y} = \frac{cov\ (x,y)}{\sigma_x \sigma_y}$$

Where $cov\ (x,y)$ is the covariance between X and Y, σ_x the standard deviation of x and σ_y the standard deviation of y.

In this thesis we are going to apply it with the aim of observing the persistence between the returns of two consecutive years, that is, to observe the existence of a linear relationship between the returns of a year and those of a previous one (t and t-1).

The statistic used in order to test the null hypothesis of lack of persistence is a t statistic with N-2 degrees of freedom:

$$t = \frac{\rho_{x,y}}{\sqrt{\frac{1-\rho_{x,y}^2}{N-2}}}$$

- Cross-Product Ratio (CRP)[26]

This nonparametric ratio classifies all the mutual funds into two groups: winners or losers. In order to make this classification, the factor that is taken into account is the median of the performance of the funds within the same investment category. Thus, a fund enters into the winners group if its performance is higher than the median of the category and on the other hand we classify it as loser if its performance is lower than the median of the category.

In this context, persistence relates mutual funds during two consecutive periods denoting WW to those that are winners during two periods or LL to those that are losers during two periods. In the same way, this ratio takes into account the possibility that a fund exceeds the median during one period becoming a winner but do not manage to repeat it in the next period becoming a loser or vice versa. In these cases, these funds are denoted WL and LW respectively.

[26] Ciriaco A., Santamaría R. (2005). Persistencia de resultados en los fondos de inversión españoles. *Investigaciones Económicas, 29(3)*, 525-573. (p.534-535)

Once mutual funds of two consecutive periods have received their respective denotations, the Cross-Product Ratio (CPR) is defined by the following formula:

$$CPR = \frac{(WW \times LL)}{(WL \times LW)}$$

Thus, the Z statistic follows a normal distribution under the null hypothesis of lack of persistence. The statistic is the following:

$$Z = \frac{ln(CPR)}{\sigma_{log(CPR)}}$$

Where: $$\sigma_{log(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}}$$

The result can be either favourable or not to the presence of persistence. In case of being favourable it become more important to analyse its source, that is, if such persistence is caused by the winners, losers or both (winners and losers) funds. In order to do so we are going to use the statistic Z_X (being X= W or L, winner and loser, respectively). Since n≥20, it follows a Normal distribution:

$$Z_X = \frac{Y_X - n_x p}{\sqrt{n_x p(1-p)}}$$

Where n_x represents the number of winner or loser funds in period t-1 and Y_X the number of winner or loser funds in period t that were also winners or loser in period t-1. p is the associated probability of the state of nature under the assumption of absence of persistence, in this case 0.5.

- Chi-squared test by Carpenter and Lynch[27]

Last but not least, we have the Chi-squared test proposed by Carpenter & Lynch (1999)[28] which compares the absolute frequencies of the observed funds (WW, LL, WL and LW). As in the previous measures, the null hypothesis assumes the lack of persistence of mutual funds. Another important aspect about this test is that these two authors realized that the χ_1^2 holds great power in detecting persistence and also that it is the most robust test when the database has a survivorship bias. Its formula is the following:

[27] Ciriaco A., Santamaría R. (2005). Persistencia de resultados en los fondos de inversión españoles. *Investigaciones Económicas, 29(3)*, 525-573. (p.535)

[28] Carpenter, J. & Lynch, A. (1999). Survivorship bias and attrition effects in measures of performance persistence. *Journal of Financial Economics, 54(3),* 337-374.

$$\chi_1^2 = \frac{\left[\left(WW - \frac{N}{4}\right)^2 + \left(LL - \frac{N}{4}\right)^2 + \left(WL - \frac{N}{4}\right)^2 + \left(LW - \frac{N}{4}\right)^2\right]}{\frac{N}{4}}$$

8. PERSISTENCE IN THE PERFORMANCE OF MUTUAL FUNDS

8.1 Performance persistence in mutual funds through raw returns study

We started analysing the raw returns of the RVE, RVI and GRV mutual funds with the main objective of studying performance persistence. In order to do so we created three different tables were we introduced the raw returns of each of the mutual funds included in each of the categories. One of the difficulties that we found while doing this task was related with the fact that some of the funds disappear, merge or new ones were created, that is the reason why when we did not have information we introduced "+" as the fund's raw return. In order to study persistence is really important that the database is free of survivorship bias an in order to do so we have kept every fund regardless of their survival or not during the 6 years covered by this study.

Once the three tables were created, we computed the Pearson correlation coefficient with the goal of determining if such returns values present the existence of correlation between the funds' raw returns in period *t* and those of period *t-1* or if the relationship was developed by chance. The resulting values were the followings:

- RVE

The correlation coefficient for RVE mutual funds reveals that there exists a negative relationship between funds' raw returns during the periods 2010-211 and 2011-12. Nevertheless, for period 2013-14 there is a positive relationship.

RVE					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	-0,0391	-0,4049	-0,3337	-0,0327	0,6344
t-Distribution $t_{(0.05,\ 199)}$**=1,972**	-0,5487	-6,2146*	-4,9693*	-0,4598	11,5176*

Table 3 Source: Own compilation from CNMV database

- RVI

The correlation coefficient for RVI mutual funds displays that there exists a positive relationship between funds' raw returns during the periods 2009-2010, 2012-13 and 2013-14. Nevertheless, for the period 2012-13 there is a negative relationship.

RVI					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,4772	0,0294	-0,1863	0,1642	0,3578
t-Distribution $t_{(0.05, 296)}$=1,968	9,3096*	0,5044	-3,2507*	2,8544*	6,5689*

Table 4 Source: Own compilation from CNMV database

- GRV

The correlation coefficient for GRV mutual funds exhibits that, as in RVE and RVI, there exists both positive and negative relationship between funds' raw returns.

GRV					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	-0,1592	0,0973	-0,6263	0,1556	0,3380
t-Distribution $t_{(0.05, 628)}$=1,964	-4.0337*	2.4467*	-20.1010*	3.9417*	8.9855*

Table 5 Source: Own compilation from CNMV database

After having analysed funds persistence through the parametric Pearson's correlation coefficient, is turn to continue with the cross-product ratio, a nonparametric one. In order to do so we obtained median raw return for each different category of mutual funds and within them, for each year. The values obtained were the followings:

RVE						
Year	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Median	27,236%	-6,215%	-12,180%	7,820%	24,720%	3,110%

Table 6 Source: Own compilation from CNMV database

RVI						
Year	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Median	25,637%	12,370%	-11,550%	11,920%	18,550%	6,930%

Table 7 Source: Own compilation from CNMV database

GRV						
Year	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Median	3,153%	-1,320%	0,720%	2,895%	4,965%	2,520%

Table 8 Source: Own compilation from CNMV database

As explained in section 7, the cross-product ratio ranks funds into winners and losers depending on their position regarding the median. That is the reason why we created a contingency table of winners and losers, where a fund is a *winner* if its performance is greater than the median of all the funds in that period, if not it is a loser. Once this was done, we started to study persistence over two consecutive years' periods, giving each of the funds their respective denotation (WW, LL, WL, and LW).

Following this line, the CPR statistic has been calculated for each of the classes of mutual funds. As already mentioned, this statistic measures the proportion of funds that exhibit persistence with respect to those that not, all under the null hypothesis of no persistence (CPR is equal to 1 and the four categories are each expected to have 25% of the funds). It is important to bear in mind that the CPR statistic does not provide direct information about the origin of persistence. To check for persistence in winning or losing funds we need to use the Z_X-test (where X= W or L, winner and looser) that since $n \geq 20$, follows a normal distribution.

- RVE

As we can appreciate on table 9, the CPR values for the periods 2009-2010, 2010-2011, 2011-2012 and 2012-2013 are below 1, this implies reversal. The significance of these CPRs is determined by the Z-statistics and the critical value is 1.96 at the 5% level. In this case, since all the z-statistics are over the critical value we can reject the null hypothesis for all the periods. When we check for the origin of this reversal over the Z_W and Z_L tests, we can clearly see that since both tests are bigger than the critical value for all the periods, those mutual funds that underperform or over perform during one period reverse their position on the next one. In other words, mutual funds that were winners in period *t-1* became losers in period *t* and vice versa.

The period 2013-2014 offers a CPR value equal to 1 meaning that each of the four categories (WW, LL, WL and LW) has 25% of the funds. Its Z-test equals zero, which is below the critical value and means that the null hypothesis is not rejected, meaning that performance persistence does not exists.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,2401	-1,4269	0,3358	-4,2494*	-4,1340*	-3,4980*
2010-2011	0,1274	-2,0607	0,3740	-5,5096*	-5,3148*	-4,6640*
2011-2012	0,1651	-1,8011	0,3866	-4,6587*	-3,9001*	-4,7343*
2012-2013	0,3771	-0,9751	0,3876	-2,5160*	-2,9104*	-3,0542*
2013-2014	1,0000	0,0000	0,3886	0,0000	-0,3974	-0,5345

Table 9 Source: Own compilation from CNMV database

- RVI

As can be seen on table 10, the CPR values for the periods 2009-2010, 2012-2013 and 2013-2014 are over 1, implying persistence. The significance of these CPRs is determined by the Z-statistics and the critical value is 1.96 at the 5% level. In this case the only the z-statistic that surpasses the critical value is the one of period 2009-2010, so it is the only period for which we can reject the null hypothesis and meaning that performance persistence exists. Once we check for the origin of persistence over the Z_W and Z_L tests, and since both values exceed the critical one, we state that the origin of persistence resides in the fact that those mutual funds that were below the median return continue being under the median return in the subsequent year and vice versa.

CPR for periods 2010-2011 and 2011-2012 is below 1, this implies reversal. When we check the significance of the CPR via the z-statistic we discover than we can only reject the null for period 2011-2012. When we check for the origin of this reversal over the Z_W and Z_L tests, we can clearly see that since both tests are bigger than the critical value for all the periods, those mutual funds that underperform or over perform during one period reverse their position on the next one. In other words, mutual funds that were winners in period *t-1* became losers in period *t* and vice versa.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	4,000	1,386	0,285	4,869*	2,455*	2,556*
2010-2011	0,653	-0,426	0,279	-1,524	-1,585	-2,435*
2011-2012	0,333	-1,101	0,298	-3,690*	-3,108*	-3,611*
2012-2013	1,071	0,068	0,301	0,228	-0,990	-1,294
2013-2014	1,477	0,390	0,316	1,234	0,417	-0,943

Table 10 Source: Own compilation from CNMV database

- GRV

On table 11 we see that CPRs for periods 2009-2010, 2012-2013 and 2013-2014 are over 1 implying persistence. The Z-statistics allow us to reject the null just for periods 2012-2013 and 2013-2014 since the one for period 2009-2010 is below the critical value. The Z_W and Z_L tests do not provide information of the origin of persistence for period 2012-2013 but

for period 2013-2014 they reveal that the origin of persistence is based on the fact that funds that underperform on period *t-1* do the same on period *t*.

CPRs for periods 2010-2011 and 2011-2012 are below 1 meaning reversal and since their z-statistics are over the critical value we are able to reject the null hypothesis. The origin of this reversal resided in the fact that those mutual funds that underperform or over perform during one period reverse their position on the next one. In other words, mutual funds that were winners in period *t-1* became losers in period *t* and vice versa.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	1,1700	0,1570	0,1944	0,8078	-1,3750	-2,9433*
2010-2011	0,6040	-0,5042	0,2126	-2,3716*	-5,9071*	-2,9268*
2011-2012	0,5733	-0,5563	0,2290	-2,4290*	-4,1858*	-4,1244*
2012-2013	2,2679	0,8189	0,2585	3,1679*	-0,4685	-1,5617
2013-2014	2,6842	0,9874	0,3172	3,1124*	-0,5222	-2,6112*

Table 11 Source: Own compilation from CNMV database

Finally, we also test for performance persistence using the chi-square statistic where the null hypothesis is no performance persistence. This final test is well specified, powerful and more robust to the presence of survivorship bias in comparison to the previous ones conducted. The critical value for the 5% significance level and one degree of freedom is 3.84. Table 12 displays the obtained results for this test:

	χ_1^2 RVE	χ_1^2 RVI	χ_1^2 GRV
2009-2010	18,9006*	24,6667*	1,5506
2010-2011	33,3514*	2,8077	10,6164*
2011-2012	23,3511*	14,0412*	6,0032*
2012-2013	6,690*	0,1977	11,6508*
2013-2014	0,0377	2,1975	21,7500*

Table 12 Source: Own compilation from CNMV database

- RVE

These aggregated results match with those of the CPR statistic and the correlation coefficient providing a greater level of robustness to our results. Therefore, from the outcome obtained through different statistics either parametrically with Pearson's correlation coefficient or non-parametrically through CPR and Chi-square statistics, we conclude that we can reject the null hypothesis of lack of persistence for RVE raw returns. In particular, RVE mutual funds experiment reversal, meaning that those funds that were winners in period *t-1* became losers in period *t* and vice versa.

- RVI

These chi-square results match with those of the CPR statistic reinforcing the robustness of our results. From these results obtained either from parametric and nonparametric statistics, we determine that is not possible to reject the null hypothesis of no relationship between returns during consecutive terms.

- GRV

After having analysed GRV mutual funds' raw returns using parametric and nonparametric statistics we resolve that we can reject the null hypothesis of no persistence between funds returns but the results do not allow us to determine whether this persistence is positive or negative.

8.2 Performance persistence in style-adjusted mutual funds through raw returns study

The next step in our analysis was related with collectively analysing the whole mutual funds in our database, but adjusting each class of fund by style. With the three tables created in the previous step we formed a new one by a combination of them. In order to adjust by style we subtracted from each mutual funds raw returns the yearly median of its group. As with the individual analysis, when we were not provided with information about a mutual fund due to different reasons we introduced "+" as the fund's raw return.

Once the table was created, we computed the Pearson correlation coefficient aiming to determine the presence of correlation between funds' raw returns in period *t-1* and those in period *t*. Based on results exhibited on table 13, we determine that that there exists both positive and negative relationship between funds' raw returns. The results are significant and allow us to reject the null for period 2009-2010, 2011-2012, 2012-2013 and 2013-2014.

STYLE-ADJUSTED					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,2896	-0,0485	-0,3821	0,1044	0,4140
t-Distribution $t_{(0.05,\ 1123)}$**=1.962**	10,1290*	-1,6255	-13,8440*	3,5138*	15,2255*

Table 13 Source: Own compilation from CNMV database

As with mutual funds raw returns, after we have analysed persistence through Pearson correlation coefficient it is time to continue with the cross-product ratio. We have also obtained the median raw return for each year obtaining the next values:

STYLE-ADJUSTED						
Year	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Median	0%	0%	0%	0%	0%	0%

Table 14 Source: Own compilation from CNMV database

The median values obtained on table 14 allowed us to classify all the funds in our study into winners and loser for each of the 6 years of our study. When we finish with this task, we were prepared to study persistence over two consecutive years' periods, giving each of the funds their respective denotation (WW, LL, WL, and LW). The next step is to calculate the CPR for every period as well as the Z_X-tests since the CPR does not inform us about the origin of persistence.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	1,1947	0,1179	0,1409	1,2626	-1,5750	-2,4140*
2010-2011	0,4620	-0,7721	0,1520	-5,0797*	-7,5010*	-5,4813*
2011-2012	0,3820	-0,9623	0,1633	-5,8945*	-6,4119*	-7,0089*
2012-2013	1,2120	0,1923	0,1721	1,1171	-2,1887	-3,2831*
2013-2014	1,6214	0,4833	0,1898	2,5461*	-0,2983	-2,5743*

Table 15 Source: Own compilation from CNMV database

On table 15 it is shown that CPR values for the periods 2009-2010, 2012-2013 and 2013-2014 are over 1 implying persistence. The significance of these CPRs is determined by the Z-statistics and the critical value is 1.96 at the 5% level and in this case we cannot reject the null. CPR values for periods 2010-2011 and 2011-2012 are below 1 which means reversal and their Z-statistics allow us to reject the null for both periods. Z_W and Z_L reveal that the origin of persistence is based on the fact that those funds that beat the median returns on period *t*-1 underperform on period *t* and those funds that underperform on period *t*-1 beat the market on period *t*.

The final nonparametric test that we are going to conduct is the Chi-squared test whose critical value at a 5% significance level and one degree of freedom is 3.84. On table 16 we have the obtained chi-square coefficients that reinforce the results provided by Pearson's correlation coefficient and CPR. However even though we can reject the null hypothesis of lack of persistence for 3 periods out of 5, we cannot conclude if they present positive or negative persistence.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
χ_1^2 **STYLE-ADJUSTED**	1,8911	28,1429*	35,5346*	1,9852	13,8957*

Table 16 Source: Own compilation from CNMV database

8.3 Performance persistence in risk-adjusted mutual funds

In the two previous points, a very important variable as it is risk has not been considered and it can lead to misleading conclusions. Therefore, this third analysis focuses on the study of performance persistence of mutual funds' returns by doing an empiric analysis that will take into account and indicator that relates returns with the risk associated to a portfolio.

On point number 6 of this bachelor's thesis we pointed out that we were going to use Sharpe's ratio in order to risk-adjust the raw returns due to the lack of information that our database has since it is based on just 6 different years. Withal, due to the complexity of the information from now on we are going to continue our study of performance persistence just on European equity funds. The proxy selected for the risk-free asset has been average return of the interbank treasury bills' market with a maturity of 34 and 94 days.

We had to create a new table with all the Sharpe's ratios for every fund and year. Later on we followed a similar analysis to the one realized in order to analyse performance persistence on raw returns. Firstly we started with Pearson's correlation coefficient and we obtained different values from those of the raw returns. For periods 2009-2010 and 2012-2013 the correlation coefficient exhibits that there exists a significant positive relationship between funds' raw returns while for period 2010-2011 and 2011-2012 a significant negative relationship. Results allowed us to reject the null hypothesis of absence of correlation.

SHARPE					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,2896	-0,0485	-0,3821	0,1044	0,4140
t-Distribution $t_{(0.05,\ 199)}$**=1.972**	2,7916*	62,2189*	-3,9250*	5,8983*	1,5724

Table 17 Source: Own compilation from CNMV database

Secondly we continued with the CPR, a nonparametric statistic. We obtained the median raw returns that are displayed on table 18.

SHARPE						
Year	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Median	1,4963%	-0,399%	-0,502%	0,509%	1,955%	0,152%

Table 18 Source: Own compilation from CNMV database

The next procedure required us to classify mutual fund into winners and losers depending on their position with regard to the median and study persistence over two consecutive years' periods, giving each of the funds their respective denotation (WW, LL, WL, and LW).

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1368	-1,9684	0,3577	-5,5611*	-4,4772*	-5,1168*
2010-2011	0,1194	-2,1255	0,3763	-5,6476*	-5,0979*	-5,0979*
2011-2012	0,1767	-1,7330	0,3844	-4,5085*	-3,6707*	-4,7343*
2012-2013	1,1934	0,1768	0,3767	0,4694	-0,9701	-1,0995
2013-2014	0,8929	-0,1133	0,3907	-0,2901	-0,6623	-0,8018

Table 19 Source: Own compilation from CNMV database

Table 19 reveals that CPR values for the periods 2009-2010, 2010-2011, 2011-2012 and 2013-2014 are below 1 implying negative persistence. The significance of these CPRs is determined by the Z-statistics and the critical value is 1.96 at the 5% level. In this case since all the z-statistics are over the critical value allowing us to reject the null except for that one of period 2013-2014. When we check for the origin of this reversal over the Z_W and Z_L tests and it is clear since both tests are bigger than the critical value for all the periods, those mutual funds that underperform or over perform during one period reverse their position on the next one. As we have said on previous points, this means that those mutual funds that were winners in period *t-1* became losers in period *t* and vice versa.

The period 2012-2013 offers a CPR value bigger than 1 pointing out positive persistence. Its Z-test is below the critical value so we cannot reject the null in this case.

Last but not least, and in order to obtain more robust results, we proceeded to calculate the Chi-squared coefficient. The results are shown on table 20 and as it can be appreciated, we are allowed to reject the null of lack of persistence for periods 2009-2010, 2010-2011 and 2011-2012.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
χ_1^2 **SHARPE**	33,6792*	35,0811*	21,8244*	0,2389	0,1810

Table 20 Source: Own compilation from CNMV database

The results achieved with the Chi-squared coefficient match with those of the Cross-Product Ratio and allow us to reject the null hypothesis of lack of persistence on European funds' risk-adjusted returns in 3 out of 5 periods. In this case and coinciding with the results obtained for the same type of funds while analysing their raw returns' persistence, we can infer that there exists negative persistence on these kinds of funds.

8.4 Performance persistence in risk-adjusted mutual funds through fund' size and level and type of fees segmentation

In order to perform an in-depth analysis, we have decided to carry out the previous risk-adjusted analysis but splitting RVE mutual funds according to their size, level of management fees and type of fees (based on results or assets under management)

Firstly we began by sorting mutual funds according to their average net assets during the period covering 2009-2014. We obtained the 30th and 70th percentiles and we classified funds into three different groups: 1º Funds below 30th percentile 2º Funds between 30th and 70th percentile 3º Funds over 70th percentile.

As in the previous cases we used both parametric and nonparametric statistics in order to test performance persistence. The correlation coefficient reveals the existence of both a positive and negative relationship between those mutual fund's returns below the 30th percentile. During period 2010-2011 the value shows an almost perfect lineal correlation for which we can reject the null. We can reject it also for period 2013-2014, which shows positive lineal correlation.

Size (<30th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,0626	0,9869	-0,1367	-0,0979	0,4440
t-Distribution $t_{(0.05,\ 96)}$=1.985	0,6084	59,3275*	-1,3377	-0,9535	4,8047*

Table 21 Source: Own compilation from CNMV database

The correlation coefficient reveals the presence of a negative relationship between those mutual fund's returns between the 30th and 70th percentile but we are not allowed to reject the null for any period.

Size (30th-70th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	-0,0092	-0,3360	-0,2124	0,2308	-0,2913
t-Distribution $t_{(0.05,\ 28)}$=2.048	-0,0470	-1,8189	-1,1085	1,2098	-1,5528

Table 22 Source: Own compilation from CNMV database

For those funds whose returns are over the 70th percentile, the correlation coefficient reveals the presence of a both a negative a positive relationship. The negative lineal correlation is significant for periods 2010-2011 and 2011-2012 while period 2012-2013 shows a significant positive relationship.

Size (>70th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,3582	-0,5665	-0,3941	0,5867	-0,1985
t-Distribution $t_{(0.05,\ 75)}$=1.992	3,2778*	-5,8729*	-3,6636*	6,1909*	-1,7306

Table 23 Source: Own compilation from CNMV database

The next step was to calculate the CPR and in order to do so we firstly obtained the median risk-adjusted return of each classification and we classified funds into winners and losers. The values obtained can be seen on tables 24, 25 and 26.

- Size (<30th)

CPRs for periods 2009-2010, 2010-2011, 2011-2012 and 2012-2013 are below 1 implying reversal. Nevertheless this reversal in only significant for period 2009-2010 and 2010-2011 since their Z-statistics are over the critical value allowing us to reject the null. When we check for the origin of this reversal through the Z_W and Z_L tests we discovered that funds that underperform on period *t-1* over perform on period *t* and vice versa. CPR is over 1 on period 2013-2014 however we cannot reject the null.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1254	-2,0766	0,5398	-3,8468*	-3,0861*	-4,0119*
2010-2011	0,1252	-2,0777	0,5653	-3,6753*	-3,6829*	-3,3627*
2011-2012	0,3867	-0,9501	0,5719	-1,6614	-1,9149	-2,6112*
2012-2013	0,9167	-0,0870	0,6118	-0,1422	-1,3472	-0,9623
2013-2014	1,6806	0,5191	0,6465	0,8030	0,0000	0,2182

Table 24 Source: Own compilation from CNMV database

- Size (30th-70th)

Cross-product ratios are below 1 for every period except for period 2012-2013 where its value is 1 but its Z-statistic is not significant enough to reject the null. We can reject the null hypothesis of lack of persistence for periods 2009-2010 and 2011-2012 in favour of

negative persistence. The origin of this negative persistence on period 2009-2010 resides on the fact that winner funds on period *t*-1 become losers on period *t* and vice versa

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1000	-2,3026	0,9369	-2,4577*	-2,1381*	-2,1381*
2010-2011	0,2143	-1,5404	0,9880	-1,5591	-1,9415	-1,9415
2011-2012	0,0816	-2,5055	1,1339	-2,2097*	-1,8974	-1,8974
2012-2013	1,0000	0,0000	1,0801	0,0000	-0,3333	-1,0000
2013-2014	0,7500	-0,2877	1,1180	-0,2573	-1,0000	-0,3780

Table 25 Source: Own compilation from CNMV database

- Size (>70th)

CPRs are below 1 for every period with the exception of period 2012-2013. However we can only reject the null in favour of reversal for periods 2009-2010, 2010-2011 and 2011-2012. Z_W and Z_L show that the origin of this negative persistence resides on the fact that winners become losers and loser become winners for periods 2010-2011 and 2011-2012. For 2009-2010 we can only reject the null for Z_L-statistic meaning that negative persistence is due to the fact that funds that underperform on period *t-1* do the same on period *t*.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,2619	-1,3398	0,5371	-2,4942*	-1,9149	-2,1213*
2010-2011	0,0646	-2,7393	0,6229	-4,3978*	-3,3075*	-3,6556*
2011-2012	0,0730	-2,6167	0,6269	-4,1740*	-3,3075*	-3,6556*
2012-2013	1,1538	0,1431	0,5352	0,2674	-0,3536	-0,5388
2013-2014	0,3640	-1,0107	0,5686	-1,7774	-1,1339	-1,8898

Table 26 Source: Own compilation from CNMV database

Finally and in order to obtain more robust results, we also obtained the Chi-squared coefficients that can be shown on table 27. We are allowed to reject the null for periods 2009-2010 and 2010-2011 for those funds below the 30th percentile, for periods 2009-2010 and 2011-2012 for funds between the 30th and 70th percentile and for periods 2009-2010, 2010-2011 and 2011-2012 for those funds over the 70th percentile. The results provided by the three different tests show that we can only reject the null hypothesis of lack of persistence for those funds over the 70th percentile. What we can deduce is that there exists negative persistence on those funds in 3 out of 5 periods.

	χ_1^2 Size (<30th)	χ_1^2 Size (30th-70th)	χ_1^2 Size (>70th)
2009-2010	16,3333*	6,8400*	6,5161*
2010-2011	14,9385*	2,6842	22,6250*
2011-2012	2,9231	5,5556*	20,2459*
2012-2013	0,2558	0,2857	0,1429
2013-2014	0,6923	0,2308	3,3774

Table 27 Source: Own compilation from CNMV database

Secondly we classified funds according to their average level of management fees during the period covering 2009-2014. Then we calculated the 30th and 70th percentiles and we classified funds into three different groups: 1º Funds below 30th percentile 2º Funds between 30th and 70th percentile 3º Funds over 70th percentile.

- Level (<30th)

Pearson correlation coefficient shows that there exists a positive linear correlation between those funds with an average level of fees below the 30th percentile. It is significant for periods 2010-2011, 2012-2013. Period 2011-2012 shows the presence of a negative linear relationship that it is also significant.

Level (<30th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,0411	0,9895	-0,3745	0,5530	0,1242
t-Distribution $t_{(0.05,\ 110)}$**=1.982**	0,4275	73,3008*	-4,1974*	6,8981*	1,3006

Table 28 Source: Own compilation from CNMV database

- Level (30th-70th)

Pearson's correlation coefficient shows a positive relationship for funds charging a fee between the 30th and 70th percentile that is significant for periods 2009-2010, 2012-2013.

Level (30th-70th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,6153	0,0589	0,3437	0,5863	-0,3633
t-Distribution $t_{(0.05,\ 20)}$**=2.086**	3,3114*	0,2505	1,5527	3,0707*	-1,6542

Table 29 Source: Own compilation from CNMV database

- Level (>70th)

Mutual funds charging fees over the 70th percentile show both negative and positive lineal relationship. The negative lineal relationship is only significant for period 2010-2011 while the positive one it is only significant for period 2013-2014.

Level (>70th)					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,1879	-0,6561	-0,1982	-0,0479	0,2790
t-Distribution $t_{(0.05,\ 69)}$**=1.999**	1,5655	-7,1164*	-1,6548	-0,3927	2,3780*

Table 30 Source: Own compilation from CNMV database

- Level (<30th)

Table 31 shows that those funds with an average level of fees below the 30th percentile exhibit reversal for periods 2009-2010, 2010-2011 and 2011-2012 allowing us to reject the null. Z_W and Z_L tests are significant meaning that the origin of reversal comes from funds that on period *t*-1 underperform and on period *t* over perform and vice versa.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1250	-2,0794	0,4979	-4,1763*	-3,5714*	-4,0415*
2010-2011	0,1075	-2,2300	0,5295	-4,2113*	-4,0249*	-3,7268*
2011-2012	0,1354	-1,9996	0,5426	-3,6856*	-2,8460*	-3,7947*
2012-2013	1,7747	0,5736	0,5097	1,1254	0,1644	-0,3333
2013-2014	1,5148	0,4153	0,5281	0,7864	0,0000	0,1796

Table 31 Source: Own compilation from CNMV database

- Level (30th-70th)

Funds with an average level of fees placed between the 30th and 70 percentile display CPR values over 1 with the exception of periods 2009-2010 and 2013-2014. However, Z-statistics do not allow us to reject the null of lack of persistence for any of the periods.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,4800	-0,7340	0,9916	-0,7402	-0,3333	-0,7071
2010-2011	1,2500	0,2231	0,9747	0,2289	0,3333	-0,3333
2011-2012	3,0000	1,0986	1,2583	0,8731	-0,3333	-0,7071
2012-2013	3,0000	1,0986	1,5275	0,7192	-0,8165	0,0000
2013-2014	0,0000	#¡NUM!	#¡DIV/0!	#¡NUM!	-1,0000	-2,0000*

Table 32 Source: Own compilation from CNMV database

- Level (>70th)

On table 33 we can appreciate that all obtained CPRs for funds charging an average fee over the 70th percentile are below 1, implying reversal. It is significant for periods 2009-2010, 2010-2011 and 2011-2012 and it is caused by funds that on period *t-1* underperform and on period *t* over perform and vice versa.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1429	-1,9459	0,5909	-3,2929*	-2,3349*	-3,0533*
2010-2011	0,1474	-1,9148	0,6087	-3,1459*	-2,6941*	-3,0533*
2011-2012	0,1830	-1,6982	0,6183	-2,7468*	-2,1170*	-2,5019*
2012-2013	0,6818	-0,3830	0,6208	-0,6170	-1,4000	-1,0000
2013-2014	0,8182	-0,2007	0,6341	-0,3165	-0,2182	-0,6547

Table 33 Source: Own compilation from CNMV database

Finally we also test for performance persistence using the chi-square statistic. For funds below the 30th percentile and over the 70th this statistic confirmed the results provided by the CPRs allowing us to reject the null hypothesis of lack of persistence in favour of

negative performance persistence in both cases for 3 out of 5 periods. On the other hand, we are not able to reject the null for those funds between the 30th and 70th percentile.

	χ_1^2 Level (<30th)	χ_1^2 Level (30th-70th)	χ_1^2 Level (>70th)
2009-2010	19,2381*	0,6471	11,7931*
2010-2011	20,1948*	0,1765	10,7407*
2011-2012	14,9143*	1,0000	8,0800*
2012-2013	1,4444	1,0000	0,4762
2013-2014	0,6207	3,8571*	0,2000

Table 34 Source: Own compilation from CNMV database

In the last step, we organized funds by type of management fees that they charge. In order to do so we created one group with those funds that charge management fees over net assets and another group with those that charge management fees over results.

- Over Results

When applying Pearson's correlation coefficient to funds charging fees over results, it shows both a positive and negative lineal relationship between returns. For period 2010-2011 the results revealed a significant and almost perfect direct relationship and we also identify a significant negative lineal relationship for period 2012-2013.

Over Results					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,3306	0,9990	-0,1087	-0,4434	-0,1189
t-Distribution $t_{(0.05, 23)}$**=2.069**	1,6055	100,8960*	-0,5010	-2,2671*	-0,5489

Table 35 Source: Own compilation from CNMV database

- Over Assets Under Management

In the case of funds charging fees over assets under management it reveals 2009-2010 and 2012-2013 as periods with significant positive relationship and 2010-2011 and 2011-2012 as periods with significant negative relationship.

Over Assets Under Management					
Year	*2009-2010*	*2010-2011*	*2011-2012*	*2012-2013*	*2013-2014*
Pearson	0,1827	-0,5575	-0,2750	0,4415	0,1400
t-Distribution $t_{(0.05, 176)}$**=1.974**	2,4506*	-8,8576*	-3,7737*	6,4913*	1,8651

Table 36 Source: Own compilation from CNMV database

As in the previous points of our analysis, the next statistic used in order to test for performance persistence is the Cross-Product Ratio.

- Over Results

The CPRs obtained for those funds charging fees over results showed 3 periods with values below 1 and 2 with values over 1 but we are not allowed to reject the null in any of the periods.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,3750	-0,9808	1,1547	-0,8494	-0,7071	-1,1339
2010-2011	0,1333	-2,0149	1,1690	-1,7235	-1,6667	-1,6667
2011-2012	1,3333	0,2877	1,2583	0,2286	0,0000	-1,1339
2012-2013	2,0000	0,6931	1,1902	0,5824	0,3780	0,0000
2013-2014	0,8929	-0,1133	0,3907	-0,2901	-0,6623	-0,8018

Table 37 Source: Own compilation from CNMV database

- Over Assets Under Management

The results changed for those funds fees over assets under management since for periods 2009-2010, 2010-2011 and 2011-2012 we obtained CPRs below 1 which are significant. When we checked the origin of this reversal on the Z_W and Z_L statistics they revealed that funds that over perform on period *t*-1 underperform on period *t* and vice versa.

Period	CPR	log CRP	σlog(CPR)	Z	Z_W	Z_L
2009-2010	0,1058	-2,2460	0,3858	-5,8210*	-4,5556*	-5,3666*
2010-2011	0,1180	-2,1374	0,3976	-5,3763*	-4,8177*	-4,8177*
2011-2012	0,1427	-1,9470	0,4101	-4,7472*	-3,8806*	-4,6082*
2012-2013	1,1267	0,1193	0,3982	0,2995	-1,1523	-1,1523
2013-2014	1,2422	0,2169	0,4156	0,5219	-0,1400	-0,2828

Table 38 Source: Own compilation from CNMV database

Last but not least, we also computed the chi-squared coefficients of both groups. For those mutual funds charging fees over results we did not get any result that allow us to reject the null of lack of persistence. For funds charging fees over assets under management we obtained significant results for periods 2009-2010, 2010-2011 and 2011-2012. With the results obtained we are not allowed to reject the null for funds charging fees over results but we can do it those that charge it over assets under management. The chi-squared confirmed the results provided by the CPR allowing us to reject the null hypothesis of lack of persistence in favour of negative performance persistence in both statistics for 3 out of 5 periods.

	χ_1^2 (Over Results)	χ_1^2 (Over AUM)
2009-2010	0,8462	37,7808*
2010-2011	3,4000	31,7820*
2011-2012	1,0000	24,4667*
2012-2013	0,6667	0,1089
2013-2014	1,3333	0,3763

Table 39 Source: Own compilation from CNMV database

9. LIMITATIONS

The carried out study faces several limitations. One of these limitations has to do with the fact that some of the mutual funds disappear, appear and/or merge from year to year. With the information provided by the Comisión Nacional del Mercado de Valores, we are not able to identify the new merged funds and moreover we are not provided with the weight of each previous fund in the new funds.

Another limitation that our study faces is that it is quite probable that among the funds that disappear from year to year, we could find many losers. Consequently, it terrible damages our persistence analysis due to the fact that the failure to take into account these funds that has negative results. Another direct consequence of this is that the average performance will be overestimated since only surviving funds with better performance will tend to survive.

Finally the last limitation that we have also faced is the lack of information. There exits more expanded information sources with more completed databases, however they are not of public access. This does not allowed us to implement more and more diverse techniques of measuring performance persistence.

10. CONCLUSIONS

This bachelor's thesis investigates performance persistence, a highly studied and debated question. The previous literature has showed difference results showing the presence of positive and negative persistence in the short and the long run as well as other studied that defend the no presence of persistence in mutual fund's results.

This thesis has focused on analysing performance persistence for a sample of European equity funds, International equity funds and Guaranteed equity funds for the period covering 2009 to 2014. The sample is free of survivorship bias since we have taken into account all the mutual funds that have been part of the database regardless of whether or not they have remained throughout the time period analysed.

The results of this study have been classified into 4 different categories. The first one analysed performance persistence for annual raw returns of each of the three categories of funds selected. In the light of the results obtained though the different statistics: Pearson's correlation coefficient, CPR and Chi-squared, it is inferred that with raw returns there exists negative performance persistence for European equity funds, that is, that funds that underperform or over perform the market in one year will on average over perform or underperform respectively on the next year. International equity funds analysis reveals that there is no persistence between results of consecutive years, so relating these results with efficient markets hypothesis; it is possible to conclude results obtained are not consistent with the existence of funds that systematically "beat" the market. Guaranteed equity funds analysis reveals the presence of persistence on the returns, however the results are inconclusive about the direction of this observed persistence.

The second category analyses performance persistence over a database including the three categories of mutual funds but having adjusted them by style. We have found enough evidence to reject the null hypothesis of absence of persistence; however the results have not provided us with enough information to know whether this persistence is positive or negative.

Once this analysis was done, we continued with the analysis that aimed to study performance persistence but trying to discover if it was due to different risk exposition. Due to the complexity of the information, we were only able to apply this risk-adjusted analysis to European equity funds. The robustness of the analysis decreased in comparison

to the one carried out over raw returns since we found evidence of negative persistence performance in 3 out of 5 periods while it previously was for 4 out of 5.

Last but not least we continued with the risk-adjusted analysis but we split European equity funds according to their size (<30th percentile, between 30th and 70th percentile and >70th percentile) and also according to the level of fees (<30th percentile, between 30th and 70th percentile and >70th percentile) and type management fees that these funds charge (over results or over net assets).

The results provided by the three different tests when applied to funds classification by size revealed that there exists negative performance persistence on funds over the 70th percentile in 3 out of 5 periods. For those funds below the 30th percentile or between the 30 and 70th percentiles the analysis that we carried out revealed that there is no persistence between funds returns of consecutive years, so there are not funds into these two groups that systematically "beat" the market. These results suggest the presence of diseconomies of scale in the mutual fund industry. One hypothesis behind these results suggesting diseconomies of scale could be that larger funds erode fund performance due to trading costs related with liquidity. The reason behind these statements resided in the fact that big funds need to identify more stock ideas where to invest in comparison with small funds, meaning that they have to take small positions in larger number of stocks which tend to be illiquid instead of large positions in few and more liquid stocks. The second hypothesis is price impact since big funds trading activity can push stock prices up or down as a consequence of a huge purchase or sale of a particular stock.

The study over European equity funds according to the level of fees that they charge revealed the existence on negative performance persistence over those funds below the 30th percentile and over the 70th percentile in 3 out of 5 periods. However in the case of those funds between the 30th and 70th percentile there is no persistence, defending the efficient markets hypothesis that states that it is impossible to beat the market. The study of the level of fees charged revealed that European equity funds are under the case of no efficient information meaning that investors can't distinguish across funds and that managing companies adopt opportunistic behaviours by charging higher fees that do not match with their obtained results since funds charging larger fees underperform on year t-1 and over perform on year t and vice versa.

Finally our last analysis tested for performance persistence over European equity funds distinguishing between those funds that charge fees over assets under management or over results. We concluded in this case that we are not allowed to reject the null for funds charging fees over results but we can do it those that charge it over assets under management due to the fact that we are allowed to reject the null hypothesis of lack of persistence in favour of a negative performance persistence in 3 out of 5 periods. These results suggest that when fees are charged over results, there is a greater alignment of objectives between managers and participants.

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