



**Improving the Equity Fund Selection Process**  
**The case of Millennium bcp's Wealth Management Unit**

Bernardo do Amaral e Silva Lopo

**201004933@fep.up.pt**

**Internship report**

**Millennium bcp Private Banking – Wealth Management Unit**

**Master in Finance**

**Supervisor:** Prof. Cláudia Alexandra Gonçalves Correia Ribeiro

**September 2015**

## **Acknowledgments**

I would like to express my gratitude to everyone who helped me on developing my Master's dissertation, particularly to my family, friends and colleagues. A special thanks to my Supervisor Professor Cláudia Alexandra Gonçalves Correia Ribeiro and to my colleagues at Millennium bcp.

## **Biographical Note**

Bernardo do Amaral e Silva Lopo was born on 28<sup>th</sup> of October 1992 in Portugal. Prior to pursuing MSc in Finance at the School of Economics and Management, University of Porto, Portugal, Bernardo was graduated in Economics also at the School of Economics and Management, University of Porto, Portugal. His Professional career started in September 2014 at Millennium bcp, where he is currently still working.

## **Abstract**

This project was developed within the internship at Millennium bcp Private Banking. The present study intends to improve the actual selection process used by Millennium Bcp's Wealth Management Unit when choosing a new mutual fund to be included in the clients' portfolios. Most of existing studies provide compelling arguments to support their theories, finding some important and useful factors that should be taken into account when identifying the best mutual funds. To achieve the goal, it was analyzed the selection process of the Wealth Management Unit in order to find out where it could be improved. Secondly, analyzing many literature, we selected one particular factor that not only has been recently capturing much attention within the mutual fund industry but also it is not taken into account by Millennium bcp's Wealth Management Unit. The chosen factor was the Active Share proposed firstly by Cremers and Petajisto (2009). Finally, following Petajisto (2013) with a sample of 205 US and 270 Eurozone mutual funds from January 2000 to December 2014, Active Share's predictive power was tested. We did not find statistically significant results to conclude it must be considered in an equity fund selection process as a tool to predict future outperformance.

**Key-words:** mutual fund, selection process, outperformance, millennium bcp's wealth management unit

**JEL-Codes:** G11, G11, G17

## **Resumo**

Este projeto foi desenvolvido durante o estágio realizado no Millennium bcp Private Banking. O presente estudo visa melhorar o atual processo de seleção de fundos de investimento usado pela Wealth Management Unit – Equipa de seleção de fundos do Millennium bcp. Muitos dos estudos existentes nesta matéria fornecem argumentos convincentes que suportam as suas teorias, salientando alguns fatores que devem ser tomados em conta quando se quer identificar os melhores fundos dentro de uma específica classe de ativos. Para atingir o objetivo, foi analisado o processo de seleção de fundos da Wealth Management Unit do Millennium bcp, a fim de perceber onde podia ser melhorado. Analisando a literatura acerca do tópico, seleccionámos um fator em particular que não só tem capturado muita atenção na indústria dos fundos de investimento, como também não é utilizado pela equipa do Millennium bcp aquando de uma nova seleção. O indicador escolhido foi o Active Share proposto por Cremers and Petajisto (2009). Seguindo a metodologia aplicada em Petajisto (2013) e com uma amostra de 205 e 270 fundos do mercado dos Estados Unidos da América e da Zona Euro, respetivamente, desde Janeiro de 2000 até Dezembro de 2014, foi testado o poder preditivo do Active Share. Não encontrámos evidência estatística que nos permitisse concluir que o Active Share deve ser considerado no processo de seleção de fundos de investimento.

**Palavras-chave:** fundos de investimento, processo de seleção, outperformance, millennium bcp's wealth management unit

**JEL - códigos:** G11, G11, G17

## Index

1.	Introduction .....	1
2.	Millennium bcp Private Banking: The internship .....	4
2.1.	Mission and values.....	5
2.2.	Wealth Management Team – Fund Selection Team.....	5
2.3.	The internship .....	8
3.	Fund selection criteria .....	11
3.1.	Past performance.....	11
3.2.	Macroeconomic timing .....	13
3.3.	Fund and manager’s characteristics .....	14
3.4.	Portfolio holdings .....	15
4.	WMU Equity Fund Selection Process.....	17
4.1.	Analysis of the current selection process.....	17
4.2.	Proposed improvements.....	22
5.	Testing Active Share .....	25
5.1.	The measure and its interpretation.....	25
5.2.	Data and sample selection.....	29
5.3.	Methodology .....	31
6.	Results .....	34
7.	Conclusions .....	40
	References .....	43
	Appendix 1 .....	47
	Appendix 2.....	50
	Appendix 3.....	54

## **Index of Figures**

<b>Figure 1.</b> WMU's Organizational Structure .....	6
<b>Figure 2.</b> Evolution of AuMs invested in international mutual funds.....	7
<b>Figure 3.</b> Selection Process - Quantitative Screening .....	18
<b>Figure 4.</b> Selection Process - Qualitative Screening .....	19
<b>Figure 5.</b> Different types of Active Management .....	27

## **Index of Exhibits**

<b>Exhibit 1.</b> Morningstar's short list - Asia Pacific Ex Japan equity fund selection ...	20
<b>Exhibit 2.</b> Combination Active Share - Tracking Error .....	31
<b>Exhibit 3.</b> Sample Statistics for Fund Categories, 2000-2014 .....	34
<b>Exhibit 4.</b> US – Fund Performance, January 2000 – December 2014 .....	35
<b>Exhibit 5.</b> Eurozone - Fund Performance, January 2000 – December 2014.....	37
<b>Exhibit 6.</b> Predictive regressions for fund performance, 2000-2014 .....	39
<b>Exhibit 7.</b> Annual distribution of US Mutual Funds across categories.....	54
<b>Exhibit 8.</b> Annual distribution of Eurozone Mutual Funds across categories .....	54

# 1. Introduction

This report was developed at Millennium bcp Private Banking where the internship took place for six months. The internship took place at the Wealth Management Unit (hereinafter WMU) – Fund Selection Team (hereinafter Team) of Millennium bcp's Private Banking and it was performed in full time working hours, five days a week during the six months.

Are there mutual funds which consistently outperform a given benchmark? If yes, how can the Team identify those funds? Is it possible to identify skilled active managers ex-ante? Actually, these questions often bear in the mind of the members of the Team and the mutual fund investors worldwide. Indeed, one of the main concerns of the Team is to select the best mutual funds within the various asset classes in order to include them in the list of recommended funds. So it is crucial to have an efficient and sophisticated selection process to ensure that it is being chosen the best mutual fund among a specific asset class.

According to Barras et al. (2010), some managers have skills that allow them to outperform the market, net of fees, but that distinguishing these skilled managers from those whose good performance is simply due to luck is very difficult to do. Indeed, whenever an investor starts a selection of a mutual fund, he faces this problem. Actually, this is the role played by the WMU Team. With its specialized skills in analyzing and screening mutual funds, the Team adds value to Millennium bcp by trying to select the best managers across all asset classes.

Over the internship's period we carried out a relevant study for the department which aimed to improve a core task of the Team – the selection process of mutual funds. The main responsibility of the Team is to screen, select, recommend and monitor the most consistent long term performing funds within a diversified range of the global asset classes, namely equity, fixed income and alternative funds. The selected and recommended funds are then delivered to the Millennium bcp's clients. All funds selected by the Team are actively-managed funds, so they have a portfolio manager managing the fund on a daily basis. The Team thinks that having a specialist managing and monitoring daily the portfolio of the fund is the best way to reach better and sustained long term performance. Typically, to understand if a portfolio manager (or a

mutual fund) is delivering good performance, the Team compares it with a particular benchmark. However, it is difficult to understand ex-ante which mutual fund, within a given universe, will perform better in the future.

However, is the current WMU's selection process missing some key points, indicators or questions? Can it be improved? The study we will develop consists in improving the equity fund selection process of WMU. We will test a specific factor, selected after analyzing the WMU's selection process as well as many literature in the topic, in order to conclude whether it must be considered in a mutual fund selection process or not. By developing this study we will try to improve the accuracy and efficiency of the WMU's equity fund selection process. If we could find compelling results, the Team will get a better selection process which will allow them to identify the potential best performer equity funds in the future more easily.

The methodology of the study we will develop involves a set of steps that we will briefly describe. Firstly, we will analyze many literature about mutual funds, particularly about some factors we should look when we want to select the best mutual funds within a specific asset class. Secondly, we will analyze and describe the WMU's equity fund selection process in an attempt to find out where it can be improved. In the third stage of the study, we will choose one particular factor, among the ones described within the literature review, that WMU does not consider to be important when comparing funds, but which is relevant in the light of the literature presented. The indicator will be the Active Share. After that, we will test it, following the methodology of the study already done, namely Petajisto (2013), with a sample of 205 US and 270 Eurozone mutual funds. Lastly, we will analyze the results and discuss whether Active Share should be considered in an equity fund selection process or not.

The main goal of the study is to improve the actual selection process used by Millennium Bcp's WMU when choosing a new mutual fund to be included in the clients' portfolios. To achieve the goal, we will not only look to the current selection process of the WMU, but also test if Active Share plays a key role in identifying future outperformer funds.

The remaining report is structured as follows: Section 2 briefly presents Millennium bcp, the WMU Fund Selection Team and a description of the internship; Section 3

reviews de literature with respect to fund selection criteria including the relation between funds' past performance with their future performance, the relation between the macroeconomic environment and the outperformance, the relation between outperformance and specific characteristics of the fund, fund managers and fund management companies as well as the relation between the fund's holdings and outperformance; Section 4 describes the WMU equity fund selection process and some proposed improvements; Section 5 goes through the entire process regarding the study of the indicator Active Share such as the relevance of testing it, the objectives of the study, the data and selected sample and lastly the methodology carried out; Section 6 presents the results obtained from the study and lastly, section 7 presents our main conclusions.

## **2. Millennium bcp Private Banking: The internship**

In this chapter it is addressed a reflective analysis of the internship at Millennium bcp Private Banking, more precisely at the Wealth Management Unit, Fund Selection Team.

Millennium bcp is the Portugal's biggest private-owned bank, with a prominent position in the financial market in Portugal. Millennium bcp is the biggest private banking institution in terms of market share - both in loans to customers and in total customer funds - with an expressive distribution network, with a total of 695 branches by the end of 2014. Particularly, Millennium bcp Private banking has 9 branches within Portugal, spread across Lisbon (5), Porto (3) and Braga (1). Furthermore, Millennium bcp Private Banking has also an operation at Poland, at Switzerland, through Millennium Banque Privée, as well as an offshore operation at Cayman Islands.

Within its aggregate offer, Millennium bcp Private Banking offers two main distinguishing services: advisory and discretionary management.

The objective of the Advisory service is to help the clients on the allocation of their financial wealth in accordance with their investment's profile, obtained by a questionnaire they must answer prior to invest in order to assess their appetite for risk, their investment horizon and their knowledge about financial markets. In this service, all the client's investments are regularly monitored. Whenever occur a specific change in market conditions, it is consequently suggested a tactical changes on the client's portfolio, always taking into account his risk profile. All this service is provided by Investment Specialists, qualified and registered at Comissão de Mercados e Valores Mobiliários, within the WMU, as will be described later.

On the other hand, Discretionary Management service consists in managing clients' financial assets in accordance with a mandate given by the client. In this service, Millennium bcp structures a well-diversified portfolio (with equity, bond and alternative funds) suitable to the client's risk profile. All these portfolios are composed by international mutual funds, managed by asset management companies worldwide, selected independently by WMU Fund Selection Team. It is important to highlight that all mutual funds selected by WMU are actively-managed mutual funds. Actively-managed mutual funds are funds, as the name implies, which are managed by a skilled professional specialist. WMU Fund Selection Team selects actively-managed funds

since they believe there are fund managers that, throughout a market cycle, outperform their benchmarks in a consistent way.

## **2.1. Mission and values**

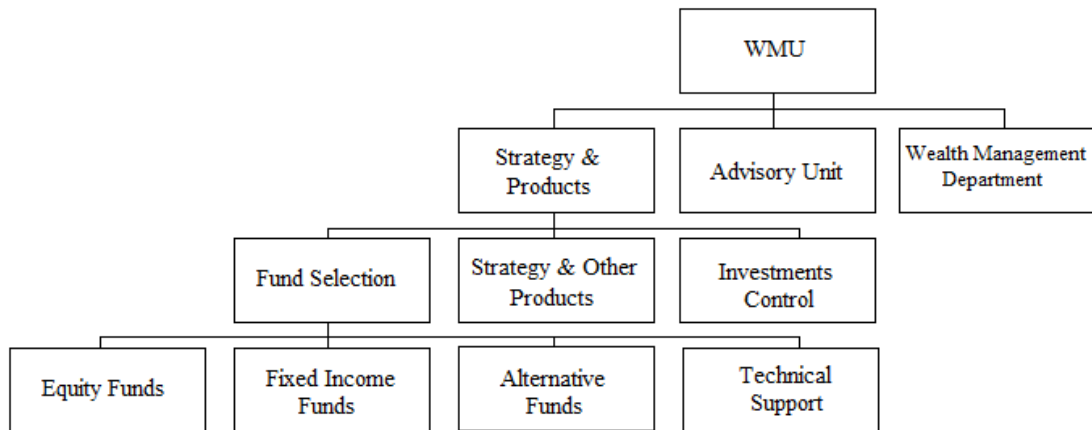
According to Millennium bcp (2015), Private Banking's mission is to provide investment solutions that fit their customer's specific needs, built on a customized global and independent financial and asset planning advisory service. Millennium bcp (2015) also states that what makes it different is its strength of maintaining solid prudence standards in the management of the assets entrusted to the bank, the trust each private banker is committed to listen, understand and provide support in the decision-making process, personalized relation to the client, independence by ensuring total exemption in its advice and management of client's assets, competence based on the expertise and skills of the teams and excellence by trying to exceed the expectations of the clients who entrust the bank with their assets.

## **2.2. Wealth Management Team – Fund Selection Team**

In this sub section I will describe the department where the internship took place. As already mentioned, the internship took place at the Wealth Management Unit of Millennium bcp Private Banking. WMU comprises three different main areas, all with different responsibilities and roles.

Figure 1 shows the organizational structure of the WMU. As it can be seen, WMU is initially divided into three different departments: strategy & products, advisory unit and wealth management department. Strategy & products' section comprises the teams responsible for the fund selection, strategy and other products as well as the team which controls all the investments within the Private Banking. Advisory Unit covers all the functions regarding the advisory service as previously explained while the wealth management department includes all steps, especially the operational ones, regarding the discretionary management, also already explained before.

**Figure 1. WMU's Organizational Structure**



Source: Millennium bcp Private Banking

The internship was entirely done at Fund Selection department. Looking at Figure 1, it is visible that Fund Selection Team can be divided into Equity Funds, Fixed Income Funds, Alternative Funds and Technical support. It is important to highlight that these different areas do not mean different teams. This distinction is only presented to distinguish the three different types of funds the Team selects as well as to focus that each type of fund is monitored by a particular member of the Team. So Fund Selection Team comprises one person who is in charge for Equity Funds, another who is in charge for Fixed Income Funds and another in charge for the Alternative ones. All the Team is backed up by a member who gives a transversal technical support.

In the internship, I supported all the Team. I was not allocated to a specific type of funds, being always available to support whatever member of the team whenever necessary. Therefore, during the internship, I reported directly to the head of the Fund Selection Team.

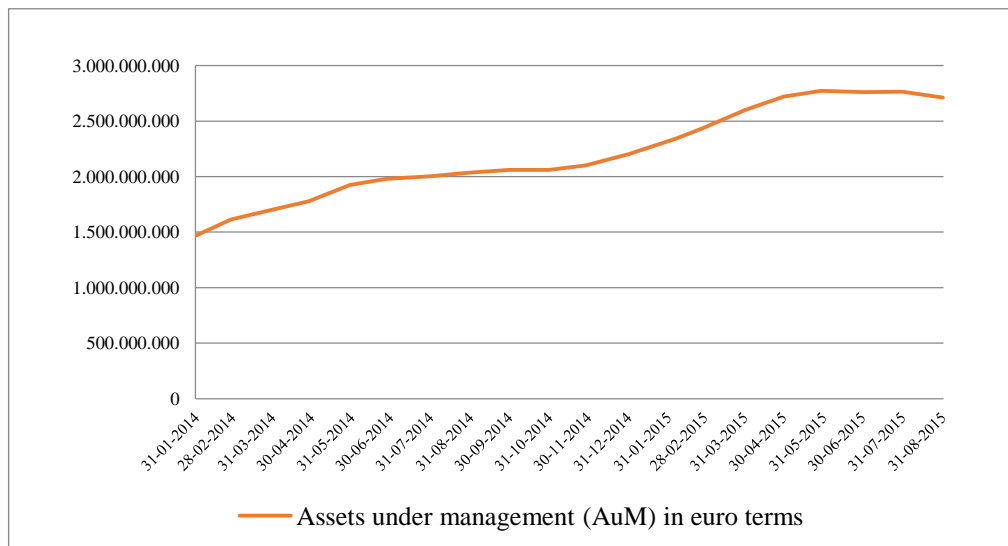
The Fund Selection Team usually illustrates a parallelism to describe themselves. I will start by presenting that parallelism to explain the role played by them. Broadly speaking, when people looks to a world record holder in decathlon, they can consider him as the most complete athlete in the world since he is the world record holder in a sport which comprises ten different events. However, he is not the world best athlete within each event separately. Actually, the fact that he must train ten different sports takes away his capacity to compete on equal terms with the specialists of each genre.

Therefore, the goal of being the most complete athlete sacrifices the specialization which would be necessary to be the best one in each discipline. It is exactly this which characterizes the Fund Selection Team.

Within the mutual fund industry, the Team seeks to select, in an independent way, the best specialists in order to maximize the final outcome. In fact, this is the great advantage of having a Team completely focused in selecting funds. Therefore, the Team aims to choose the best specialists in each asset class – its main goal. Globally, the Team is responsible for selecting and monitoring mutual funds which will be recommended and included in the clients’ portfolios, both discretionary and advisory portfolios. Discretionary and advisory portfolios are the ones which derive from the discretionary and advisory services, respectively, as it was previously described.

To understand the role played by the Fund Selection Team at Millennium bcp Private Banking, it is presented here one fact that clearly shows its skills. Figure 2 shows the evolution of assets under management Millennium bcp holds in international mutual funds.

**Figure 2. Evolution of AuMs invested in international mutual funds**



**Notes:** this figure comprises the sum of the Millennium bcp’s assets under management invested in international funds through discretionary management portfolios and advisory portfolios, both in Portugal and Switzerland, internet and retail branches, Poland and Intermoney Millennium Gestão de Ativos (as custodian bank). **Source:** Millennium bcp Private Banking

As it can be seen on Figure 2, the total assets under management at Millennium bcp have been exponentially increasing. Looking to this figure it can be concluded the Team has been adding a lot of value to the bank with its skills as fund selectors. In the 20-month period from January 2014 to August 2015 the value of assets under management grew 84.5%.

Figure 2 thus shows the job is being well done, although the value of AuMs has stabilized somewhat recently. Therefore, it seems to be not needed improving anything. Nevertheless, anything is perfect and everything has always space to improve. That is what this study intends to do.

### **2.3. The internship**

The present project was developed at WMU Fund Selection Team where the internship took place. The internship was for six months in full time. The main objective of the internship was to support the Team in its daily functions and responsibilities, being one more helping to achieve WMU's goals. In Millennium bcp I had the opportunity to work in a department of mutual funds, where the connection to the financial markets is central. I could deepen my background in finance, by working with a very skilled Team. I supported the Team in many tasks of its daily routine. As it was said, I was not allocated to any specific asset class, so my expertise has increased in all type of funds the Team covers.

During the internship, I have participated in several **meetings with asset management companies** whenever they came to present new funds or to review the funds within the WMU's recommended list. All funds within that list are monitored on a regular basis and so it is necessary to discuss the performance of the fund during a given period (normally 1 year), changes in the management team, performance attribution, comparison with its peer group and benchmark, manager's outlook and so on with the asset management company, specifically with the management team who manages it. As of August 2015, the recommended list comprised 71 mutual funds spread across the three asset classes (29 equity funds, 20 fixed income funds and 22 alternative funds) and the funds' review is done at least once per year. During the internship I have not only participated in the meetings, both face meetings and conference calls, but also supported the Team in **producing the file notes** which summarized the review. After that, all file

notes are presented to the WMU's investment specialists (in Lisbon, Porto, Braga, Poland and Switzerland) of the advisory unit. In the internship I was also called to do these presentations.

I also supported the team on producing the **monthly reports of the recommended funds**. These internal reports contain a single page's analysis of each recommend fund as well as a summary of the main market events in the month. I was also in charge for producing a monthly presentation about the funds' performance which was delivered to the private bankers, aiming to be a support whenever they have a meeting with clients.

Another important part of the WMU's activity is the **asset allocation meetings** which are conducted once per month. The Strategy & Other products' department presents the outlook of the markets as well as an exhaustive market review of the month. This team has also a highly important role within the Private Banking, since they are in charge of defining the asset allocation of the discretionary portfolios. According to their outlook, they decide in which asset classes and sub asset classes the portfolios should be overweight, underweight or neutral. I have also participated in every asset allocation meeting during the six months.

Whenever a fund does not meet what was expected in terms of performance, face a change in management team or a change in its investment philosophy or universe, it goes automatically to an "on watch" list. This list is carefully monitored and if the different/bad behaviour stays for too long, a new mutual fund selection is considered.

During the internship, the Team conducted **two fund selections**, namely an Asia Pacific ex Japan equity fund and an Asian bond fund. In both selections I had the opportunity to help the team at many stages of the process: screening the universe of available funds, comparing the potential funds to be selected and analyzing each of them in order to identify the best one (in accordance with their pre-defined requisites that will be further presented later). Actually, it was during these activities that I realized the pertinence and relevance of this study. The participation in both selection processes gave me the opportunity to get acquainted with the entire process and to develop a critical analysis in order to improve it.

Therefore, the Team and I defined this **critical analysis in order to improve the fund selection process** as one of the main objectives of the internship. At the same time,

during the internship I was another peer member of the team supporting in any task that was needed, contributing to the achievement of the department's goals.

To meet the objectives, it was extremely important the Team I was working with. They always looked at me as a colleague, contributing a lot to my performance as well as my growth at a professional level.

At the end of the internship, I was invited to stay at Millennium bcp. I got the job and I am still currently working at WMU.

### **3. Fund selection criteria**

The process of fund selection is one of the main concerns of the WMU. Indeed, the Team has to ensure that it is being selected the mutual funds with the highest level of long term performance within the universe available, in the best interest of Millennium bcp's clients. Therefore WMU needs to have got a suitable and reliable model to compute the greatest screening possible, i.e., the screening has to include all the relevant factors to compare a considerable amount of funds. It must provide the Team with the perfect view about what are the best and the worst ones. Therefore the process has to be carefully defined and thoroughly conducted.

Many debates have been carried out and a number of studies have been published about the most relevant factors to identify skilled fund managers and the best mutual funds. However, there is no consensus over this issue in the investment funds' environment.

The opinions are slightly divergent. Globally, Barras et al. (2010) argued that some managers have skills that allow them to outperform the market, net of fees, but that distinguishing these skilled managers from those whose good performance is simply due to luck is very difficult to do. Therefore, this chapter reviews the literature on this topic, following Jones and Wermers (2011)'s classification of the general factors determining the process of identifying and evaluating the best skilled managers: (1) past performance, (2) macroeconomic timing, (3) fund manager characteristics and (4) fund holdings.

#### **3.1. Past performance**

If the best active managers have in fact superior information and analytical capabilities, the advantage should persist along the future. If so, the best managers who outperform the respective market in one period will likely outperform in the next period as well. The existence of performance persistence tells us whether past fund performance information should be taken into account by investors when making their investment decisions. In fact, performance persistence's topic has consistently occupied a place to many debates.

The first studies on mutual fund performance persistence were already contradictory. Sharpe (1966) used the Sharpe ratio to measure fund performance. He ranked funds over two periods 1944-1953 and 1954-1963 and found a positive relationship between the two ranking periods. Conversely, Jensen (1968) measured the performance of 115 mutual funds in the 1945-1964 period using the Jensen alpha measure and showed that they do not outperform on average a buy-and-hold strategy.

Some evidence indicate that investment fund returns exhibit persistence but only when excess returns are adjusted to account for style biases by using both the Carhart (1997) four factor model or the Fama and French (1993) three factor model. For example, Harlow and Brown (2006) found that using style-adjusted returns can improve the odds of identifying an outperforming fund from 45 to 60 percent. Additionally, Pástor and Stambaugh (2002) suggested that adjusting for sector biases can improve those results even more.

On the other hand, Kosowski et al. (2006) found that adjusting for non-normality in fund alphas increases the probabilities of finding funds with greater return persistence, distinguishing lucky managers from skilled managers. Kosowski et al. (2007) advanced further ahead and used this latter study in the universe of alternative funds, namely the hedge funds. They also found results that support the existence of persistence – top decile hedge funds outperformed bottom decile funds by 5.8 percent in the following year.

Several studies suggest some significant advances on this topic such as Bers and Madura (2000) which found that closed-end funds (a publicly-traded fund that raises a fixed amount of capital through an IPO and it is then structured, listed and traded like a stock) exhibit return persistence. According to the study, the main reason for that is the unusual existence of inflows and outflows as it happens regularly in an open-ended fund. Also Elton et al. (1995) found that past performance is predictive of future risk-adjusted performance. Many other studies such as Grinblatt and Titman (1992), Zeckhauser et al. (1993) and Goetzmann and Ibbotson (1994) also found evidence of predictability at time horizons from one month to three years.

All of these studies lend strong support to the conventional wisdom that the track record of a fund manager contains information about future performance.

Conversely, Barras et al. (2010) developed a simple technique to classify funds into skilled and unskilled funds. They exhibited a significant proportion of skilled funds prior to 1996 while this proportion rapidly decreased to an insignificant level of 0.6% in 2006. This is consistent with the theoretical work of Berk et al. (2004) who showed that past performance cannot be used to infer skill level of fund managers. Phelps and Detzel (1997) found also no evidence of performance persistence.

### **3.2. Macroeconomic timing**

Based on the analysis of past performance, it is also feasible to relate the funds' performance with the macroeconomic environment in which the performance was achieved. Several studies analyzed this relation aiming to forecast which managers will be outperformers in a given macro environment in future. To the extent that the alpha of the fund varies over time, according to Jones and Wermers (2011), this variation may be a consequence of three different events: (1) embedded macroeconomic sensitivities (for example, a persistent overweight in cyclical stocks), (2) time-varying skills, or (3) time-varying opportunities for managers to benefit from their skills. However, it seems to exist higher consensus regarding the third one – some periods in an economic cycle offer more mispricing opportunities for managers to take advantage of their superior insights and skills. The example illustrated by the authors is categorical: *Many contrarian managers underperformed during the tech bubble of the late 1990s, when prices diverged significantly from fundamentals, but outperformed by a huge margin when the bubble burst.*

On the one hand, the study of Moskowitz (2000) suggest that the odds of the average active manager outperform the market are higher during periods of recession. On the other hand, Kosowski (2006) found that the average active funds do better in times of higher return dispersion and volatility, i.e., times of higher levels of uncertainty.

These studies focused on fund performance during periods of instability in the economies such as stress, slowdowns and recessions. There are a lot of data frequently released by governmental and non-governmental entities which according to some studies may be very useful to investors when trying to predict future performance. Avramov and Wermers (2006) found a connection between macroeconomic variables

and outperformer funds. Actually, they identified good funds, in terms of outperformance, by using this approach. The macroeconomic variables that they have used in their study are: the level of short term rates, the credit default spread, the term structure of interest rates and the market's dividend yield. According to them, selecting funds under this approach makes being possible to reach annual four factor alphas of more than 600 basis points, net of fees. Many others studies followed their methodology, achieving good results as well: Banegas et al. (2009) regarding European equity funds and Avramov et al. (2011) into the hedge fund universe.

### **3.3. Fund and manager's characteristics**

Studies in this area have also looked to specific characteristics of the fund, the asset management company and the fund managers.

Asset management companies present different organizational structures, use different techniques and managers do not have all the same level of skills, both in collecting, gathering and analyzing information. Indeed, they are not all equal. Many studies found that some types of fund managers/asset management companies outperform on average.

Regarding fund managers' characteristics, Ding and Wermers (2005) found that experienced managers of large funds outperform less experienced managers. Cohen et al. (2007) found that managers that take larger exposure in companies in which they have some connection (for instances, family businesses; close relationship of friendship with some member of the board of directors; companies they have a considerable level of stake etc.) have higher probability of achieving outperformance. According to the study, the "connected holdings" do, on average, better than those non connected holdings. In fact, the stronger is the connection between the manager and the company, the better is the access to privileged information. Still regarding the manager's characteristic, Chevalier and Ellison (1999) emphasized that managers who have graduated at schools with higher average SATs do better.

De Souza and Gokcan (2003) documented that managers who invest in their own funds outperform. Indeed, the expression of "skin in the game" has been often cited by the literature. Most of investors like to see that, for example, the CEO of the companies in

which they are investing has a considerable stake in that company. The same can be applied to the mutual fund universe. In other words, in accordance with the study, if investors select funds from firms whose managers have the most skin in the game, they are substantially improving their odds of beating the market. Moreover, Kinnel (2015) examined a list of 500 funds and have discovered that funds whose managers have more than one million dollars invested had survived and beat the average of their peers over the past eight years.

Other studies focused on the specific features of the asset management companies rather than their fund managers. Massa and Zhang (2009) found that funds managed by companies with a flat organization structure outperform funds managed by companies with more hierarchal structures. Kacperczyk et al. (2005) found that industry- or sector-concentrated funds do better, suggesting that this specialization along sector or industry improves the manager's ability to select, gather and analyze information.

Lastly, some studies focused on the characteristics of the fund itself instead of focusing in the essence of the company or fund manager. Here stands out the study of Edelen (1999) and Kinnel (2010). The first one documented that funds with large cash balances are more likely to lag their benchmarks than other funds and the latter asserted that the cheapest funds, in terms of expense ratios, outperformed the most expensive funds in every period and every category. Lastly, Wermers (2012) found that funds with the most variation in style exposures do better in outperforming their benchmarks.

### **3.4. Portfolio holdings**

According to many other financial researchers, a deeper analysis of the fund's holdings is an interesting way to address when deciding about the best mutual fund to invest. Results seem to be quite promising. Jones and Wermers (2011) considered holdings-based analysis as one of the best ways to identify the best managers and the best funds. Kacperczyk et al. (2008) compared the returns of the actual fund's holdings with the returns of the publicly disclosed holdings of the fund. Here it is important to highlight the "window dressing" phenomena – when a manager tries to hide his bad trades in the fund. That difference is called as return gap. According to them, funds with large return gaps between published and holdings-derived performance underperform. At the same

time, Wei et al. (2009) documented that contrarian managers outperform the managers who trade in the same direction as the aggregate of other managers (herding managers) by more than 2.6% a year.

Lastly, Cremers and Petajisto (2009) and more recently Petajisto (2013) focused their study on an indicator called Active Share. This indicator measures how much an equity portfolio's holdings differ from the benchmark index constituents. They found that funds that take bigger active positions outperform those with lowest levels of Active Share. According to both studies, the most active Stock Pickers have been able to add value for investors, beating their benchmarks indexes by about 126bps a year, net of fees. They also correlated that indicator with Tracking Error, finding that the most recommended approach (in terms of risk-return) involves picking funds with high Active Share and low Tracking Error. It means the fund is similarly exposed to the benchmark in terms of industries/sectors (low Tracking Error), but the fund manager is very selective, picking just some stocks as well as different stocks within each industry (high Active Share). Therefore, a higher Active Share, *ceteris paribus*, should allow a skilled manager the opportunity to add greater value.

## **4. WMU Equity Fund Selection Process**

In this section we present an analysis of the current selection process of WMU Fund Selection Team, aiming to improve it. We describe the different steps of the process as well as one selection that occurred during the internship – a selection of an Asia Pacific Ex Japan Equity Fund. Finally, we present some improvements that we suggest should be incorporated in the process.

### **4.1. Analysis of the current selection process**

One of the main activities of WMU is to select the best performing mutual funds worldwide. An overview about the key global criteria used by WMU when selecting can be summarized as follows:

- **Process:** they prefer actively-managed funds, i.e., funds that are managed by an individual manager, co-managers or a team of managers. Furthermore, the investment process of the fund must be understandable and make economic sense.
- **Philosophy:** they prefer fundamental managers who exploit inefficiencies over the long term.
- **People:** they prefer funds with stability of management and firm as well as stability of idea generators, namely analysts and portfolio managers.
- **Performance:** they prefer funds with consistent positive risk adjusted returns over market cycles and the alpha generated must be related with the strategy implemented by the management team.

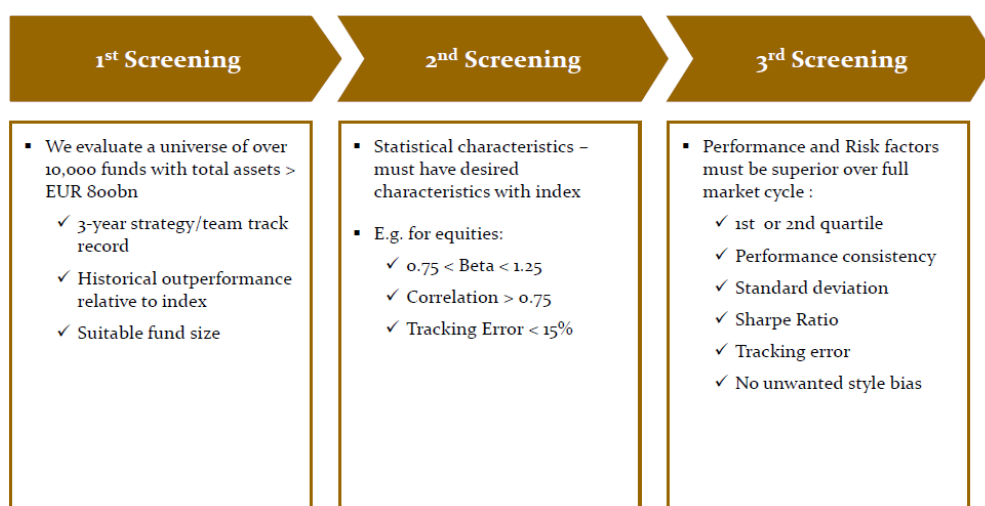
These previous criteria are set by the Team to guarantee a disciplined selection process in order to protect investors as much as possible. According to the Team, a judicious selection process can add value but long term winners are not easily identifiable in advance. Here emerges the need to have a specialized team in selecting mutual funds.

The selection process WMU carries out can be initially divided into two: quantitative screening and qualitative screening.

Figure 3 shows the three main screenings that are done during the quantitative screening stage of the process. All of these screenings are computed using Morningstar database.

Morningstar is a research tool which provides data on approximately 473,000 investment offerings, including stocks, mutual funds and similar vehicles. So the Team only considers funds with at least 3-year strategy/team track record, with historical outperformance relative to index and suitable fund size. Furthermore, the Team sees as important that a fund has similar characteristics to the index that best fits it. For example, if they are selecting an US large cap equity fund, they want a fund similar to the MSCI USA Index. Thus, the fund should have a beta between 0.75 and 1.25, a correlation of more than 0.75 and a Tracking Error below 15%. However, all these defined thresholds are flexible and are always depending on the market conditions in which the selection is taking place. Lastly, they look to the funds with superior performance and risk factors over a full market cycle.

**Figure 3. Selection Process - Quantitative Screening**



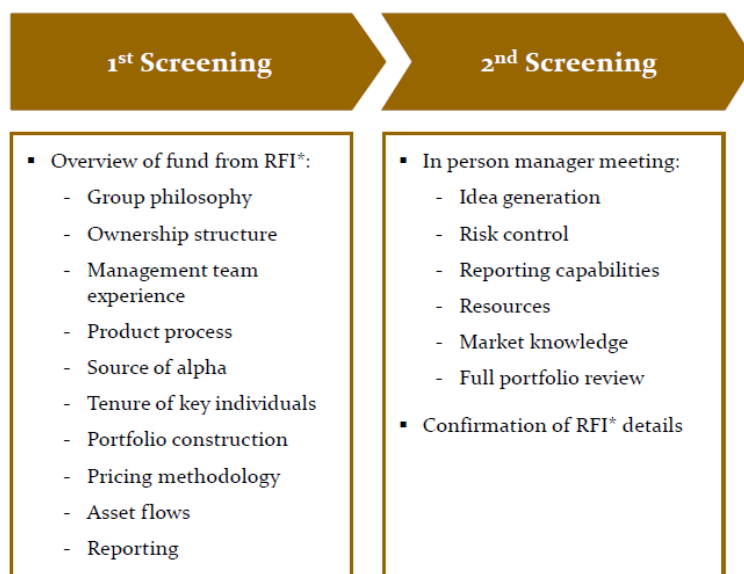
Source: Millennium bcp Private Banking

Globally, after analyzing track record, fund size and correlation to the index, the Team looks to risk-return indicators to choose which funds go to the second part of the process.

Figure 4 shows the second part of the process – the qualitative screening. In this stage, the Team firstly send a questionnaire to the fund providers of the funds who passed the previous screening. This questionnaire is named RFI (request for information) and contains detailed questions to understand the fund’s investment process, management team, philosophy, strategy etc. After analyzing the answers given by the fund providers, the process goes to the next stage. In the second part of the qualitative screening, the

Team meets with the portfolio manager of the funds which has passed the previous stage in order to confirm the RFI details as well as any other questions that have arisen. Normally, only around 3 or 4 funds reach this last phase.

**Figure 4. Selection Process - Qualitative Screening**



**Source:** Millennium bcp Private Banking

Finally, everything analyzed, the Team chooses the fund which has fitted more its requisites. One fund is selected.

During the internship, two new selections were carried out. We briefly describe the selection of an Asia Pacific Ex Japan Equity fund<sup>1</sup>. This selection was developed because the Asia Pacific Ex Japan Equity fund in the list of recommended funds at that time was consistently underperforming its benchmark index and its peer group. Thus the team decided to select a new one.

---

<sup>1</sup> Asia Pacific Ex Japan Equity Fund means an equity fund whose portfolio comprises companies of the western Pacific Ocean's region such as East Asia, Southeast Asia, South Asia and Oceania, excluding Japan.

## Exhibit 1. Morningstar's short list - Asia Pacific Ex Japan equity fund selection

Name	Inception Date	Fund Size	Total Return			Tracking Error	Morningstar Rating
			YTD	3 Yr	5 Yr	3 Yr	
MSCI AC Asia Pac Ex JPN NR USD	31-12-1998		6,43	7,44	7,40		
First State Asian Eq Plus I Acc	14-07-2003	2,448,341,901	14,39	11,84	11,47	4,92	★★★★★
Schroder ISF Asian Eq Yld A Acc	11-06-2004	2,486,575,326	10,20	10,35	10,65	5,34	★★★★
BGF Asia Pacific Equity Inc A2 USD	18-09-2009	822,008,398	3,42	9,86	9,15	5,56	★★★★
Fidelity Asia Pacific Dividend A-USD	16-12-2004	371,092,625	5,56	9,49	8,50	4,49	★★★★
Investec GSF Asia Pacific Equity AS Acc	14-05-2010	615,715,976	6,60	9,21	-	4,34	★★★★
AB Asia Pacific Ex-Japan Equity S USD	16-09-2010	643,687,732	9,63	9,06	-	4,40	★★★★
Vontobel Far East Equity B	25-02-1998	850,946,878	18,39	8,99	10,81	8,61	★★★★
Henderson Horizon Asian Div Inc A2	26-10-2006	423,712,830	4,66	8,95	6,68	4,04	★★★
M&G Asian A USD	19-12-2008	995,052,774	4,66	8,41	8,55	5,31	★★★★
JPM Asia Pacific Strategic Eq A (acc)-\$	09-09-2009	358,588,671	3,90	8,35	9,70	3,90	★★★★
Threaneedle Asia RetNet USD	31-10-1990	780,177,455	7,68	7,83	6,19	2,42	★★★
Mirae Asset Asia Sector Leader Eq A	17-05-2013	335,344,329	13,60	-	-	-	-

Source: Morningstar (November 2014)

Exhibit 1 shows a short-list of 12 funds, ordered by 3 years' past return, obtained from Morningstar. As previously explained, all funds on the list were assessed, taking into account the quantitative screening stage of the process. Furthermore, during this stage, the Team also analyzed some reports provided by Morningstar with more detailed information about the funds as fund's characteristics, fund's holdings, portfolio manager, expenses and many other statistics.

Looking to the list, we see firstly the First State Asian Equity Plus fund. This fund has a high track record, as its inception date was in 2003, a suitable fund size and a brilliant performance. However, the fund was soft closed at that time, meaning that additional inflows are only allowed to current investors and not to new ones. That is normally the case of funds that reach a big size. The second fund in the list is the Schroder ISF Asian Equity Yield fund. This fund was also removed from the short-list, since it was also soft closed. BGF Asia Pacific Equity fund is the following fund in the list. Looking to the main indicators, the fund seemed to be a good candidate. However, the team knew that the portfolio manager had left the team in February 2014. According to the WMU criteria described before, this is a sufficient reason to exclude the fund from the process. Actually, it makes much sense. Since the portfolio manager had left the team, a new one took his place. However, the Team does not know if the philosophy and strategy of the previous one will remain the same with the new one managing the fund.

Another fund which was automatically removed from the list was the Mirae Asset Asia Sector Leader Equity fund, the last placed in the list. Its inception date had been May 2013. Once again, according to the criteria used by WMU, a fund is only available to be

selected when has more than 3 years of track record. However, if the fund has no more than 3 years but its strategy is older, it can be actually chosen. But it was not the case for Mirae Fund and therefore it was taken off the list. Once again, it is also a prudent measure as a way to ensure that the decisions are sufficiently supported by representative historical information. In fact, analyzing a fund with less than three years of track record is not enough to formulate a well-founded opinion.

Another issue in the short-list relates to Fidelity and Henderson Horizon funds - both funds are biased to companies that usually distribute dividends or have a high probability of doing it in the future. Actually, the Team does not want funds with that bias, so they were also removed. As mentioned before, the Team prefers funds that their philosophy is to find opportunities in the market by companies' fundamental analysis rather than their probability of distributing dividends. In fact, this also makes sense. The fact of a company distributes dividends does not mean the company is solid and is well-managed. Furthermore, companies that are known by their characteristic of distributing dividends are highly exposed to negative market movements whenever they cannot comply with the distribution expectations.

After an overall analysis, the Team identified the funds in the short-list to proceed to next step of the process. Those funds were:

- Investec GSF Asia Pacific Equity
- AB Asia Pacific Ex Japan Equity
- JPM Asia Pacific Strategic Equity

The final step consists of a qualitative screening of the three funds. The Team sent the RFI to the management firms of the finalist funds and met the management team of the three funds. The final decision is taken based on the analysis of the feedback, both from the answers to the RFI and the meeting and this time has favoured JPM Asia Pacific Strategic Equity fund. The fund was selected and the Team started to recommend the fund for clients who seek exposure to Asia Pacific Ex Japan equity market.

## **4.2. Proposed improvements**

Analyzing the selection, we had opportunity to look carefully to the entire process. Actually, we saw it critically and we concluded it can be improved.

Our first suggestion goes to the correlation with the index. According to the criteria mentioned before, WMU prefer funds with a correlation to its benchmark index higher than 0.75. Although this threshold can be adjusted, the concern of the Team is that the fund follows the index closely. However, one of the main objectives of the Team is to select funds which are consistent outperformers. These two conditions seem incoherent. Therefore, we think they should not include this characteristic as a criteria. Taking into account fees and expenses, the higher the correlation to the index, the higher the probability of the actively-managed fund underperform the index, net of fees. This is what WMU does not intend. We think that correlation should be a matter to analyze further ahead in the process. It should not be a criteria used in the first steps of the screening, since the Team could initially eliminate good funds, simply because they have a lower degree of correlation with the index. We think that this is a question to analyze when WMU sends the questionnaire RFI. Only in that stage, it should be analyzed whether the fund is consistent in its process and philosophy as well as disciplined with a benchmark aware strategy.

Our second suggestion relates to all phases of the selection process. In almost every selection, more than one fund passes to the last phases of the process. However, at the end of the line only one fund is selected. We think that the Team should create a “pool” of the funds that go to the last phase of the process but are not selected for some reason. This would be valuable information to take into account the next time the Team would need to select another new fund. We think this can improve the efficiency of the selection process.

We also think that additional indicators could be considered in the quantitative screening phases. Sortino and Van Der Meer (1991) and Appel (2005) highlighted the relevance of considering sortino ratio and drawdown measure, respectively, when assessing mutual funds. Drawdown measures the gradual decline in the price of a fund between its highest and lowest value over a given period while sortino ratio is a risk-adjusted return indicator which only penalizes “harmful” volatility. As regular standard

deviation does not discriminate between up and down volatility, sortino ratio measures only the part of the standard deviation that in fact matters for investors – the downside risk. Since upside volatility is usually good, sortino ratio measures the actual level of risk the portfolio is taking in fact– the higher the sortino ratio, the better the portfolio has performed relative to the risk taken. On the other hand, drawdown risk becomes more and more relevant to investors. Some funds are able to recoup their losses much more quickly than others, and this can be a key indicator of how well the fund is managed. For example, a fund that can lose over half of its value in a short time and take years to recoup this is probably not very well managed. Therefore, we think that these two indicators must also be carefully analyzed whenever the Team initiates a fund selection.

Moreover, we think Active Share should also be considered by the Team when assessing mutual funds in the quantitative screening stage. As previously mentioned, Cremers and Petajisto (2009) proposed Active Share as a new factor of active management. Since the authors found compelling arguments to prove its predictive power, we decided to study Active Share deeply in order to see whether we find statistic relevance that allow us to agree with them.

Finally, we sent a questionnaire (see appendix 1) to three different asset management companies – Fidelity, Schroders and Pictet - in an attempt to understand their views regarding the indicators they think to be fundamental when comparing funds in the same asset class. After analyzing the answers given by them at question 1, we realized that understanding if the attribution of returns fits the stated philosophy and investment process of the fund, stability of the team, managers' alignment with clients (i.e., whether managers' performance drives a large part of their compensation and whether they invest in the fund alongside clients) and risk-adjusted returns over a three and five year cycle are examples of what they see as important measures to assess a mutual fund/portfolio manager. Actually, the Team looks carefully for these topics whenever a new fund is selected. Good news for WMU.

On the same questionnaire, we also inserted two questions asking their views regarding Active Share. Reading all answers, we see that all three firms agree when saying Active Share, although being not a guarantee for future outperformance, is an important and

relevant indicator when selecting from a universe of active equity funds. Schroders says that clearly a fund needs to be different to its benchmark index in order to outperform it and Active Share gives that notion. Schroders says also that Active Share is becoming more prevalent in the industry as something that investors are paying attention to. Besides Schroders' point of view, Pictet asserts Active Share is one indicator that can be useful, particularly if we are comparing managers who state that a large proportion of their alpha contribution will come from a high conviction bottom-up approach while Fidelity says Active Share contribute to a fuller picture of active management.

In the next chapter, we develop a study which aims to test the ability of Active Share to predict future outperformance. It will be presented the relevance of investigating Active Share, the objectives of the study, the methodology, the database and the selected sample as well as all the steps carried out during the study.

## **5. Testing Active Share**

In this chapter we present our study of testing Active Share.

The main objective of this study is to conclude whether Active Share should be taken into account in the selection process of a new equity mutual fund or not. If we can find compelling arguments to do so, this can be one additional improvement to suggest to WMU. In fact, this is what all of this project intends to do.

Furthermore, as the literature shows relevant findings in this topic, we think that studying Active Share not only in the US but also in the Eurozone as well as in a different time period of Petajisto (2013) we could find innovative conclusions.

Looking to the answers given by Fidelity, Schroders and Pictet (see appendix 1) we actually realize Active Share has been increasingly approached within the mutual fund industry. This fact together with the encouragement received by WMU as well as our purpose to improve the selection process was enough for us to be sure that it would be interesting and useful to test it. Since the Team does not look to Active Share when selecting mutual funds and existing studies find evidence that Active Share is a predictive tool to identify the most probable outperformers in the future, we decided to study it deeply.

The next sub sections will be divided as follows: the measure and its interpretation, data and sample selection and lastly the methodology carried out.

### **5.1. The measure and its interpretation**

As previously mentioned, Active Share is a metric proposed firstly by Cremers and Petajisto (2009) and more recently by Petajisto (2013) to measure the percentage of the mutual fund's portfolio that differs from the passive benchmark index. A passively-managed portfolio consists of replicating the return on an index with a strategy that holds almost all (or even all) the stocks held by the index, in the same proportions. Conversely, actively-managed portfolios are defined as everything which deviates from passive management. Actively-managed mutual funds are funds, as the name implies, which are daily managed by a skilled professional specialist(s) – called portfolio manager/management team. Active equity managers normally buy and select stocks in

order to achieve a particular goal, such as providing a certain level of return or beating a relevant benchmark. As a result, they trade much more frequently than managers of passively managed funds whose goal is to mirror the performance of the index the fund tracks. However, it is difficult to investors measure the degree of active management the fund comprises. To try to solve this problem, both studies started by defining two different measures that will accompany the entire study: Tracking Error and Active Share.

Kahn and Grinold (1999) defined Tracking Error as the time series standard deviation of the difference between a fund return ( $R_{fund,t}$ ) and its benchmark index return ( $R_{index,t}$ ) as follows:

$$\text{Tracking Error} = \text{Stdev} (R_{fund,t} - R_{index,t})$$

Therefore, Tracking Error measures the volatility of the fund that is not explained by movements in the fund's benchmark index.

Cremers and Petajisto (2009) designed Active Share which they characterized as a simple way to quantify active management through comparing the holdings of a mutual fund with the holdings of its benchmark index. They defined it as follows (where  $w_{fund,i}$  is the weight of stock  $i$  in the fund's portfolio and  $w_{index,i}$  is the weight of the same stock in the fund's benchmark index):

$$\text{Active Share} = \frac{1}{2} | w_{fund,i} - w_{index,i} |$$

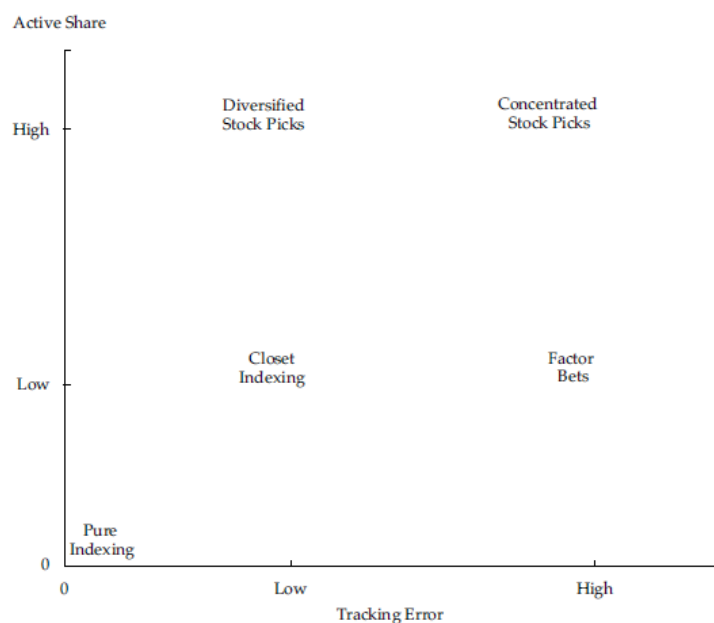
According to Cremers and Petajisto (2009) and Petajisto (2013), Active Share helps investors to quantify active management as it compares the holdings of a mutual fund with the holdings of its benchmark index.

Both Active Share and Tracking Error are thus two different measures to evaluate the degree of active management. Conceptually, when comparing a fund with its benchmark index, an active manager can only add value through stock selection and/or market timing. Stock selection consists of taking active bets on individual stocks while market timing consists of time-varying bets on broader factor portfolios. In practice, when a fund manager selects only one stock within a given sector, he is clearly putting in practice his stock selection skill. Whenever a fund manager is overweight to a

specific sector or country, for instances, he is trying to add value by a factor timing bet. However, although both stock selection and market timing (also known as stock picking and tactical asset allocation) give us an insight of active management, they are in fact different concepts. Petajisto (2013) demonstrates a practical example which shows the difference. Considering a portfolio with 50 stocks, it seems to be well diversified. However, if all the overweight positions of the portfolio are in the technology sector, even small active positions will generate a high Tracking Error. Theoretically, technology stocks, as most of the stocks within a particular sector, tend to move together in the same direction. Conversely, considering an index which comprises 50 industries with 20 stocks each, if a portfolio picks only 1 stock out of 20 in each industry, it will hold 50 stocks and the overall sector positioning of the fund will be the same of the benchmark index. The manager is thus very selective within sectors, generating a high Active Share. However, since he is not taking any active positions across industries, the portfolio will produce a low Tracking Error.

In this sense, despite both measure active management, Active Share and Tracking Error evaluate two different aspects. Active Share evaluates the manager's stock picking skill while Tracking Error is a proxy for systematic factor risk. Figure 5 shows the different categories of active management sorted by Petajisto (2013).

**Figure 5. Different types of Active Management**



Source: Petajisto (2013)

Figure 5<sup>1</sup> plots 4 different types of mutual funds simply by the combination between Active Share and Tracking Error. Diversified stock picks (hereinafter Stock Pickers) characterize the funds with higher Active Share and low Tracking Error. Concentrated stock picks (hereinafter Concentrated funds) combine high levels on both Active Share and Tracking Error. Factor Bets are defined as funds with low Active Share but high Tracking Error while closet indexing (hereinafter Closet Indexers funds) gives respect to the funds with low levels on both Active Share and Tracking Error. Following this distinction, the author believes it is meaningfully distinguished the different active management styles.

Therefore:

- **Stock picker:** the fund's sector weights are similar to those of the benchmark (low Tracking Error) but the manager focuses on finding individual underpriced stocks within each sector through his stock picking skill (high Active Share).
- **Factor bet:** the fund's sector weights are different to those of the benchmark (high Tracking Error) and its philosophy does not go too much through stock picking (low Active Share).
- **Concentrated:** the fund follows not only a stock picking strategy (high Active Share) but also factor bets (high Tracking Error). The fund takes large active positions both on individual stocks and sector weightings.
- **Closet indexer:** the fund do not engage much in either stock selection or factor bets strategies (low Active Share and low Tracking Error).

Traditionally the most common way that people measure the degree of active management is to use Tracking Error, which is a returns-based way of measuring active management. However, the authors think their way of quantifying active management would be a useful compliment to Tracking Error but it is inherently better. Both Cremers and Petajisto (2009) and Petajisto (2013) found that active management, as measured by Active Share, significantly predicts fund performance relative to the benchmark. Funds with the highest Active Share outperform their benchmark both

---

<sup>1</sup> Petajisto (2013) defines, apart from the ones showed in the figure 5, another category during his article – Moderately Active funds.

before and after expenses while funds with the lowest Active Share underperform after expenses. Conversely, they concluded active management as measured by Tracking Error does not predict higher returns.

In our study, since Petajisto (2013) achieved relevant findings in his study, we will follow Petajisto (2013) with a few exceptions that will be examined hereafter. Our study will comprise both US and Eurozone mutual funds, from January 2000 to December 2014.

## 5.2. Data and sample selection

In our study, we needed information of both Active Share and Tracking Error. To get this information we used the database Morningstar, through the available access at Millennium bcp.

Being aware of the availability of Active Share and Tracking Error via Morningstar, we advanced thus for the next step: selecting a sample of mutual funds. To select the funds we used also the Morningstar database, computing a screening according to the following criteria:

- **Morningstar category:** US large-cap blend equity funds; US large-cap value equity funds; US large-cap growth funds; US mid-cap equity funds; US small-cap equity funds; US flex-cap equity funds
- **Base currency:** US dollar
- **Distribution status:** Accumulation<sup>2</sup>
- **Oldest share class:** Yes
- **Fund size:** higher than \$10M

Computing this screening, we achieved 277 US mutual funds<sup>3</sup>.

The screening criteria above were globally the same of Petajisto (2013). The only exception is the oldest share class. While we defined it at the beginning, Petajisto

---

<sup>2</sup> The distribution status “Accumulation” means the fund reinvests any dividend distributed within the portfolio.

<sup>3</sup> Although we called US mutual funds, it does not necessarily mean a fund domiciled in the United States, but instead funds which their investment universe comprises the US stock market.

(2013) computed the value-weighted average of monthly returns for funds with multiple share classes.

After the screening regarding US mutual funds, we computed the same research criteria for Eurozone funds with two differences: base currency switched from dollar to euro and the Morningstar categories changed from US to Eurozone. We achieved 283 funds with data of Active Share and Tracking Error.

All the calculations regarding Active Share and Tracking Error were done, through Morningstar, against the funds' primary prospectus benchmark. Whenever a fund had not available its primary prospectus benchmark, we chose the index which produced the lowest average Active Share (called best fit index at Morningstar) or the Morningstar's defined benchmark for its respective category. For example, if a US large-cap blend equity fund had not published its primary prospectus benchmark and Morningstar could not define the best fit index, we chose the Morningstar category index for US large-cap blend equity funds which is Russell 1000 index.

From Morningstar we exported annual data on Active Share and Tracking Error, from 2000 to 2014. We obtained data on Active Share as of the last day of each year as well as 1-year Tracking Error, both from 2000 to 2014.

Regarding funds' and benchmark indices' returns, we obtained data on monthly returns from Bloomberg platform. Since some mutual funds had not available their price series within Bloomberg, we were forced to reduce our sample. We finally obtained 205 US mutual funds and 270 Eurozone mutual funds (see appendix 2 – list of mutual funds used in the study). Comparing our sample with the one used by Petajisto (2013) we see ours is smaller. We were not capable to reach a bigger sample, because Morningstar does not have much funds with available Active Share yet.

In the US study, we used the benchmarks Russell 1000, Russell 1000 Value, Russell 1000 Growth, Russell 2000, Russell 2000 Value, Russell 3000, Russell Midcap, Russell Midcap Value, Russell Midcap Growth, S&P 500, S&P 500 Value, S&P 600, S&P 100, MSCI USA, MSCI North America, FTSE USA and Dow Jones Industrial Average, all of those returns included dividends and were expressed in dollar terms. In the Eurozone study, we used the benchmarks MSCI EMU, MSCI EMU Mid, MSCI EMU Mid Value, MSCI EMU Smid, MSCI EMU Smallcap, MSCI Europe, MSCI Europe ex UK, MSCI

Euro and MSCI Pan Euro, all of their returns also included dividends and were expressed in euro terms.

### 5.3. Methodology

On this sub section, we will focus on the methodology carried out to test the predictive power of Active Share.

Firstly, we sorted all mutual funds into the five categories of active management defined before: Closet Indexers, Factor Bets, Moderately Active, Concentrated and Stock Pickers funds. The division was exactly the same of Petajisto (2013) and the combination (Tracking Error versus Active Share) was defined as the following matrix:

**Exhibit 2. Combination Active Share - Tracking Error**

Active Share Quintile	Tracking-Error Quintile					Group	Label
	1 (Low)	2	3	4	5 (High)		
5 (high)	5	5	5	5	4	5	Stock pickers
4	2	2	2	2	3	4	Concentrated
3	2	2	2	2	3	3	Factor bets
2	2	2	2	2	3	2	Moderately active
1 (low)	1	1	1	1	3	1	Closet indexers

Source: Petajisto (2013)

Exhibit 2 shows the matrix of possible combinations between Active Share and Tracking Error. We sorted mutual funds into the above categories on an annual basis. Each year, we divided the funds' Active Share and Tracking Error into quintiles and then we labelled them. The 1<sup>st</sup> quintile of Active Share comprised the funds with the lowest Active Share in the year while the 5<sup>th</sup> quintile comprised the funds with the highest value. Similarly, the 1<sup>st</sup> quintile of Tracking Error included the funds with the lowest value of Tracking Error in the respective year whilst the 5<sup>th</sup> quintile included the funds with the highest Tracking Error. According to that, if a fund in a given year ranked 1<sup>st</sup> quintile in Active Share range and ranked 1<sup>st</sup> quintile of Tracking Error, we labelled the fund "Closet Indexer" in that year. Conversely, if a fund ranked 5<sup>th</sup> quintile of Active Share and 5<sup>th</sup> quintile of Tracking Error, we labelled it "Concentrated".

Following the matrix on exhibit 2, we found annually in which category each fund belonged.

The annual distribution of our samples, both the US and the Eurozone, across the different categories is expressed in appendix 3.

After the division has been done, we focused on the core part of the study, the part of knowing how the performance varies across the different categories of actively-managed funds. In this stage we defined 5 different portfolios: portfolio P1 held Closet Indexers funds, portfolio P2 held Factor Bets funds, portfolio P3 held Moderately Active funds, portfolio P4 held Concentrated funds and portfolio P5 held Stock Pickers funds. Therefore, every fund was annually channelled to the portfolio it belonged in that year.

Thereafter, we calculated the equal-weighted average returns for the 5 portfolios as well as the equal-weighted average across all groups. These calculations were done in a monthly basis. We achieved the monthly return of each portfolio from January 2000 to December 2014. Therefore, portfolios' monthly returns comprised the equal-weighted average returns of the living funds belonging to the portfolio's category in each month. As we were going forward in time, each portfolio comprised more funds since some funds in the sample were launched after 2000. Finally, we calculated the annualized return of each portfolio for the 15-year period from 2000 to 2014.

We did exactly the same for benchmarks. Whenever a fund was channelled to a given portfolio, its respective benchmark followed the same path within the benchmarks' portfolios. For instance, if a fund was Stock Picker in one year, its benchmark went to the portfolio of Stock Pickers' benchmark in the same year. The benchmarks' portfolios were also computed on the same way as well as their monthly returns. We also calculated the annualized return of each portfolio of benchmarks for the period.

We highlight that, as we sorted funds annually, a fund could be Closet Indexer in one year and Factor Bet in the following year, for example. It could happen in every fund, every year.

Therefore, we ended with 5 portfolios of funds (P1, P2, P3, P4 e P5) and 5 portfolios of benchmarks, both for the US and the Eurozone. For each of these 10 portfolios we calculated the annualized return for the 15-year period from January 2000 to December

2014. After that, we compared the returns of each portfolio of funds with their respective portfolio of benchmarks in order to get benchmark-adjusted returns. Finally, we regressed the monthly benchmark-adjusted returns on the four factor model of Carhart (1997) to control for exposure to the market, size, value and momentum effects. These regressions allowed us to obtain the average annual alpha delivered from each portfolio of funds.

## 6. Results

In this section we present the empirical results of our study.

Exhibit 3 shows some sample statistics for the fund groups. For each sample, we computed an equal-weighted mean across all the months. Fund size is the only exception as the presented values in its column are expressed as of August 2015.

**Exhibit 3. Sample Statistics for Fund Categories, 2000-2014**

<b>US Mutual Funds</b>					
<i>Mean values</i>					
Category	Label	No. of funds	Active Share	Tracking Error	Fund Size (millions)
5	Stock Pickers	23	95,3%	5,0%	\$281
4	Concentrated	19	96,3%	8,9%	\$590
3	Factor Bets	22	82,8%	8,0%	\$375
2	Moderately Active	101	78,7%	4,7%	\$458
1	Closet Indexers	40	37,3%	2,2%	\$718
All		205	74,5%	5,0%	\$493

<b>Eurozone Mutual Funds</b>					
<i>Mean values</i>					
Category	Label	No. of funds	Active Share	Tracking Error	Fund Size (millions)
5	Stock Pickers	23	89,8%	5,8%	123 €
4	Concentrated	32	92,2%	9,3%	79 €
3	Factor Bets	21	71,9%	8,7%	103 €
2	Moderately Active	141	65,1%	4,4%	236 €
1	Closet Indexers	53	34,2%	2,6%	231 €
All		270	64,9%	5,1%	196 €

**Notes:** this table shows sample statistics for the fund categories defined in exhibit 2. The values in this table are equal-weighted means of each variable computed across all months over the sample period.

Our samples have thus a total of 205 US and 270 Eurozone mutual funds each. Exhibit 3 shows also the means regarding Active Share, Tracking Error and fund size. Within the Eurozone sample, the average Active Share among Stock Pickers is 89.8% while Tracking Error is 5.8%. Regarding the US sample, Active Share among Stock Pickers averages 95.3% while Tracking Error averages 5.0%. All merged, we see the average

fund has 64.9% and 74.5% of Active Share within the Eurozone and the US samples, respectively.

Exhibit 4 shows the annualized net returns, the annualized benchmark-adjusted returns and the annualized four-factor alphas<sup>1</sup> for the 5 portfolios of US all-equity mutual funds. We also computed the same calculations without distinguishing among groups, meaning the average fund across all groups.

#### Exhibit 4. US – Fund Performance, January 2000 – December 2014

	<b>Fund Net Returns</b>	<b>Benchmark-adjusted Returns</b>	<b>Four Factor Alphas</b>
<b>Closet Indexers (P1)</b>	2,92%	-2,53%*** (-4,21)	-1,85%*** (-3,95)
<b>Factor Bets (P2)</b>	4,03%	-0,78% (-0,28)	-1,05% (-0,72)
<b>Moderately Active (P3)</b>	4,78%	-0,96%* (-1,40)	-0,92%** (-1,82)
<b>Concentrated (P4)</b>	6,73%	-0,42% (-0,07)	0,16% (0,09)
<b>Stock Pickers (P5)</b>	7,07%	0,89% (0,98)	0,41% (0,57)
<b>Total</b>	5,12%	-0,91% (-1,13)	-0,87%* (-1,43)
<b>P5 - P1</b>	4,15%*** (3,03)	3,42%*** (3,55)	2,27%*** (2,55)

**Notes:** Exhibit 4 shows the annualized equal-weighted performance of US all-equity mutual funds for five types of active management (defined in exhibit 3). The numbers are expressed in US dollars and in percent per year, followed by t-statistics (numbers in parenthesis). \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level.

When computing the four factor model of Carhart (1997), we see the average fund delivered a negative alpha of -0.87% (t=-1.43). According to that, we note the average fund was not able to add value for investors.

Looking at the different portfolios, we found that the difference in the net returns between Closet Indexers and Stock Pickers is 4.15% (t=3.03). We computed one tailed t-statistics to test if the difference between both differs significantly. We concluded the observed difference between both portfolios in terms of net returns is convincing enough to say that the average net return between Stock Pickers and Closet Indexers

<sup>1</sup> Four factor alphas were obtained through the four-factor model of Carhart (1997)

differs significantly. Therefore, we conclude Stock Pickers funds produce higher net returns than Closet Indexers funds, on average.

Adjusting for benchmark returns, we found that Closet Indexers funds delivered strongly negative relative returns (-2.53%) which allow us to say the Closer Indexers underperform on average their benchmarks after fees ( $t=-4.21$ ). Comparing Stock Pickers and Closet Indexers in terms of benchmark-adjusted returns, we once again conclude Stock Pickers post much higher excess returns than Closet Indexers (3.42%) and the positive difference is also statistically significant at the 1% level ( $t=3.55$ ). Therefore, we conclude that Stock Pickers funds deliver, on average, superior excess returns than the Closet Indexers in the US space. Regarding all the remaining portfolios, we did not achieve statistically significant results to conclude they are different from zero.

The right column of exhibit 4 represents the alpha values of each portfolio when we regress the monthly benchmark-adjusted returns on the four factor model of Carhart (1997). Controlling for exposure to the market, size, value and momentum factors, we see once again that Closet Indexers add the least (-1.85%). Alphas for Moderately Active are also statistically significant ( $t=-1.82$ ), posting -0.92%. The difference between alphas on Stock Pickers and Closet Indexers is once again statistically significant ( $t=3.33$ ). Alpha generated by Stock Pickers was 2.27% higher than the one delivered by Closet Indexers.

In fact, exhibit 4 shows Stock Pickers deliver higher returns, higher benchmark-adjusted returns and higher alphas than the Closet Indexers portfolio. Moreover, the differences are statistically significant which supports the theory achieved by Petajisto (2013). We also achieved statistically significant results in respect to Closet Indexers portfolio. We found that Closet Indexers post on average negative returns, both absolute and benchmark-adjusted, as well as negative alphas. These findings are also consistent with the ones achieved by Petajisto (2013). However, in contrast to Petajisto (2013), we did not find relevant results to argue Stock Pickers deliver the highest benchmark-adjusted return and alpha.

Exhibit 5 presents the same analysis for Eurozone funds. It also shows the equal-weighted average returns, the benchmark-adjusted returns and the four-factor alphas for the five portfolios of funds within the Eurozone universe.

**Exhibit 5. Eurozone - Fund Performance, January 2000 – December 2014**

	<b>Fund Net Returns</b>	<b>Benchmark-adjusted Returns</b>	<b>Four Factor Alphas</b>
<b>Closet Indexers (P1)</b>	-1,29%	-2,25%*** (-3,43)	-1,66%*** (-3,56)
<b>Factor Bets (P2)</b>	0,49%	-1,21% (-0,62)	-0,85% (-0,76)
<b>Moderately Active (P3)</b>	0,69%	-0,63% (-0,67)	-0,60% (-1,01)
<b>Concentrated (P4)</b>	2,80%	-0,08% (0,03)	0,56% (0,60)
<b>Stock Pickers (P5)</b>	3,22%	0,23% (0,23)	0,43% (0,27)
<b>Total</b>	0,99%	-0,45% (-0,82)	-0,56% (-0,92)
<b>P5 - P1</b>	4,51%*** (3,01)	2,48%* (1,38)	2,13%* (1,30)

**Notes:** Exhibit 5 shows the annualized equal-weighted performance of Eurozone all-equity mutual funds for five types of active management (defined in exhibit 3). The numbers are expressed in euro terms and in percent per year, followed by t-statistics (numbers in parenthesis). \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level.

Looking at the exhibit 5, we did not find anything new that we have not found before when we analyzed the performance among the US sample. We found once again evidence to conclude Closet Indexers funds underperformed their benchmarks after fees - they delivered an annualized benchmark-adjusted return of -2.25% (t=-3.43) and -1.66% of four factor alpha (t=-3.56).

The difference in net returns and benchmark-adjusted returns between Closet Indexers and Stock Pickers was 4.51% (t=3.01) and 2.48% (t=1.38), respectively. Therefore, also in the Eurozone space, we found that Stock Pickers delivered higher absolute and benchmark-adjusted returns than those who closely track the index.

Regressing the benchmark-adjusted returns on the four factor model of Carhart (1997), we observe that all obtained alphas are not statistically significant, except for Closet Indexers. Once again, we see this portfolio of funds delivered negative alphas. As previously, we also investigated whether the difference between alphas on Stock

Pickers and Closet Indexers is statistically significant or not. We found statistical significance at the 1% level ( $t=1.30$ ).

Overall, exhibit 5 shows Stock Pickers deliver on average higher returns than the ones delivered from Closet Indexers portfolio whose returns are consistently negatives. When comparing these results with the previous ones regarding US mutual funds, we did not find anything relevant beyond what was already concluded before.

Petajisto (2013) concluded that Stock Pickers are able to add value for investors as they outperform on average their benchmark indexes. Petajisto (2013) also found that Factor Bets, as indicated by high Tracking Error, are not rewarded in the market. In our study, results are not robust enough to conclude this. However, one thing we think to be clear: Closet Indexers are not a good choice for investors who seek outperformer funds. Whenever considering fees and expenses, these funds will consistently underperform their benchmarks. In this sense, we conclude WMU should select funds away from the ones which closely track benchmark indexes. Actually, Closet Indexers funds are the ones with small amounts of Active Share, since they place at the 1<sup>st</sup> quintile of Active Share (where 5<sup>th</sup> is the quintile with the highest Active Share). Therefore, we are able to suggest WMU to avoid these funds when selecting mutual funds.

Besides all tests computed before, a recent non-published working paper by Frazzini et al. (2015) concludes that small-cap funds<sup>2</sup> tend to have higher Active Share while large-cap funds tend to have lower Active Share. We analyzed our US sample and noted that indeed 97% of the Closet Indexers are large-cap biased funds. As such, we decided to remove this bias from the sample and we computed exactly the same study but now without the small-caps funds within both samples. However, we found no changes in our findings.

Lastly, we analyzed the correlation between Active Share (and Tracking Error) and performance, by single regressing mutual funds' benchmark-adjusted performance with Active Share and Tracking Error, respectively. Here we do not combine both, since our intention is to analyze each metric separately.

---

<sup>2</sup> Small-cap funds typically invest in companies with market capitalization of less than 1 million dollars/euros.

### Exhibit 6. Predictive regressions for fund performance, 2000-2014

	US Mutual Funds	Eurozone Mutual Funds
Active Share	0,0012* 1,61	0,0021*** 3,51
Active Share x Large Cap	0,0001 0,23	0,0025*** 4,28
Active Share x Small/Mid Cap	0,0079* 1,29	-0,0036 -0,52
Tracking Error	0,0107* 1,50	0,0116** 2,29

Notes: \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level, respectively.

Exhibit 6 tries to explain fund performance with the explanatory variables Active Share and Tracking Error. Here we calculated the average return, the average Active Share and the average Tracking Error of each fund in both samples from January 2000 to December 2014. With this, we intended to analyze further how Active Share and Tracking Error are related with fund performance.

Looking at exhibit 6, we see that 1pp increase in Active Share predicts 0.12 basis points increase in US funds' excess return ( $t=1.61$ ) while among small and midcap funds this increase is a bit higher – 1pp increase in Active Share predicts 0.79 basis points in funds' excess return ( $t=1.29$ ). At the same time, in contrast to Petajisto (2013), 1pp increase in Tracking Error predicts around 1.1 basis points in funds' benchmark-adjusted returns ( $t=1.50$ ).

Regarding the Eurozone, we found that a 1pp increase in Active Share predicts a 0.21 basis points increase in fund's excess return ( $t=3.51$ ). Furthermore, we found that among large cap funds, 1pp increase in Active Share predicts 0.25 basis points in fund's adjusted-benchmark return ( $t=4.28$ ). Once again, conversely to Petajisto (2013), we found that 1pp increase in Tracking Error predicts around 1.2 basis points increase in Eurozone mutual funds.

## 7. Conclusions

This report has two different objectives. Firstly, it aims to present the nature of the internship at Millennium bcp Private Banking, Fund Selection Team. Secondly, it intends to make a critical analysis of the equity fund selection process of WMU in order to identify where it can be improved. Additionally, it was carried out a study to test the ability of Active Share in predicting future outperformance, aiming to conclude whether it must be included in the selection process.

The internship took place at Millennium bcp Private Banking, Wealth Management Unit – Fund Selection Team and it was for six months in full time. The main objective of the internship was to support the Team in its daily functions and responsibilities, being one more helping to achieve the department's goals. In the internship it was possible to deepen the background in finance, by working with a very skilled Team.

In the second part of the study, we started by searching factors that according to the literature in finance should be taken into account when selecting mutual funds. After that, we developed a critical analysis of the current fund selection process of WMU. Analyzing it, we could initially propose some improvements that will certainly benefit the Team. We firstly suggested the Team should avoid funds with high correlation levels with their benchmark indexes as they will probably underperform. According to Sortino and Van Der Meer (1991) and Appel (2005), we also suggested they should look to sortino ratio and drawdown when assessing mutual funds as both measures give a complementary overview of the quality of the portfolio manager/management team. Furthermore, we suggest the Team should create a “pool” of funds in order to improve their efficiency when selecting a new one in the future.

After that, we advanced to test whether Active Share matters for fund performance or not. We decided to study Active Share mainly because two reasons: Active Share has been increasingly approached within the mutual fund industry and the encouragement received by WMU. Since the Team does not look to Active Share when selecting mutual funds and existing studies find evidence that Active Share is a predictive tool to identify the most probable outperformers in the future, we decided to study it deeply. Following Petajisto (2013), we firstly distinguished the different types of active management. According to both studies, active management can be measured in two

different dimensions: Active Share and Tracking Error. Active Share emphasizes stock selection while Tracking Error emphasizes exposure to systematic factor risk. It was defined five categories of funds, in accordance with the type of active management they practice: Stock Pickers, Concentrated, Factor Bets, Moderately Active and Closet Indexers funds. We applied the methodology followed by Petajisto (2013), in the time period between January 2000 to December 2014, not only to US, but also to Eurozone all-equity mutual funds.

Globally, we found statistically-significant results to say Closet Indexers are not good choices for investors who seek outperformer funds. We obtained reliable results to prove their consistent underperformance. Furthermore, we also obtained relevant evidence for the difference between Stock Pickers and Closet Indexers returns. We found that Stock Pickers delivered higher absolute and benchmark-adjusted returns than Closet Indexers, in both US and Eurozone samples. Moreover, we found positive correlation between Active Share and benchmark-adjusted return within the Eurozone and the US as well as positive correlation between Tracking Error and benchmark-adjusted returns in both regions.

Therefore, we did not find evidence to directly improve the WMU's fund selection process through the Active Share. We are not able to say that funds with higher Active Share are more likely to outperform in the future. On the other hand, we found that Closet Indexers funds consistently underperform their benchmark after fees. In this sense, we conclude WMU should avoid this kind of funds.

Although we followed the methodology used by Petajisto (2013), some characteristics differentiate both studies. In fact, these different characteristics to some extent limited our study. Firstly, our sample is smaller than the one carried out by Petajisto. Furthermore, we sorted mutual funds into the five categories on an annual basis while Petajisto (2013) did it monthly. Moreover, our samples considered both institutional and retail share classes. These two share classes have highly different fees and expenses – institutional share classes are theoretically cheaper than the retail ones. Since we only considered net returns in our study, this could have biased the results. Lastly, we just considered living funds while Petajisto (2013) considered both living and dead funds.

Although we did not find relevant evidence, probably the Team should be alert to further advances into this matter, since some existing studies find robust evidence to prove the predictive power of Active Share.

For future research, it would be interesting to extend the analysis to a bigger sample as well as in a longer time period. Furthermore, it would be also enriching to investigate it within other markets such as Emerging Markets, Europe as a whole (not restricting to Eurozone), Asian markets and other markets with regulated financial markets.

## References

Appel, G. (2005). "Technical analysis: power tools for active investors". FT Press.

Avramov, D., Kosowski, R., Naik, N. and Teo, M. (2011). "Hedge funds, managerial skill, and macroeconomic variables." *Journal of Financial Economics*, Vol. 99, N° 3, pp. 672-692

Avramov, D. and R. Wermers (2006). "Investing in mutual funds when returns are predictable." *Journal of Financial Economics*, Vol. 81, N° 2, pp. 339-377.

Banegas, A., Gillen, B., Timmermann, A. and Wermers, R. (2009). "The performance of European equity mutual funds." Unpublished working paper, University of California, San Diego and University of Maryland.

Barras, L., Scaillet, O. and Wermers, R. (2010). "False discoveries in mutual fund performance: Measuring luck in estimated alphas." *The Journal of Finance*, Vol. 65, N°1, pp. 179-216.

Berk, J. B., Green, R. C. and Naik, V. (2004). "Valuation and return dynamics of new ventures." *Review of Financial Studies*, Vol. 17, N° 1, pp. 1-35.

Bers, M. K. and J. Madura (2000). "Why does performance persistence vary among closed-end funds?" *Journal of Financial Services Research*, Vol. 17, N° 2, pp. 127-147.

Carhart, M. M. (1997). "On persistence in mutual fund performance." *The Journal of finance* 52(1): 57-82.

Chevalier, J. and G. Ellison (1999). "Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance." *The Journal of Finance*, Vol. 54, N° 3, pp. 875-899.

Cohen, L., Frazzini, A. and Malloy, C. (2007). "The small world of investing: Board connections and mutual fund returns", National Bureau of Economic Research Cambridge, Mass., USA.

Cremers, K. M. and A. Petajisto (2009). "How active is your fund manager? A new measure that predicts performance." *Review of Financial Studies*, Vol. 22, N° 9, pp. 3329-3365.

De Souza, C. and S. Gokcan (2003). "How some hedge fund characteristics impact performance." *AIMA Journal*, Vol 58, pp. 11-14.

Ding, B. and R. Wermers (2005). "Mutual fund performance and governance structure: The role of portfolio managers and boards of directors." Unpublished working paper, State University of New York at Albany and University of Maryland.

Edelen, R. M. (1999). "Investor flows and the assessed performance of open-end mutual funds." *Journal of Financial Economics*, Vol. 53, N° 3, pp. 439-466.

Elton, E. J., Gruber, M. J. and Blake, C. R. (1995). "The persistence of risk-adjusted mutual fund performance." *The Journal of Business*, Vol. 69, N° 2, pp. 133-157

Fama, E. F. and K. R. French (1993). "Common risk factors in the returns on stocks and bonds." *Journal of financial economics*, Vol. 33, N° 1, pp. 3-56.

Frazzini, A., Friedman, J. and Pomorski, L. (2015). "Deactivating Active Share." Unpublished working paper, Available at SSRN 2597122.

Goetzmann, W. N. and R. G. Ibbotson (1994). "Do winners repeat?" *The Journal of Portfolio Management*, Vol. 20, N° 2, pp. 9-18.

Grinblatt, M. and S. Titman (1992). "The persistence of mutual fund performance." *The Journal of finance*, Vol. 47, N° 5, pp. 1977-1984.

Harlow, W. V. and K. C. Brown (2006). "The right answer to the wrong question: Identifying superior active portfolio management." *Journal of Investment Management*, N° 4, pp. 15.

Huang, J., Sialm, C. and Zhang, H. (2011). "Risk shifting and mutual fund performance." *Review of Financial Studies*, Vol. 24, N° 8, pp. 2575-2616.

Jensen, M. C. (1968). "The performance of mutual funds in the period 1945–1964." *The Journal of finance*, Vol. 23, N°2, pp. 389-416.

Jones, R. and R. Wermers (2011). "Active management in mostly efficient markets." *Financial Analysts Journal*, Forthcoming.

Kacperczyk, M., Sialm, C. and Zheng, L. (2005). "On the industry concentration of actively managed equity mutual funds." *The Journal of Finance*, Vol. 60, N° 4, pp. 1983-2011.

Kacperczyk, M., Sialm, C. and Zheng, L. (2008). "Unobserved actions of mutual funds." *Review of Financial Studies*, Vol. 21, N°6, pp. 2379-2416.

Kahn, R. and R. Grinold (1999). *Active Portfolio Management*, McGraw-Hill.

Kinnel, R. (2010). "How expense ratios and star ratings predict success." Unpublished paper, Morningstar, Inc.

Kinnel, R. (2015). "Why you should invest with managers who eat their own cooking." Unpublished paper, Morningstar, Inc.

Kosowski, R. (2006). "Do mutual funds perform when it matters most to investors? US mutual fund performance and risk in recessions and expansions." Manuscript, Imperial College, London 1.

Kosowski, R., Naik, N. and Teo, M. (2007). "Do hedge funds deliver alpha? A Bayesian and bootstrap analysis." *Journal of Financial Economics*, Vol. 84, N° 1, pp. 229-264.

Kosowski, R., Timmermann, A., Wermers, R. and White, H. (2006). "Can mutual fund "stars" really pick stocks? New evidence from a bootstrap analysis." *The Journal of Finance*, Vol. 61, N° 6, pp. 2551-2595.

Massa, M. and L. Zhang (2009). "The effects of the organizational structure on asset management." Unpublished paper, INSEAD and Nanyang Technological University, October.

Millennium bcp (2015), <http://ind.millenniumbcp.pt/pt/Private/Pages/Mission.aspx>, accessed in 20<sup>th</sup> September of 2015.

Moskowitz, T. J. (2000). "Discussion." *The Journal of Finance*, Vol. 55, N° 4, pp. 1695-1703.

Pástor, L. and R. F. Stambaugh (2002). "Mutual fund performance and seemingly unrelated assets." *Journal of Financial Economics*, Vol. 63 N° 3, pp. 315-349.

Petajisto, A. (2013). "Active share and mutual fund performance." *Financial Analysts Journal*, Vol. 69, N° 4, pp. 73-93.

Phelps, S. and L. Detzel (1997). "The nonpersistence of mutual fund performance." *Quarterly Journal of Business and Economics*, Vol. 36, N° 2, pp. 55-69.

Sharpe, W. F. (1966). "Mutual fund performance." *The Journal of business*, Vol. 39, N° 1, pp. 119-138.

Sortino, F. A., and Van Der Meer, R. (1991). "Downside risk." *The Journal of Portfolio Management*, Vol. 17, N° 4, pp 27-31.

Wei, K., Wermers, R. and Yao, T. (2009). "Uncommon value: The investment performance of contrarian funds." Unpublished paper, University of Texas at Dallas, University of Iowa, and University of Maryland.

Wermers, R. (2012). "Matter of style: The causes and consequences of style drift in institutional portfolios." Available at SSRN 2024259.

Zeckhauser, R., Patel, J. and Hendricks, D. (1993). "Hot Hands in Mutual Funds: Short-Run Persistence of Relative Performance, 1974-1988." *The Journal of finance*, Vol. 48, N° 1, pp. 93-130.

## Appendix 1

### (Question 1) Which indicators do you believe to be fundamental when comparing funds in the same asset class?

- “The key question we think is to what extent was the performance of the manager in line with the clients’ expectations given the environment we were in. Do they have a documented style bias and was their performance consistent with what one might have expected from such a style bias? An understanding of how the fund is run in detail will help to align manager and client expectations. Beyond performance and relevant risk metrics the following should be important: stability of Team, incentive structures for managers (potential indicator of future stability); managers’ alignment with clients (i.e. does their performance drive a large part of their compensation? Do they invest in the fund alongside clients?” – **Schroders**

- “Investment philosophy and style. If there is an approach described as growth or value or top down or bottom-up etc, is this consistently reflected in the process and the contribution of returns? As a key indicator for these issues, I would look at consistency of a style analysis over a long period of time. For example, does the manager reflect their stated philosophy in their portfolio construction and are they consistent with it? I would also look at the attribution of returns to see how this fits in with the stated style and process. I would look at risk adjusted returns over a three and five year cycle as a key indicator. I would also look at the investment management and analyst turnover ratio, particularly following periods of poor performance. This may be a good indicator of firms and teams self belief in their stated investment philosophy and process after a dip in short term performance.” – **Pictet, Equity Portfolio Manager**

- “A variety of factors are important when assessing a range of comparable equity funds, which could be split between a qualitative and quantitative outlook. Qualitatively, one could look at the portfolio manager and management team (experience/remuneration/assets under management), the manager’s philosophy and the investment process. Quantitatively, the elements involved could include returns (past performance drivers/performance in different market conditions), underlying holdings (verification of process/trading behaviors/Active Share) and style (structural biases/evolution of style exposures). This is not an exhaustive list and before making a

fund selection decision, a whole host of indicators and elements should be analyzed before making a final investment decision.” – *Fidelity, Equity Investment Team*

**(Question 2) What do you think about the indicator “Active Share” in a process of fund selection? Is it relevant?**

- “We think it is relevant and we quote it frequently. ‘Traditional’ measures of how active a fund is, such as ex ante Tracking Error, can be very volatile and difficult to compare given the number of multi-factor models that could be used across the industry. Active Share is simple to calculate, simple to understand and simple to compare measure of how different a fund is from its index at any point in time. It is becoming more prevalent in the industry as something that investors are paying attention to.” – *Schroders*

- “I think it is one indicator that can be useful, particularly if you are comparing managers who state that a large proportion of their alpha contribution will come from a high conviction, bottom-up approach. One would have to ensure though, that to make the comparison relevant, all the funds were following the same benchmark index. As above I would look at the consistency of Active Share over time and understand why there have been (if any) major changes to a managers Active Share ratio.” – *Pictet, Equity Portfolio Manager*

- “Active Share is an important and relevant indicator when selecting from a universe of active equity funds, but it is not an element that should be focused on in isolation. When using Active Share as a decision metric, one should also take into account Tracking Error, concentration of holdings in the portfolio, market capitalization, etc., which all contribute to a fuller picture of active management.” – *Fidelity, Equity Investment Team*

**(Question 3) Regarding the last question, if yes, is there any kind of relationship between “Active Share” and “Tracking Error”? Combining both, do they give any insight about future relative performance?**

- “(...) In the extreme for example, a portfolio could only own one stock (which is a non index stock) and have an Active Share of 100%. But if that stock demonstrated

a high degree of correlation to the index over time then Tracking Error could look quite low. All else being equal you would however expect a relationship between the two (I.e higher Active Share = higher Tracking Error), but the behavior of the underlying holdings in the fund could cause this relationship to break down.(...) A higher Active Share and Tracking Error only tells that a fund is different to its benchmark – clearly a fund will need to be different in order to outperform, but being different on its own does not guarantee outperformance – it could be different and better or different and worse. Active risk enables outperformance but certainly does not guarantee it.”- **Schroders**

- “I think both measures taken over time and when analyzed for consistency or changes in ratios can provide some interesting insights into understanding a manager. However, I do not think they alone can give insights into future relative performance.” – **Pictet, Equity Portfolio Manager**

- “Yes, there is a relationship between the two. (...) In short, the less active the fund, the harder the task of outperforming. (...) Petajisto carried out a 2013 study (published in the Financial Analysts Journal), which provided the most comprehensive Active Share study ever conducted in relation to the US equity mutual fund market. The study found that diversified stock-pickers were the only group to outperform over the 1990-2009 period, as it appears that high Active Share tends to be put to good use through effective stock selection, while good diversification across sectors limits factor exposure, ensuring low Tracking Error.” – **Fidelity, Equity Investment Team**

**Note:** Schroders is a British multinational asset management company, founded in 1804 in London. Fidelity Worldwide Investment is also an asset management company originally established in 1969 in Boston. Pictet is a private bank and also an asset management company founded in Geneva, Switzerland, in 1805. The three companies did not provide information regarding the specific name of who answered the questions. We could only know that from Fidelity the answers were given by the Equity Investment Team while from Pictet were answered by an Equity Portfolio Manager.

## Appendix 2

### Sample 1 - US Funds represented by Bloomberg tickers

ABASCI2 LX Equity	CONLYRI LX Equity	HEPYACC ID Equity	MFSSGA1 LX Equity
ABCUSEA LX Equity	CRMGRAA ID Equity	HERACVA LX Equity	MFSVAB1 LX Equity
ABUEQAU LX Equity	CRMUSSA ID Equity	HERUSGR LX Equity	MIGSNOI LX Equity
ABUSMAU LX Equity	CRSNABI LX Equity	HESEGSC LX Equity	MIRUSAA LX Equity
ACMBAVA LX Equity	CSEUSVB LX Equity	HSMANIX LX Equity	MLWUSUI ID Equity
AETAMSI LX Equity	CUNAHAA ID Equity	IAK4151 BB Equity	MORAMFA LX Equity
ALLAAXI LX Equity	DAVDVFA LX Equity	INGNAUA LX Equity	MORIUSE LX Equity
ALLBSUE LX Equity	DBVWDJI LX Equity	INUSELI LX Equity	MSSUCEA LX Equity
ANDUSAA AD Equity	DEUGUWA LX Equity	INUSGWI LX Equity	MTAUSEA LX Equity
ARUSVIU ID Equity	DIPVBAA LX Equity	IOFNAVA LX Equity	NATHCVI LX Equity
ATLAMDI LX Equity	DLCVLFA ID Equity	IPMUIBC LX Equity	NAUSFGI FP Equity
ATLAMOI LX Equity	DSMUSLA LX Equity	IRIUSEI ID Equity	NAUSOPI FP Equity
AXARUEA ID Equity	DUSIIICU LX Equity	IUSVAAU LX Equity	NBSCUIA ID Equity
AXAUSEA ID Equity	EDMIAMG LX Equity	JANACA1 ID Equity	NBUSU11 ID Equity
BAC6220 BB Equity	EPCLCEI LX Equity	JANTWA1 ID Equity	OFIDRUI LX Equity
BALUSAI FP Equity	ESPAMGR LX Equity	JBSUSAB LX Equity	OMSUSEI LX Equity
BAUSCBU ID Equity	ESXTUSA AV Equity	JFSRAME HK Equity	OPPUSOP LX Equity
BAUSSCB ID Equity	EVMUSMD ID Equity	JIUSEQU DC Equity	OYUSIU2 LX Equity
BBHCOSI LX Equity	FALNAVT LX Equity	JPMNAMA LX Equity	PARUSMC LX Equity
BCINUSB SW Equity	FAMAAGI LX Equity	JUSRCUA LX Equity	PBIUSRY ID Equity
BCPNAUI LX Equity	FEDUCCU LX Equity	KBC7157 BB Equity	PERUSEI LX Equity
BERUSSB LX Equity	FEGUCCE LX Equity	KBCUSCK BB Equity	PIFUEIV ID Equity
BGINAA2 LX Equity	FIFINUS FP Equity	KBDNADU ID Equity	PIHUSEA LX Equity
BGINAMI ID Equity	FIUSMVU ID Equity	KBI8985 BB Equity	PIMSISA ID Equity
BGNAEA2 LX Equity	FOREQUC LX Equity	KEA2091 BB Equity	PLNOAIC BB Equity
BISEQNA LX Equity	FORESCC LX Equity	KLPAUSA NO Equity	PLQUASA LX Equity
BLE4727 LX Equity	FRAUSCA LX Equity	LCUFLMA ID Equity	PNBUCUI LX Equity
BPQFCPC FP Equity	FRUSSCP ID Equity	LGMMEAB LE Equity	POPUSEI LX Equity
BSIUSST LX Equity	FRUUSAI ID Equity	LLBAKNA LE Equity	PRIUEQC LX Equity
CDCOLCI LX Equity	FUSFAUS LX Equity	LNGPUSI ID Equity	PUK3017 LX Equity
CDCUSRI LX Equity	FVSUSEI LX Equity	LNTMVTR AV Equity	PUTULGA ID Equity
CDCVNUS LX Equity	GAMAOAU ID Equity	LUEQPRM LX Equity	PWMUSDG GR Equity
CFDWESA LN Equity	GSUSEAP LX Equity	LUXUSSP LX Equity	QULUSAB LX Equity
CIUSIU LX Equity	GSUSEUA ID Equity	MCUSELC ID Equity	RBCUSMA LX Equity
CMRPSAA FP Equity	GUTZONE SW Equity	MEL500A ID Equity	REYNAEQ LX Equity
CNAUIAA ID Equity	GVFNAES BH Equity	MELULAD ID Equity	RGCUPUD LX Equity
COMWPSC LX Equity	HENAEA2 LX Equity	MEREQGA LX Equity	RUSOEDU LX Equity

SAMRGRO LE Equity	SKAENAI LX Equity	TRPUBCA LX Equity	VANUISI ID Equity
SANNAEA LX Equity	SMVUSIU LX Equity	TRPULVI LX Equity	VANUSFD ID Equity
SARUSAB LX Equity	SNAETEU ID Equity	UBAUSRC LX Equity	VGTECH1 LX Equity
SAUSLUI GR Equity	STHUSOA FP Equity	UBSKSUB LX Equity	VITUSQC LX Equity
SBCSMUI LX Equity	STKIDXU AV Equity	UBSUSB LX Equity	WALPCNA LX Equity
SCENAME LX Equity	STRALFA LX Equity	UBSUSQB LX Equity	WBSMIDU LX Equity
SCSGUSA ID Equity	STUSMVU ID Equity	UBSUSRI LX Equity	WBUSACA LX Equity
SEIUEPN ID Equity	SWESNAB LX Equity	UNINAVI LX Equity	WELUSCA ID Equity
SESAMFU ID Equity	SWLEQUI LX Equity	UNMVUB1 LX Equity	WELUSQA ID Equity
SESYSUS LE Equity	SWMSCUN SW Equity	UOBKSMC ID Equity	WFUSLCA LX Equity
SGGUACB ID Equity	TEMAGAI LX Equity	VAMSCCB LX Equity	WILEQNA LX Equity
SGMUCGB ID Equity	TEMAMAI LX Equity	VAMSMCB LX Equity	WMPUSEB LX Equity
SHBAMSI LX Equity	TEMFUAI LX Equity	VAMUMCB LX Equity	XCRUR1C LX Equity
SIMUSEA LE Equity	TQEUSGC LX Equity	VANGUOD ID Equity	ZKBUSPN SW Equity
SIV2686 BB Equity	TRPLGEI LX Equity	VANUDVU ID Equity	

## Sample 2 - Eurozone Funds represented by Bloomberg tickers

ABEURSL SM Equity	AXAEQEC BB Equity	BPBAZEU IM Equity	CIPREDI FP Equity
ABFEUR1 FP Equity	AXAINEC FP Equity	BPIELCI LX Equity	CIPREPE FP Equity
ACMEGAI LX Equity	AXAREBA ID Equity	BPIEURO PL Equity	CIUNIEU FP Equity
AGFACTJ FP Equity	AXARSNE FP Equity	BRNGNC FP Equity	CMTEMKY LX Equity
AGFAEQA LX Equity	AXAVEUC FP Equity	BROAVEN FP Equity	COCEPET FP Equity
AGFCTEV FP Equity	AXFERIA LX Equity	BSOEURF FP Equity	CONSUNC FP Equity
AGFEUAC FP Equity	AXWECEI LX Equity	CAAESCA LX Equity	CRMIDCP FP Equity
AGFOPII FP Equity	AZUCROC FP Equity	CAEUOPA LX Equity	CSEQEUF LX Equity
ALETHII FP Equity	BALEURI FP Equity	CAGNEER LX Equity	CSEUROPE FP Equity
ALEXANC FP Equity	BANEUAC PL Equity	CAIDXEC LX Equity	DARD80C FP Equity
AMPEU50 GR Equity	BANSBSE SM Equity	CAJINGI SM Equity	DARDIVC FP Equity
AMPPRMU FP Equity	BAREVOI LX Equity	CAMDVLO FP Equity	DBVWESI LX Equity
AMRAEUR FP Equity	BAZEURO IM Equity	CAMMICO FP Equity	DEGEMUA BB Equity
AMSCEUR FP Equity	BBKBEUR SM Equity	CAREMCA FP Equity	DEXEMUC LX Equity
ANIEUEI ID Equity	BBKDIVI SM Equity	CARSTSP FP Equity	DEXLSEZ LX Equity
ARCAFLO FP Equity	BGIEMFA ID Equity	CCXIMMO FP Equity	DEXQEMU LX Equity
ARGACLF LX Equity	BKPYMCO SM Equity	CFDAMEU LX Equity	DORVMEC FP Equity
ARGEURO SM Equity	BLAR2IB FP Equity	CFEUROC BB Equity	DUEUEQI LX Equity
ARGFBIB SM Equity	BMMACOP FP Equity	CHOLCAP FP Equity	DWSTEFCLX Equity
ASTITBO SM Equity	BNPAMEU FP Equity	CIAVEUP FP Equity	ECACCEC FP Equity
AVENEUR FP Equity	BNPEAAC FP Equity	CICEUAC FP Equity	ECACTRC FP Equity
AWFEEAC LX Equity	BPAZETI IM Equity	CICEUOP FP Equity	ECOSCRC FP Equity

EFEULEQ LX Equity	HENEUDI LX Equity	MADBOEU SM Equity	PFEURID LX Equity
EISPBEE LX Equity	HOCHEUR FP Equity	MADUSOL FP Equity	PIMEURI FP Equity
ELK3591 LX Equity	HRGHEAP FP Equity	MAIT100 FP Equity	PLACPHE LX Equity
ELNOPEU FP Equity	HSBCFEC FP Equity	MEEFRNE FP Equity	PLEISEL FP Equity
EPSQGRO IM Equity	HSBEUAC FP Equity	MEEREVA FP Equity	PLIEUIC BB Equity
ESSEUOP FP Equity	HSBMIDC FP Equity	MEESAET FP Equity	PLUUEUR SM Equity
ETOINEU FP Equity	HUMFSER FP Equity	MEESVAL FP Equity	POETHIC FP Equity
ETVALUE FP Equity	HYPERIO FP Equity	MELLEEA ID Equity	PREEURO LE Equity
EURBVLE LX Equity	IBELBOL SM Equity	MEREMAI LX Equity	PREVBOL SM Equity
EUREXEE LX Equity	IDEUR50 SM Equity	MESGPLI FP Equity	PRIMEURP FP Equity
EURSKGI AV Equity	INGEMQA LX Equity	METREUR FP Equity	PSEUEQ2 LX Equity
EURZQEQLX Equity	INGEUPC LX Equity	METVSRI FP Equity	RAYMICC FP Equity
EUSTAUF GR Equity	INT4830 LX Equity	MEURMPK FP Equity	RBEURST FP Equity
EUSTCK2 FP Equity	INVAEUR FP Equity	MEZEIIE ID Equity	REN4CAR SM Equity
EUVALEU SM Equity	ISCERAC FP Equity	MFCSFAC LX Equity	RGACTFR FP Equity
EXELSIO FP Equity	ISIGROC LX Equity	MILEUEI LX Equity	ROTEMEC FP Equity
EXPEXDU FP Equity	IXACEVI FP Equity	MIREEAE LX Equity	RTA4VAL SM Equity
FCPOPOA FP Equity	JBMEVII LX Equity	MMAEUAC FP Equity	RUREURV SM Equity
FDIALAZ IM Equity	JPEDEAA LX Equity	MMGIEUA FP Equity	SAILEEY LX Equity
FDROPTS FP Equity	JPEURAA LX Equity	MONBBMD FP Equity	SANACCI SM Equity
FIDIEBC LX Equity	KBC6733 BB Equity	MONOFUN NA Equity	SANACEU PL Equity
FIEUCAP FP Equity	KBCEULK BB Equity	MONQUAD FP Equity	SANEURB LX Equity
FIGRAVE FP Equity	KBHDVEK BB Equity	MOREFAI LX Equity	SANOEUR LX Equity
FIMFPME FP Equity	KBI2690 BB Equity	MSGLESM SM Equity	SCHPEIN SM Equity
FIMUNIA FH Equity	KBLBDVE LX Equity	MTEUEAC LX Equity	SCRNDOC FP Equity
FININTN SM Equity	KEE6789 BB Equity	MULEURO SW Equity	SEAEAI1 LX Equity
FNBEURO SM Equity	KIEUEIC BB Equity	NATEUVC FP Equity	SGACTES FP Equity
FNDMUSU SM Equity	KIFLIDX BB Equity	NBGASTA LX Equity	SGAMEUV FP Equity
FONBEUR SM Equity	LAPLACE GR Equity	NII2447 BB Equity	SGEURIE LX Equity
FONCAB5 SM Equity	LCELEOP FP Equity	NSMCRET FP Equity	SGEUZSE LX Equity
FONDEUC LX Equity	LFOBDVC FP Equity	OBJACEU FP Equity	SGINEUR FP Equity
FONDEUD LX Equity	LFPARNC FP Equity	ODDGENC FP Equity	SGREAEF ID Equity
FONDEUR SM Equity	LFPLEDD FP Equity	ODDPIFR FP Equity	SICEURS FP Equity
FONFIVA SM Equity	LFRAUDN FP Equity	ODEVEPP FP Equity	SLFEUZM FP Equity
FOREBSA LX Equity	LOBETHQ FP Equity	OFIEQUI FP Equity	SOGESCA LX Equity
GAESMAL SM Equity	LUPALMC LX Equity	OFIEURI FP Equity	SPAFAZI IM Equity
GEFEUQC LX Equity	LUPSECA LX Equity	OPPES50 GR Equity	SSFEEZB LX Equity
GESDEAL SM Equity	LUXESNI LX Equity	OSI2706 BB Equity	SSGAEAI LX Equity
GNREQP3 LX Equity	MACRDRC FP Equity	OSI9180 BB Equity	SSMEIEC LX Equity
HAENISO GR Equity	MACRODC FP Equity	OXFXSEL FP Equity	SSTSEUC FP Equity

STHOPME FP Equity  
STRATAC FP Equity  
SURVA21 FP Equity  
SWIEQUA LX Equity  
SYCEURO FP Equity  
SYCLGCP FP Equity  
SYMAZEU IM Equity

SYNSMAC FP Equity  
SYSEREI FP Equity  
SYSYCTE FP Equity  
TAJFGSE FP Equity  
TEMGROA LX Equity  
TRICOLO FP Equity  
UBSEITL LX Equity

UIASUI GR Equity  
ULYSSEC FP Equity  
UNIGEST FP Equity  
UNTRAKT GR Equity  
VALCACE FP Equity  
VANESII ID Equity  
VINCACT FP Equity

WESCEUR LX Equity  
WWWPERF FP Equity  
XCRERIC LX Equity

## Appendix 3

**Exhibit 7. Annual distribution of US Mutual Funds across categories**

<b>Category</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>1</b>	10	11	15	22	24	27	30	28	32	29	32	30	37	38	39
<b>2</b>	8	7	10	10	9	12	8	12	17	17	18	24	22	22	21
<b>3</b>	32	38	42	51	61	56	65	71	68	74	82	84	91	97	99
<b>4</b>	4	6	6	8	11	12	18	16	17	17	16	15	19	20	23
<b>5</b>	10	10	11	12	9	16	10	12	16	17	17	26	22	25	23

**Exhibit 8. Annual distribution of Eurozone Mutual Funds across categories**

<b>Category</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>1</b>	21	21	24	24	27	32	34	30	35	35	39	37	42	45	45
<b>2</b>	9	10	12	13	16	16	18	21	23	13	68	25	78	15	14
<b>3</b>	38	39	49	57	63	71	78	82	91	103	99	151	101	106	164
<b>4</b>	28	27	33	35	41	49	59	59	65	78	24	20	23	88	32
<b>5</b>	12	12	14	14	14	16	16	16	17	11	16	27	22	16	15