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STYLE ANALYSIS OF PORTUGUESE EQUITY FUNDS

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APFIPP - *Associação Portuguesa de Fundos de Investimento, Pensões e Patrimónios*

CMVM – *Comissão do Mercado de Valores Mobiliários*

EUR - Euros

GSC – Generalized Least Squares

NAV – Net Asset Value

SEC – Securities and Exchange Commission

ST DEV – Standard Deviation

USD – United States Dollars

Abstract

Information is a key point for investment decisions. Most investors base their decisions on what is known about markets and their financial products. Hence, they are appealed by some vehicles that can offer diversification, lower transaction costs and professional management, such as mutual funds. But if mutual funds are not correctly classified, there can be an incongruity between the funds stated objectives and the investor's needs.

This study's main goal is to apply a style analysis to a set of Portuguese equity funds in order to verify if the fund investments policies are in line with what is advertised by the fund and if they are consistent over time. The study uses a sample of 47 Portuguese mutual funds between January 2000 and March 2012.

This study concludes that the funds in our sample are, in general, correctly classified. Yet, there seems to be no consistency of the funds' styles over time.

Keywords: Fund Classification, Style Analysis, Style Consistency, Mutual Fund

JEL: G11, G23

Resumo

A informação é um ponto-chave para as decisões dos investidores. A maioria dos investidores baseia as suas decisões de investimento no conhecimento que tem do mercado e dos seus produtos financeiros. Assim, são atraídos por veículos que lhes proporcionem diversificação, custos de transação mais baixos e gestão profissional. Os fundos de investimento apresentam estas vantagens. No entanto, se estes fundos não se encontrarem corretamente classificados, podem existir incongruências entre os objetivos do fundo e as necessidades dos investidores.

O objetivo deste estudo é aplicar uma análise de estilos a um conjunto de fundos de acções portugueses de forma a verificar se as políticas de investimento estão em linha de conta com os objectivos divulgados pelo fundo e se são consistentes ao longo do tempo. Foi utilizada uma amostra de 47 fundos portugueses no período entre janeiro de 2000 e dezembro de 2012.

As conclusões deste estudo sugerem que, de forma geral, os fundos da amostra estão bem classificados, ou seja, praticam o estilo que sugerem. No entanto, parece não existir consistência nos estilos dos fundos ao longo do tempo.

Keywords: Classificação de Fundos, Análise de Estilos, Consistência de Estilos, Fundos de Investimento

JEL: G11, G23

Executive Summary

In global markets, investors choose their investment decisions based on the information available. Sometimes, investors are appealed by mutual funds because they can offer diversification, lower transaction costs and professional management since management expertise is associated with better performance given the thorough knowledge.

Style analysis is the process of determining the strategy that an investor or manager employs when making investment decisions, i.e., identifying the characteristics of a fund that differentiates it from its benchmark or competitors. In this sense, style analysis provides a way to analyze and describe managers' behavior by classifying their funds. Style Analysis proposed by Sharpe (1992) constitutes the foundations for this study. It is the construction of a portfolio of indices (or factors) that best mimics the historical performance of a mutual fund. The style of the fund is represented by the loadings (regression coefficients) on the benchmarks.

Classifications attributed to mutual funds are based on their stated objectives. Funds are misclassified when these classifications differ from their stated objectives. These deviations can occur because fund managers may have incentives to deviate their funds from their initial classification in order to provide superior performance and attract investors. By taking higher risks than the stated objectives would, they earn higher returns beating the other funds with the same classification. Hence, it is important to verify if funds are consistent with their styles over time, ie, to verify the fund's style consistency.

This study's main goal is to apply a style analysis to a set of Portuguese equity funds in order to verify if the fund investments policies are in line with what is advertised by the fund and if they are consistent over time. It was used a sample of Portuguese funds between January 2000 and March 2012.

It was extracted a list of all Portuguese mutual funds from Lipper Global from which there were selected only the equity funds, resulting in a sample of 47 Portuguese equity mutual funds. Based on the Lipper Global and APFIPP, it was attributed a style for each of these funds. The benchmarks chosen for this study represent five different indices or markets and they are: PSI-20, Eurostoxx 50, S&P 500, Euribor 1 month and Barclays Euro Government Inflation-Linked Bond Index. The information about funds and benchmarks returns was extracted from the Lipper Global software and Datastream terminal.

For the fund classification test, the portfolio weights are obtained through the minimization of the residual term variance. This minimization was obtained on software Matlab. In order to measure the effect of the benchmarks' returns on the funds' returns it was computed the R^2.

In the second part of this study I analyse whether funds' investment policies are consistent through time . For this part I used a tool in Stata software called Rolling Windows in which the benchmark's weights are computed over time.

This study concludes that the funds in our sample are, in general, correctly classified. The style with better results of classification is Equity Portugal in which the PSI-20 index has a great influence over all funds in this category and the regression's R^2 is high, leading to the conclusion that the model can explain the variability of the funds' returns by its style. The Equity US funds are those with lower results, whose funds showed a R^2 lower than 70% and the benchmarks' weights are higher for Euribor, instead of the expected S&P500. This can be explained because the S&P500's returns were originally in USD and were converted to EUR and the regression performed in this study does not take into account the variations on the EUR/USD exchange rate.

Yet, the results show that there is no consistency of the funds' styles over time. The graphical representations performed on Stata showed that the funds' investment on the selected benchmark for their style was not constant over time. However, the tendency after 2008 was to increase the weight on the selected benchmark for almost every fund, which means that although the fund managers are not constant over time with their investment policies, they have been approaching their funds' strategies to their declared styles.

"An investment philosophy is a coherent way of thinking about markets. How they work (or not)…"

Damodaran (2003)

1. Introduction

Investors take their investment decisions based on funds' styles. The style of a fund is disclosed, by its management, on the fund prospectus. This document is the fund's selling document and it contains also valuable information, such as the investment policy or goals, risks, fees, expenses and performance.

The Portuguese regulatory bodies – CMVM and APFIPP - are responsible for publishing the mentioned prospectus which can guarantee that investors are aware of the fund characteristics, allowing them to build their investment portfolio. If this information was not correct it could lead to unbiased analysis that would not meet the investors' needs. Therefore, the right classification of mutual funds has a major relevance for investors and for markets. Fund managers may have incentives to deviate their funds from their initial classification in order to provide superior performance and attract investors. By taking higher risks that the stated objectives would, they earn higher returns beating the other funds with the same classification. This study adds value to the subject by verifying the correct or wrong classification of the mutual funds in scope.

This study applies a style analysis to a set of Portuguese equity funds in order to verify if the fund investments policies are in line with what is advertised by the fund and if they are consistent over time. It was used a sample of funds between January 2000 and March 2012.

Style analysis is the process of determining the strategy that an investor or manager employs when making investment decisions, i.e., identifying the characteristics of a fund that differentiates it from its benchmark or competitors. In this sense, style analysis provides a way to analyze and describe managers' behavior. It is helpful for investors in matters of comparison with competitors. The Portuguese equity styles designed by the APFIPP will be presented in this study and, as it was previously stated, it will be verified if the styles disclosed by the managers are the ones implemented.

The test showed that, globally, funds are correctly classified according to Lipper Global and APFIPP. Equity Portugal is the style with the best results having most of funds' R^2 values

higher than 80%. Of all 47 funds, BPI Poupança Acções PPA (Table 6) is the one with higher R^2, which means that in this case 84% of return variability can be attributed to style or asset allocation. Equity US funds were the ones with lower results.

However, the rolling windows analysis concluded that there is no consistency of funds' styles over time. The graphical representations performed on Stata showed that the funds' investment on the selected benchmark for their style was not constant over time. Nonetheless, the funds had a turning point by mid-2008, time when they started to enhance their investment in the benchmark that represents the style declared by them.

In order to conclude about this matter, this study was structured as follows: first, it was made a research about mutual funds and its market in Portugal, style analysis and style classifications. This research will provide foundations and support for this study's tests and conclusions. In section 4, Data and Methodology, it is defined the sample used along with the benchmarks. It was extracted a list of all Portuguese mutual funds from Lipper Global from which there were selected only the equity funds, resulting in a sample of 47 Portuguese equity mutual funds. Based on the Lipper Global and APFIPP, it was attributed a style for each of these funds. Also in this section, it is presented the Model used. It is important to note the Style Analysis proposed by Sharpe (1992) was strictly followed in order to have reliable results. The information about funds and benchmarks returns were extracted from the Lipper Global software and the tests were performed on MATLAB and Stata software.

This analysis is helpful for investors as it verifies if portfolio performance matches the declared style of the fund. The conclusions are also of interest of supervision that has to monitor mutual fund companies and protect investors interests.

2. Review of Mutual Fund Investing

2.1 Mutual Funds

A mutual fund is an investment vehicle that pools money from investors and invests it in stocks, bonds, money market instruments, and other securities or assets. A mutual fund that invests in equity, bonds or money market shares is called equity fund, bond fund or money market fund, respectively. A balanced fund is a fund that allocates its money to both equity and bonds. Other mutual funds can invest in, for example, real estate and those are called real estate funds. Mutual funds can offer diversification, lower transaction costs for investors and professional management, which appeals investors since expertise is associated with better performance given the thorough knowledge. It can also assure liquidity since the shares of the fund can be traded at any time.

A mutual fund is an open-end fund which means that the number of shares outstanding is not fixed and investors can buy or sell it at any time as it was mentioned before. On the other hand, a closed-end fund has a limited number of shares that are available publicly.

Investors purchase those shares from the fund itself instead of using a secondary market such as NYSE and pay the NAV per share and any other fee that the fund requires. The NAV represents a fund's market value and it corresponds to the total value of assets in a fund's portfolio excluding liabilities. The price per share is computed by dividing the NAV by the number of shares outstanding.

A fund is "mutual" in the sense that all of its net returns are distributed to the fund's shareholders. These returns are interests, dividends, and realized and unrealized gains or losses. The expenses are the fund's fees for the fund's management, depositary bank and supervision/regulatory body.

In particular, equity funds invest principally in stocks. They are linked with higher potential growth and return and therefore exposed to higher risk. This risk comes from the price fluctuations that the stocks suffer every day enabling potential capital losses. Since there is a great diversity of types of equity, these kinds of funds are classified based on the size of the companies invested in and the style of the fund's managers.

Like most investments, mutual funds are susceptible to various risks. From risk theory, total risk can be divided into: systematic risk and idiosyncratic risk (Tole, 1982 and Wilson, 1998).

The first one is related with the market while the second one depends on the conditions of each security. This risk can be reduced with diversification so that only the systematic risk remains. This is a great advantage of mutual funds because they have a great pool of money that can be invested in more securities than an individual investor would invest.

2.1.1 Mutual Funds in Portugal

In Portugal, the history of mutual funds is recent when compared to other countries. Only in June of 1964 there is a record of the first investment fund in the country.

According to CMVM, in the end of 2012 there were 273 mutual funds. The majority of Portuguese mutual funds are managed by specialized companies that are 100% held by universal banking groups. In the end of 2012, those 273 mutual funds had 12,295 million Euros of assets under management, according to APFIPP.

Table 1 - Historical Evolution of Mutual Funds

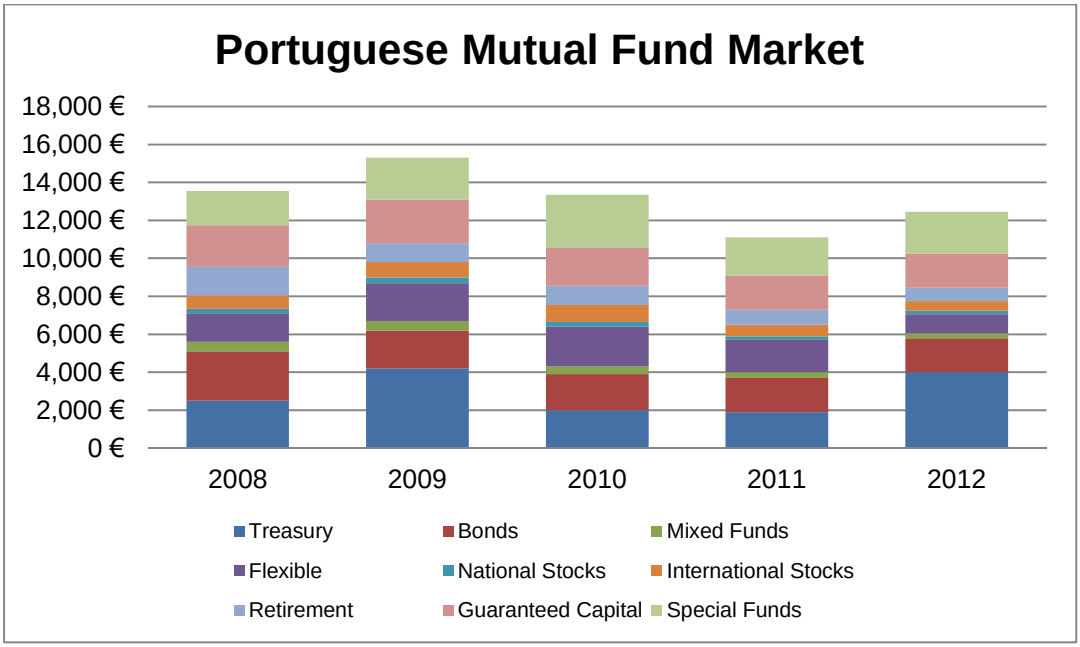
Unit: 10^6 Euro

Year	Net Asset Value	No. of Funds
2000	21,558.0	260
2001	21,266.4	262
2002	20,610.4	221
2003	22,850.1	215
2004	24,415.2	224
2005	28,290.0	242
2006	29,137.7	263
2007	25,763.0	291
2008	14,341.8	292
2009	17,230.9	288
2010	14,237.4	291
2011	10,835.3	299
2012	12,295.3	273

Source: APFIPP

In 2008 there was a great downturn of the investment funds industry resulting in a decline of the NAV of the mutual funds in 44%, reaching the lowest value in the history of the funds. This behaviour was in line with the world financial crisis that crashed that year along with the subprime crisis in the USA.

Figure 1 - The Portuguese Mutual Fund Market from 2008 to 2012 – thousands of euros



As we can see, money market (Treasury) funds have the largest weight in the Portuguese mutual funds market along with special investment funds.

Table 2 - Investment in Listed Securities - Equity Market - 2012

Unit: 10^6 Euro

Countries	**Value**	**% Total**
Portugal	323.5	23.9%
USA	280.9	20.8%
France	110.1	8.1%
United Kingdom	105.1	7.8%
Germany	90.4	6.7%
Spain	80.0	5.9%

Brazil	67.9	5.0%
Switzerland	46.4	3.4%
The Netherlands	43.4	3.2%
South Africa	26.4	2.0%
Others	179.0	13.2%
Total	**1,353.1**	**100.0%**

Source: CMVM

In the case of Portuguese equity mutual funds, the securities in which they most invest are from both Portugal and USA (Table 2).

2.2 Mutual Fund Styles

The APFIPP defines several categories for the funds based on their characteristics, which are described in the investment policy of each fund's Prospectus. The Prospectus is the fund's selling document and it contains valuable information, such as the investment policy or goals, risks, fees, expenses and performance.

According to the APFIPP classification, the Equity Funds are divided into 5 groups:

1. Domestic Equity Funds – Equity funds that invest 100% in securities issued by Portuguese companies (100% investment in Euros);

2. European Union, Switzerland and Norway Equity Funds - Equity funds that invest 100% in securities issued by European Union countries, Switzerland and Norway, in their respective currency;

3. North American Equity Funds - Equity funds that invest 100% in securities issued by American and Canadian companies (at least 75% investment in either US Dollar or Canadian Dollar);

4. Sector Equity Funds - Equity funds that invest in companies of a specific sector or activity, defined in their Prospectus;

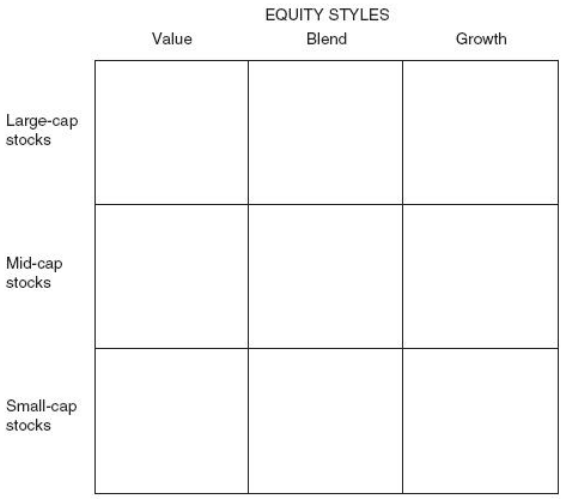
5. Other International Equity Funds – Other Equity Funds.

The APFIPP has a policy for categories' deviations. All deviations are reported to the Management Company (*"Entidade Gestora"*), and if in any given month the fund does not comply with the criteria defined for the APFIPP category, the fund must change the category. In these cases, the Management Company has to decide whether the fund is classified as "Other Funds" for the next 12 months or the fund is classified according to the criteria of the fund's actual policy in the 3 months of the quarter prior to the current analysis.

For instance, every mutual fund in the U.S. should register to the SEC before its operation and have to follow some operating standards, obey anti-fraud rules and disclose complete information to investors. The SEC ensures that if the objective is included as a part of the fund's name, it has to comply with it in its composition.

Also, as it was stated in the previous topic, this type of funds is classified based on the companies' size and management's style. In this sense, Morningstar has created an Investment Style Box, which is a graphical representation where it classifies each fund according to market capitalization and growth and value factors. This representation was created in 1992 in order to help investors to determine the investment style of a fund.

Figure 2 - Morningstar Investment Style Box



Source: Morningstar

If a fund owns mostly large-growth stocks, for example, it will probably fall in the large-growth section of the style box. If it owns stocks both from the value and growth market, it may fall in the blend section. If there are changes in the portfolio over time, a fund may move from one section to another.

3. Literature Review

In financial markets it is common to classify assets as liquid (stocks and bonds) or illiquid (real estate and venture capital), stocks in domestic or international markets, cyclical or non-cyclical, small or large stocks. This is called asset styles or classes. They describe the basic characteristics of the underlying asset such as growth versus value or large cap versus small cap (as shown before in the Morningstar Style Box in the previous topic).

Style analysis of an investment fund developed by Sharpe (1988, 1992) can be a useful tool in investment decisions in a way that helps to describe the characteristics of an investment portfolio. The style is used to know what type of investment investors are buying and to select the style appropriate to their investment. Furthermore, it is also used to compare funds between the same fund's class or style.

Return-based style analysis is useful to understand the style of a fund manager without knowing in detail which securities are held or in what proportion to the fund, i.e., it attempts to explain the variability in the observed returns to a security portfolio in terms of the movements in the returns to a series of benchmark portfolios designed to capture the essence of a particular security characteristic. This process involves the use of past returns of a portfolio along with those to a series of indexes representing different investment styles. Hence, it is possible to determine the relation between the fund and the specific styles. The higher correlated fund's returns are with a given style index, the greater the weighting that style is given in the statistical assessment.

The focus on style appeals investors because it helps them to organize their investment decisions, as well as to compare the performance of their portfolio's manager relative to a benchmark manager. When there is a change in the fund's style it may be harmful for the investor since it defrauds his initial investment decision. However, it is difficult to have real time information for the investors about a portfolio. As *Riepe* (1996) states, even specialists like *Morningstar* or *Value Line* have problems in presenting updated information on the portfolios they follow.

The Style Analysis can be described as the creation of a portfolio of market indexes that mimics the historical performance of a given portfolio (*Lobosco and DiBartolomeo, 1997*).

Lobosco (*1999*) mentions that this technique only requires rates of return as input data, so that usually are involved several years of monthly returns.

The Style Analysis is a particular case of a multiple linear regression (statistical term) or a model factor (financial term). These models are typically evaluated by its capacity of explaining the asset's returns and they're called "Factor" models because they claim that the return on a security is sensitive to the movement of explanatory variables. This happens because within the economy there is more than one factor that can affect security's returns.

As it was stated before, the main goal of this study is to apply style analysis to a set of Portuguese funds between 2006 and 2012 in order to verify if the fund investments policies are in line with the goals advertised by the fund.

In order to achieve this goal it was used the methodology introduced by *Sharpe (1988,1992).* It is a statistical technique that uses a quadratic function to determine a fund's exposure to changes in the returns of major asset classes. It identifies the set of long and short positions in style indices that best reproduce the real performance of a fund at a determined period of time. The goal is to find the best set of asset classes, i.e., to select the style (set of asset class exposures) that minimizes the fund's tracking error and the fund's tracking variance.

$$\widetilde{e_t} = \widetilde{R_t} - \left[b_{i1}\,\widetilde{F_1} + b_{i2}\,\widetilde{F_2} + \cdots + b_{in}\,\widetilde{F_n}\right] \quad (1)$$

This Asset Class Factor Model distinguishes the performance of different funds between "style" and "selection". The $\widetilde{e_t}$ is interpreted as the difference between the return on the fund ($\widetilde{R_t}$) and that of a passive portfolio with the same style (sum of the terms in the brackets in which *b* represents the sensibility of the returns to each factor and *F* the value of the *n* factors). It is the tracking error of the fund, i.e., fund performance at each date t that is independent of any of the style portfolios. The sum of the terms in the brackets can be termed as the return attributable to style and the residual component (ei) the return due to selection.

The regression has constraints that oblige the coefficients to be zero or positive and to sum up to 100% in order to represent a complete asset allocation. However, it can be a downside since this representation may not be consistent with the actual portfolio holdings that are constantly changing over time. But, on the other hand, style analysis reveals the strategy that better tracks the fund's activity and measures performance relative to its strategy.

A good performance measure is the R^2 that measures the percentage of return variability that can be attributed to style or asset allocation. It is the proportion of variance explained by the selected asset classes. The closest the R^2 is to 1, the better the capacity of the model to explain the data in analysis.

$$R^2 = 1 - \frac{Var(\widetilde{e_i})}{Var(\widetilde{R_i})} \quad (2)$$

Brinson, Singer and Beebower (1991) concluded that, on a population of 82 pension funds over 10 years (1977-1987), on average, the R^2 was 91.5% which means that the investment policy explained, on average, 91.5% of the variation in quarterly total plan returns.

Also *Horst, Nijman and DeRoon* (*2004*) contributed with relevant work for the style analysis. They classified the analysis according to the restrictions imposed to the model as follows:

(i) Weak style analysis – when no constraints are imposed on the factor loadings;

(ii) Semi-strong style analysis – when only a portfolio constraint is imposed, i.e., the coefficients must sum up to 1;

$$\sum_{i=1}^{n} \beta_i = 1 \quad (3)$$

(iii) Strong style analysis – both the portfolio and the positivity constraints are imposed, i.e., factor loadings must be positive and sum up to 1.

$$\sum_{i=1}^{n} \beta_i = 1 \; and \; \beta_i = 1 \quad (4)$$

As it was stated before, this is the case of the model used by *Sharpe* (*1992*). Also *Horst, Nijman and DeRoon* (*2004*) said that strong style analysis might be the preferable style analysis because of the efficiency gains. They also stated that if restrictions are adjusted to reality, then its imposition may lead to better results.

Sharpe (1988,1992) used a model with twelve factors, corresponding to twelve asset classes, each one represented by a market capitalization-weighted index of the returns on a large number of securities.

3.1 Previous Research Results

In respect to style analysis and consistency analysis there have been several research papers that present relevant results for this study. Those results were divided in two sub-categories: Fund Misclassification and Style Consistency. Additionally, it was pointed out the main limitations found by the previous researchers. These conclusions are presented in the following topics.

Classifications attributed to mutual funds are based on their stated objectives. Funds are misclassified when these classifications differ from their stated objectives. Fund managers may have incentives to deviate their funds from their initial classification in order to provide superior performance and attract investors. By taking higher risks that the stated objectives would, they earn higher returns beating the other funds with the same classification.
As it was explained, managers can get higher returns if they differ from their stated style, i.e., if they were not consistent over time. Hence, it is also important to verify if funds are consistent with their styles over time, ie, to verify the fund's style consistency.

3.1.1 Fund Misclassification

As it was stated before, regulatory and supervision authorities such as SEC and CMVM have rules for style classification of mutual funds which prevent them from being misclassified. Though, several studies have concluded there are funds with an improper classification. Actually, there are incentives for managers to deviate from their fund's styles since it is linked with the performance evaluation of the funds in relation to others in the same style category. So, a motivation for this behavior is also related with the higher profitability that can be obtained if they deviate from their styles and take higher risk for instance and therefore possible higher returns.

Kim, Shukla and Tomas (2000) classified mutual funds based on their attributes to compare its stated objectives with the attributes-stated objectives. They concluded that stated objectives of more than one half of the funds differ from their attribute-based objectives and over one third of these funds are severely misclassified. This conclusion is shared by Brown and Goetzmann (1997) and diBartolomeo and Witkowski (1997), defining that the

classification system of funds based on their stated objectives is not the most appropriate and can be improved in order to assure that the funds follow their stated objectives. Even, diBartolomeo and Witkowski (1997) uses a multifactor approach of portfolio holdings to evaluate whether funds are misclassified with respect to their stated objectives. They conclude that 40 percent of the 748 equity funds in their sample were misclassified, due to their classification method at the time. Brown and Goetzmann (1997) developed a new classification system based in style factors rather than categories. They found evidence that the funds may be misclassified intentionally in order to improve ex-post relative performance measures and verified that managers who have losses in the first half of the year tend to raise their portfolio's volatility to try to outperform the funds in the same style category which have had the same losses. This is one way to reclassify the portfolio style, called *Window dressing.* It is a technique used near the period end by the portfolio's managers to improve the appearance of the portfolio performance before presenting it to its clients/shareholders (Lakonishok, Shleifer, Thaler, and Vishny, 1991). This is performed by selling recently weak stocks and buying recently strong stocks just before the fund's holdings are made public, in order to show that they have been holding good stocks and therefore to make its portfolio more attractive to investors. Brown, Harlow, and Starks (1996) show that managers of different funds in the same objective class have different incentives to adjust portfolio risk depending on relative performance.

Moreno, Marco and Olmeda (2006) used nonlinear techniques to identify which mutual funds are misclassified and if their past performances do not conform to their investment objectives stated. He concluded that 40% of the Spanish mutual funds are misclassified but it can be attributed to the fact that there are an excess of categories.

In this matter, Horst, Nijman e Deroon (2004) concluded that the actual portfolio holdings do not reveal the actual investment style of a fund because of cross exposures between the asset classes. They also conclude that return-based style analysis performs better than holding-based style analysis in predicting future fund returns.

3.1.2 Style Consistency

Style analysis can also be used to determine if a manager is able to maintain a consistent investment style over time. It is known that the mutual fund returns are influenced by the mutual fund's investment styles (*Harlow and Brown, 2004*). After identifying a fund's style it is important to assess if there is consistency in the style in order to identify changes in the investment policy. If these changes are significant, a fund can be incorrectly classified. The style consistency measures the style drifting of the mutual funds i.e., mutual funds stability (*Chan, Chen and Lakonishok 2002*). Hence, consistency is needed in order to compare performance between funds (*Brown, Goetzmann, 1997*).

This style drift may be due to either performance pressures or less control (*Harlow and Brown, 2004*) or to avoid market risks during the decline of the market (*Brown and Goetzmann, 1997*).

Style consistency indicates how closely the mutual funds follow their designated (actual) investment style in a specific period (*Brown, Harlow and Zhang,* 2009). *Huang, Sialm and Zhang (2008)* have suggested that a style consistent portfolio can signal superior skills of the managers to potential investors. However, less consistent managers might outperform more consistent managers taking advantage of some market cycles (*Brown, Harlow and Zhang,* 2009), being able to take advantage of these conditions by switching between more or less consistent strategies. However, in their study they concluded that, on average, the most consistent funds in their investment styles produce over time better absolute and relative performance than the less consistent funds.

Brown, Harlow and Starks (1996) conclude that deciding to maintain a consistent investment style is an important aspect of the portfolio management process.

Chan, Chen and Lakonishok (2002) states that checking for consistency helps to verify that styles correspond to meaningful dimensions of fund behavior. The correlations between current and future loadings are about 70%.

In fact, Gallo and Lockwood (1999) have shown that about two-thirds of funds that changed poor performing managers subsequently changed their investment styles, as determined by a

shift in the primary factor loading in an equation following the installation of the new manager.

As stated by Brown and Goetzmann (1995), there is a great need to have objective and empirically determined style classifications because they are used for the performance measurement, compensation and comparison between funds of the same style. It is also an important aspect for the portfolio management process (*Brown, Harlow, Zhang, 2009*).

4. Data and Methodology

Although it is a good and very used method, style analysis has some limitations that difficult its practical implementation. Horst, Nijman and Roon (2002) state that individual portfolio holdings do not necessarily match with factor exposures, which in this case may lead to misclassification.

Time varying portfolio weights is one limitation pointed to the style analysis in the sense that portfolios do not hold the same weights over time *(Chan, Chen and Lakonishok, 2002;* Kim, Shukla and Tomas, *2000; Swinkels and Van Der Sluis, 2001; Brown and Goetzmann, 1997*). However, a way to face this problem is to use the called *Rolling Windows* method *(Sharpe, 1992; Lucas and Riepe, 1996; Buetow, Johnson and Runkle, 2000*). In rolling windows context, full sample period is taken to pieces in a set of fixed dimension periods in order to avoid style changes over the period considered. It is then possible to represent the portfolio weights' variations over time. But this method has also some limitations because it does not identify the possible variations of weights in each windows rolling period.

Goetzmann and Brown (1997) propose then a model that does not require the need to know the factors' coefficients.

$$R_{jt} = \mu_{jt} + \varepsilon_{jt} \tag{5}$$

The return of the fund is equal to the expected return for style j (μ_{jt}) plus the idiosyncratic component (ε_{jt}). It was applied a generalized least squares (GSC) procedure that admits variations through time. This procedure does not compete with style analysis, instead it complements style analysis. GSC identifies the aggregate behaviour and style analysis helps to interpret it as a strategy.

Another limitation of the style analysis is related with the imposition of inequality restrictions to the regression's coefficients. *Judge* e *Takayama* (1966) state that when there is more than two independent variables this method has limitations on its application because of multicollinearity problems. Sharpe (1992) and Riepe (1996) consider that the selected benchmarks must be mutually exclusive, exhaustive and that their returns are not correlated. In order to control this problem, is to test the correlation between the benchmarks and exclude the ones with high correlations to avoid multicollinearity problems. The resulting model should be able to span the whole portfolio asset mix. Nonetheless, in this study the Sharpe's

model (1992) is strictly followed, and so the key assumption is that the benchmarks are not correlated and that there is no multicollinearity problemas.

As referred in the Literature Review, both Sharpe (1988, 1992) and Horst, Nijman and DeRoon (2004) research constitute the basis of this style analysis study. This basis was also used in other countries style analysis and therefore it can be applied in this study and lead to consistent and reliable results. It will be presented the criteria used to select the sample as well as the benchmarks applied for each defined style and, finally, the model for the style analysis.

Our approach considers a sample of 47 Portuguese equity mutual funds for the 2000-2012 period, a total of 147 months.

In order to select the sample, a list of all equity mutual funds domiciled in Portugal was extracted from the *Lipper Global* software. There were selected only the funds whose benchmarks were Portugal, Europe, Eurozone and USA from this list. Therefore, there was the need to include a significant amount of Portuguese investment funds, whose data would be enough to analyse their styles. Also, there would have to be a significant number of funds for each category.

Sharpe (1992) suggested a minimum of 60 consecutive monthly returns for the style analysis and the sample selection of this study was based on this criteria.

Gallo and Lockwood (1997) concluded that a fund's classification may manipulate the results of style analysis. In order to avoid this problematic it was compared the classifications of two different distinct entities for each fund: Lipper Global and APFIPP's classifications. The funds selected in the previous topic are then classified into 4 different styles according to their reported styles and available classifications from the entities stated before. This enables us to check their style consistency. See the sample used and its respective classifications on Table 3.

Table 3 - Fund Sample - Classification by Lipper Global and APFIPP

Fund	Classification		
	Fund Manager Benchmark	Lipper Global	APFIPP
AF Investimentos Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Alves Ribeiro Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Alves Ribeiro Medias Empresas Portugal	Not Provided	Portugal	Domestic Equity Funds
Banif Accoes Portugal	PSI 20	Portugal	Domestic Equity Funds
Banif Euro Accoes	Euro Stoxx	EuroZone	European Union, Switzerland and Norway Equity Funds
Banif PPA	PSI 20	Portugal	PPA Funds - Equity Saving Funds
Barclays FPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Barclays Premier Accoes Portugal	Not Provided	Portugal	Domestic Equity Funds
BBVA Bolsa Euro	Not Provided	EuroZone	European Union, Switzerland and Norway Equity Funds
BBVA PPA Indice PSI20	PSI 20 CR	Portugal	Index Funds
BPI America D	Not Provided	US	North American Equity Funds
BPI Euro Grandes Capitalizacoes	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
BPI Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
BPI Portugal	Not Provided	Portugal	Domestic Equity Funds
BPI Poupanca Accoes PPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
BPN Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Caixagest Accoes EUA	Not Provided	US	North American Equity Funds
Caixagest Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Caixagest Accoes Portugal	Not Provided	Portugal	Domestic Equity Funds
Caixagest Gestao Accoes EUA	Not Provided	US	North American Equity Funds
Caixagest Gestao Euroaccoes	Not Provided	EuroZone	European Union, Switzerland and Norway Equity Funds
Caixagest Gestao Lusoaccoes	Not Provided	Portugal	Domestic Equity Funds
Caixagest PPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Caixagest Private Equity FEI	Not Provided	EuroZone	Other - Special Investment Funds
Espirito Santo Accoes America	Not Provided	US	North American Equity Funds
Espirito Santo Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds

Espirito Santo Portugal Accoes	Not Provided	Portugal	Domestic Equity Funds
Espirito Santo PPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Millennium Accoes America	S&P 500	US	North American Equity Funds
Millennium Accoes Portugal	PSI 20	Portugal	Domestic Equity Funds
Millennium Eurocarteira	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Millennium PPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Montepio Accoes	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Montepio Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Orey Accoes Europa	Euro Stoxx 50	Europe	European Union, Switzerland and Norway Equity Funds
Popular Accoes	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Popular PPA - Poupanca Accoes	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Postal Accoes	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
PPA Montepio	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Raiz Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Raiz Poupanca Accoes	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Santander Accoes America	Not Provided	US	North American Equity Funds
Santander Accoes Europa	Not Provided	Europe	European Union, Switzerland and Norway Equity Funds
Santander Accoes Portugal	Not Provided	Portugal	Domestic Equity Funds
Santander Accoes USA	Not Provided	US	North American Equity Funds
Santander PPA	Not Provided	Portugal	PPA Funds - Equity Saving Funds
Santander Selecção Acções FEI	Not Provided	EuroZone	Other - Special Investment Funds

Thereby, these funds are grouped in the four following categories: Equity Europe, Equity Portugal, Equity Eurozone and Equity US.

In this analysis, the funds' returns are compared with the returns of a number of passive style indices that represent each investment style. *Sharpe* (1992) and *Riepe* (1996) consider that those selected benchmarks must be mutually exclusive, exhaustive and that their returns are not correlated. Because the input for return-based style analysis are indices which are a viable alternative, not easily beaten, identifiable and easily replicated, the major criteria for measuring performance are met. Yet, it does not assure that the indices are not correlated and

that the model will not provide multicollinearity problems. However, in this study the Sharpe's (1992) model is strictly replicated using five factors instead of twelve factors as Sharpe did.

A typical combination of asset classes was selected to compose the benchmark portfolio. This portfolio comprises equity indices along with bond and money market indices, representing the asset classes in which the funds selected declare to invest in (see the selected benchmarks in Table 4). This representation is essential since in style analysis we are trying to find a set of positions in passive indices that best replicate the real performance of a determined fund in a given period of time.

The data relative to the benchmarks were extracted from the Thompson's database *Datastream*.

Table 4 - Benchmarks: Equity Indices, Bond Indices and Money Market

Equity Indices	Description
Portugal PSI20	Portuguese Stock Index
Euro Stoxx 50	Index for the Eurozone
Stoxx Europe 600	Index for the Eurozone
S&P 500	Index for the USA
Bond Index	Barclays Euro Government Inflation-Linked Bond Index
Money Market	Euribor 1 month

Source: Datastream

Style analysis thus is the construction of a portfolio of indices that best mimics the historical performance of a mutual fund. The style of the fund is represented by the loadings (regression coefficients) on the benchmarks.

Return-based style analysis uses the Capital Asset Pricing Model as its structure (Sharpe, 1964), in which a single index is used as a proxy of the market's return. Hence, extending this to multiple market indices results the following equation:

$$R_t = \alpha + \sum_{k=1}^{N} \beta_k F_{kt} + e_i, with\ t = 1, \dots, T \quad (6)$$

Where:

R_t represent the fund returns at time t;

N is the number of asset class factors;

α is the intercept of the regression equation (the independent term), often interpreted as manager skill;

$\beta_k$are the Factor loadings that represent the fund's return sensibility to each factor;

F_{kt} are the Factors that denote the return of index k at time t;

and e_i represents the statistical error related to the regression, i.e., idiosyncratic error.

In this equation the style component is represented by the term $\sum_{k=1}^{N} \beta_k F_{kt}$.

Back to the equation, the portfolio weights (β_k) are obtained through the minimization of the residual term variance ($Var(e_i)$) . This minimization was obtained on software Matlab. In order to measure the effect of the benchmarks' returns on the funds' returns it was computed the R^2. This coefficient indicates the proportion of the fund's returns explained by the benchmarks' returns. Thus, the higher the R^2, the better the capacity of the model to explain the data in analysis.

For the second test of this study, it will be concluded whether funds are consistent through time on their investment policies. For this part it will be used a tool in Stata software called Rolling Windows in which the benchmark's weights are computed over time. This is, the programme computes several regressions over time and gives the coefficient for the benchmarks. In this test, it was defined that the regression would have 24 months each and that it will be regressed for each fund just one benchmark, the one with higher weights on the regression made on the first part of this study. In this case, it will be used a weak analysis in which there are no restrictions imposed. Hence, it will be analysed over time the investment of each fund in the benchmark that corresponds to the style that the fund declares to follow. If there are substantial variations on the weight over time then it can be concluded that there are variations on the fund's investment policies and that there is no consistency in the fund's styles.

The model and procedures used in both tests are considered the most adequate, in line with Sharpe's analysis (1992) and with the fund's characteristics. The results obtained are consistent and reliable for this analysis.

5. Results

As it was stated previously, the restrictions imposed in the model proposed by Sharpe (1992) are interesting if they apply in reality. In this study, it is reasonable to use the restrictions mentioned earlier as it is supposed that the funds in analysis only assume long positions in passive indices. This is called the Strong Style Analysis in which both the portfolio and the positivity constraints are imposed, i.e., factor loadings must be positive and sum up to 1.

For this analysis it was used the software Matlab in which regression were made based on the Sharpe's model (1992). The funds' monthly returns between January 2000 and March 2012 are the dependent variables and the benchmarks PSI 20 index, Eurostoxx 50 index, S&P 500 index, Euribor 1 month and Barclays Euro Government Inflation-Linked Bond Index returns are the independent variables (see Table 4).

For a first analysis, it was computed in Matlab a correlation coefficient between the funds and the benchmarks and the results are presented in Table 5. In general, and as it was expected, the funds' returns are highly correlated with the benchmark for each category. The funds from Equity Europe and Equity Eurozone are highly correlated with Eurostoxx 50, an index composed by 50 stocks from countries within the Eurozone. On the other hand, the correlation coefficient for funds from Equity Portugal is higher for the benchmark PSI-20, the main stock exchange of Portugal.

The funds from Equity US are the ones with less consistent correlations. It was expected that the funds would be more correlated with S&P500 than with the other benchmarks tested. However, most of the funds show a higher correlation with Eurostoxx 50. One reason that may affect these results is the fact that they were originally in US Dollars and had to be converted to Euros in order to make the data comparable. Hence, the variations on the EUR/USD exchange rate may affect the variability if those returns. Nevertheless, this is just a first approach and these results will be confirmed with the style analysis regression with restrictions and with the rolling windows analysis. These results will be presented in two parts in order to answer to the main questions of this study:

i) Comparison between the stated style and the style practiced by each fund
ii) Style Consistency Analysis

Table 5 - Correlation Between Funds and Benchmarks

No.	Fund	Psi20	Eurostoxx 50	S&P 500	Euribor 1m	Bond Index
	Style: Equity Europe					
1	AF Investimentos Accoes Europa	0.3183	0.4574	0.2787	0.0218	-0.0784
2	Alves Ribeiro Accoes Europa	0.4298	0.6238	0.4792	0.0427	-0.1528
12	BPI Euro Grandes Capitalizacoes	0.6845	0.8671	0.4754	0.0473	0.1617
13	BPI Europa	0.6599	0.8060	0.4726	0.0381	0.1796
16	BPN Accoes Europa	0.5463	0.6322	0.3507	-0.0293	0.3087
18	Caixagest Accoes Europa	0.6805	0.8638	0.4937	0.0459	0.2021
26	Espirito Santo Accoes Europa	0.5986	0.7711	0.4016	-0.0115	0.2171
31	Millennium Eurocarteira	0.6302	0.7653	0.4644	-0.0037	0.2328
33	Montepio Accoes	0.8228	0.7669	0.3676	0.0335	0.2256
34	Montepio Accoes Europa	0.6876	0.8381	0.4785	0.0477	0.2008
35	Orey Accoes Europa	0.3585	0.3968	0.1363	-0.0846	0.2212
36	Popular Accoes	0.7700	0.8032	0.3840	0.0279	0.1426
38	Postal Accoes	0.5210	0.6231	0.3364	0.0087	0.3473
40	Raiz Europa	0.6283	0.7753	0.4242	-0.0080	0.1949
43	Santander Accoes Europa	0.6945	0.8734	0.4994	0.0581	0.1931
	Style: Equity Eurozone					
5	Banif Euro Accoes	0.6108	0.7897	0.4274	0.0588	0.2375
9	BBVA Bolsa Euro	0.6124	0.7719	0.4024	0.0331	0.2024
21	Caixagest Gestao Euroaccoes	0.3162	0.4958	0.2986	0.0159	-0.1428
24	Caixagest Private Equity FEI	-0.0514	-0.0057	-0.1010	0.2583	0.0115
47	Santander Selecção Acções FEI	0.4666	0.4327	0.1391	-0.0214	0.4347
	Style: Equity Portugal					
3	Alves Ribeiro Medias Empresas Portu	0.8260	0.6337	0.2243	-0.0065	0.2936
4	Banif Accoes Portugal	0.7643	0.6118	0.2714	0.0170	0.3356
6	Banif PPA	0.7607	0.6180	0.2781	0.0243	0.2781
7	Barclays FPA	0.8636	0.6140	0.2371	-0.0024	0.2778
8	Barclays Premier Accoes Portugal	0.8518	0.6198	0.2480	-0.0018	0.2837
10	BBVA PPA Indice PSI20	0.8693	0.6288	0.2380	0.0237	0.2437
14	BPI Portugal	0.8152	0.6295	0.2642	-0.0096	0.2726
15	BPI Poupanca Accoes PPA	0.8692	0.6385	0.2263	-0.0150	0.2690
19	Caixagest Accoes Portugal	0.7573	0.6125	0.2743	0.0298	0.3297
22	Caixagest Gestao Lusoaccoes	0.5414	0.3494	0.0808	-0.0099	-0.0187
23	Caixagest PPA	0.8551	0.6227	0.2289	0.0203	0.2747
27	Espirito Santo Portugal Accoes	0.8636	0.6426	0.2468	-0.0245	0.2836
28	Espirito Santo PPA	0.8627	0.6381	0.2456	-0.0264	0.2904
30	Millennium Accoes Portugal	0.8688	0.6377	0.2509	0.0271	0.2465
32	Millennium PPA	0.7732	0.6117	0.2804	0.0332	0.2991
37	Popular PPA - Poupanca Accoes	0.8581	0.6406	0.2517	0.0206	0.1693
39	PPA Montepio	0.8580	0.6274	0.2333	0.0150	0.2633
41	Raiz Poupanca Accoes	0.7675	0.6133	0.2638	0.0095	0.3163
44	Santander Accoes Portugal	0.8679	0.6402	0.2338	0.0083	0.2490
46	Santander PPA	0.8717	0.6318	0.2333	0.0120	0.2521
	Style: Equity US					
11	BPI America D	0.5024	0.7543	0.7564	-0.0636	0.0342
17	Caixagest Accoes EUA	0.5193	0.7326	0.6652	-0.1012	0.0690
20	Caixagest Gestao Accoes EUA	0.3527	0.5831	0.5120	0.0337	-0.1358
25	Espirito Santo Accoes America	0.5346	0.6609	0.4174	-0.0329	0.2244
29	Millennium Accoes America	0.5422	0.7110	0.6499	-0.0705	0.1429
42	Santander Accoes America	0.5906	0.7864	0.7496	-0.0237	-0.0004
45	Santander Accoes USA	0.4185	0.5340	0.3370	-0.0098	0.3910

5.1 Comparison between the stated style and the style practiced by each fund

Taking into account the results of all funds in analysis and the available information, in general, the investment policies are in accordance with the assumptions of strong analysis. See the results for each style in the next sections.

Table 6 - Results for the Fund BPI Poupança Acções PPA

BPI Poupança Acções PPA			
Benchmarks	Weights	R^2	T.E.
PSI 20	31%	84%	2.45%
Eurostoxx 50	13%		
SP500	16%		
Euribor 1m	19%		
Bond Index	22%		

Of all 47 funds, *BPI Poupança Acções PPA* (Table 6) is the one with higher R^2, which means that in this case 84% of return variability can be attributed to style or asset allocation. It is the proportion of variance explained by the selected asset classes. It obeys to the restrictions that all weights must be positive and lower than one and that the sum of all weights must be equal to one. This fund is categorized as Equity Portugal Fund so it can be concluded that the fund manager is following the investment policy proposed since the benchmark with higher weight in the portfolio is PSI-20, the Portuguese index, as suggested by Sharpe (1992).

5.1.1 Equity Europe Funds

In this style 15 funds declare to invest mostly in European markets. Hence, it is expected that the benchmark with higher weight is Eurostoxx 50. The results are presented in Table 7 below and as it can be seen funds tend to invest mostly in European stocks. In general, the R^2 for each fund is high and demonstrate that these funds invest accordingly to its classifications, which in this case is Equity Europe Funds". There are a few exceptions in which the R^2 is not significant. As Riepe (1996) stated, a lower R^2 does not mean a failure of the model. Instead, it can indicate that the benchmarks should be more specific for that fund. This type of analysis

is out of the scope of this study which objective is to verify if in general the funds are correctly classified.

Table 7 - Results for Equity Europe Style

Equity Europe Funds	Benchmarks' Weights					R^2	T.E.
	PSI20	Eurostoxx50	SP500	Euribor1m	Bond Index		
AF Investimentos Accoes Europa	1%	16%	5%	69%	10%	24%	2%
Alves Ribeiro Accoes Europa	0%	18%	1%	63%	18%	42%	4%
BPI Euro Grandes Capitalizacoes	1%	50%	18%	12%	19%	82%	2%
BPI Europa	4%	49%	14%	5%	28%	70%	3%
BPN Accoes Europa	2%	19%	6%	43%	30%	52%	3%
Caixagest Accoes Europa	0%	36%	11%	31%	21%	82%	3%
Espirito Santo Accoes Europa	2%	46%	18%	4%	30%	69%	3%
Millennium Eurocarteira	3%	40%	9%	11%	36%	65%	3%
Montepio Accoes	21%	27%	15%	14%	23%	80%	3%
Montepio Accoes Europa	4%	45%	14%	8%	29%	77%	3%
Orey Accoes Europa	1%	14%	9%	65%	10%	26%	7%
Popular Accoes	13%	35%	19%	22%	12%	78%	3%
Postal Accoes	0%	15%	5%	56%	24%	52%	3%
Raiz Europa	2%	42%	15%	17%	25%	67%	3%
Santander Accoes Europa	1%	40%	13%	24%	22%	83%	3%

5.1.2 Equity Eurozone Funds

The category Equity Eurozone comprises five funds. These funds are expected to invest mostly in stocks from the Eurozone. Hence, the Eurostoxx 50 is the one that best suits their investment philosophy. In this case, not all R^2 values are what were expected. The reasons that can explain this fact were already mentioned above. Additionally, differences in the weights of the index stocks used by these funds can be another cause for these low R^2 values. For the last two funds, it was already possible to see in the correlation Table 5 that they were not highly correlated with Eurostoxx 50. These funds will be tested in Rolling Windows in order to understand its behavior through time.

Table 8 - Results for Equity Eurozone Style

Equity EuroZone	Benchmarks' Weights					R^2	T.E.
	PSI 20	Eurostoxx 50	SP500	Euribor1m	Bond Index		
Banif Euro Accoes	2%	45%	16%	6%	31%	71%	3%
BBVA Bolsa Euro	0%	31%	12%	37%	19%	68%	3%
Caixagest Gestao Euroaccoes	2%	16%	5%	63%	13%	30%	2%
Caixagest Private Equity FEI	11%	16%	16%	50%	7%	3%	2%
Santander Selecção Acções FEI	3%	9%	6%	54%	27%	42%	3%

Is is notable the poor performance of Caixagest Private Equity FEI. This can be explained because, as its prospectus states, the scope of its investment is larger than the other funds'. This fund invests in venture capital funds (national and international) and in bonds or index-linked certificates. Hence, the benchmarks chosen may not be appropriate to explain the performance of this fund.

5.1.3 Equity Portugal Funds

In this group of 20 funds who declare to invest mostly in Portuguese stocks, the results are the most homogeneous amongst our sample of funds. As shown in Table 9, the PSI-20 index has a great influence over all funds in this category and the regression's R^2 is high leading to the conclusion that the funds are well classified and that the model can explain the variability of the funds' returns by its style. The results could be even better if it was not th**e** fund *Caixagest Gestão Lusoacções* whose R^2 is relatively low and the benchmark with a higher weight is Barclays Bond Index. This can be considered a normal situation and is related with the investment style of the management. It is not possible to say that the fund is not following the style that declares so this fund will be tested in the Rolling Windows test in order to understand it.

Table 9 - Results for Equity Portugal Style

Equity Portugal Funds	Benchmarks' Weights					R^2	T.E.
	Psi 20	Eurostoxx50	SP500	Euribor1m	Bond Index		
Alves Ribeiro Medias Empresas Portugal	27%	15%	16%	16%	26%	78%	3%
Banif Accoes Portugal	19%	11%	9%	33%	28%	68%	3%
Banif PPA	19%	11%	8%	42%	20%	65%	3%
Barclays FPA	39%	11%	16%	4%	30%	82%	3%
Barclays Premier Accoes Portugal	33%	11%	14%	16%	27%	80%	3%
BBVA PPA Indice PSI20	38%	12%	17%	12%	22%	82%	3%
BPI Portugal	26%	12%	12%	27%	23%	73%	3%
BPI Poupanca Accoes PPA	31%	13%	16%	19%	22%	84%	2%
Caixagest Accoes Portugal	23%	14%	10%	19%	34%	67%	3%
Caixagest Gestao Lusoaccoes	24%	6%	14%	42%	14%	34%	3%
Caixagest PPA	37%	14%	18%	4%	28%	81%	3%
Espirito Santo Portugal Accoes	35%	14%	17%	6%	28%	82%	3%
Espirito Santo PPA	36%	14%	17%	4%	30%	82%	3%
Millennium Accoes Portugal	29%	10%	13%	31%	17%	82%	3%
Millennium PPA	15%	8%	6%	53%	18%	67%	3%
Popular PPA - Poupanca Accoes	27%	11%	13%	42%	7%	79%	3%
PPA Montepio	32%	12%	15%	19%	22%	81%	3%
Raiz Poupanca Accoes	15%	9%	7%	49%	20%	68%	3%
Santander Accoes Portugal	25%	10%	13%	37%	15%	83%	3%
Santander PPA	27%	9%	12%	35%	16%	83%	3%

Concluding, it can be said that, in general, the funds from Equity Portugal category invest accordingly to the style that declares.

5.1.4 Equity US Funds

The funds from Equity US are expected to invest in American stocks. In this study, the group is composed by 7 funds.

As it was mentioned earlier on the analysis of correlation Table 5, these funds were expected to be highly correlated with S&P500, one of the most commonly followed equity indices which best represents the U.S. stock market. However, the correlation test performed showed that only *BPI América D* has a great correlation with the S&P500 index, while the remain funds have a great correlation with Eurostoxx 50.

However, the results from the regression in Table 10 show lower R^2 values than in the other styles and the benchmarks' weights are higher for Euribor. This can be explained because the S&P500's returns were originally in USD and were converted to EUR. Hence, in this study it is not take into account the impact of EUR/USD exchange rate variations. This is not a test in the scope of this study so it will be performed a Rolling Windows analysis in the next section to identify the variations on the benchmarks' weights over time.

Table 10 - Results for Equity US Style

Fund	Benchmarks' Weights					R^2	T.E.
	Psi 20	Eurostoxx50	SP500	Euribor1m	Bond Index		
BPI America D	1%	14%	17%	56%	11%	67%	3%
Caixagest Accoes EUA	1%	22%	14%	45%	18%	59%	3%
Caixagest Gestao Accoes EUA	4%	21%	7%	50%	19%	38%	2%
Espirito Santo Accoes America	1%	18%	3%	56%	22%	50%	4%
Millennium Accoes America	4%	23%	22%	15%	36%	57%	3%
Santander Accoes America	6%	24%	29%	34%	6%	69%	3%
Santander Accoes USA	1%	10%	1%	62%	26%	45%	3%

5.2 Style Consistency Through Time

A fund can be incorrectly classified over time if the changes of benchmarks' weights on the funds' portfolios are significant. It is possible to represent graphically these changes through the representation of the weights of benchmarks over time. This methodology was described on Sections 3.1.2 and 4 and it is called Rolling Windows. This test was performed in Stata software and consists on regressing the funds' returns with benchmarks' for several periods of 24 months from January, 2000 until March, 2012. Since the purpose of this test is just to verify if the funds are consistent over time with its style, for this analysis it was used the weak style analysis, not applying restrictions to the coefficients. For each fund, it was applied the Rolling Windows process with just one benchmark, the most suitable one in terms of what the fund declares to follow.

The analysis concluded that there is no consistency of the funds' styles over time. The graphical representations performed on Stata showed that the funds' investment on the selected benchmark for their style was not constant over time. However, the tendency after 2008 was to increase the weight on the selected benchmark for almost every funds which means that although the fund managers are not constant over time with their investment policies, they have been approaching their funds' strategies to their declared styles.

Table 11 below shows the mean, standard deviation and median for the benchmarks in the rolling windows analysis. The benchmark with higher weight on its respective funds is PSI-20 with a mean of 88%. These results are in line with what was concluded in the style analysis test. The Equity Portugal style is the one with more consistent results, followed by Equity Europe and Equity Eurozone. Yet, the benchmark with higher variations from the average is the Eurostoxx 50. The weight on the benchmark S&P500 has an average of only 50% mean and the lowest standard deviation, leading to conclusion that the funds from Equity US may not be following its declared style. All benchmarks' mean is very close to the median meaning that the benchmarks' weights are evenly divided around the mean.

Table 11 - Rolling Windows - Statistics for the benchmark weight

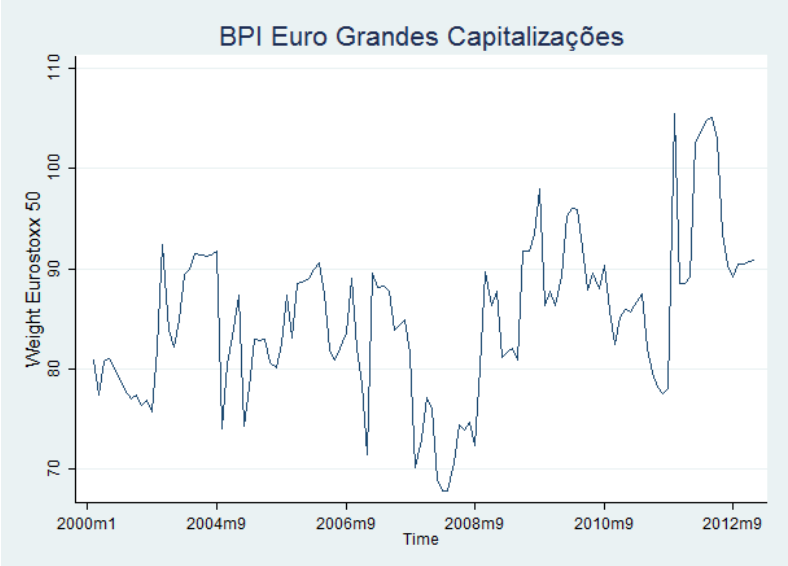
Benchmark	Mean	St dev	Median
PSI-20	88%	24%	91%
Eurostoxx 50	61%	30%	67%
S&P 500	51%	23%	50%

The fund *BPI Euro Grandes Capitalizações*, who declares to invest in European stocks, had the best results of all funds in the style analysis test, concluding that this fund is correctly classified. This result is presented in Table 11 below. However, the regression made on Rolling Windows with the benchmark Eurostoxx 50, the index with higher weight on this portfolio, shows that its investment on this benchmark was not constant over time. On the graphical representation of this benchmark weight in the composition of the fund (Figure 3) it is possible to see a low weight in 2008, the beginning of a global financial crisis. After this period, there is a tendency for the raise of the benchmark's weight. This fact can justify the variations around these years.

Table 12 - Weights - BPI Euro Grandes Capitalizações

Fund	PSI-20	Eurostoxx 50	S&P500	Euribor 1m	Bond Index
BPI Euro Grandes Capitalizações	1%	50%	18%	12%	19%

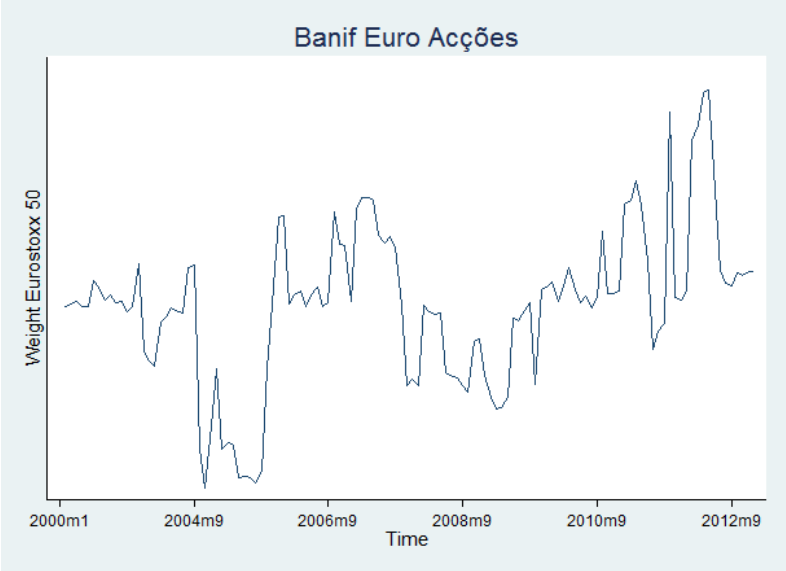
Figure 3- Rolling Windows - Equity Europe – BPI Euro Grandes Capitalizações



In general, from the analysis performed, the conclusion is that the funds from the Equity Europe style have not been consistent over time.

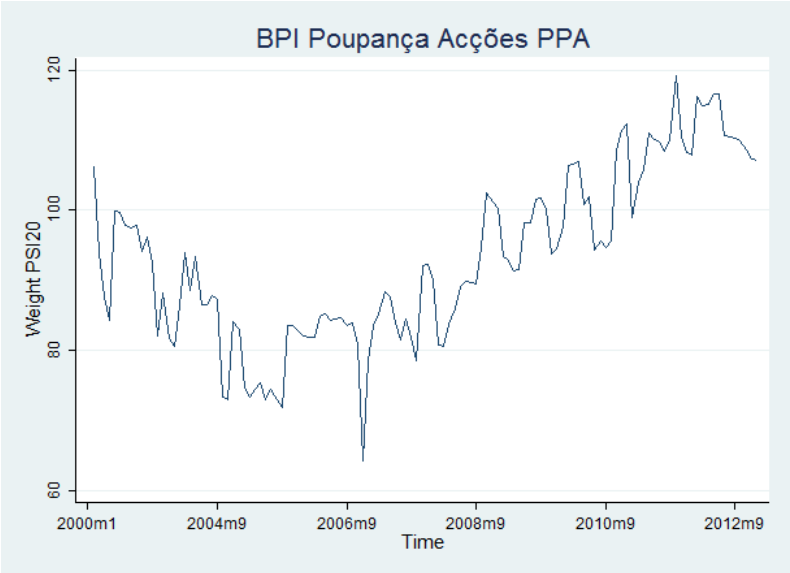
For the Equity Eurozone funds, the regressions where also made with the funds' returns against the fund Eurostoxx 50 because this is the benchmark with higher weight on the style analysis and it is also the style that the funds declare to follow. The fund *Banif Euro Acções* also showed inconsistency in this analysis. However, this fund also showed a low peak in 2008 followed by an increase after this crisis period.

Figure 4 - Rolling Windows - Equity Eurozone – Banif Euro Acções



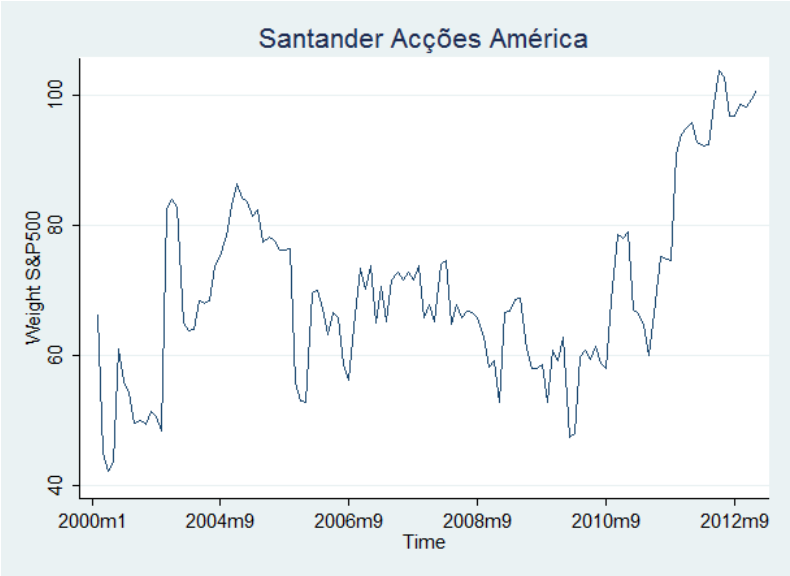
In general, the funds from Equity Portugal style showed a pattern in the weight of PSI-20 in their portfolios over time. Only between 2004 and 2006 these funds seemed to have some consistency on this matter. Though, after this period the tendency of PSI-20's weight on the fund's portfolios was to increase. In Figure 5 it can be seen the example of the *BPI Poupança Acções PPA* fund.

Figure 5 - Rolling Windows - Equity Portugal – BPI Poupança Acções PPA



Finally, the Equity US funds, which declare to invest in US stocks, only showed some consistency on the period between 2008 and 2010. Also, they demonstrate the same behavior as the previous funds in the last 2 years of the period: an increase of the S&P 500's weight on their portfolios. In Figure 6 below, the fund *Santander Acções América* illustrates the behavior previously described.

Figure 6 - Rolling Windows - Equity US – Santander Acções América



In general, the 47 funds analyzed did not present signs of consistency with the declared style over time. However, this instability observed can be explained by some factors, as Riepe (1996) mentioned, such as:

i) Changes in the stocks that constitute the portfolio;

ii) Rotation of the asset classes by the fund manager;

iii) Existence of inaccuracy in the data;

iv) Inadequate choice of benchmarks.

Also, and as was stated previously, the global financial crisis started in 2008 may have affected the preferences of managers in terms of the 4 factors mentioned above.

Concluding, there seems to be no consistency in the styles declared by the funds analyzed between 2000 and 2012. Nonetheless, the funds had a turning point by mid-2008, time when they started to enhance their investment in the benchmark that represents the style declared by them.

6. Conclusion

This study conducted a Sharpe's style analysis (Sharpe, 1992) in order to verify whether the Portuguese equity funds are correctly classified and if they show consistency over time in the investment style stated by the fund manager.

Using a sample of 47 equity Portuguese funds, two tests were performed in order to get results for the two goals previously mentioned. For the first one, the funds were regressed against a sample of 5 benchmarks (PSI 20 index, Eurostoxx 50 index, S&P 500 index, Euribor 1 month and Barclays Euro Government Inflation-Linked Bond Index representing respectively the Portuguese market, European Market, American Market, Money Market and Bond Market). The test showed that, globally, the funds are correctly classified according to Lipper Global and APFIPP. Equity Portugal is the style with the best results having most of funds' R^2 values higher than 80%. Additionally, the fund with better results was *BPI Poupança Acções PPA*, a fund who declares to invest in Portuguese stocks, with an R^2 of 84%. The Equity Europe and Equity Eurozone funds also showed positive results, even though there are some outliers with low R^2 values in both groups leading to the conclusion that these funds in specific may be misclassified. The Equity US funds are those with lower results whose funds showed a R^2 lower than 70% and the benchmarks' weights are higher for Euribor, instead of the expected S&P500. This can be explained because the S&P500's returns were originally in USD and were converted to EUR and the regression performed in this study does not take into account the variations on the EUR/USD exchange rate.

Mutual funds disclose information about its investment policies and goals, allowing investors to make investment decisions based on this information. If this information was not correct it could lead to unbiased analysis that would not meet the investors' needs. Therefore, the right classification of mutual funds has a major relevance for investors and for markets. This study adds value to the subject by verifying the correct or wrong classification of the mutual funds in scope.

From the rolling windows analysis it was concluded that, apart from what was expected, the funds were not consistent over time with their stated style. This analysis was performed on Stata software, were several 24-month regressions were computed starting on January, 2002 and ending on December, 2012.

The analysis performed in this study has sufficient foundations to be explored in other types of mutual funds in order to understand their behaviour in terms of classification and consistency.

This analysis is helpful for investors as it verifies if portfolio performance matches the declared style of the fund. The conclusions are also of interest of supervision that have to monitor mutual fund companies.

Our results suggest some caution regarding funds investing in the US.

7. Bibliography

Brinson, G., Singer, B.,and Beebower, G. (1991), *Determinants of Portfolio Performance II: An Update*, The Financial Analysts Journal, 47, 3

Brown, K., Harlow, V. and Starks, L. (1996), *Of Tournaments and Temptations: An Analysis of Managerial Incentives in the Mutual Fund Industry*, Journal of Finance 51, 85-110.

Brown, S., and W. Goetzmann (1995), *Performance persistence*, Journal of Finance 50: 679-698.

Brown, S. and W. Goetzmann, W.N. (1997), *Mutual Fund Styles*, Journal of Financial Economics, 43, 373-399.

Buetow, G., Johnson, R. and Runkle, D. (2000), *The inconsistency of return-based style analysis*, Journal of Portfolio Management 61-77

Chan, L.K.C, Chen, H. and Lakonishok, J.K. (2002), *On Mutual Fund Investment Styles*, The Review of Financial Studies, 15 (5), 1407-1437.

De Roon, F.A., Nijman, T.E. and TerHorst, J.R. (2004), *Evaluating Style Analysis*, Journal of Empirical Finance, 11, 29–53.

DiBartolomeo, D. and Witkowski, E. (1997), *Mutual Fund Misclassification: Evidence Based on Style Analysis*, Financial Analysts Journal, 53 (5), 32-43.

Gallo, J.G. and Lockwood, L.J. (1999), *Fund Management Changes and Equity Style Shifts*, Financial Analysts Journal, 55 (5), 44-52.

Judge, G.G. and Takayama, T. (1966), *Inequality Restrictions in Regression Analysis*, Journal of the American Statistical Association, 61, 166-181.

Kim, M., Shukla, R. and Tomas, M. (2000), *Mutual Fund Objective Misclassification*, Journal of Economics and Business, 52, 309–323.

Lakonishok, J., A Shleifer, R. Thaler, and R. Vishny (1991), *Window dressing by pension fund managers*, American Economic Review, 81: 227-231

Lobosco, A. and DiBartomoleo, D. (1997), *Approximating the confidence intervals for Sharpe style weights*, Financial Analysts Journal 53 (53): 80-85

Lobosco A. (1999), *Style/Risk-Adjusted Performance*, Journal of Portfolio Management, 25(3), 65-68

Moreno, D., Marco, P. and Olmeda, I. (2006), *Self-Organizing Maps Could Improve the Classification of Spanish Mutual Funds*, European Journal of Operational Research, 174 (2), 1039-1054.

Sharpe, W.F. (1964), *Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk*, The Journal of Finance, 19 (3), 425-442

Sharpe, W.F. (1988), *Determining a Fund's Effective Asset Mix*, Investment Management Review, 59-69

Sharpe, W.F. (1992), *Asset Allocation: Management Style and Performance Measurement*, Journal of Portfolio Management 18 (2), 7-19

Swinkels, L.A.P. & Sluis, P.J. van der (2001), *Return-Based Style Analysis with Time-Varying Exposures*, Discussion Paper 2001-96, Tilburg University, Center for Economic Research.

Tole, T. (1982), *You Can't Diversify Without Diversifying*, Journal of Portfolio Management, 8, 5-11.

Working Papers

Brown, K. and W. Harlow (2004), *Staying the Course: Mutual Fund Investment Style Consistency and Performance Persistence*, Working Paper, University of Texas.

Brown, K., W. Harlow, and Zhang, H. (2009), *Staying the course: The role of investment style consistency in the performance of mutual funds*, Working paper, University of Texas at Austin.

Huang, J., C. Sialm, and H. Zhang (2008), *Risk shifting and mutual fund performance*, Working Paper, University of Texas.

Lucas, L. and Riepe, M.W. (1996), *The Role of Return-Based Style Analysis: Understanding, Implementing, and Interpreting the Technique*, Working Paper, Ibbotson Associates.

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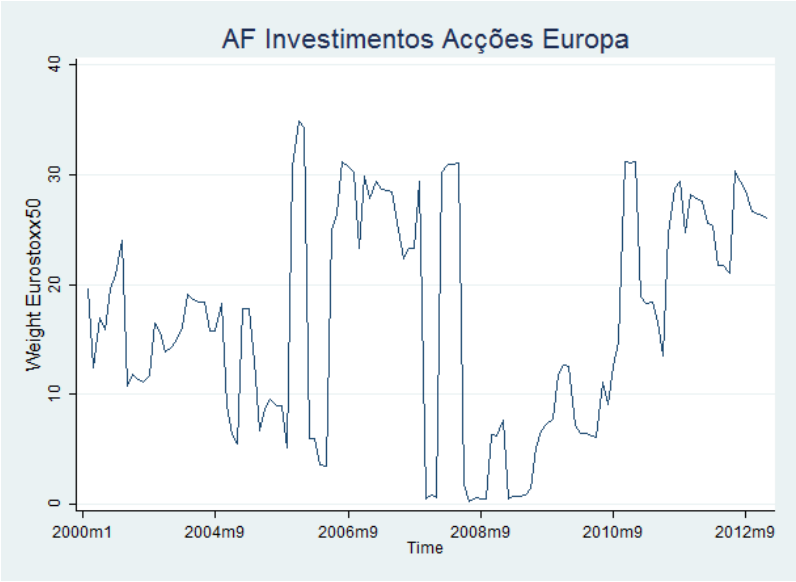
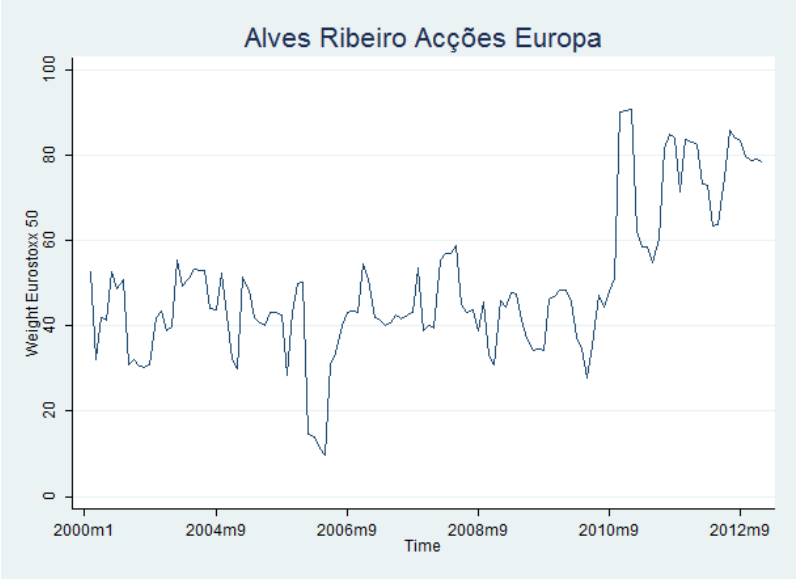
8. Annexes – Style Analysis – Rolling Windows

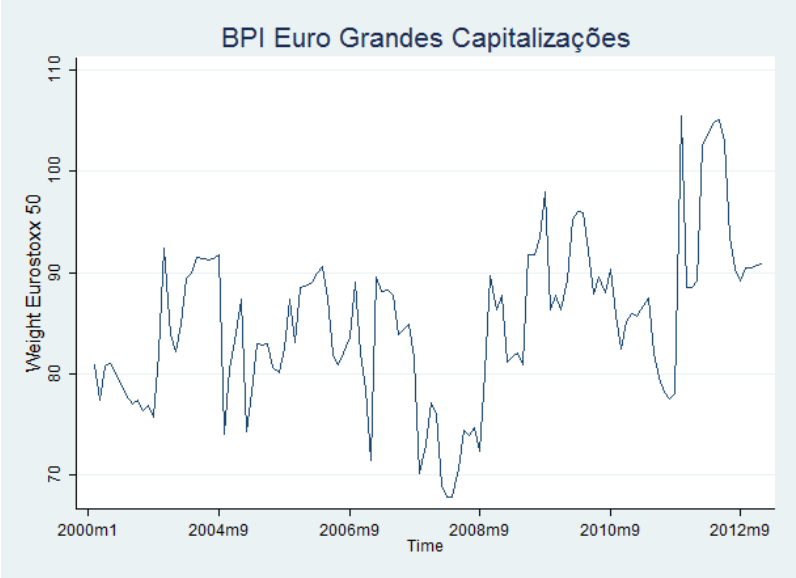
Annex 8.1 Equity Europe Funds - AF Investimentos Acções Europa



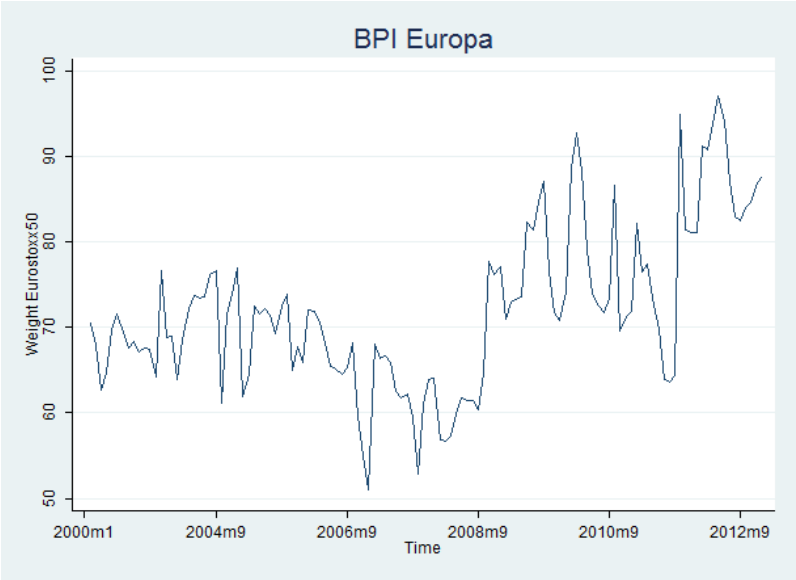
Annex 8.2 Equity Europe Funds – Alves Ribeiro Acções Europa



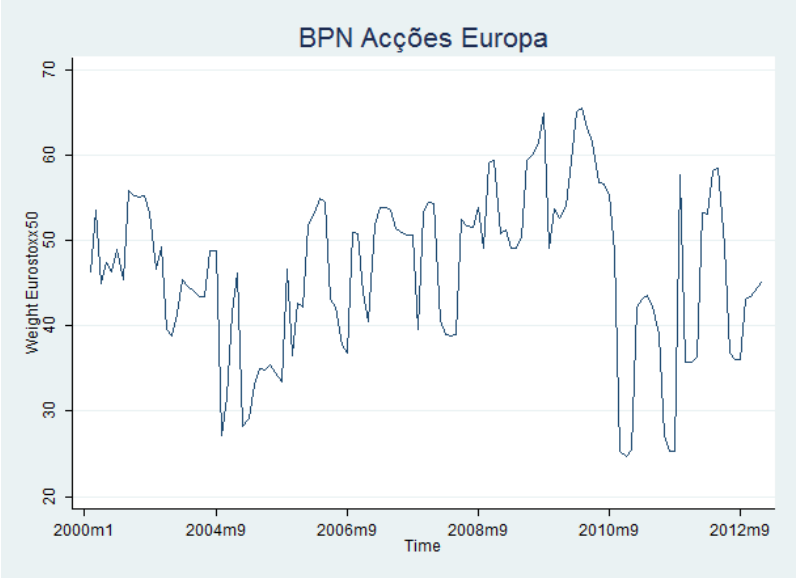
Annex 8.3 Equity Europe Funds – BPI Euro Grandes Capitalizações



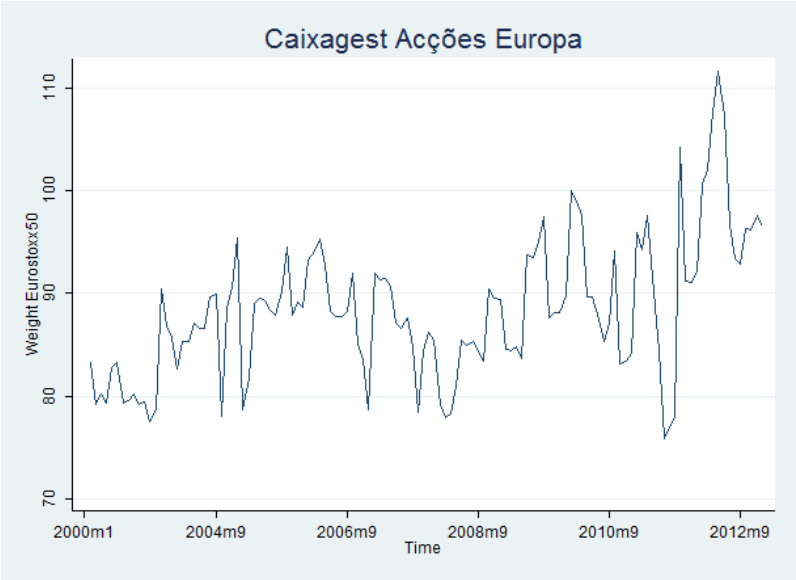
Annex 8.4 Equity Europe Funds – BPI Europa



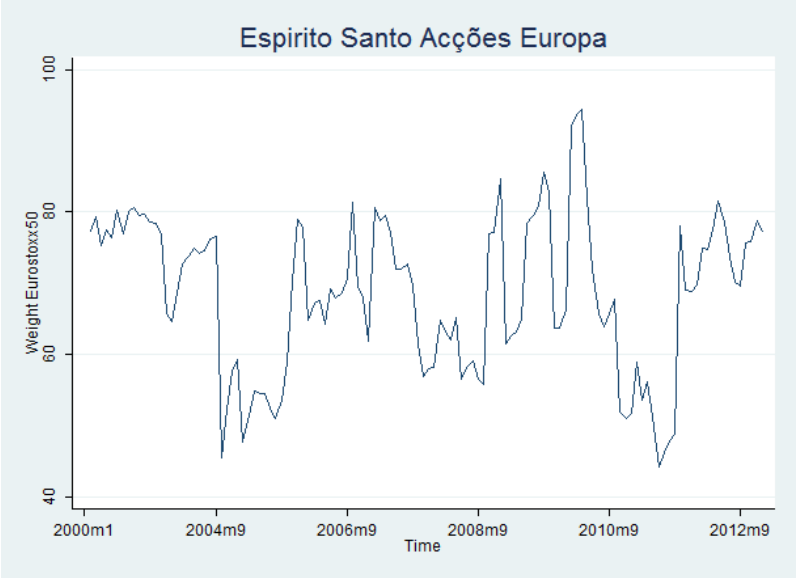
Annex 8.5 Equity Europe Funds – BPI Acções Europa



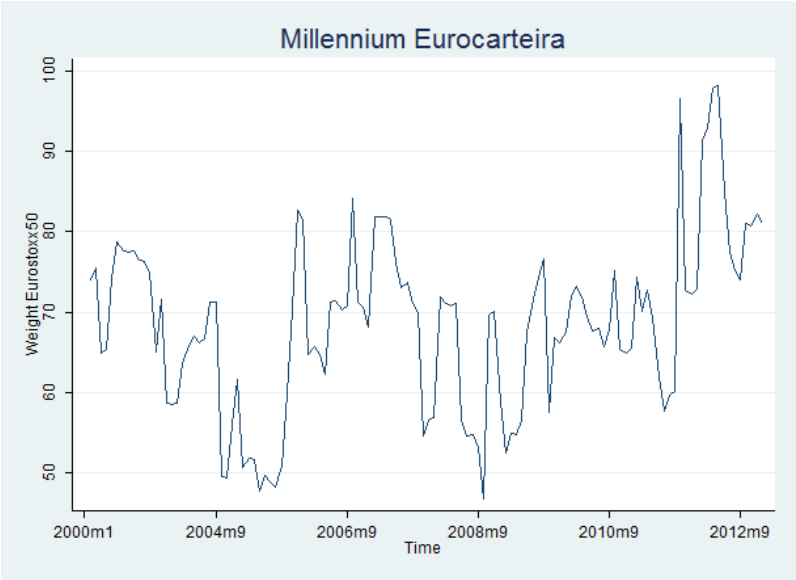
Annex 8.6 Equity Europe Funds – Caixagest Acções Europa



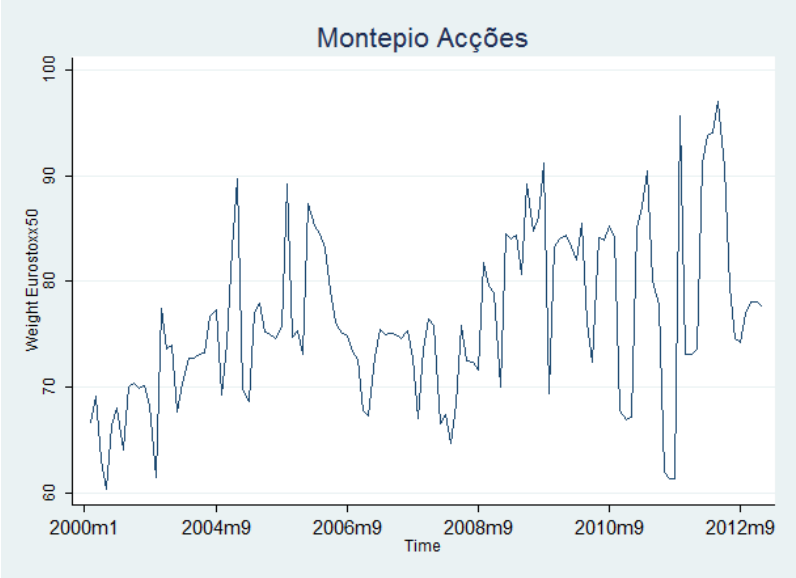
Annex 8.7 Equity Europe Funds – Espírito Santo Acções Europa



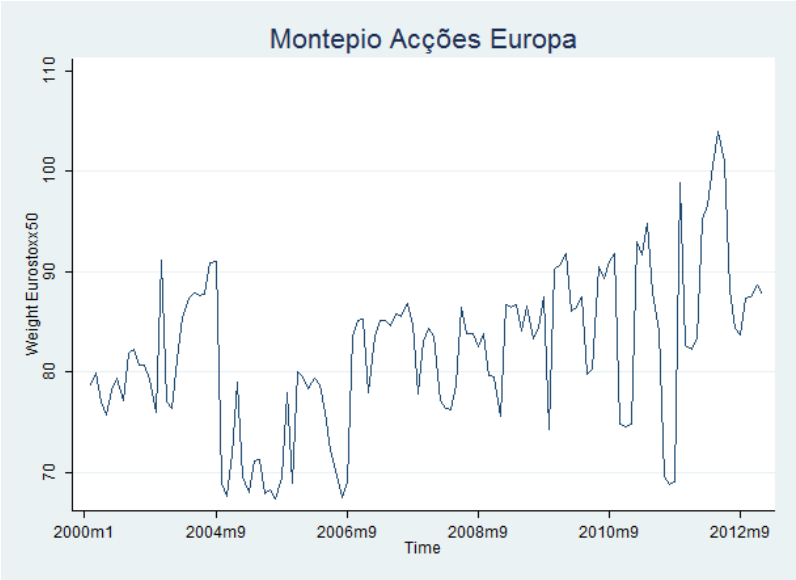
Annex 8.8 Equity Europe Funds – Millennium Eurocarteira



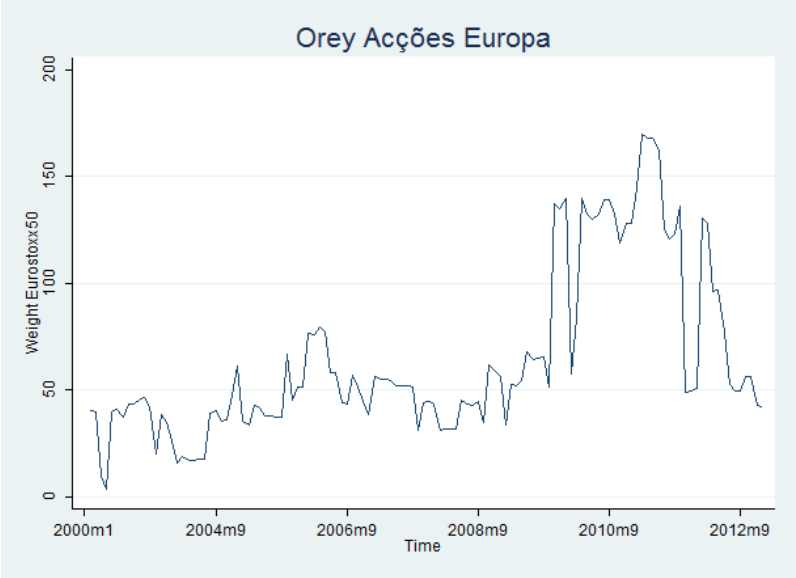
Annex 8.9 Equity Europe Funds – Montepio Acções



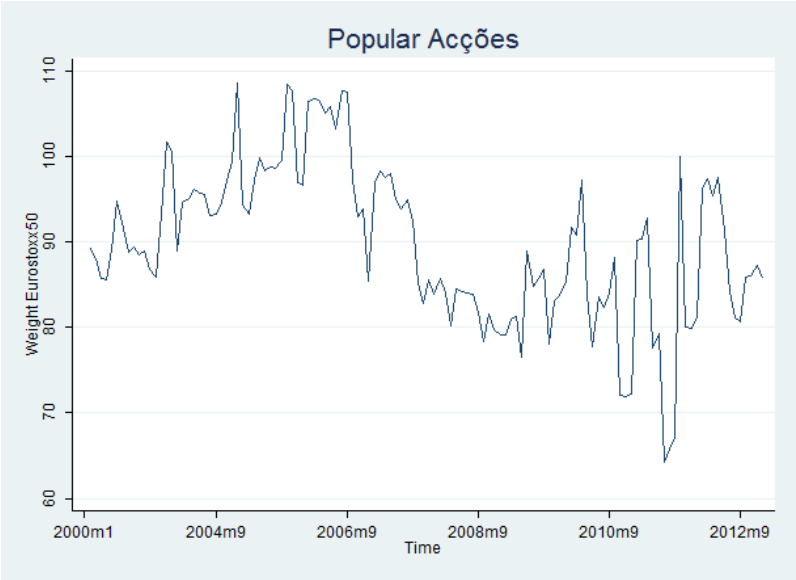
Annex 8.10 Equity Europe Funds – Montepio Acções Europa



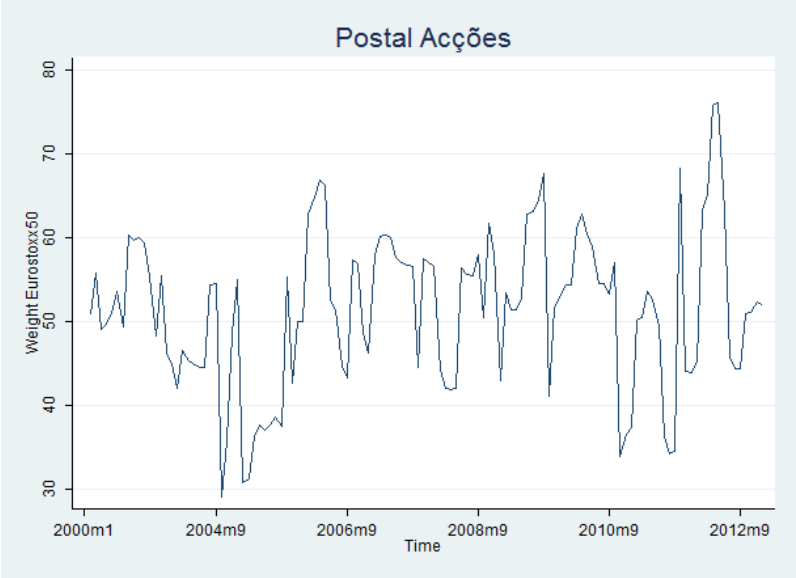
Annex 8.11 Equity Europe Funds – Orey Acções Europa



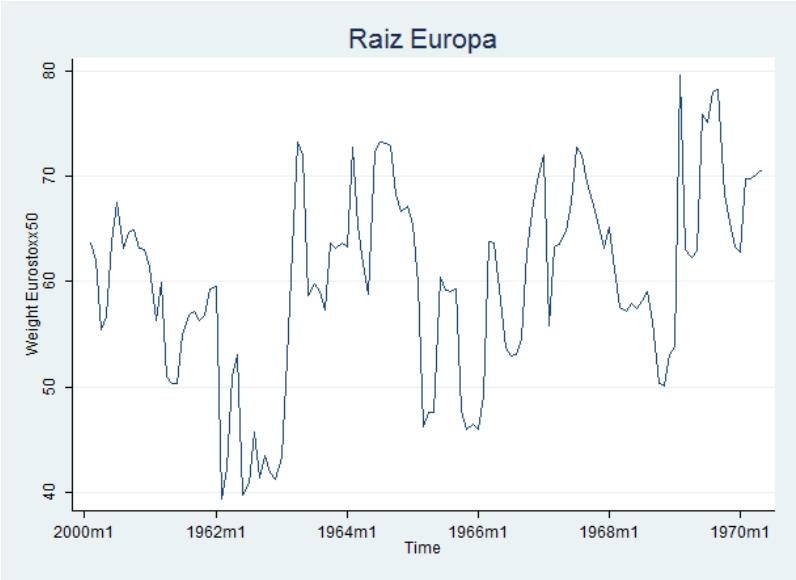
Annex 8.12 Equity Europe Funds – Popular Acções



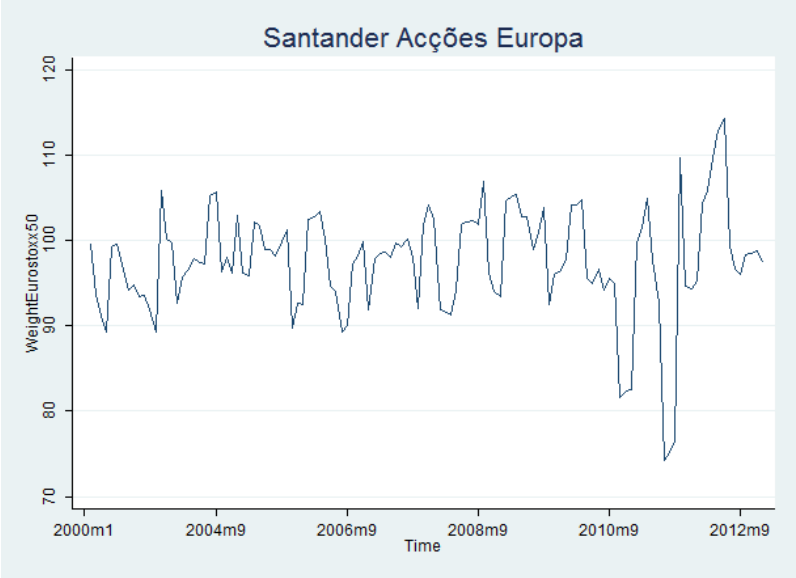
Annex 8.13 Equity Europe Funds – Postal Acções



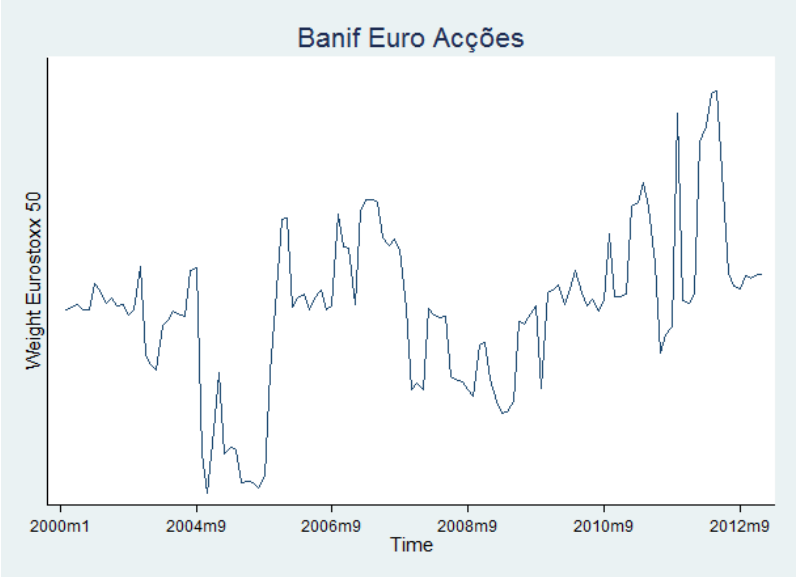
Annex 8.14 Equity Europe Funds – Raíz Europa



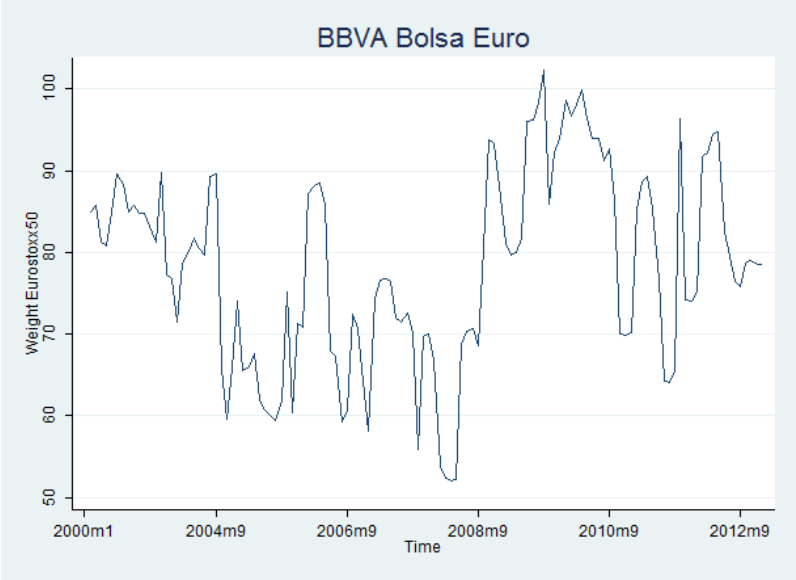
Annex 8.15 Equity Europe Funds – Santander Acções Europa



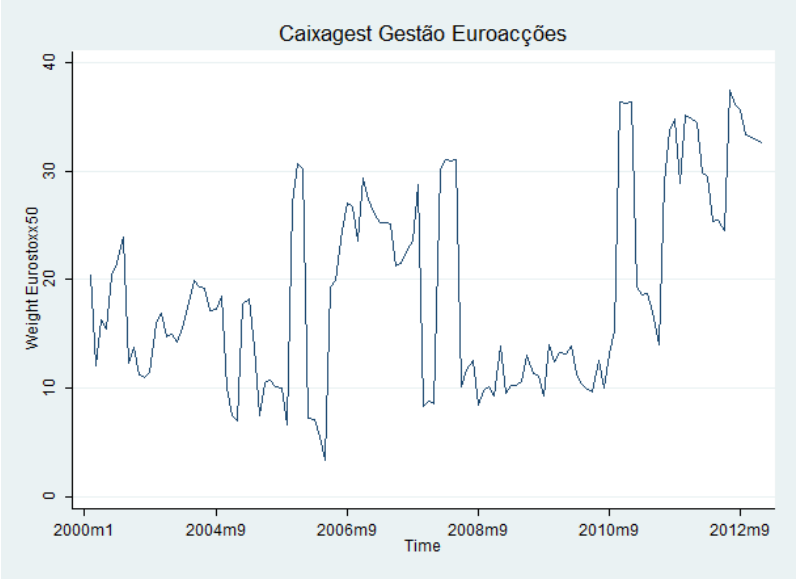
Annex 8.16 Equity Eurozone – Santander Acções Europa



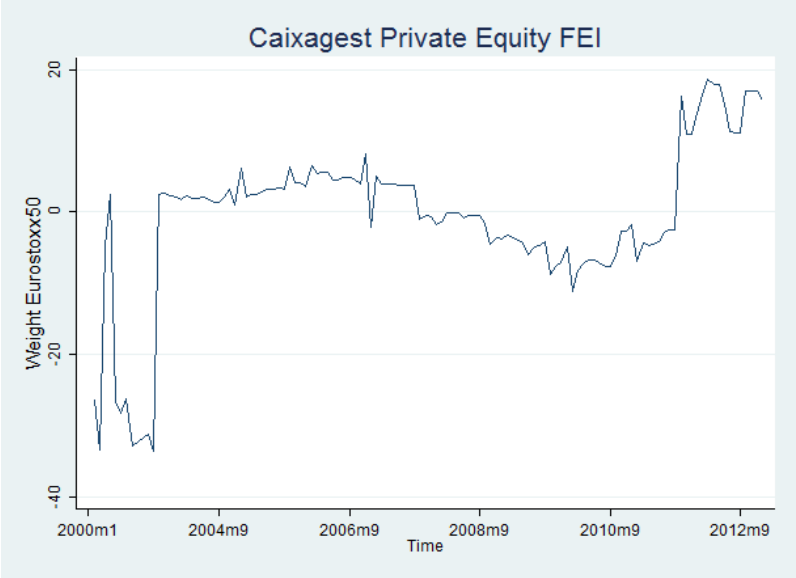
Annex 8.17 Equity Eurozone – BBVA Bolsa Euro



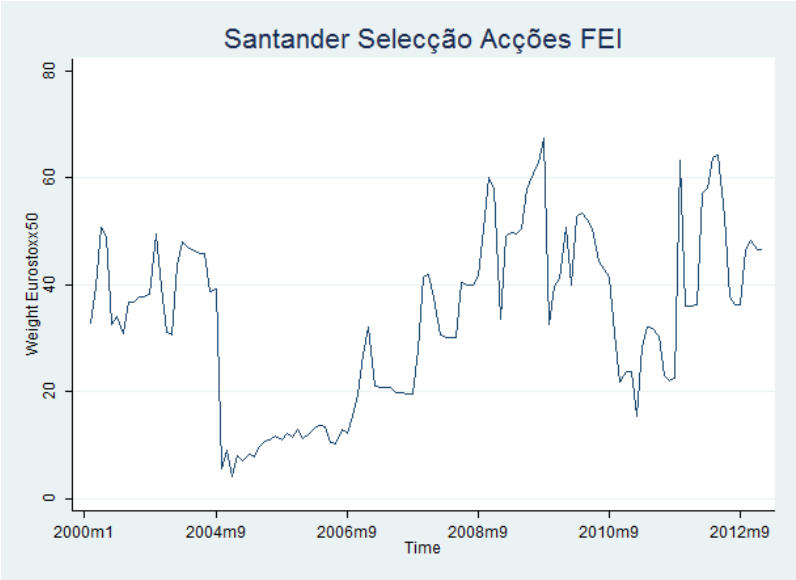
Annex 8.18 Equity Eurozone – Caixagest Gestão Euroacções



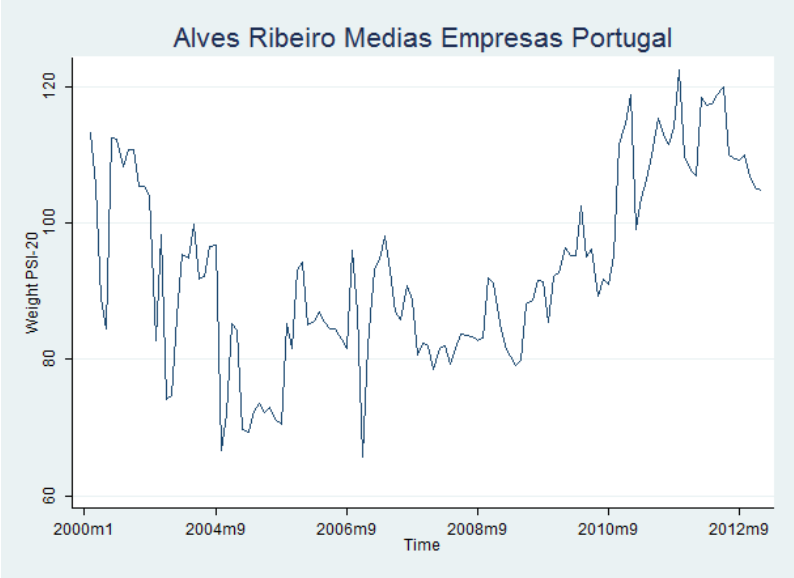
Annex 8.19 Equity Eurozone – Caixagest Private Equity FEI



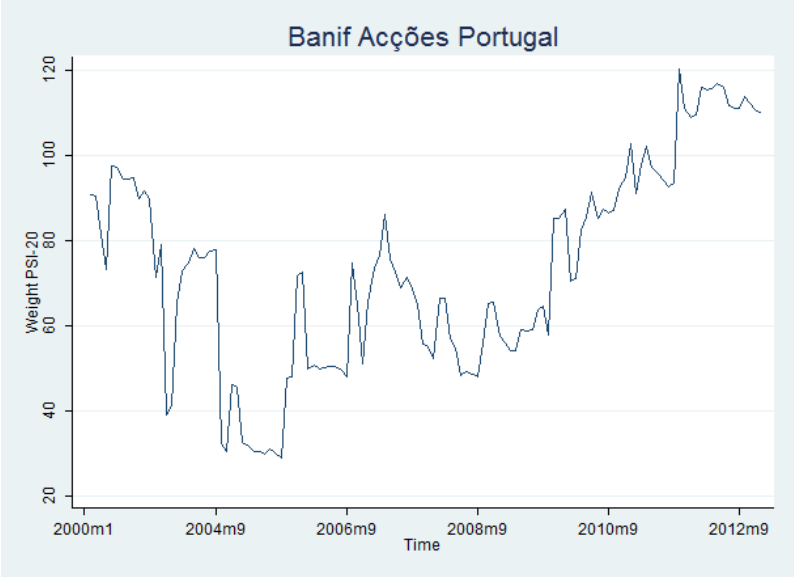
Annex 8.20 Equity Eurozone – Santander Selecção Acções FEI



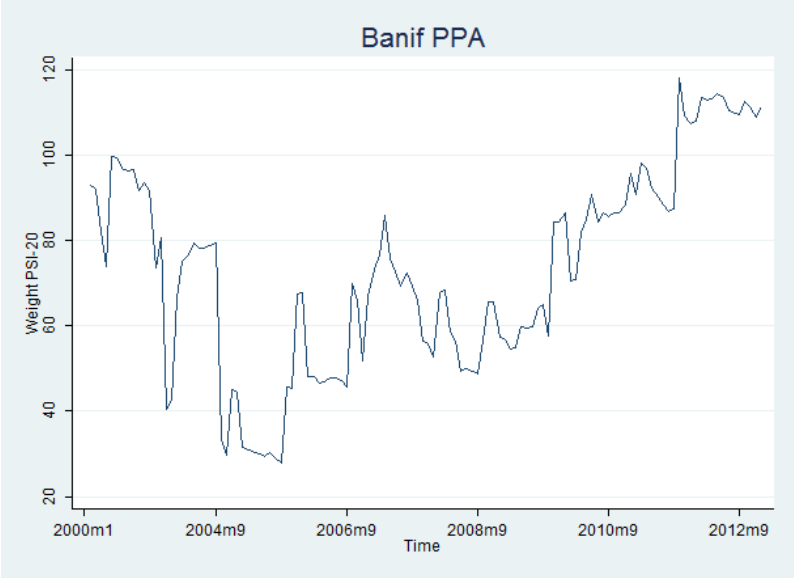
Annex 8.21 Equity Portugal – Alves Ribeiro Médias Empresas Portugal



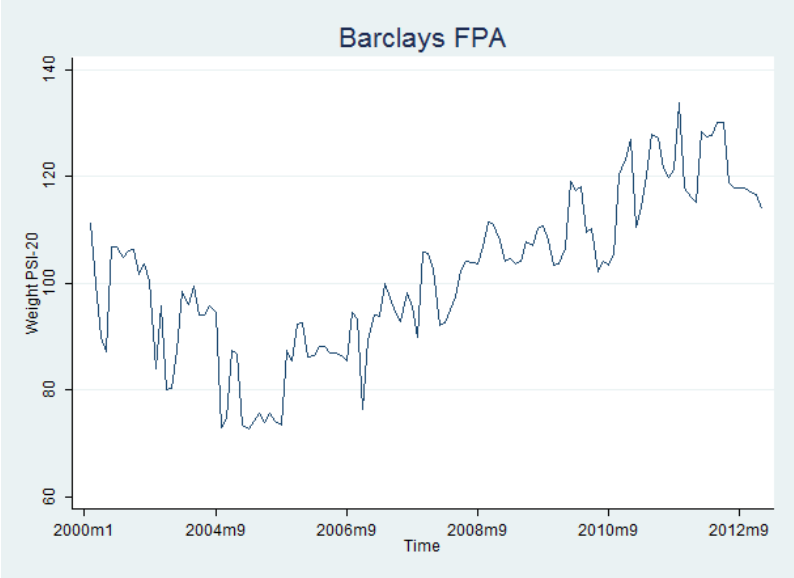
Annex 8.22 Equity Portugal – Banif Acções Portugal



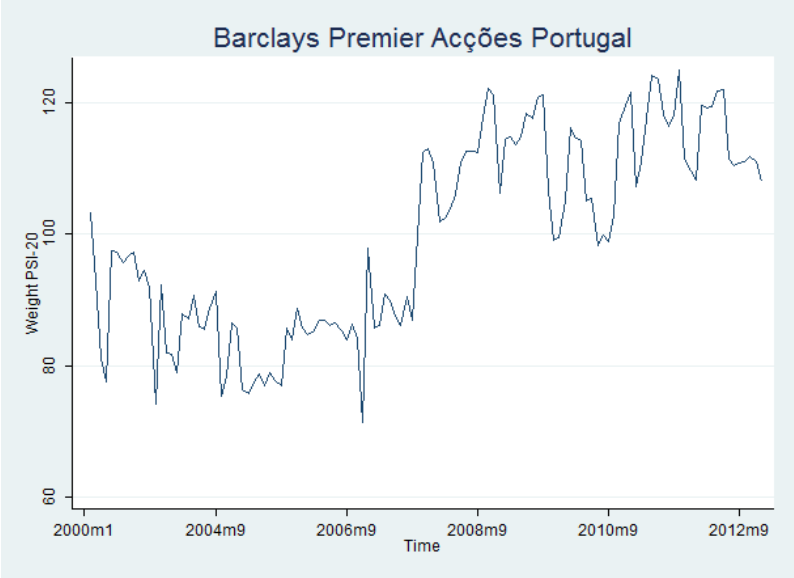
Annex 8.23 Equity Portugal – Banif PPA



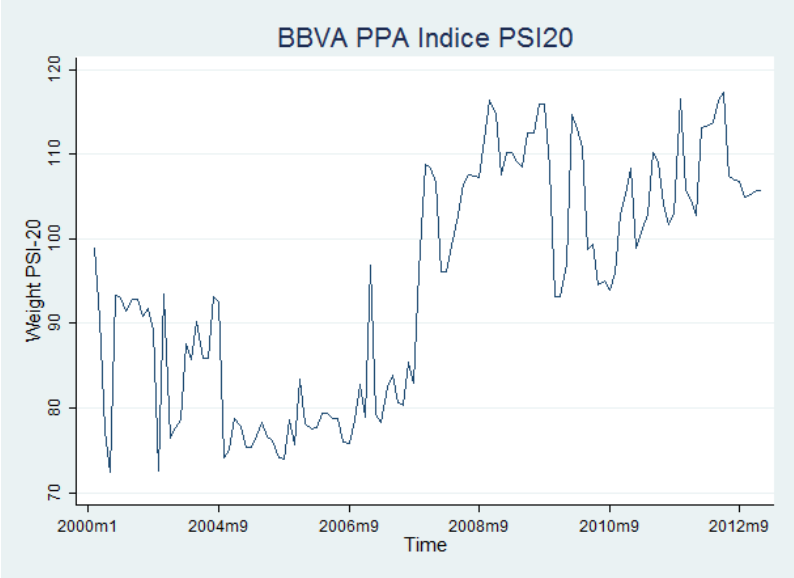
Annex 8.24 Equity Portugal – Barclays FPA



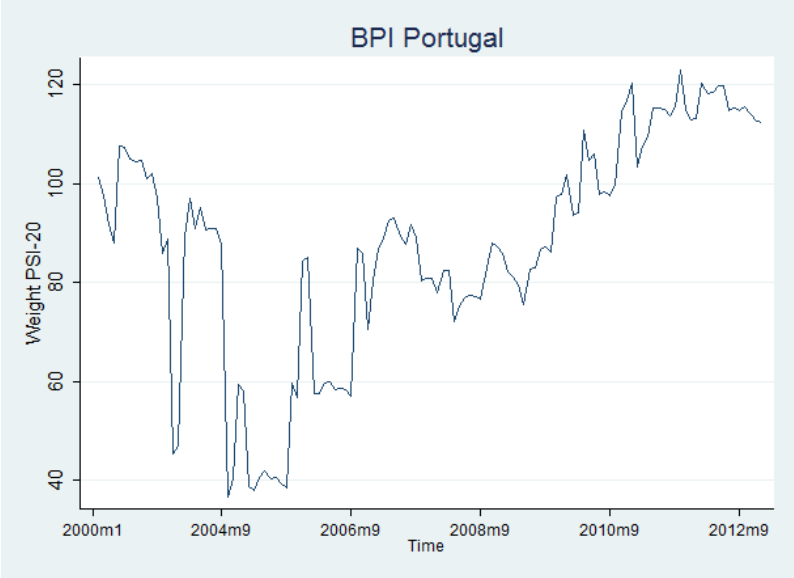
Annex 8.25 Equity Portugal – Barclays Premier Acções Portugal



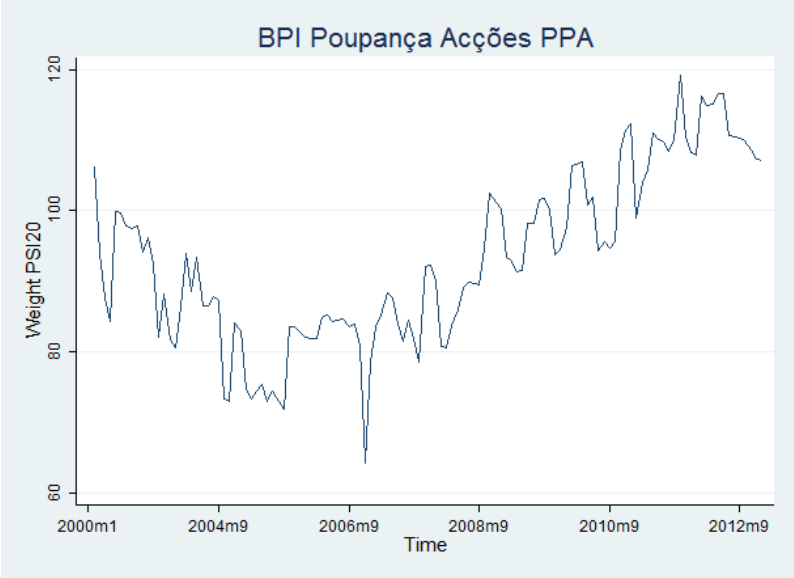
Annex 8.26 Equity Portugal – BBVA PPA Indice PSI20



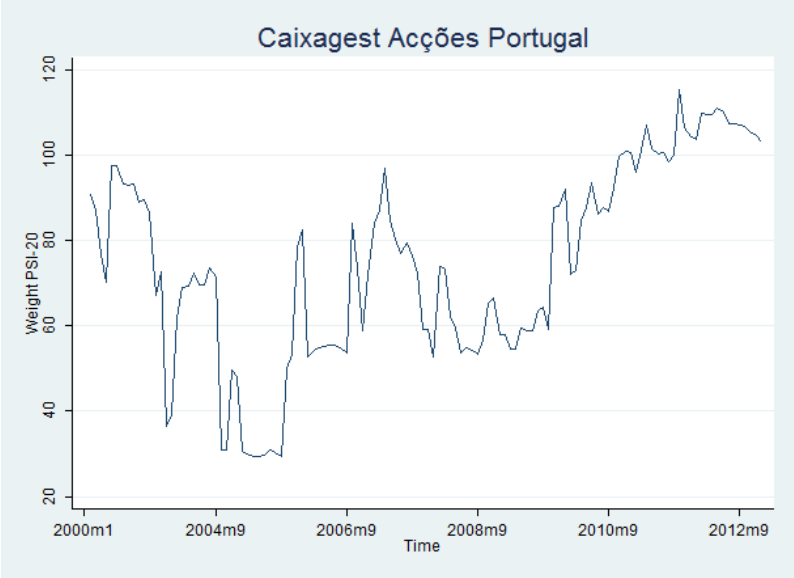
Annex 8.27 Equity Portugal – BPI Portugal



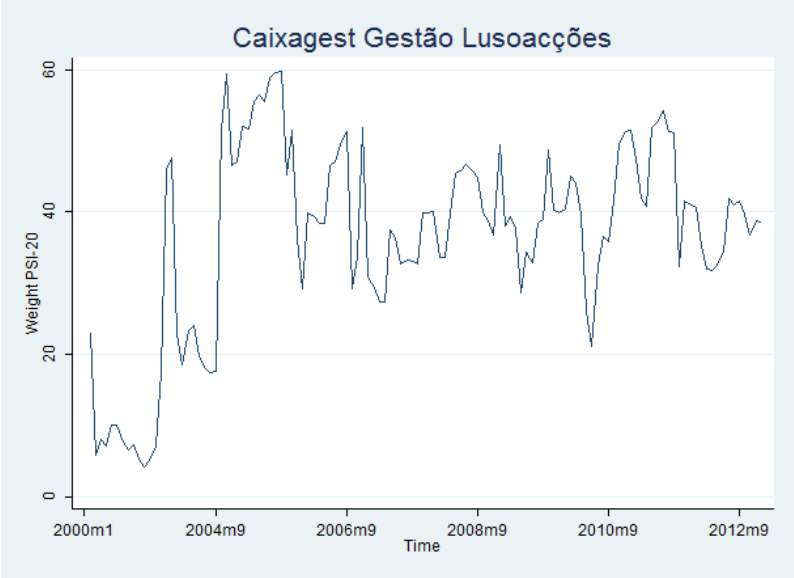
Annex 8.28 Equity Portugal – BPI Poupança Acções PPA



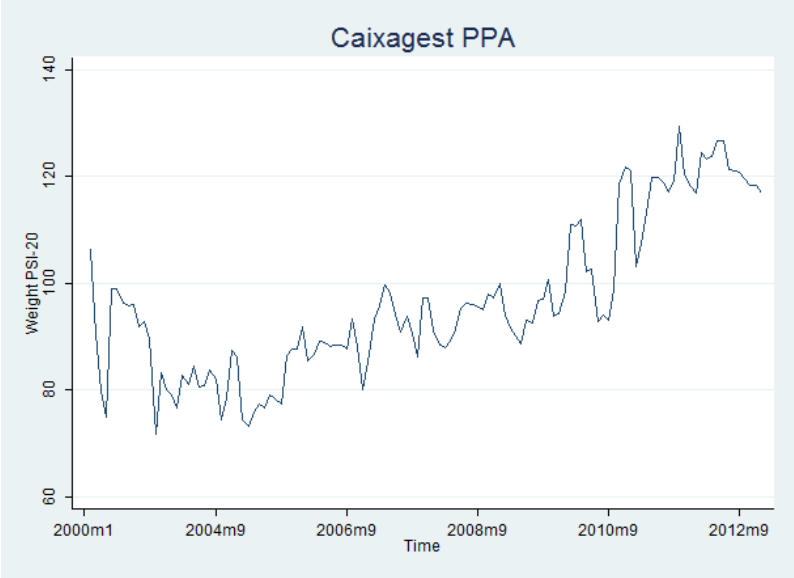
Annex 8.29 Equity Portugal – Caixagest Acções Portugal



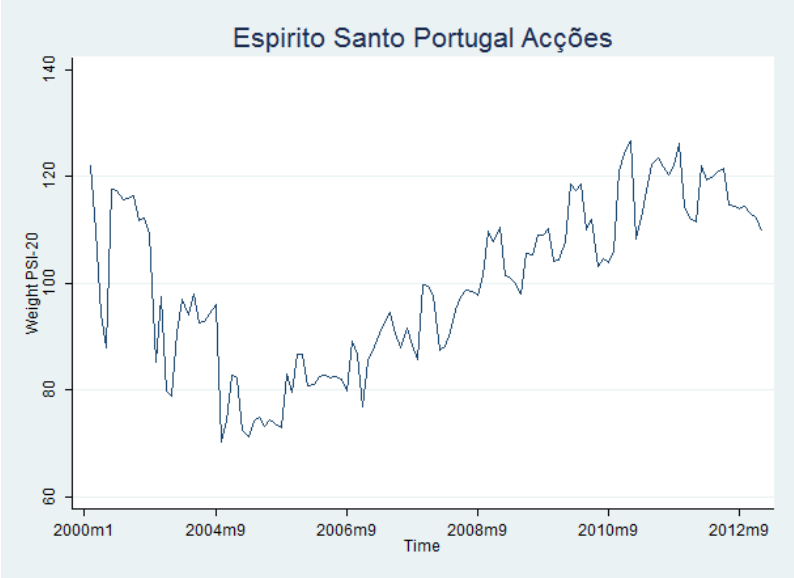
Annex 8.30 Equity Portugal – Caixagest Gestão Lusoacções



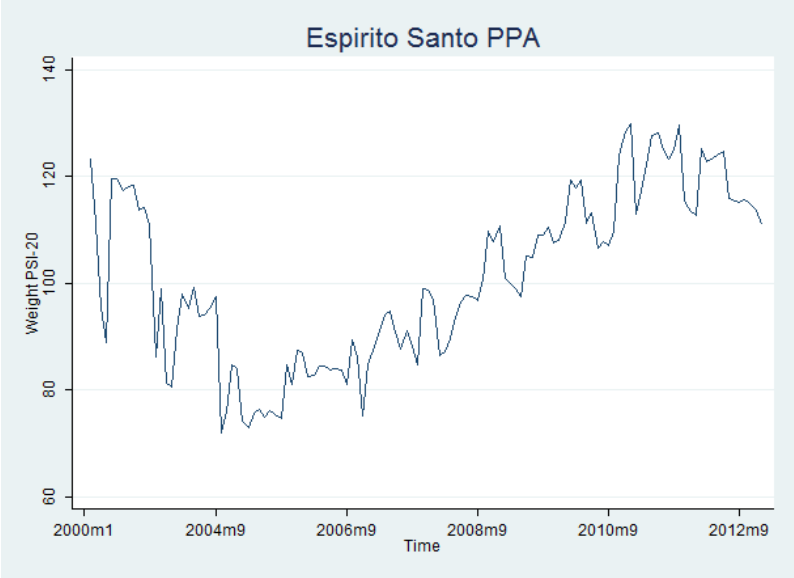
Annex 8.31 Equity Portugal – Caixagest PPA



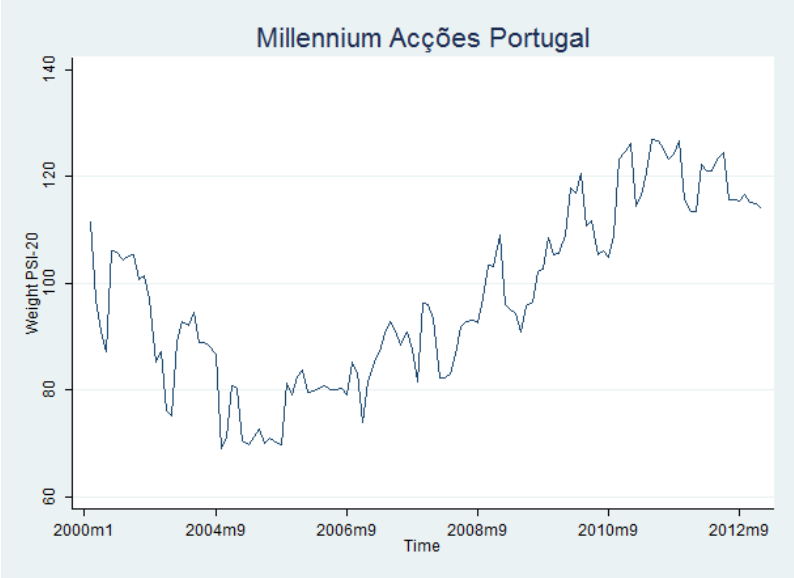
Annex 8.32 Equity Portugal – Espírito Santo Portugal Acções



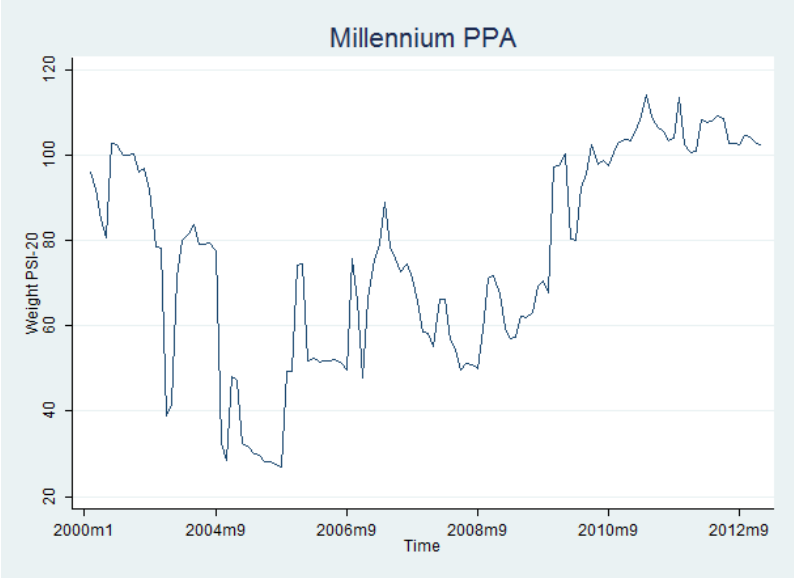
Annex 8.33 Equity Portugal – Espírito Santo PPA



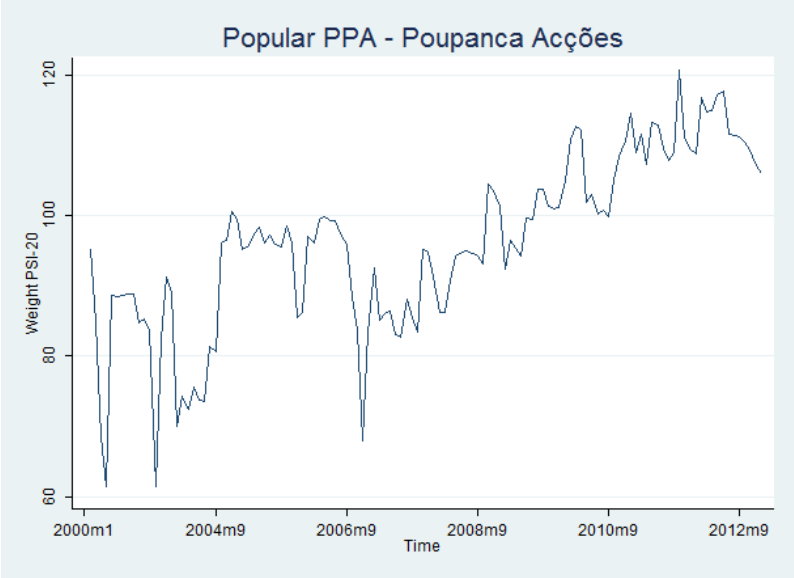
Annex 8.34 Equity Portugal – Millennium Acções Portugal



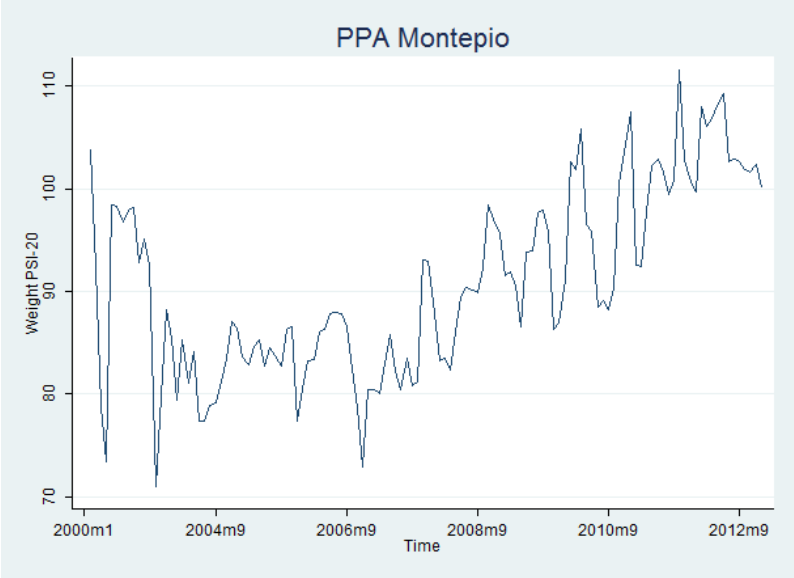
Annex 8.35 Equity Portugal – Millennium PPA



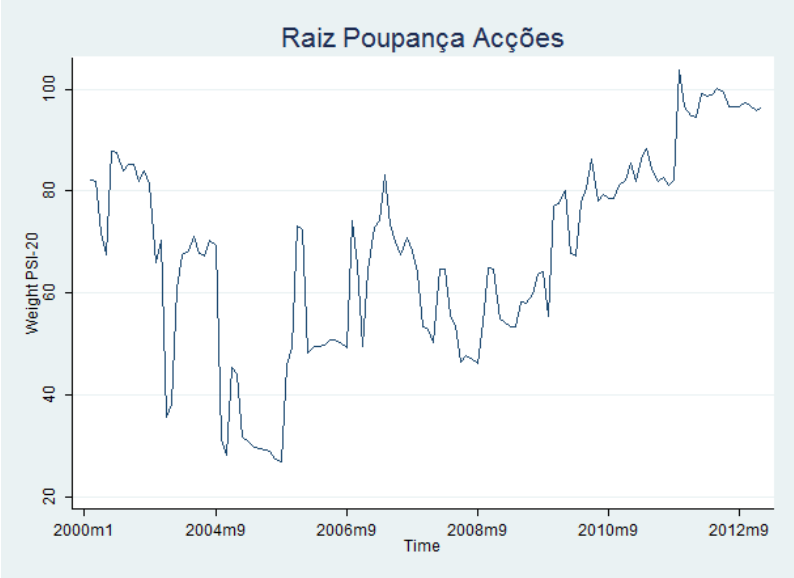
Annex 8.36 Equity Portugal – Popular PPA- Poupança Acções



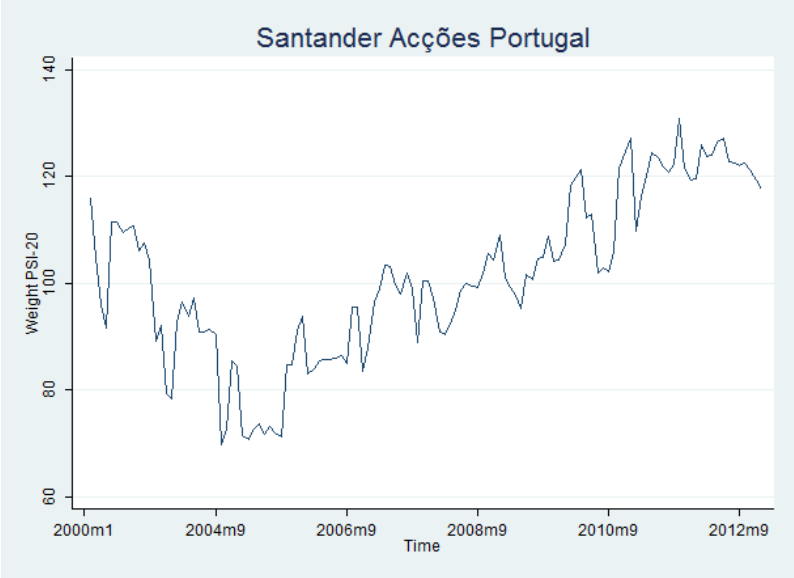
Annex 8.37 Equity Portugal – PPA Montepio



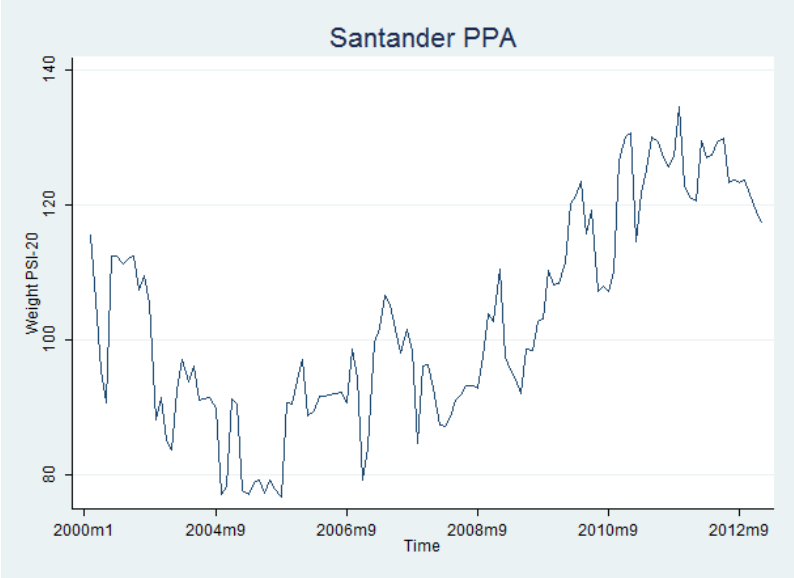
Annex 8.38 Equity Portugal – Raiz Poupança Acções



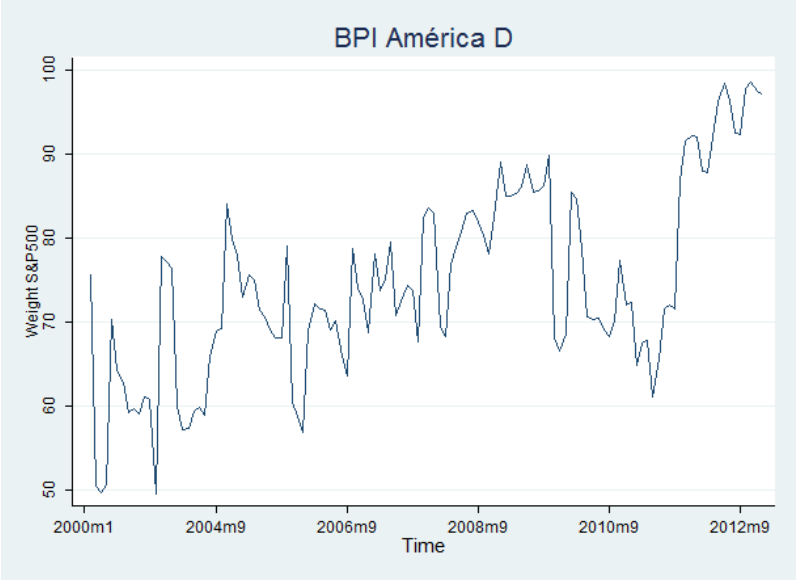
Annex 8.39 Equity Portugal – Santander Acções Portugal



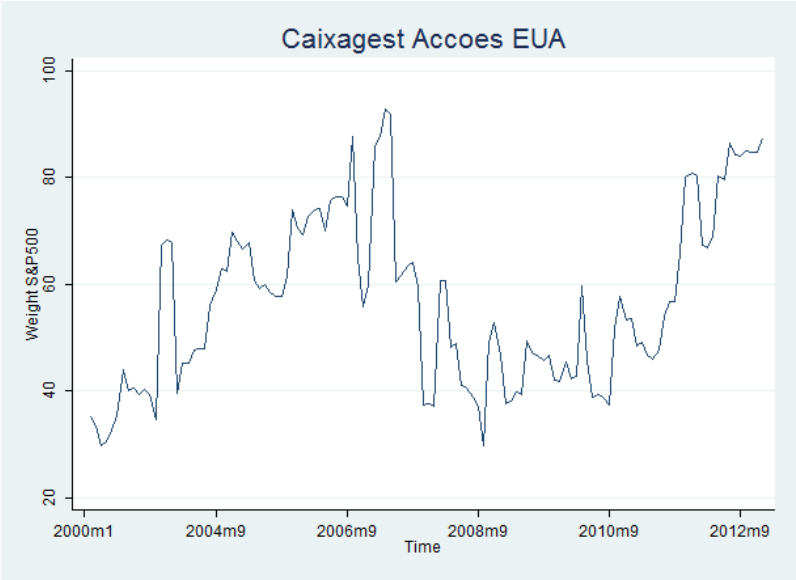
Annex 8.40 Equity Portugal – Santander PPA



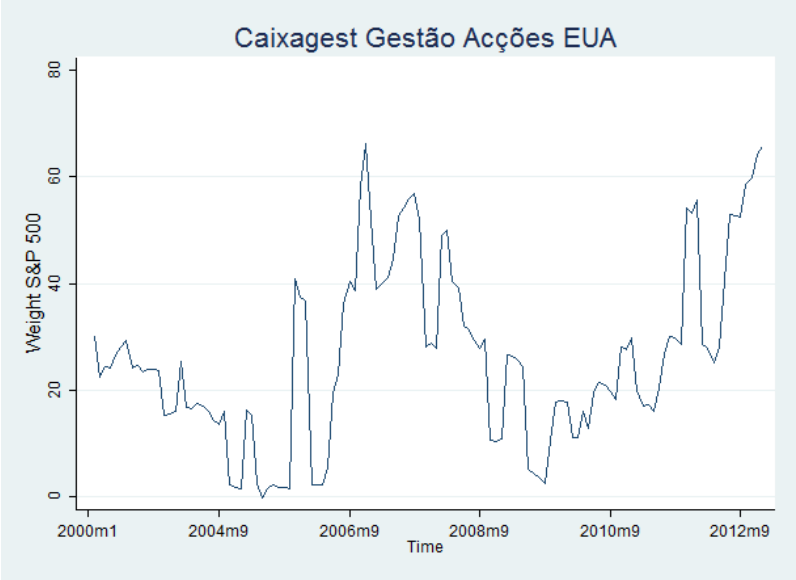
Annex 8.41 Equity US – BPI América D



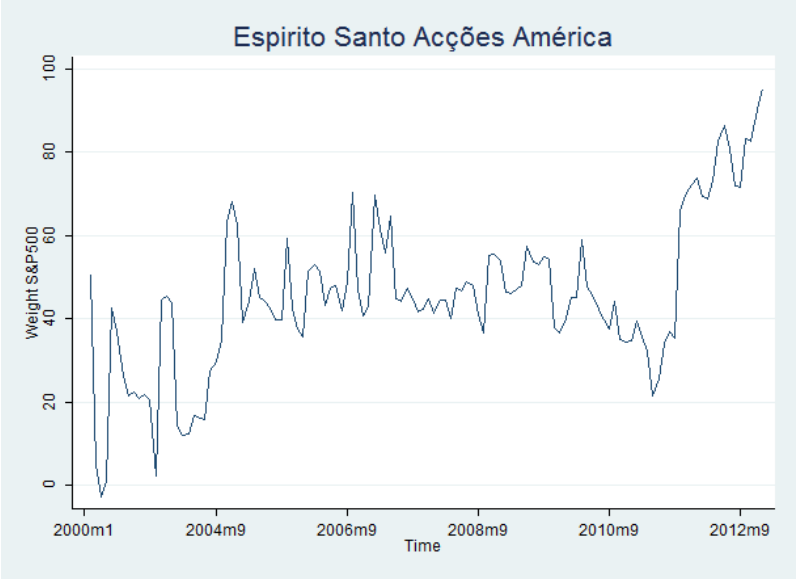
Annex 8.42 Equity US – Caixagest Acções EUA



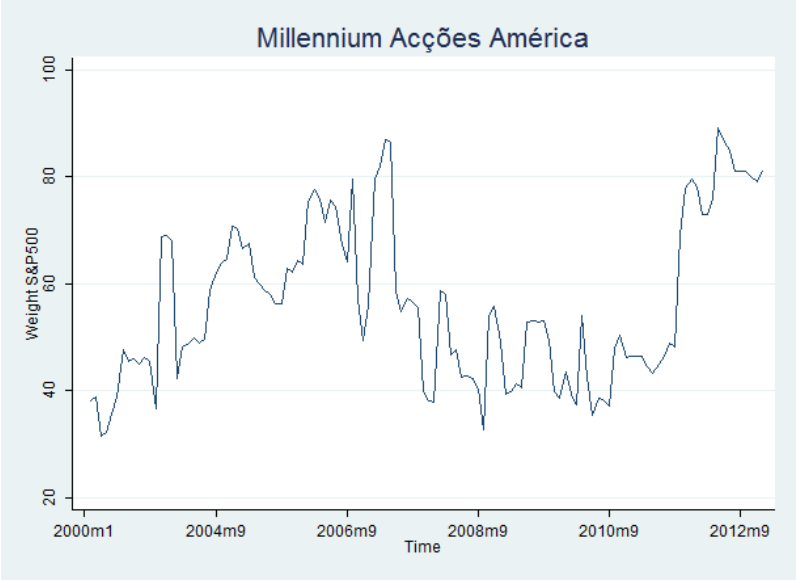
Annex 8.43 Equity US – Caixagest Gestão Acções EUA



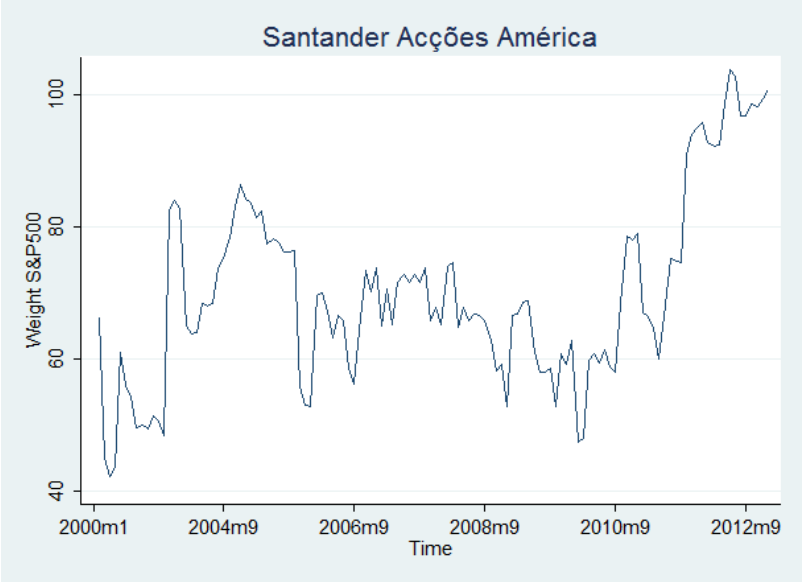
Annex 8.44 Equity US – Espirito Santo Acções América



Annex 8.45 Equity US – Millennium Acções América



Annex 8.46 Equity US – Millennium Acções América



Annex 8.47 Equity US – Santander Acções USA