Are SRRI risk classes informative about pension funds' risk–return characteristics?

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Executive Summary

In 2010, the Committee of European Securities Regulation (CESR) published the guidance on how to calculate the synthetic risk and reward indicator (SRRI) for Undertakings for Collective Investment in Transferable Securities (UCITS) to improve disclosure and presentation of risk information in relation to all UCITS. The SRRI methodology defines seven risk classes based on predefined values of annualised standard deviations of UCITS. In this paper, I discuss some of the issues related to the adoption of SRRI as the methodology for informing pension fund investors on their risk exposure and expected risk–return relationship.

Using a sample of 518 UK pension funds with group agreements over the period of January 1990 – June 2021, and 1,908 UK domiciled mutual funds that use the UK as the region of sale I show that

(i) the SRRI risk classes are roughly consistent with a separation of funds into investment groups such as equity, allocation, fixed income, property and money market, or a separation of according to their market beta (the MSCI World index is used as the proxy for the market portfolio).

(ii) the SRRI risk classification does not help investors assess the risk–return characteristics of funds that are allocated to SRRI risk class 5 and above (which is approximately two thirds of the funds in the sample).

(iii) the introduction of SRRI risk classes may encourage undue risk taking. For example, moving one risk class may not seem much of a change in risk to investors, however, moving from an investment within the SRRI risk class 4 to risk class 5 is equivalent to switching from investing in fixed income to equity, which are traditionally seen as having very different risk profiles.

(iv) preliminary evidence suggests that (i) to (iii) above are common to mutual funds and pension funds.

Keywords: pension funds, mutual funds, risk assessment, performance, regulation

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1. Introduction

There is an urgent need to develop a methodology that will support individuals in their financial decision making. This is particularly important given that a high proportion of pension provision now depends on DC pension schemes. Given that risk taking is an intrinsic element of any investment, it is important that investors have an appropriate understanding of the risks are associated with investments and what consequences they may have for the success of their investments. However, quantifying risk and linking it to potential investments outcomes is not straightforward and may create a significant barrier for many individuals. Von Rooij et al. (2011) report that only 48% of Dutch respondents correctly answered a question about which asset (savings accounts, bonds, or stocks) gives the highest return over a long–time horizon. Also, they report that less than half of the respondents was aware that diversified portfolios were typically less risky than individual stocks, and only about a quarter of respondents correctly answered a question about the relationship between bond prices and interest rates. Von Rooij et al. (2011) show that only 5% of respondents were able to answer all the advanced literacy questions correctly. Given that the Dutch are typically ranked highly in international comparisons of financial literacy,[2] the findings of von Rooij et al. (2011) are particularly relevant and indicate a need to help investors in their investment decisions.

The concept of risk aversion is fundamental in finance. Investors expect to be compensated for risks taken, i.e. it is expected that there is a positive relationship between risk exposure and expected returns. However, expectations about future returns are not always fulfilled and, of course, investors should not be expected to be compensated for all total risk taken. For instance, in the case of equity markets, it is well recognised that periods of high volatility (i.e. of high total risk) are associated with low, often negative, returns. Thus, while advising individuals on what risk exposure particular investments have and what level of risk might be optimal for them, it is also important to explain to investors the complexity of the risk–return relationship, notably differences across and within asset classes.

In 2010, the Committee of European Securities Regulation (CESR) published the guidance on how to calculate the synthetic risk and reward indicator (SRRI) for Undertakings for Collective Investment in Transferable Securities (UCITS) to improve disclosure and

[2] Klapper et al. (2014) documents that 66% of the Dutch population are financially literate, i.e. could correctly answer at least three out of five questions testing their basic understanding of such fundamental concepts of finance as reduction of risk through diversification, inflation, and compounded interest rates. The UK’s score was 67%, Germany’s 66%, Denmark’s and Sweden’s 71%, but France’s 52 and Italy’s 37%.

presentation of risk information in relation to all UCITS. The SRRI methodology defines seven risk classes based on predefined values of annualised standard deviations of UCITS. The lowest SRRI risk class (denoted as 1) has the narrowest spread of the standard deviation bounds defining it, the highest SRRI risk class (denoted as 7) has only a lower bound for the standard deviation defining it. These widening spreads of the bounds defining the SRRI risk classes aim to preserve the allocation of individual funds to particular SRRI risk classes over time.

The choice of the bounds defining individual SRRI risk classes is closely related to the volatility of common asset classes such as deposits, bonds and equity. As my analysis shows funds are typically associated with the SRRI risk class 5 and above. Fixed income funds tend to belong to the SRRI risk class 3 or 4. The SRRI score of money market funds do not exceed 2. Thus, while investors may struggle with understanding and quantifying risk levels of funds, the SRRI methodology provides a simple tool that assigns risk classes to funds. The advantage of the SRRI methodology is also that the assigned risk classes are relatively stable over time. Moreover, the SRRI methodology provides a simple tool to quantify risk levels of investments that are more 'exotic'. If investors struggle to compare risk of such fundamental investments as bank deposits, bonds and equity, one can expect that they find it even harder to quantify the risk of funds that invest in mixed asset classes or provide 'specialist' portfolios (e.g. invest in alternative assets, property, commodities, etc.). The SRRI methodology provides the range of risk classes that is wide enough to separate most common asset classes (i.e. deposits, bonds and equity) into different risk categories, provides a plausible risk classification of funds that invest in mixed asset classes or assets outside the main asset categories and, at the same time, the number of different risk classes used is small enough for investors to comprehend them.

Yet, while the SRRI methodology has many benefits, the important questions are whether it is suitable for pension funds and how helpful it is for less financially savvy investors. There are two problems with the adaptation of the SRRI methodology to pension funds. One is the time frame of SRRI assessments. Although, a period of five years (the base of the SRRI methodology) may be long enough to provide an informative assessment of mutual funds' characteristics and performance, five years are typically insufficient to provide information about the performance of pension fund investments. Long–term investment strategies may not be associated with short–term gains, hence assessing the performance of pension funds using methods used to assess the performance of mutual funds may deliver an unfair and biased picture of long–term returns earned by pension funds (e.g. Campbell and Viceira 2002). The second problem is somewhat related to the time frame used in the SRRI risk classification.

While the SRRI methodology is designed to provide a stable risk classification of funds, it does not help, and even clouds, the assessment of a risk–return relationship. This is particularly prevalent in the upper end of the SRRI risk classes. Finally, the creation of risk classes that mask the true risk of underlying assets may create more damage than help if investors are not fully aware of the true risk characteristics of the SRRI bounds and their association with the probability of losing money. Moving one risk class has material consequences for the probability of losing money. An investment with normally distributed returns that delivers 10% return will have 5.5% probability of losing money (i.e. earning negative returns) if its standard deviation is 5% (i.e. it is at the lower bound of SRRI risk class 4, equivalent to a bond investment). A similar investment that delivers 10% return but has the standard deviation of 10% (i.e. is at the lower bound of SRRI risk class 5, equivalent to a lower risk equity investment) has the probability of losing money of 21%. Thus, although moving only one SRRI risk class within its middle range of risk classes seems like opting for a slightly riskier investment, it increases the probability of earning a negative return fourfold.

In the rest of the paper, I discuss these issues using the UK pension funds that offer group agreements and UK domiciled mutual funds that have the UK as the region of sales. I use data covering the period of January 1990–June 2021. The data was collected from the Morningstar Direct database.

2. Methodology

2.1. Basic definitions

Given that the assessment of the SRRI approach is the focus of this analysis, the methodology closely follows the recommendations of CESR (2010). The CESR (2010) recommendation is to use a five–year period as the base of the assessment. They recommend using weekly data and, if these are not available, using monthly statistics. Given that Morningstar Direct provides monthly returns for funds, these will be used in the calculations. Therefore, an average return of a fund at any given time t, $\bar{r}_{\mathrm{t}}$, is defined as the arithmetic average of the monthly returns, r_k, where k changes between t-59 and t:

$$\bar{r}_{\mathrm{t}} = \sum_{k=t-59}^{t} \frac{\mathrm{r}_k}{60}.$$

The average returns, $\bar{r}_{\mathrm{t}}$, are monthly, thus they are annualised using the following formula:

$$R_t = 100\left(\left(1 + {}^{\bar{r}_t}/_{100}\right)^{12} - 1\right). \quad (1)$$

The corresponding standard deviation, σ_t, calculated at any point in time t is

$$\sigma_t = \sqrt{\frac{1}{59}\sum_{k=t-59}^{t}(r_k - \bar{r}_t)^2},$$

and its annualised value, STD_t, is defined as

$$STD_t = \sqrt{12} \times \sigma_t.$$[3]

The synthetic risk and reward indicator, SRRI, categorises the annualised standard deviations into seven groups:

$$SRRI_t = \begin{cases} 1 \text{ if } 0 \leq STD_t < 0.5 \\ 2 \; if \; 0.5 \leq STD_t < 2 \\ 3 \; if \; 2 \leq STD_t < 5 \\ 4 \; if \; 5 \leq STD_t < 10 \\ 5 \; if 10 \leq STD_t < 15 \\ 6 \; if \; 15 \leq STD_t < 25 \\ 7 \; if \; 25 \leq STD_t \end{cases}$$

The choice of the defining bounds of the seven risk classes is the result of consultation with "external stakeholders, the outcome of several empirical studies by regulators, industry representatives and other external contributors and independent experts" (CESR, 2010). To further smooth the allocation of risk classes to funds, short term changes (up to four months) in the assigned SSRIs are adjusted to the values prior to a change.[4]

In this way, for every fund, a time series of annualised returns $\{R_t\}$ annualised standard deviations, $\{STD_t\}$, and of the $\{SRRI_t\}$ scores based on the $\{STD_t\}$ are obtained. To simplify the notation, these time series are denoted as R, STD, and SRRI, respectively.

The SRRI framework has been created for Undertakings for Collective Investment in Transferable Securities (UCITS). This means that while it may be suitable for such investment vehicles as mutual funds, it should be treated with caution in the case of pension funds, and particularly UK pension funds under group agreements.

Given that mutual fund investors are free to choose from a wide range of funds and providers and move their investments at relatively low cost, using arithmetic returns to assess

[3] This formula is adopted following CESR (2010). However, multiplying standard deviations obtained from monthly observations by $\sqrt{12}$ to annualise them is mathematically incorrect and creates a bias.
[4] More details are in Box 3 in CESR (2010).

fund performance has some merits. First, it assumes that there are no reinvestments, that the basic period for which returns are calculated (a month in our case) is the period over which investors would hold their portfolios. The five–year period of averaging is chosen as it is assumed that five years of data (or 60 monthly observations) are sufficient to provide a reliable drawing from the distribution of returns, i.e. to be long enough to capture various states of the market rather than to be biased by prolonged bull or bear markets. Second, using arithmetic returns (which are an empirical proxy for the first moment of a distribution of returns) is consistent with numerous theoretical constructs used in Finance (including the Capital Asset Pricing Model) used to price assets. However, using the average returns is not suitable when one wishes to assess the long–term performance of an investment, especially when the investment is subject to reinvestments.

Pension investments fall in this category. Pension investments are made for more than a month, and even if pension portfolios' performance is evaluated on a monthly basis, money generated in one month is carried over and invested in its entirety over the next month. Thus, rather than using average returns calculated over the period of assessment, cumulative returns should be calculated. This is because average returns tend to overestimate returns generated by risky investments.

2.2. Average versus cumulative returns

To illustrate how the assumption that no reinvestment takes place, i.e. using average arithmetic returns, overestimates the performance of multiperiod investments consider the following example. Let us assume that we have invested for two periods with no withdrawals after period 1, and that the investment generates 100% return in period 1 and -50% return in period 2. That is, if our initial investment was £1, at the end of period 1 we would have £2. This amount would drop to £1 at the end of period 2 as the result of the 50% loss. Thus, after the two periods we would have the same amount of money (£1) as before we made the initial investment at the start of period 1. In other words, our return on the investment is 0%. However, the average return of one period investments is (100% - 50%)/2 = 25%. The difference between the average return (25%) and the true return (0%) is simply a consequence of the fact that when we invest at the start of period 1 and hold the investment for two periods, we reinvest the money that the investment is worth at the start of period two. In the second scenario, we treat one period investments as separate events. That is, we treat the investment as if we had a choice to invest in period one or in period two, each time for one period only. Such investment, given different states of the market would generate 25% average return, whereas investing across the different states of the market delivers the return of 0%.

If investors assess the value of their pension pots based on average (arithmetic) returns, their understanding of how much money they have in the pot and, consequently, how much money they may have at retirement may be highly inaccurate. Moreover, the scale of their miscalculations increases with the risk of investments. That is, the return made on equity investments will tend to the more overestimated than the returns made on gilts. This is because the difference between returns calculated under the assumption of reinvestment and without reinvestment increases with the risk of the investment. Therefore, equity, on account of being riskier than gilts will generate greater error.

If we assume that a five–year period is the basis of assessment (I discuss the appropriateness of this assumption later), it seems more appropriate that the performance of funds at any point in time t is measured using the geometric average return, gr_t, calculated over the five–year period of monthly observations:

$$gr_t = \left(\sqrt{\prod_{k=t-59}^{t}\left(1+\frac{r_k}{100}\right)}-1\right).$$

These monthly averages are annualised using formula (1) defined in Section 2.1. The annualised geometric returns are denoted GR_t.

2.3. Nominal versus real returns

While adjusting for inflation may not be an important aspect of assessing the performance of monthly investments, it should not be overlooked in the case of assessing the performance of long–term investments. Given that the CPI index has become the standard inflationary adjustment in the pension industry, the monthly CPI–adjusted return is defined as:

$$r_{rk} = 100\left(\frac{1+{r_k}/_{100}}{1+{CPI_k}/_{100}}-1\right).$$

This CPI–adjustment can be applied to r_t and gr_t to find their CPI–adjusted values before these are annualised.

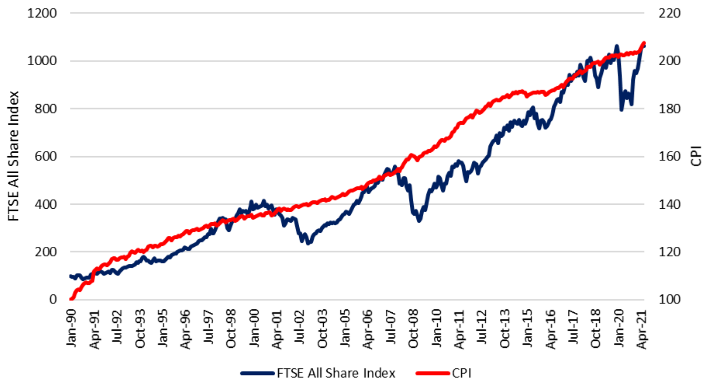
2.4. SRRI of CPI–adjusted returns

The SRRI methodology has been developed to "achieve an adequate degree of stability in the risk classification process with respect to normal trends and fluctuations of financial markets" (CESR 2010). In addition, the bounds have been chosen to "ensure an appropriate spread of UCITS across different risk classes" (CESR 2010). In other words, the assigned SRRI scores should be closely related to the types of asset classes of the underlying investments and remain as such regardless of whether markets are at the growing or declining phase. The open question remains as to whether and how adjusting for inflation affects the SRRI risk class allocation.

Adjusting for inflation reduces positive returns and increases negative returns. This means that the adjusting for inflation will shift the distributions of returns to the left. If the rate of inflation is constant over time and small in comparison with the rates of returns generated by the investment under assessment, adjusting for inflation will not have any impact on the standard deviation of the time series of returns. This is because when an inflation rate is small, the inflationary adjustment is similar to simply subtracting the inflation rate from the return on the investment. Therefore, under the assumption that the inflation is constant over time, the inflationary adjustment results in the creation of a time series that has the same standard deviation as the time series of the nominal returns. However, when a rate of inflation is not negligible and changes with market conditions, then the time series of nominal and of the CPI–adjusted returns may have different standard deviations. If adjusting for inflation reduces positive returns by less than it magnifies negative returns (i.e. the inflationary pressure increases during market downturns), then the standard deviation of the CPI–adjusted returns will be greater than the standard deviation of the nominal returns. Whether the increase in the standard deviation of CPI–adjusted returns is large enough to change the SRRI score of an asset will also depend on how close to the bound defining the asset's SRRI score the assets' SRRI score was in the first place. In other words, the effect of the CPI–adjustment depends on the appropriateness of the specification of the SRRI bounds.

Figure 1 shows monthly values of the FTSE All Share index (left–hand axis) and of the CPI (right –hand axis) for January 1990–June 2021. Both time series are normalised to 100 on January 1990. Figure 1 shows that the CPI has periods of higher and lower growth that do not necessarily follow periods of stock market expansion and contraction. For instance, the decline in the FTSE All Share index following the burst of the dotcom bubble was not associated with a change in the long–term inflationary tend. However, the decline of the stock market during the Global Financial Crisis (GFC) was associated with an increase in inflation and was the start a longer trend of higher inflation. Thus, the CPI adjustment may magnify the volatility of the market during the GFC. Yet, these changes seem relatively small and whether they can lead to changes in SRRI risk class allocation depends on how close the scores of assets were to the SRRI bounds before the GFC.

Figure 1. Monthly values of the FTSE All Share Index and the CPI, January 1990 = 100.



2.5. Market risk (beta)

While a standard deviation provides information about the total volatility of fund returns, the Capital Asset Pricing Model (CAPM) states that investors can only claim compensation for non-diversifiable risk, also referred to as the market risk or beta, that is calculated as the ratio of the covariance between returns on a fund and the market portfolio to the variance of the market portfolio’s returns. The accuracy of the calculations of a fund’s beta depends heavily on the accuracy of the choice of the market index that proxies for the CAPM market portfolio.

In the case of equity investments, it is commonly accepted that popular stock market indexes (such as FTSE All Share index for the UK, S&P 500 index for the USA, etc.) proxy for the market portfolio even if it is recognised that the construction of these indexes is inconsistent with the CAPM assumptions, and therefore the resulting betas are likely to be underestimated. However, when it comes to finding the betas of investments consisting of, or including, non-equity asset classes, further problems emerge due to the lack of commonly approved risk factors that could be easily combined with or used as a replacement of equity indexes.

Yet, given that returns on fixed income assets are positively correlated with equity indexes, especially in the case of developed markets, equity indexes are occasionally used as a proxy for market indexes for fixed income investments, too.

In the case of pension funds, the classification of funds into investment sectors is based on criteria set by the Association of British Investors (ABI). These criteria are quite flexible in the sense that funds are not restricted to invest entirely in asset classes of their classification. For instance, a fund is classified as a global equities fund if it invests "at least 80% of their assets in equities" (ABI 2017). This means that even if formally a fund is classified as specialising in equity investments its asset allocation may not be solely in equity and may be quite similar to a fund classified as flexible investments that, according to the definition adopted by ABI, has no restrictions on equity, fixed income and cash investments. Moreover, there are investment groups (such as property funds, money market funds), which asset allocation is not monitored, therefore, asset classes these funds invest in may be broader than specified by their investment objectives.

Given that the purpose of this research is to assess the informativeness of the SRRI approach, the accuracy of the beta estimates is not as important as the relativity of the betas. That is, I am more concerned with assessing whether the SRRI risk class allocation of funds is consistent with the groupings by the funds' betas rather than with assessing whether the estimates of individual betas are most accurate. For that reason, the pound sterling denominated MSCI World index is chosen as the proxy for the market portfolio. This index covers a wide range of equities worldwide.

3. Sample

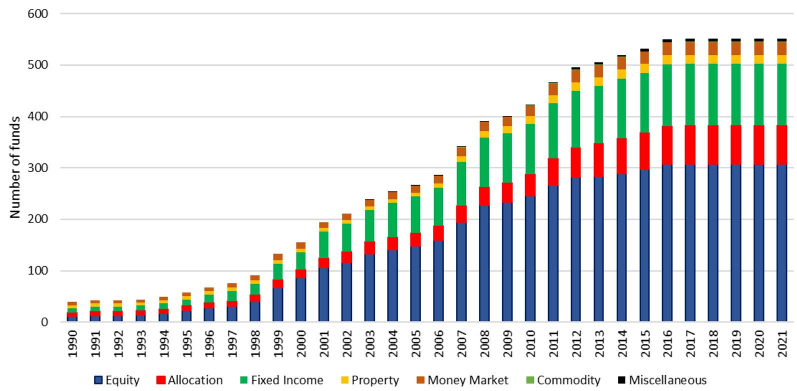
According to Morningstar Direct there are 571 UK pension funds with group agreements (only the primary asset classes are counted) in the period January 1990–June 2021. Out of these, 518 funds have monthly time series of returns for at least five years and 408 have specified investment group classification. Investment group classification of a further 101 funds was established through the search of the descriptions of investment objectives, asset allocation statistics and Primary Prospectus Benchmarks provided by Morningstar Direct. Thus, the sample used in this study comprises of 296 equity funds, 119 fixed income funds, 65 allocation funds, 18 property funds, 11 money market funds, 4 miscellaneous funds and 1 commodity fund.

The three most numerous investment groups (equity, fixed income funds and allocation funds) account for 93.4% of the funds with the identified investment group classification. Adding the next two most numerous groups, that is property funds and money market funds, increases the coverage to 99.0% of the funds with the identified investment group classifications.

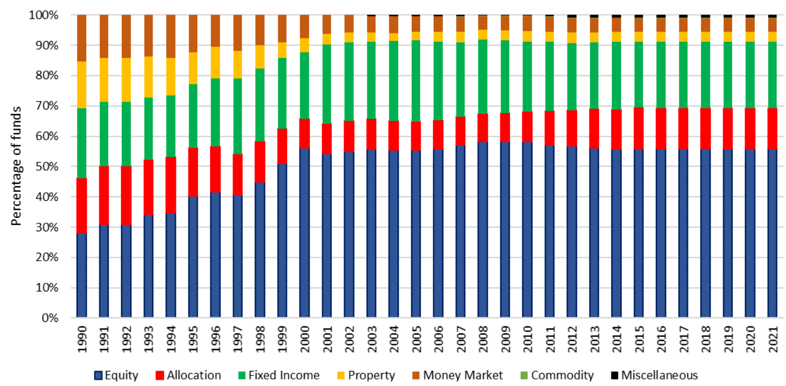
Figure 2 Panel A shows the number of funds in each investment group in our sample that operated in January of each calendar year. It shows that the number of funds increased steadily between 1990 and 2016. Given that I request that funds have at least five years of data to keep the analysis consistent with the CESR's (2010) specifications, no new funds are included in the sample from 2016 onwards. Figure 2 Panel B shows the fraction (of all funds) that the individual investment groups accounted for. At the start of the sample equity funds accounted for about 30% of all the funds. This proportion increased to about 55% by 2000 and has remained at this level ever since. The proportion of fixed income funds remained roughly similar over time varying between 20% and 26%.

Figure 2. Growth of the pension funds over time: number of funds in individual investment groups (Panel A) and the proportion of each investment group in the population of all funds (Panel B). Statistics correspond to January of each calendar year.

Panel A



Panel B



Monthly returns were collected for each fund over the period January 1990–June 2021. These returns were used to calculate the time series of annualised averages, standard deviations and SRRI scores as defined in Section 2. The CPI adjustment was performed using the monthly returns on the CPI index as provided by the Morningstar Direct.

4. Do SRRI scores provide an informative base?

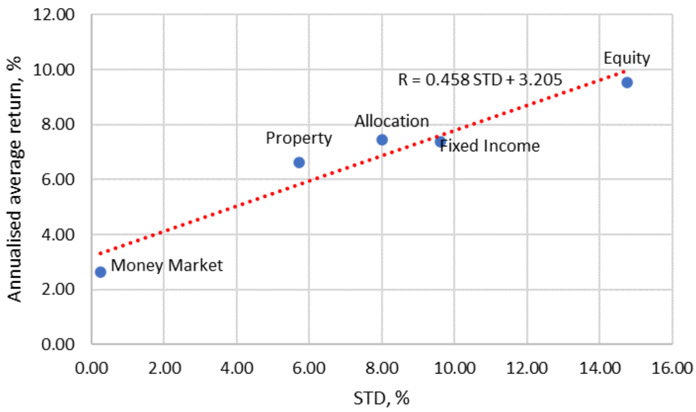
The idea that expected returns are an increasing function of expected risk exposure is fundamental in finance. However, the correctness of this assumptions is measured based on realised returns, that is, based on returns and risk exposure that an investor has already experienced. Therefore, the existence and strength of the risk–return relationship may be affected by the choice of period of assessment. If a period of analysis is dominated by bull markets, the positive risk–return relationship may appear strong. If, on the other hand, a period of analysis is dominated by bear markets, the positive risk–return relationship may be much weaker or even may appear to be nonexistence or negative. Therefore, to get robust results it is paramount to consider periods long enough to cover various states of the market.

Our sample covers over thirty years of data but, as Figure 2 shows, the numbers of funds increased over time giving more weight to the GFC and the post–GFC observations than to the before the GFC observations. Yet, the last 15 years or so have been years during which the markets have experienced periods of sharp decline as well as of recovery, hence the results should provide a fair representation of five–year investment periods.

We start from averaging returns and standard deviations across all funds and all time points. Figure 3 plots the annualised average returns (R) calculated across all the funds in a given investment group and across all the time observations against the corresponding averages of the standard deviations (STD). Figure 3 shows that, on average, there exists a positive relationship between risk and return across investment groups. That is, equity funds having the highest average STD of 14.76%, earn the highest annualised average return of 9.53%. The money market funds with the STD of 0.25% earn the annualised average return of 2.65%. The pension funds of the other investment groups are situated somewhere between the equity and the money market funds along the trend line R = 0.458 STD + 3.205.

Even though there seems to be a positive risk–return relationship, it is important to note that the slope of the trend line (0.458) is relatively low meaning that although STD of the equity funds is nearly 60 times higher than the STD of the money market funds, the annualised average return of the equity funds is just over three-and-half times higher than the annualised average return of the money market funds.

Figure 3. Relationship between annualised average returns, R, and annualised standard deviations for the equity, allocation, fixed income, property and money market funds.



The SRRI as a synthetic risk indicator is designed to help investors assess risk. Figure 4 is equivalent to Figure 3 except that SRRI, and not the STD, is on the horizontal axis. Obviously, as the SRRI is an upward stepping function of the STD, the positive association between risk and return is preserved. However, as a unit increase in the SRRI is associated with increasingly wider bounds of the STD, funds that have high STD are 'squeezed' closer towards funds with low STD. This is illustrated by Figure 4 which shows that moving from the least risky investment group (money market funds) that on average (across years and funds) has an SRRI of 1.17 to the riskiest investment group (equity funds) that has an average (across years and funds) SRRI of 5.36 increases the average return from 2.65% to 9.53%.

Figure 4 also shows that if one fits a trend line using the SRRI and R of the investment groups, the slope of it is 1.602, meaning that increasing one SRRI unit corresponds to 1.6% increase in an average annual return. There are several issues with this interpretation of the risk–return relationship and I discussed them in turn.

First, as discussed in Section 2, pension fund investors do not have the flexibility of investing for one month only, and therefore, using average monthly returns to assess long–term fund performance may lead to an overestimation of the risk–return relationship. Second, the long–term nature of pension investments implies one needs to account for the depreciation of the value of money. Thus, using the geometric CPI–adjusted returns rather than average returns is more appropriate.

Figure 4. Relationship between annualised average returns, R, and SRRI risk classes for the equity, allocation, fixed income, property and money market funds.

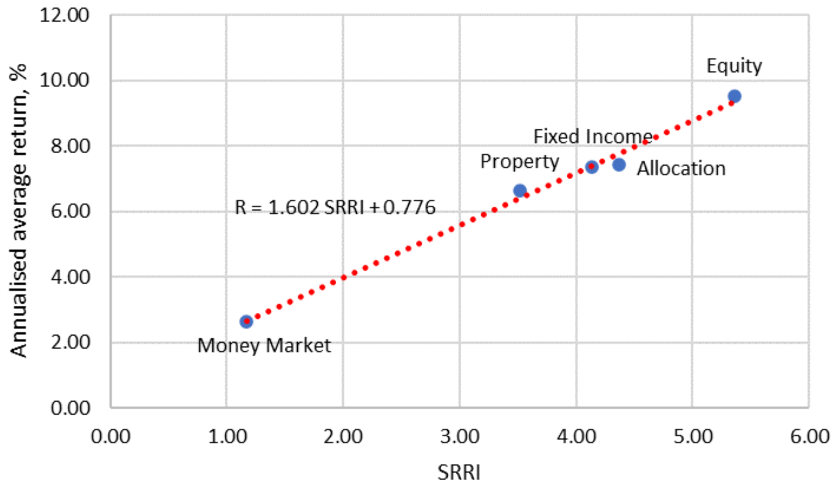
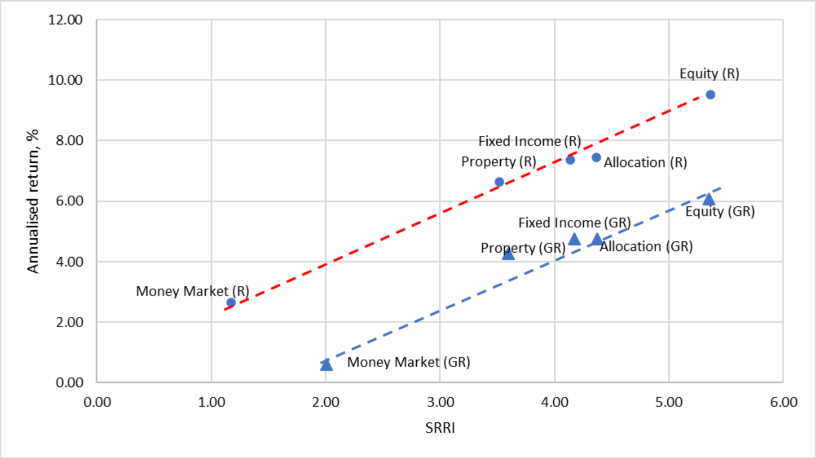


Figure 5 illustrates how using the average returns and the geometric CPI–adjusted returns affects the results. Figure 5 is analogous to Figure 4, that is, the average SRRIs of the funds are on the horizontal axis and the returns are on the vertical axis but in addition to the statistics obtained for the annualised average returns it adds the statistics obtained for the annualised CPI–adjusted geometric returns. Thus, the blue dots and the red trend line are identical to the ones presented in Figure 4 and correspond to the statistics of the annualised average returns. The blue triangles and their trend line (in blue) correspond the statistics of the annualised CPI–adjusted geometric returns.

Figure 5 shows that while adjusting the returns for CPI and calculating geometric and arithmetic returns had very small impact on the average SRRI of the investment groups, it has lowered the returns by about 3% p.a. The slope of the trend line changes from 1.602 to 1.630. Given these differences the rest of the analysis focuses on the annualised CPI–adjusted geometric returns.

Figure 5. Relationship between annualised average returns, R, annualised CPI–adjusted geometric returns, GR, and SRRI risk classes for the equity, allocation, fixed income, property and money market funds.



Although Figures 4 and 5 seem to indicate that there is a clear separation between investment groups regarding risk–return characteristics and that there is a positive relationship between risk and return, Figure 6 shows that the story is not that straightforward. Figure 6 shows time–paths of SRRIs (Panel A) and of the geometric CPI–adjusted returns (Panel B) for the five investment groups.

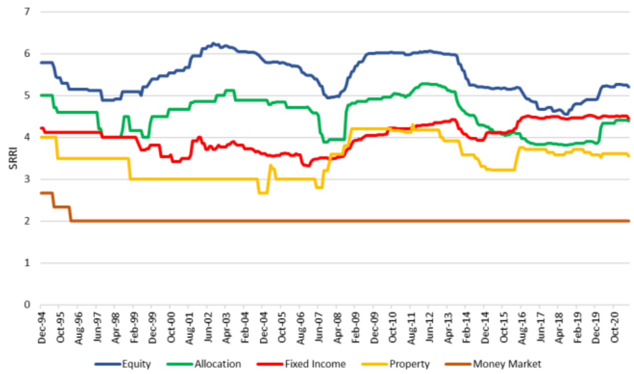
Figure 6 Panel A shows that although, in general, the investment groups sit quite comfortably in particular spreads of the SRRI levels, there are periods in which (historically) less risky investment groups become as risky as (historically) more risky investment groups. For instance, the equity funds tend to have their average SRRIs between 5 and 6 most of the time. The average SRRIs of the fixed income funds oscillate around 4. Yet, in the period 2016-2018, the SRRIs of the equity funds are quite comparable with those of the fixed income funds. Moreover, the average SRRI of the allocation funds that since the late 1990s remained above the average SRRIs of the fixed income funds, became lower than the average SRRIs of the fixed income funds since 2015.

These changes in the SRRI values across time suggest that the SRRI bounds may not be as informative about the long–term risk profile of individual investment groups as would be desired. The introduction of the SRRI risk classes aimed to "provide investors with at meaningful indication of the overall risk and reward profile" (CESR, 2010) of their investments. The fact that funds are prone to moving across SRRI risk classes complicates the comparison of the risk and reward profiles within and across SRRI risk classes as it signals that the need to adjust returns earned for risk (i.e. calculate risk–adjusted returns) within investment groups is not eradicated by the introduction of the SRRI risk classes.

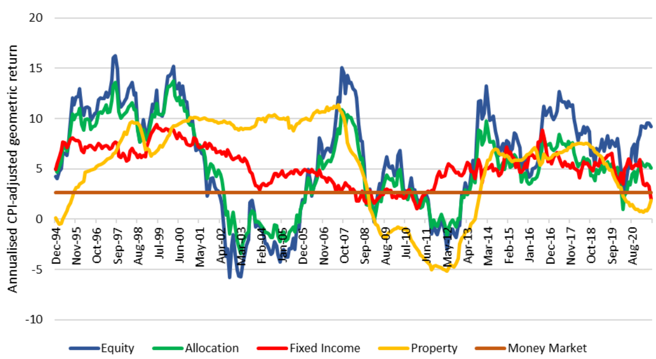
Figure 6 Panel B shows that different investment groups have even less stability across time when it comes to the size of realised returns than they have in their SRRI risk classes. As expected, periods of high volatility (and hence higher SRRIs) are associated with low returns and periods of low volatility (and hence lower SRRIs) are associated with high returns in the case of the equity funds and allocation funds. The returns earned by the fixed income funds are less volatile than returns earned by the equity funds, yet the recent rise in the SRRI scores of the fixed income funds in relation to the allocation funds does not seem to be reflected in their returns.

Figure 6. Time paths of the average SRRI scores (Panel A) and of the annualised CPI–adjusted geometric returns (Panel B) for different investment groups.

Panel A



Panel B



The poor association of SRRI risk classes with realised returns is particularly visible for the property and the money market funds. The SRRIs of the property funds tend to be far below the SRRIs of the fixed income funds and of the allocation funds indicating relatively low investment risk. However, the time–path of the corresponding returns shows that the property funds outperformed the other investments groups by a considerable amount until the start of the GFC (delivering on average up to 10% per annum), underperformed in 2009-2013 (five-year CPI–adjusted geometric returns dropped as low as -5%), and delivered comparable returns to the allocation and fixed income funds in the last few years. Finally, the money market funds, with the historically lowest SRRIs, performed quite well up to the GFC. However, the low interest rates of the last decade pushed the returns of the money market funds into negative figures.

These differences between the volatility of SRRIs and realised returns are related to how the SRRI risk classes are defined. The spread of the SRRI bounds increases with the volatility, that is, while the spread of bound 1 is 0.5%, the spread of bound 6 is 10%. Bound 7 has no upper limit at all. This allows asset classes to be associated with relatively stable bounds regardless of the market conditions yet it does not capture the relationship between volatility and returns within these bounds. Therefore, while it may be easier to present asset classes as asset classes of particular SRRI risk classes (e.g. money market funds with SRRI of 1, equity funds are funds with SRR between 5-6, etc.), it becomes important to explain to investors the differences in risk within these SRRI levels and their association with returns. The next section discusses this issue.

5. Risk–return relationship within SRRI bounds.

The discussion of Section 4 is based on returns and SRRI as average characteristics of each investment group. In this section I discus investment groups in more detail, as there are considerable differences not just across them but also within them.

Given that there is little variability in SRRI risk classes within each investment group, I reverse to using STD to measure risk of funds. Also, to focus our attention and to take advantage of the structure of the sample, I focus on the two most numerous investment groups, the equity and the fixed income funds. Discussing these two groups also has the advantage that these investment groups belong to different SRRI risk classes with the equity funds having wider bounds of volatility within their SRRI risk classes and wider spreads in returns than the fixed income funds.

We start with the graphical illustration of the risk–return relationship for all the funds in the sample. Figure 7 plots annualised CPI–adjusted geometric returns for all the funds against their corresponding STDs. It shows that there is no risk–return relationship, that is the slope of the trend line is practically zero.

Figure 7. The relationship between the annualised CPI–adjusted geometric returns, GR (vertical axis) and the annualised standard deviations, STD (horizontal axis).

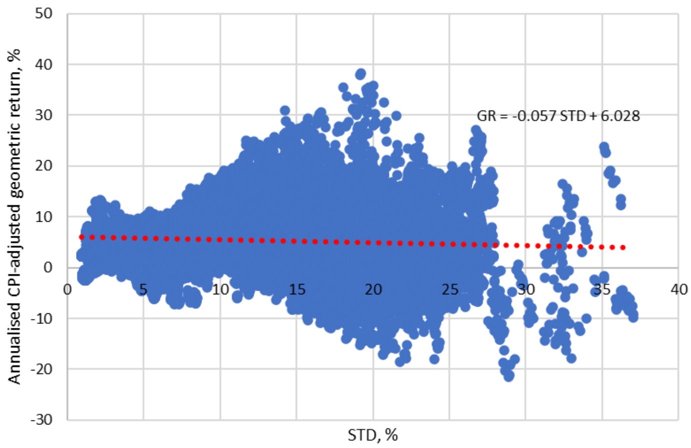


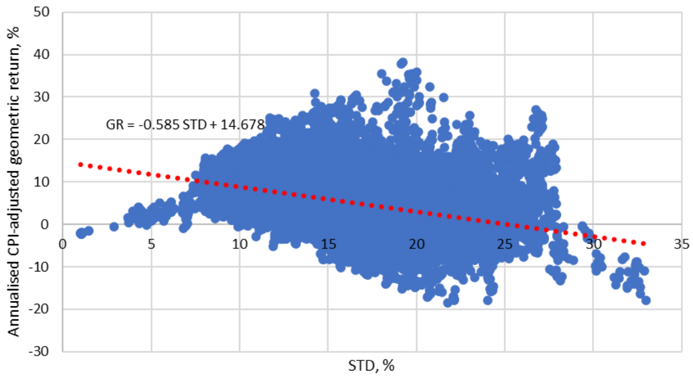
Figure 8 is analogous to Figure 7 but shows the plot for the equity funds (Panel A) and for the fixed income funds (Panel B) separately. It shows that while there is a relatively strong positive relationship for the fixed income funds, the risk–return relationship is negative for the equity funds.

To better understand the risk–return relationship of the equity and of the fixed income funds I regress the annualised CPI–adjusted geometric returns on their corresponding standard deviations. Each regression, because strong time and fund fixed effects are likely, also has year and fund dummies. Moreover, given that the time series of returns and of standard deviations are obtained from five–year moving windows with one–month step, it is important to control for lack of time independence within each fund's time series. To deal with this issue clustering per fund is applied. The coefficients of interest, i.e. the coefficient obtained for STD, their standard errors and p-values are reported in Table 1. Table 1 also reports the R-squared adjusted, number of funds (clusters) and number of data points for each regression. This format is used in all the tables presenting regression results.

First, the estimate of the risk–return covariate is obtained when all the funds are used in the regression. The coefficient (-0.467) is highly statistically significantly negative, delivering even stronger evidence against the existence of the positive risk–return relationship than Figure 7. Second, the separation into the equity and the fixed income funds confirms the general picture shown in Figure 8. That is, the regressions confirm that the risk–return relationship is negative for the equity funds and positive for the fixed income funds.

Figure 8. The relationship between the annualised CPI–adjusted geometric returns, GR (vertical axis) and STD (horizontal axis) for the equity funds (Panel A) and the fixed income funds (Panel B).

Panel A



Panel B

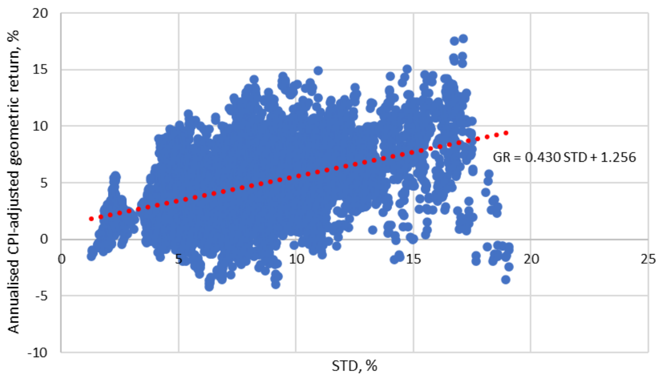


Table 1. Slope coefficients obtained from regressing funds' annualised CPI–adjusted geometric returns on betas.

	Coefficient	p-value	R-sq adj	Funds	Obs
All funds	-0.467***	(0.000)	0.514	515	72,415
Equity funds	-0.399***	(0.000)	0.579	295	41,016
Fixed income funds	0.612***	(0.000)	0.648	118	18,435

6. Is five years not long enough?

The idea behind the introduction of the SRRI risk classes is to provide investors with a meaningful indication of funds' total risk. However, it seems that, as much as a simplification of risk measurement is needed for investors with low financial skills, oversimplification causes problems. Assigning funds to particular SRRI risk classes may make it easier for investors to separate high–risk from low–risk investments, however, the very nature of high–risk investments tend to get lost. That is, SRRI risk classes hide from investors the magnitude of volatility and its association with volatility of returns. An investor may observe that a fund's SRRI risk class moved from 5 to 6 and does not perceive it as a big change, but in fact the total risk (STD) of the fund might have more than doubled by moving from 10% (the lower end of SRRI risk class 5) to nearly 25% (the upper bound of SRRI risk class 6). This change is likely to be associated with significant changes in returns delivered by the fund.

Thus, a natural question arises of whether a five–year period on which the SRRI methodology is based is, in fact, too short to deliver a meaningful approximation of the long–term performance that is needed in the case of pension funds? To address this question, Figure 9 shows the time–paths of the average SRRIs (Panel A) and of the average annualised CPI–adjusted geometric returns (Panel B) for the five investment groups discussed in Sections 4 and 5 but the averaging is performed over ten–year windows rather than five–year windows that the CESR (2010) advocates.

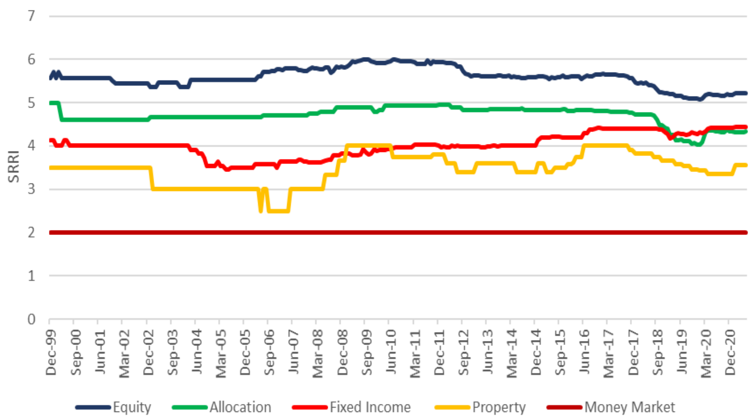
Figure 9 confirms that using a ten–year window as the base of averaging levels up the time paths of both the SRRIs and of the returns, yet it also shows that the ten–year window is still insufficient to smooth the high volatility and its effects for the riskiest investment groups. While the average SRRI of the equity funds remains around 5.5 for most of the period, the returns vary between 12% and 0%.

Even the money market funds, with an average SRRI equal to 2 over the whole period of the analysis, have returns varying between 4.7% and -1.3%. The statistics for this investment group alone question the existence of a positive risk–return relationship between the SRRIs and returns.

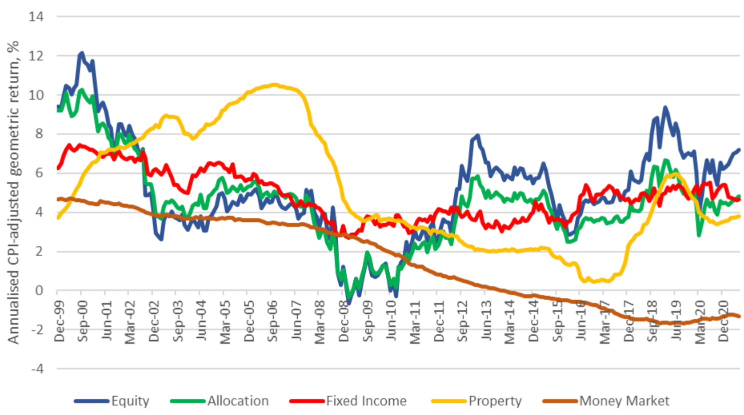
One could argue that even a ten–year window of assessment is insufficient in the case of the pension funds. This is true given that an average investor is encouraged to start saving for retirement as soon as they enter labour market and keep doing so till they retireme. Thus, we are talking about 40 years of saving and investing. However, there are very few funds that have at least 40 years of performance history. Moreover, assessing the performance of funds based on the historical data of the underlying asset classes for a given fund may be highly inaccurate given that asset managers change asset exposure, and markets as such change beyond recognition. Whether we like it or not, shorter periods of funds' assessment need to be used. Therefore, while five years seem short, they are still long enough to observe the direction of change and consider any changes to an investment strategy. If money market funds deliver negative returns for ten consecutive years, it should be made clear to investors.

Figure 9. Time paths of the average SRRI scores (Panel A) and of the annualised average returns (Panel B).

Panel A



Panel B



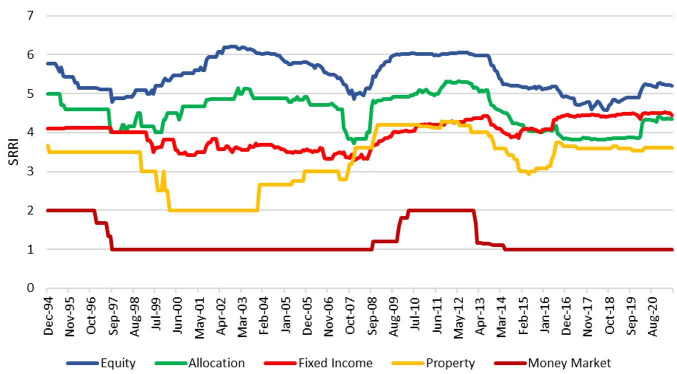
7. Do geometric means cause the absence of a positive risk return relationship?

I have discussed the importance of using CPI–adjusted geometric returns to assess pension fund performance. However, the SRRI methodology is not designed for the assessment of long–term performance. Is the lack of evidence of the positive risk–return relationship the consequence of using the CPI adjustment and assuming reinvestment of funds?

Figure 5 directly compares the (arithmetic) average returns against the CPI–adjusted geometric returns. It shows that using the CPI–adjusted geometric returns lowers the trend line. Yet, given the level of aggregation, it is impossible to say whether the greatest impact of CPI–adjustment is in periods of high or low volatility. Figure 10 is analogous to Figure 6 save for the fact that it plots the statistics based on (arithmetic) average returns. It shows that the impact of using CPI–adjustment and geometric means is practically negligible when it comes to the shape of the time–paths. Figure 6 Panel A and Figure 10 Panel A are very similar. There also is great similarity in the shapes of time–paths of returns except that Figure 10 Panel B looks like Figure 6 Panel B moved down by about 3%.

Figure 10. Time paths of the average SRRI scores (Panel A) and of the annualised average returns (Panel B).

Panel A



Panel B

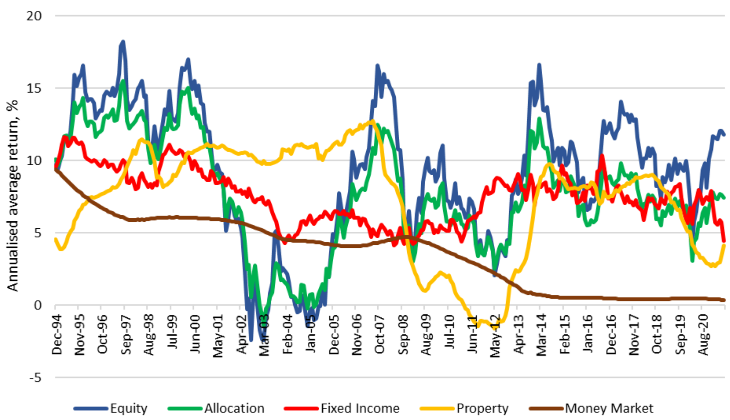


Table 2 is analogous to Table 1 except that this time the average returns are used as the dependent variable. Table 2 confirm that after controlling for the time and the fund fixed effects and clustering per fund, there is no evidence of a positive relationship between average returns and standard deviations (the slope coefficient is -0.325 and statistically significant at 1%). Moreover, despite using the arithmetic returns, there is no evidence of the positive risk–return relationship for the equity funds.

Table 2. Slope coefficients obtained from regressing annualised average returns on standard deviations of returns of funds.

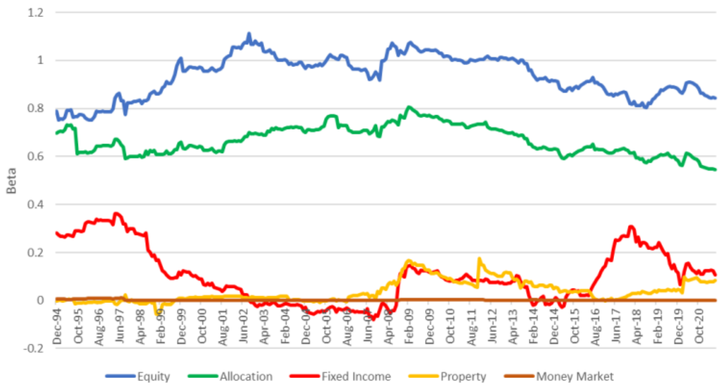
	Coefficient	p-value	R-sq adj	Funds	Obs
All funds	-0.325***	(0.000)	0.489	515	72,415
Equity funds	-0.214**	(0.030)	0.526	295	41,016
Fixed income funds	0.702***	(0.000)	0.662	118	18,435

8. Is beta a better proxy for risk?

As discussed in Section 2.5, according to the CAPM, investors are entitled to compensation for undiversifiable risk only. However, calculating the betas of pension funds is not straightforward given that pension funds' portfolios are rarely made of one asset class. For the purpose of this exercise, the MSCI World index is used as the proxy for the CAPM market portfolio and betas are calculated for five–year windows to keep them comparable with the other statistics used in this paper.

Figure 11 shows the time–paths of the average betas for each of the five investment groups. It shows that consistent with the previous analysis, the equity and the allocation funds are riskiest. Also, as one would expect, the market risk of money market funds is practically zero. Moreover, betas of the property funds are very low which is consistent with the fact that the property, as an asset class, tends not to correlate with equities. It is interesting that the beta of the fixed income funds was relatively high during the rising markets of the late 1990s, declining markets of the GFC and in the last few years when stock markets around the world were doing relatively well. This indicates that the simple story that bond yields indicate the opportunity cost of investing in equity may not be as simple as one would assume or that fixed income funds exposure to other asset classes changes with market conditions.

Figure 11. Time–paths of average betas estimated for five–year windows using the MSCI World index as the proxy for the CAPM market portfolio.



Even with these potential imperfections, it is clear that there is a strong separation of risk levels across the investment groups. The separation is consistent with the picture delivered by Figures 6 and 10 (Panels A) in the sense that (i) the shape of the time–paths of the betas and of the SRRIs are similar for the equity and the allocation funds (ii) the time–paths of the fixed income and of the property funds are quite similar and (iii) the time–paths of the money market funds are practically flat.

Figure 12 is analogous to Figure 7 save for the fact that Figure 12 plots the annualised CPI–adjusted geometric returns as a function of beta. Using betas as the measure of risk improves the slope of the risk–return relationship. While the slope of the trend line is close to zero (-0.057) when the standard deviations are used, it is positive (1.477) when the betas are used.

However, further analysis shows that betas (at least those calculated against the MSCI World index) are still far from perfect. Given that the equity index is used as the market portfolio, one would expect that the estimates of betas are more accurate for the equity funds than they are for the fixed income funds. Thus, if the beta is an informative measure of risk–return relationship, the positive relationship should be more likely for the equity than the fixed income funds. Figure 13 and Table 3 show that this is not necessarily the case.

Figure 13 shows that the relationships between risk and return documented in Figure 8 are preserved when fund risk is measured by betas. Figure 13 Panel A shows that the slope of the risk–return relationship is negative (-3.631) for the equity funds while it is still positive for the fixed income funds (2.002).

Figure 12. The relationship between the annualised CPI–adjusted geometric returns, GR (vertical axis) and the fund beta (horizontal axis).

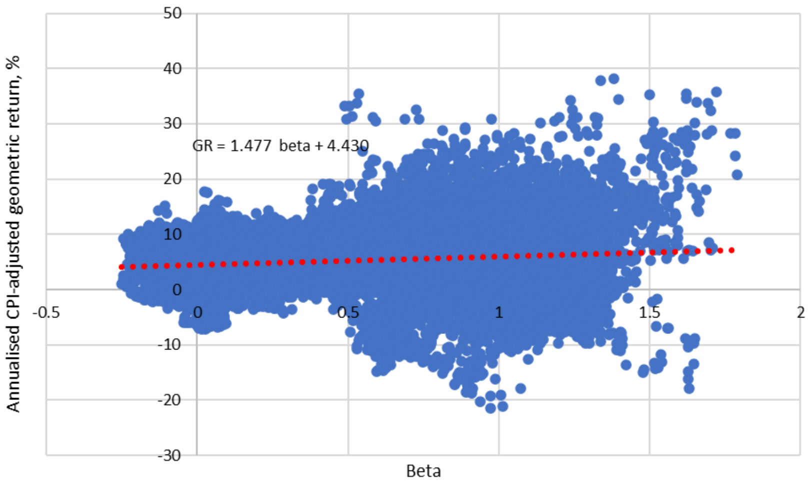
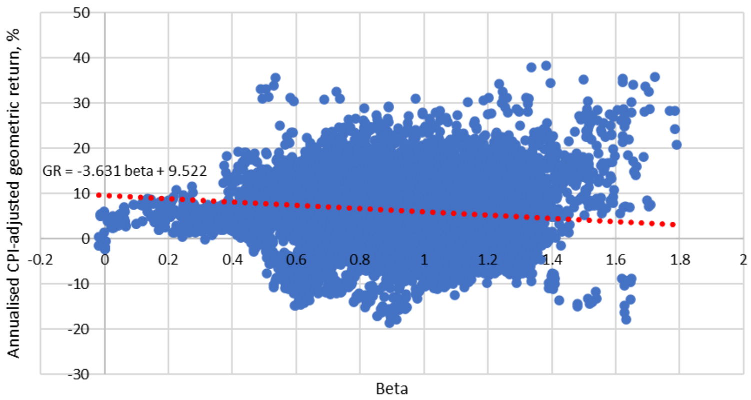


Figure 13. The relationship between the annualised CPI–adjusted geometric returns, GR (vertical axis) and the fund beta (horizontal axis) for the equity funds (Panel A) and the fixed income funds (Panel B).

Panel A



Panel B

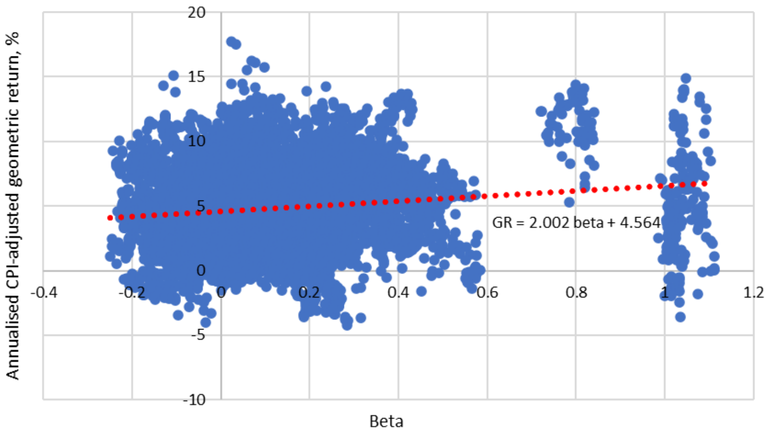


Table 3 shows an even more problematic outcome. After controlling for time and the fund fixed effects, there is no evidence of the positive risk–return relationship whether all funds are used or just the equity or the fixed income funds.

Table 3. Slope coefficients obtained from regressing annualised CPI–adjusted geometric returns on fund beta.

	Coefficient	p-value	R-sq adj	Funds	Obs
All funds	-4.691***	(0.000)	0.495	514	70,326
Equity funds	-1.396	(0.429)	0.571	293	39,826
Fixed income funds	-0.196	(0.839)	0.592	118	17,989

9. SRRI based analysis

The analysis, so far, was based on statistical characteristics of individual investment groups. However, as there are differences in risk taking within the investment groups, it is important to step outside the investment group classification and assess the risk–return relationship directly in relation to the risk taken. To do so, Figure 14 plots the time–paths of annualised CPI–adjusted geometric returns averaged across funds with a given SRRI risk class. That is, the SRRI = 2 line is the time–path of annualised CPI–adjusted geometric returns calculated across all the funds that had SRRI equal 2 at a given point in time, the SRRI = 3 line is the time–path of annualised CPI–adjusted geometric returns calculated across all the funds that had SRRI equal 3 at a given point in time, etc. Once more, we can observe that the higher SRRI score is, the more volatile the average returns are. Moreover, funds that have SRRI equal to 3 and 4 have similar returns across time, and since the GFC the similarity in returns earned by funds with the SRRIs equal 4, 5 and 6 increased.

Even though the SRRI methodology smooths short–term changes in funds' SRRI risk class allocation, it is possible that funds change their SRRI scores during periods of increased market volatility that typically last more than four months. Therefore, to further smooth the funds' SRRI risk class allocation, each fund is allocated the median of its SRRI risk class scores. That is, for example, a fund that has the SRRI equal to 4 in more than half of its observation has the SRR score of 4 assigned for all its observations. Figure 15 shows the time–paths of the annualised CPI–adjusted geometric returns for each of SRRI risk class after smoothing according to the funds' median SRRI. Smoothing SRRI risk classes allocation results in more volatile time–paths of returns.

Figure 14. Time paths of the annualised CPI–adjusted geometric returns for each of the SRRI risk classes.

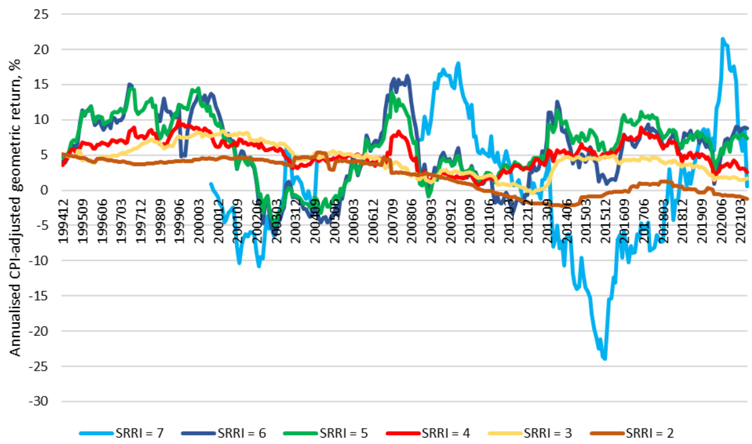
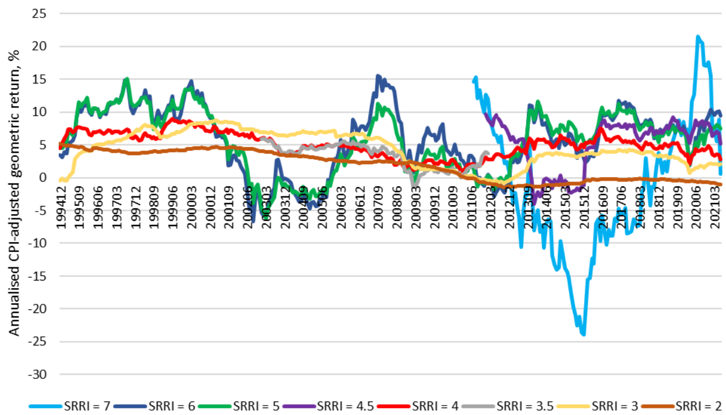


Figure 15. Time paths of the annualised CPI–adjusted geometric returns for each of the SRRI risk classes (a fund is assigned a SRRI risk class equal to the median SRRI risk class across all its observations).



To gain more insight into the risk–return relationship, Figure 16 plots the annualised CPI–adjusted geometric returns as a function of their annualised standard deviations, STD for each of the SRRI risk classes (there are no funds with SRRI equal to 1). It shows that only two out of the six SRRI risk classes has some hint of a positive risk–return relationship. Consistent with the expectation that SRRI risk classes of 5 and 6 are dominated by equity funds, the negative slopes of the trend lines are consistent with the previous results. However, the fact that funds of the SRRI asset class 3 also have a negative slope of the trend line is slightly surprising. It shows that the lack of the positive risk–return relationship is not an exclusive property of high volatility investments.

After controlling for the time and the fund fixed effects, and clustering per fund, there is evidence of a positive risk–return relationship only for the funds with the SRR scores equal to 4. This group of funds has a high proportion of fixed income funds. The regressions for the funds with the SRRI scores 5 and 6 show that within these two groups the risk–return relationship is negative. These two groups are dominated by equity funds. The estimate of the slope coefficient for funds with SRRI equal to 3 is negative but statistically insignificant.

Figure 16. The relationship between the annualised CPI–adjusted geometric returns, GR, (vertical axis) and the annualised standard deviations, STD (horizontal axis) for funds within the SRRI risk class 2 (Panel A), 3 (Panel B), 4 (Panel C), 5 (Panel D), 6 (Panel E) and 7 (Panel F).

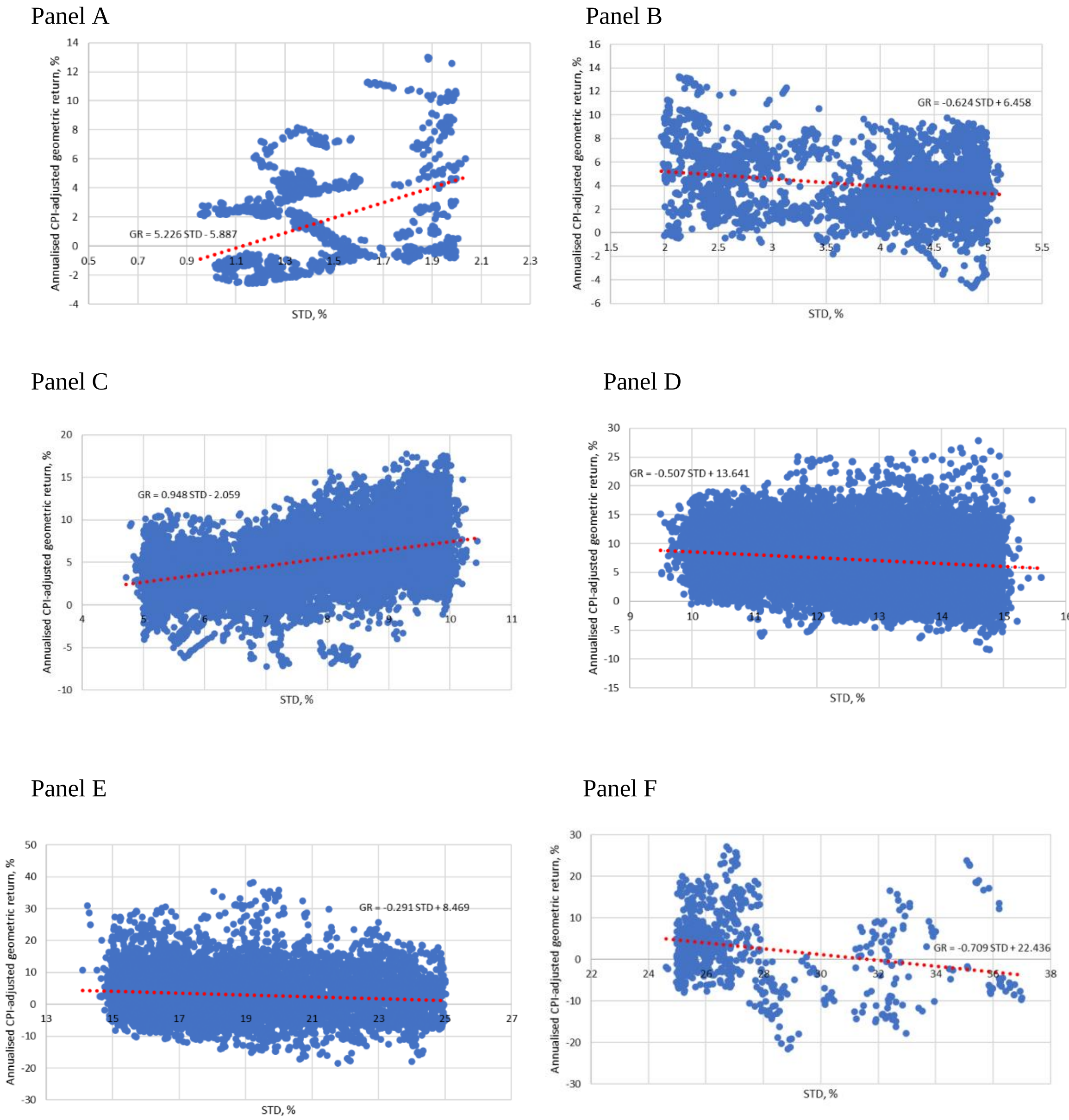


Table 4. Slope coefficients obtained from regressing annualised CPI–adjusted geometric returns on standard deviations of returns of funds.

	Coefficient	p-value	R-sq adj	Funds	Obs
SRRI = 2	0.146	(0.670)	0.987	21	2,308
SRRI = 3	-0.484	(0.239)	0.747	85	3,987
SRRI = 4	0.487***	(0.000)	0.734	322	19,497
SRRI = 5	-0.433***	(0.000)	0.572	397	27,873
SRRI = 6	-0.269**	(0.019)	0.609	276	18,018
SRRI = 7	-0.664	(0.384)	0.830	24	732

10. Mutual funds versus pension funds

To complete the analysis, it is important to assess how the above discussed measures of risk help in understanding the risk–return relationship for mutual funds. Do the problems with adopting the SRRI risk classes to pension funds arise because of the adoption of the CPI–adjusted geometric returns? Are the issues arising related to the fact that pension funds are long–term investors? In other words, if the analysis is repeated for mutual funds that have much shorter performance targets and the (arithmetic) average returns are used to assess the performance, will the positive risk–return relationship resurface?

To tackle the issue, I have collected a sample of UK domicile mutual funds that have the UK as the region of sale. I used the same criteria of fund selection (i.e. used only the primary asset classes of funds incepted before July 2016 to obtain five years of data). In total, I collected monthly observation for 1,908 funds of which 762 are equity funds, 825 allocation funds, 228 fixed income funds, 41 property funds and 12 are money market funds. The remaining 40 funds are alternative, miscellaneous or do not have their investment group specified.

To save space I present only the diagrams that plot the annualised average returns as a function of standard deviations for all funds (Figure 17) and for the equity funds and the fixed income funds separately (Figure 18). Figure 17 shows that indeed, when all funds are used there is a weak positive risk–return relationship. However, the separation into the equity and the fixed income funds confirms the results obtained for the pension funds, i.e. that the equity funds have a negative risk–return relationship. Moreover, a more careful assessment of the risk–return relationship through regressing annualised average returns on the corresponding standard deviations that controls for the time and the fund fixed effects and the lack of independence of funds' observations shows that the slope coefficients obtained for the equity funds are statistically significantly negative. The slope for the fixed income funds is 0.182 and statistically significant at 1%. See Table 5 for the details.

Figure 17. The relationship between the annualised average returns, R (vertical axis) and the annualised standard deviations (horizontal axis).

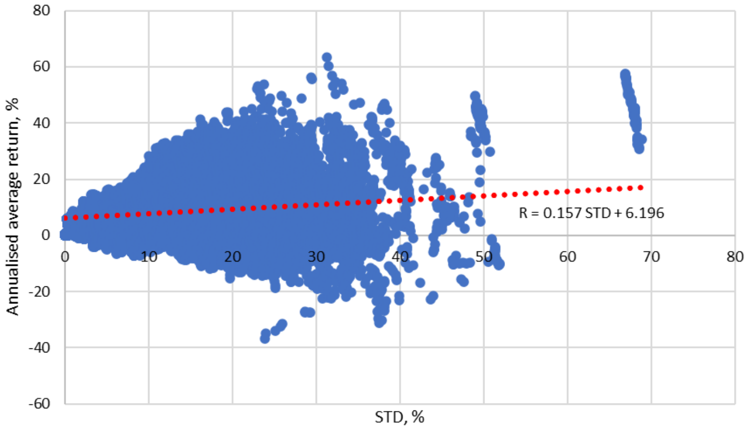
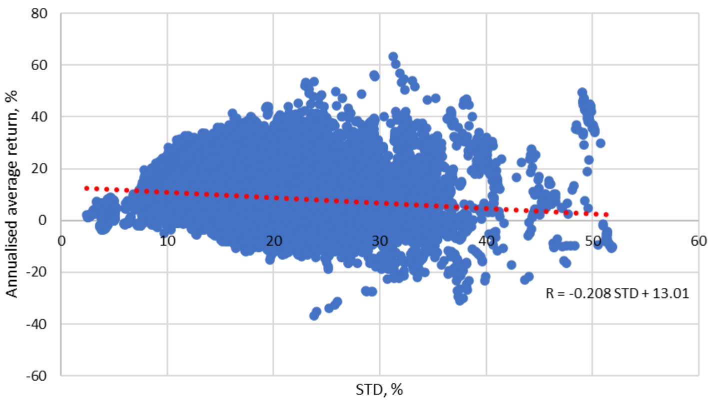


Figure 18. The relationship between the annualised average returns, R (vertical axis) and the annualised standard deviations, STD (horizontal axis) for the equity funds (Panel A) and the fixed income funds (Panel B).

Panel A



Panel B

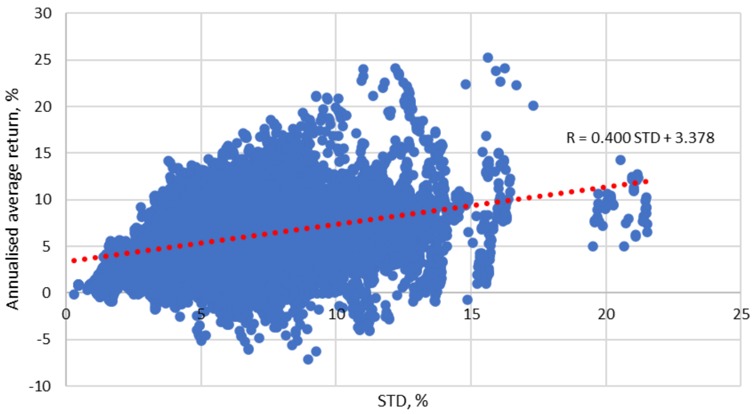


Table 5. Slope coefficients obtained from regressing annualised average returns on standard deviations of returns of funds.

	Coefficient	p-value	R-sq adj	Funds	Obs
All funds	-0.180	(0.144)	0.500	1,883	244,415
All equity funds	-0.197*	(0.070)	0.466	763	124,829
All fixed income funds	0.182***	(0.004)	0.571	228	28,760

11. Conclusions and recommendations

There is increasing need to provide individuals with constructive and informative advice on pension saving options available to them and the performance of their pension investments. This need is fuelled by the rapidly growing reliance of pension provision on defined contribution (DC) schemes and persistently low levels of financial literacy of investors. The SRRI risk classes proposed by CESR (2010) offer a convenient tool to provide investors (especially those with poor statistical skills) with simple classification of funds into seven (in practice, six as there are no pension funds that belong to the SRRI risk class 1) risk classes that are consistent with different levels of risk associated with underlying assets funds invest in. There also seems to be positive relationship between the SRRI risk classes and the average returns earned by these asset classes when all available observations are averaged per investment group. However, the positive risk–return relationship breaks down when a more careful regression analysis is performed and when individual SRRI risk classes are assessed separately. The analysis across investments groups shows that the risk–return relationship is negative for equity funds that typically belong to high SRRI risk classes. This result is confirmed when the funds are divided by their SRRI risk classes rather than investment groups.

The analysis also shows that using fund beta produces similar results, in the sense that the positive risk–return relationship does not hold for funds with high market risk.

These results are consistent with the notion that high–risk assets require much longer periods of assessment to calculate their long–term performance than low–risk assets. There is no surprise in this result. Unfortunately, the SRRI methodology does not provide the tool to mitigate this predicament. Moreover, the SRRI methodology masks the true levels of risk taken. Moving one risk class may not seem much, but whether an investor increases risk taking from SRRI risk class 2 to 3 or 4 to 5 has enormous impact on the probability of losing money.

References

Association of British Investors (ABI), 2017. ABI sector definitions: September 2017. https://www.abi.org.uk/globalassets/files/subject/public/regulation/abisectordefinitions.pdf.

Campbell JY., Viceira LM., 2002. Strategic asset allocation: Portfolio choice for long-term investors", Oxford University Press, USA.

Committee of European Securities Regulators (CESR), 2010. CESR's guidelines on the methodology for calculation of the synthetic risk and reward indicator in the Key Investor Information Document". CESR/10-673.

Klapper L., Lusardi A., van Oudheusden P., 2014. Financial Literacy Around the World: Insights from the the Standard & Poor's Ratings Services Global Financial Literacy Survey. https://gflec.org/wp-content/uploads/2015/11/3313-Finlit_Report_FINAL-5.11.16.pdf?x63881

van Rooij M., Alessie R., Lusardi A., 2011. Financial Literacy and Stock Market Participation, Journal of Financial Economics 101(2), 449-472.