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Systemic Impact of the Risk Based Fund Classification and Implications for Fund Management

Martin Ewen

Marc Oliver Rieger

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Martin Ewen, Chief Risk Officer, ARKUS Financial Services

150 Minories, London EC3N 1LS, UK, mewen@arkus-fs.com

Marc Oliver Rieger, Chair of Finance and Banking at the University of Trier

Universitätsring 15, 54296 Trier, DE , mrieger@uni-trier.de

Abstract

This paper examines the impact of European legislation regarding risk classification of mutual funds. We conduct analyses on a set of worldwide equity indices and find that a strategy based on the long term volatility as it is imposed by the Synthetic Risk Reward Indicator (SRRI) would lead to substantial variations in exposures ranging from short phases of very high leverage to long periods of under-investments that would be required to keep the risk classes. In some cases funds will be forced to migrate to higher risk classes due to limited means to reduce volatilities after crises events. In other cases they might have to migrate to lower risk classes or increase their leverage to ridiculous amounts. Overall we find if the SRRI creates a binding mechanism for fund managers, it will have substantial negative impact on portfolio management.

Keywords: portfolio risk, volatility, SRRI, regulation

JEL: G11,G23, G32

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1 Introduction

Recently introduced European regulation implicitly overlays the core strategy of a mutual fund under the regime for undertakings for collective investments in transferable securities (UCITS) with a long term target volatility strategy, if investors are unwilling to accept a change in the risk class of their fund. In this context we would like to examine two questions. Firstly, what is an effective way to keep the volatility in the desired risk class and secondly, how far this will alter the investment strategy of a portfolio and what will be the systemic effects.

To maintain a predetermined volatility band we use strategies that are structured along the investment constraints for UCITS funds, i.e. we examine two risk on - risk off strategies that cut all exposures to the market, if the upper limit is exceeded and raise the exposures, if the realized volatility falls below the lower limit. We find that huge variations in exposures would be required to maintain the risk bands and that in some cases funds would not be able to keep the risk class. The impact on the investment strategy can at times be quite substantial and potentially induce style drift. We further find that the SRRI may cause systemic effects at an aggregate level. As they may lead to herding behaviour and considering the well documented phenomenon of volatility spillovers between equity markets, there is a danger of a potential amplification of extreme events.

The rest of the paper is organised as follows. Section 2 outlines in detail the regulatory framework and the impact on fund management to finally outline the investment strategies used in section 3 for historical backtesting of said investment strategies outlining the problems assciated with the SRRI. Section 4 examines potential herding effects induced by the SRRI and section 5 concludes this paper.

2 Fund Classification and Impact on Portfolio Management

2.1 Regulatory Background

Investment funds in Europe are required to publish a document that contains principle information about the strategy, costs, risk and return characteristics of the fund (Key Investor Infomation Document - KIID). One element of this document is the so called Synthetic Risk Reward Indicator (SRRI) which classifies funds according to their riskiness (ESMA 10-673). The aim is to improve comparability and investor awareness of the risks associated with their investments. The classification is based on the volatility of the portfolio and is performed according to table 1.

SRRI Risk Classes		
Risk class	Volatility >=	Volatility <
1	0%	0.5%
2	0.5%	2%
3	2%	5%
4	5%	10%
5	10%	15%
6	15%	25%
7	25%	

Table 1: SRRI risk classes on corresponding volatility buckets as defined in the ESMA 10-673 guidelines.

Initially one has to determine to which fund type the strategy belongs. The process for the determination of the fund types is outlined in the decision tree in figure 1. As you can see the distinction is made between investments across asset classes, the constraint through a risk limit, the change of the asset allocation and pay-off structures. In the case of a market fund[1] the historical annual volatility of its weekly return time series or of a representative asset mix (resp. Benchmark) are used to calculate the SRRI. In other cases the volatility reverse engineered from the VaR limit or the maximum of all three are used to read the risk class from table 1. This approach applies for absolute return or total return funds. Regarding structured funds a simulation study is required to obtain a VaR number that may be transferred into a volatility number. Most of the standard funds that follow an index for retail investors will fall into the category of market funds.

Should the volatility obtained by one of the appraches above not lie within the current range for more than 16 weeks, the SRRI will change into the new risk class and consequently the KIID needs to be updated. This may be undesirable from a fund's point of view for two reasons. Firstly, of course, the administrative burden is cumbersome and costly. Secondly, the change of the risk class may incline investors to reallocate their funds, if the new risk and reward structure does not suit their investment objectives. This may be the case for migrations to riskier classes as well as to less risky classes as both signal deviations from the risk and reward profile initially subscribed by investors. To avoid outflows and supplementary costs the fund manager needs to keep the risk classes stable. This overlays the core strategy of the fund with a longterm volatility strategy.

[1] According to ESMA 10-673 market funds are portfolios whose investment objective is to reflect risk and return characteristics of specific predetermined market segments.

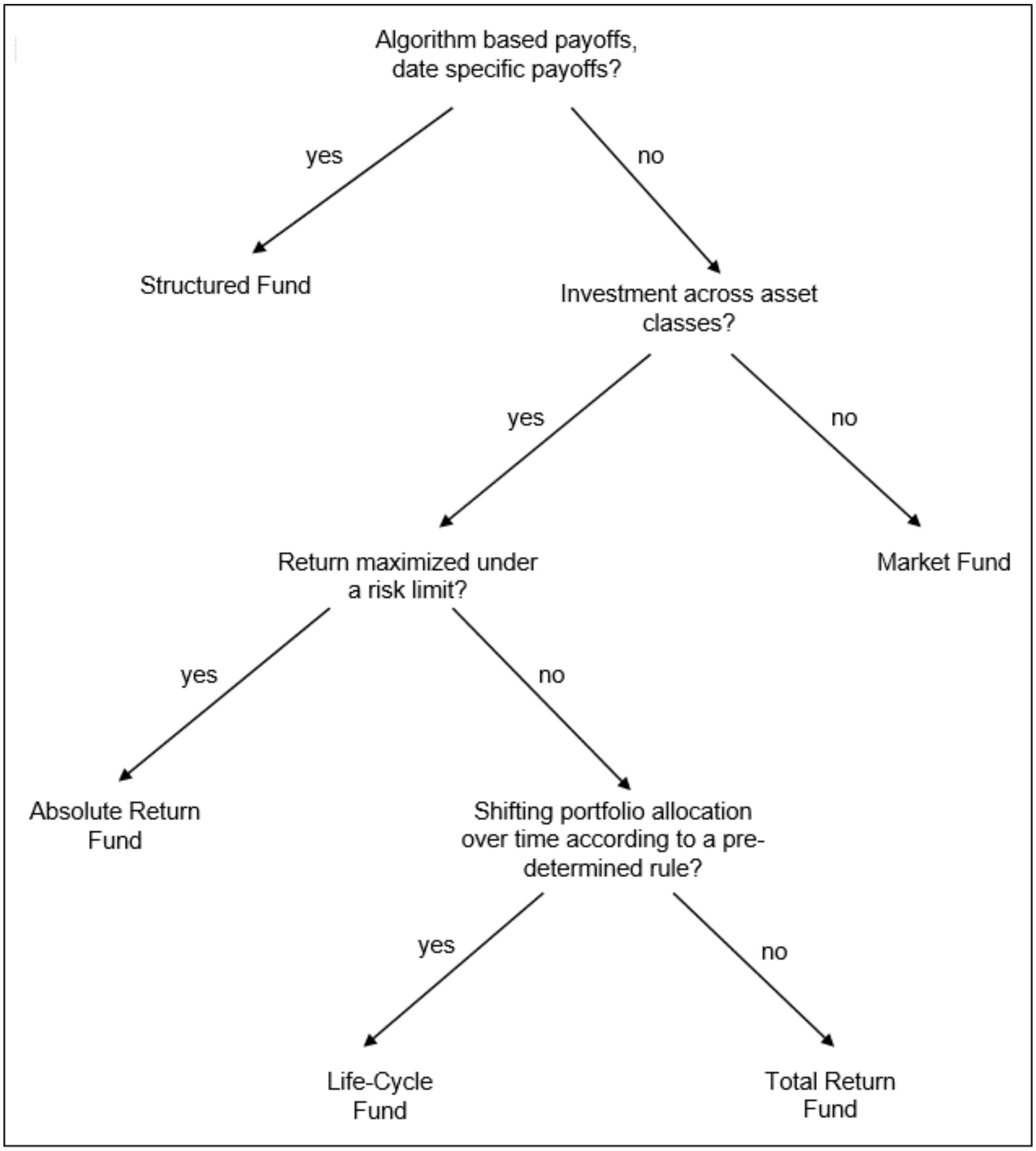

Figure 1: This figure shows the deciscion tree that is applicable as per the ESMA 10-673 Guidelines to determine the fund type for SRRI purposes.

2.2 Critical Review of the SRRI

2.2.1 General Remarks

Although volatility plays a predominant role in asset and risk management, its drawbacks are well known and have been discussed extensively in literature. Being a measure of dispersion volatility treats positive and negative returns equally, which is not quite intuitive since positive returns are generally beneficial for investors. Overall, Arztner et al. (1999) conclude that volatility is not a coherent measure of risk. However, the regulatory background described above paves the way to foster its role even further. Regulators attempt to force fund managers to take a more dynamic perspective in their assessment of portfolio risk rather than looking at the levels of risk measures only. For the SRRI it is the stability of the risk measure (or more generally the risk profile) of the fund that has been added to the objective function of the fund managers. Besides the particularities of the measure chosen to describe the riskiness of a portfolio, it is quite surprising that the level of the returns does not come into play at all. It is standard in the asset management industry (by researchers and practitioners) to consider the risk and return dimension when measuring the performance of mutual funds. As the name SRRI suggests, regulators have been aware of this as well. However the SRRI is only based on the risk dimension, in that sense the term is somewhat misleading.

2.2.2 Implications for Fund Management

The implications of the SRRI will depend on the fund type chosen. However, for market funds and in certain cases for absolute and total return funds, realized volatility is the decisive metric for the SRRI and as such needs to be monitored and controlled. So it is worth having a closer look at this metric with respect to its implications.

The concept of the SRRI effectively overlays the core investment strategy with a secondary investment principle based on the long term ex post volatility of the fund‘s returns. This overlaying strategy will only be applied if investors are unwilling to accept the new risk class and exercise their power accordingly.

To avoid changes in the risk class the portfolio manager either needs to reduce the risk in the portfolio, if the portfolio migrates to a riskier class, or increase the risk in case of a transition to a less risky class. In the first case the fund manager needs to deliver the realized mean of weekly returns in the upcoming weeks to add as few dispersion as possible and bring portfolio volatility back to lower levels. This is of course only a theoretical alternative for mainly two reasons. Firstly it would require perfect information by the fund manager, particularly perfect prediction capacities and secondly, from a more practical angle, if the realized mean was close to zero or even negative, it would certainly not be in the interest of neither fund manager nor investors to repeat this outcome to maintain the risk band. In practice achieving lower realized volatility will go along with a reduction of exposures to either the entire market or high risk stocks.

In order to bring realized volatility up, fund managers need to add as much variation to realized returns (ideally to the positive side) as possible by raising the exposure e.g.

through derivatives. An alternative would of course be to raise the concentration in the portfolio (i.e. reduce the number of positions by taking out less risky assets), but this would of course also need to be seen in the light of return expectations the fund manager has. It should be noted that the SRRI is based on longterm data (250 datapoints of weekly data) so it will show a rather smooth pattern in most of the cases and fund managers are given a 16 weeks grandfathering period. However, depending on the distance between the current volatility and the critical limit of the binding risk class the strategy will take some time to bring volatility back down (or up) as new observations only have a limited impact. The indirect effect of high contributing observations dropping out may be much more pronounced.

The course of the metric chosen to be relevant for the determination of the risk class can be characterized by two patterns. The first is a trendlike movement within its current regime which may lead to a smooth migration to other classes. In this case the fund manager can react gradually and will have time to re-allocate the portfolio if the trend proves to be persistent. On the other side volatility is exposed to shocks induced by systemic events (see e.g. Engle (2001) or Engle and Patton (2001)). This pattern, also known as regime switches, in conjunction with the fact that fixed boundaries are prescribed by regulators, will create pressure on fund managers to reduce their exposures drastically in a very timely manner in an attempt to maintain the current risk class, if such shocks (or more generally volatility regime shifts) put their realized volatility into a higher risk class.

On the other side, the opposite is true in times of lower volatilities where fund managers are inclined to raise the exposure by e.g. leveraging the portfolio up to keep higher volatilities. This second aspect may also occur in an ad hoc way when e.g. highly contributing observations drop out of the observation period. In this case fund managers would generally be able to anticipate the effect, though. Another potentially problematic phenomenon around volatility is that it tends to cause spillovers between equity markets. This may lead to herding behaviour consequently creating the danger of an amplification of extreme events and contagion of market slides across equity markets.

There will be limits as to how much variation a UCITS fund can add to the portfolio, as they are constrained through either VaR or leverage limits. Most portfolios classified as market funds can not use derivatives extensively and have a legal maximum limit of 100% on the leverage, so the maximum exposure to the market is 200%. This would be the case for portfolios that monitor their global exposure through the commitment approach as per ESMA Guidelines 10-766. This restriction would not apply for funds measuring their global exposure through the Value at Risk approach.[2] It should finally be noted that any trading activity taken as response to the SRRI will incur supplementory trading costs that will be borne by investors. Further to this, potential migrations will evoke additional administrative burden for the management company of the funds as the investor and marketing documents will have to be changed.

2.3 Investment Strategies Based on the SRRI

As mentioned above, if the SRRI creates a binding mechanism for fund managers, it basically introduces a longterm volatility trading strategy that overlays the core strategy of the portfolio. That is to say it creates a trading signal to either reduce the amount of risk in the portfolio in times of high volatility (compared to the current volatility band) or to

[2] These funds do also have restrictions such as 20% VaR on 20 days (CI 0.99) or two times the benchmark VaR, we abstract from these for the time being.

add more risk to the portfolio in times of lower volatility. To investigate in how far fund managers are able to maintain the defined risk classes and what the impact would be, we carry out an historical backtesting which uses the SRRI as a trading signal using two trading strategies that are structured around the legal constraints fund managers concerned by this regulation face. First, we consider an investment strategy that follows an equity index and only alters the exposure according to the following rule:

$$E(\sigma) = \begin{cases} 0, & \text{if } \sigma_{t-1} > ub \\ 2, & \text{if } \sigma_{t-1} < lb \\ 1, & \text{else} \end{cases}$$

where:

E = The Exposure to the index

σ = Annual volatility of weekly returns calculated for the purposes of the Synthetic Risk Reward Indicator (ESMA 10-673)

ub = upper bound of the selected risk class

lb = lower bound of the selected risk class

So basically the portfolio follows a risk on - risk off strategy if the SRRI of the previous period falls outside the current band. If the upper bound is breached the exposure is reduced to zero (in practice this could be done by e.g. hedging the portfolio completely through derivatives). To add as few dispersion as possible the fund manager would theoretically need to deliver the realized mean over the observation period. This would require perfect information and would not be senseful in cases of negative mean returns. If the previous volatility falls below the lower bound, the exposure to the index is raised to 200%. This is the most a fund manager of a UCITS structure measuring the global exposure accoring to the commitment approach can do to maintain the portfolio in a defined risk class. When the portfolio is not invested in the index we assume an investment in the risk free rate. If realized volatility lies within the current band, the fund is just 100% invested in the index. Using passive indices isolates the impact of the SRRI implied trading rule from that of active investment decisions by the fund managers. To account for the greater possibilities to add exposure that VaR portfolios may dispose of the second trading strategy we examine follows the same approach as above, but doubles the exposure in case the lower bound is not reached within 4 weeks. This pattern is repeated until the desired risk class is reached.

$$E(\sigma, n) = \begin{cases} 0, & \text{if } \sigma_{t-1} > ub \\ 2^{\lfloor \frac{n}{4}+1 \rfloor}, & \text{if } \sigma_{t-1 \ldots t-s} < lb, n \in \mathbb{N}^+ \\ 1, & \text{else} \end{cases}$$

where:

E = The Exposure to the index

σ = Annual volatility of weekly returns calculated for the purposes of the Synthetic Risk Reward Indicator (ESMA 10-673)

n = Number of weeks where where σ has been consecutively below lb, and $\lfloor x \rfloor$ denotes the interger part of x

ub = Upper bound of the selected risk class

lb = Lower bound of the selected risk class

This strategy has more means to add exposure to the portfolio to bring risk levels back up if a lower bound is undercut. As our focus is on equity markets we concentrate the analysis on risk classes 5-7, because the lower risk classes would rather match with the risk levels associated with balanced or fixed income funds, where the asset allocation would obviously be managed differently. Furthermore historically, equity indices mostly displayed volatilities calculated as per the SRRI that were in the ranges of with these risk classes.

3 Backtesting on Historical Data for Equity Indices

We apply the trading rules to ten equity indices from economies around the world. The price indices are obtained from the Thomson Reuters database and the risk free rates are obtained from Kenneth French‘s webpage. Weekly return data are available for the period 13-09-1991 to 27-02-2015. The descriptive statistics of the indices are presented in table 2. As mentioned above the analysis is only conducted on risk classes 5-7, so the strategies we examine have a minmum target volatility of 10% per annum.

3.1 Effectiveness of the Strategies

3.1.1 Commitment Portfolios

We start by examining the results for the portfolios with limited possibilities to raise exposures.[3] First, one notices that the volatilities of the strategies show the expected run up times in case the initial risk class differs from the intended strategy. These may be substantial depending on how far the actual volatility is away from the binding boundary. This is true for migrations to the upside e.g. risk class 7 for the S&P500 or to lower volatility bands such as risk class 5 for the HangSeng Index (please refer to figures 2 and 3). Both patterns are not surprising given the limited possibilities in both directions coming from the investment restrictions (200% leverage) to the upside and to downside migrations from the limited means to reduce volatility. It should be noted that this situation is similar to occasions where the volatility is changing in a sudden disruptive way putting the fund into another risk class. This can be seen e.g. at the beginning of the Lehman crisis throughout

[3]For reasons of brevity we only show selected figures. All results are available on demand.

Metric/Index	S&P 500	EuroStoxx50	DAX	FTSE	CAC40	IBEX 35	Hang Seng	Dow Jones	MSCI World	NASDAQ
Volatility	0.1671	0.1870	0.2219	0.1684	0.2116	0.2207	0.2461	0.1623	0.1602	0.2548
Mean	0.0016	0.0013	0.0021	0.0011	0.0012	0.0016	0.0021	0.0017	0.0013	0.0029
Min	-0.1820	-0.2318	-0.2161	-0.2105	-0.2216	-0.2120	-0.1806	-0.1815	-0.2007	-0.2530
Max	0.1203	0.1455	0.1612	0.1341	0.1324	0.1455	0.1493	0.1129	0.1237	0.2109
VaR	0.0603	0.0669	0.0742	0.0632	0.0751	0.0732	0.0979	0.0577	0.0553	0.0926
SR	0.0712	0.0505	0.0669	0.0453	0.0421	0.0526	0.0610	0.0765	0.0569	0.0817

Table 2: This table shows the descriptive statistics of the equity indices used in our analysis. Volatility is calculated as per the ESMA 10-788 guidelines. The set-up for the Value at Risk (VaR) is 0.99 5 days (weekly returns).

the indices examined. The limited firepower in times of lower volatilities is more problematic for risk class 7 of course, we can see migrations for most of the indices in the years preceding the Lehman Event. To a lesser extent this effect can also be observed for risk class 6, with a notably lower number of weeks outside the current band and fewer overall migrations (e.g. S&P500).

Risk classes 5 and 6 are highly impacted by crises events such as the Technology Bubble or the Lehman Event. The strategies where risk class 5 is applied are notoriously close to the upper boundary with some exceptions in the years precending the Lehmann event (e.g. Dow Jones, MSCI World displayed in figures 4 and 5). This indicates that risk class 5 might not be suited for pure equity portfolios but rather for balanced portfolios. The results also illustrate that the categories will highly depend and datapoint effects induced by either market events or subsequent actions taken to raise the exposure. The reversal will be observed 260 weeks later when the highly contributing observations drop out.

It should be noted that unless a disruptive event catapults volatility into another band, the volatility based strategies managed to avoid clear penetrations in adjacent risk classes. We observe that the strategies' volatilities hover around the respective binding boundaries occasionally, only in some cases sligthly surpassing the allowed number of 16 weeks outside the current bands.

The maximum number of weeks outside the respective risk class and the overall number of migrations per strategy are given in table 3. Overall, however, we can state that in only one case, the HangSeng Index for risk class 6, the strategy was able to maintain the risk class for the entire period under review without breaking the rule of 16 weeks as defined by ESMA. This leads to the conclusion that the effectiveness of the strategies in maintaining the risk classes based on the commitment approach is very limited. Although our strategies are indeed quite extreme, a less drastic reaction would have even more problems to maintain the risk class.

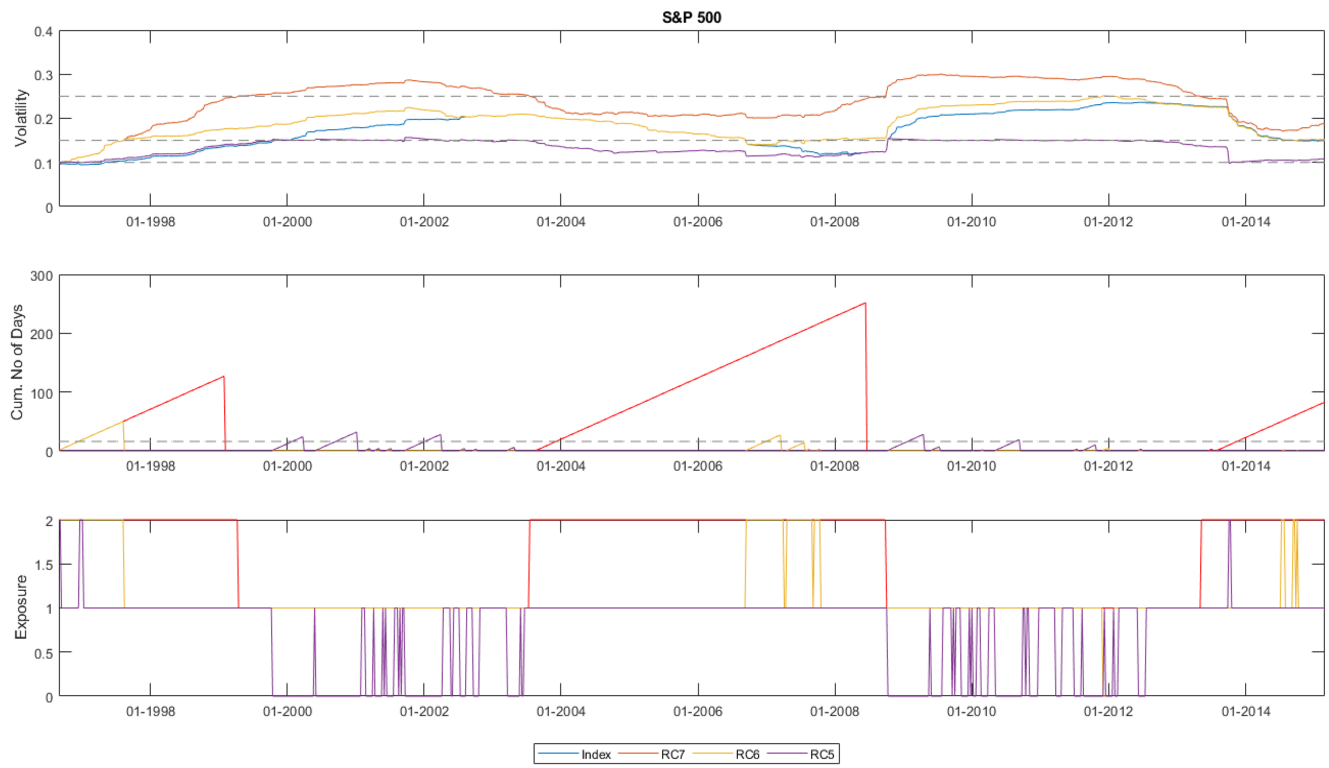

Figure 2: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the commitment approach. It is calculated as per the ESMA 10-673 guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related expsosures that the strategies take according to the trading rules based on the realized volatility.

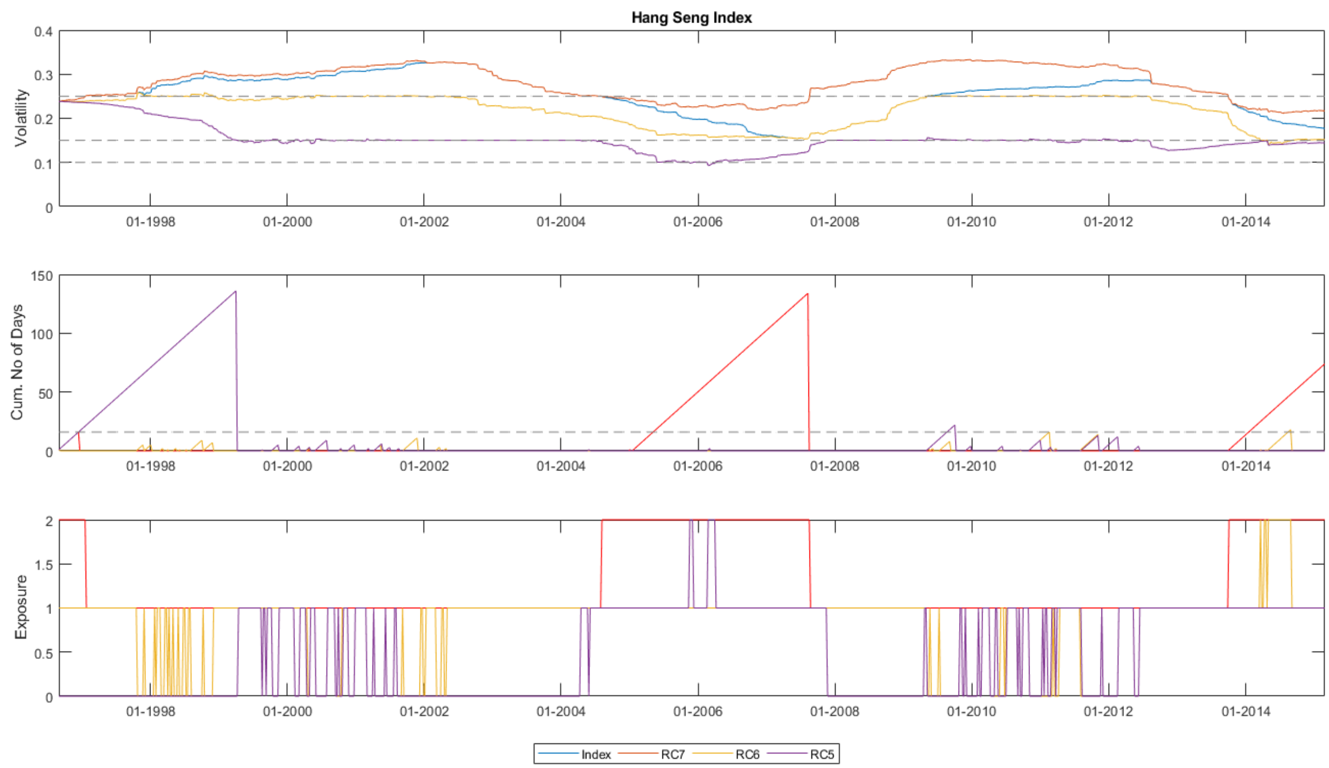

Figure 3: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the commitment approach. It is calculated as per the ESMA 10-673 guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related expsosures that the strategies take according to the trading rules based on the realized volatility.

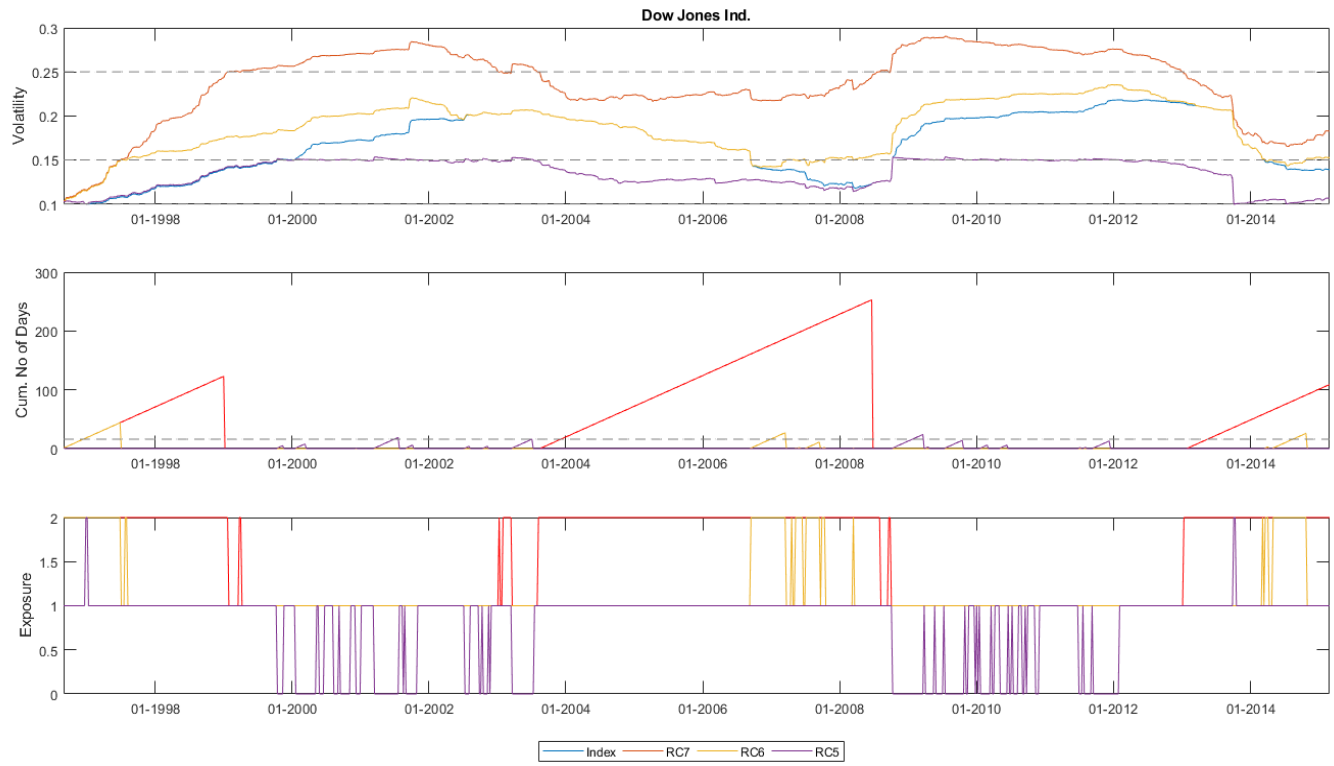

Figure 4: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the commitment approach. It is calculated as per the ESMA 10-673 guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related expsosures that the strategies take according to the trading rules based on the realized volatility.

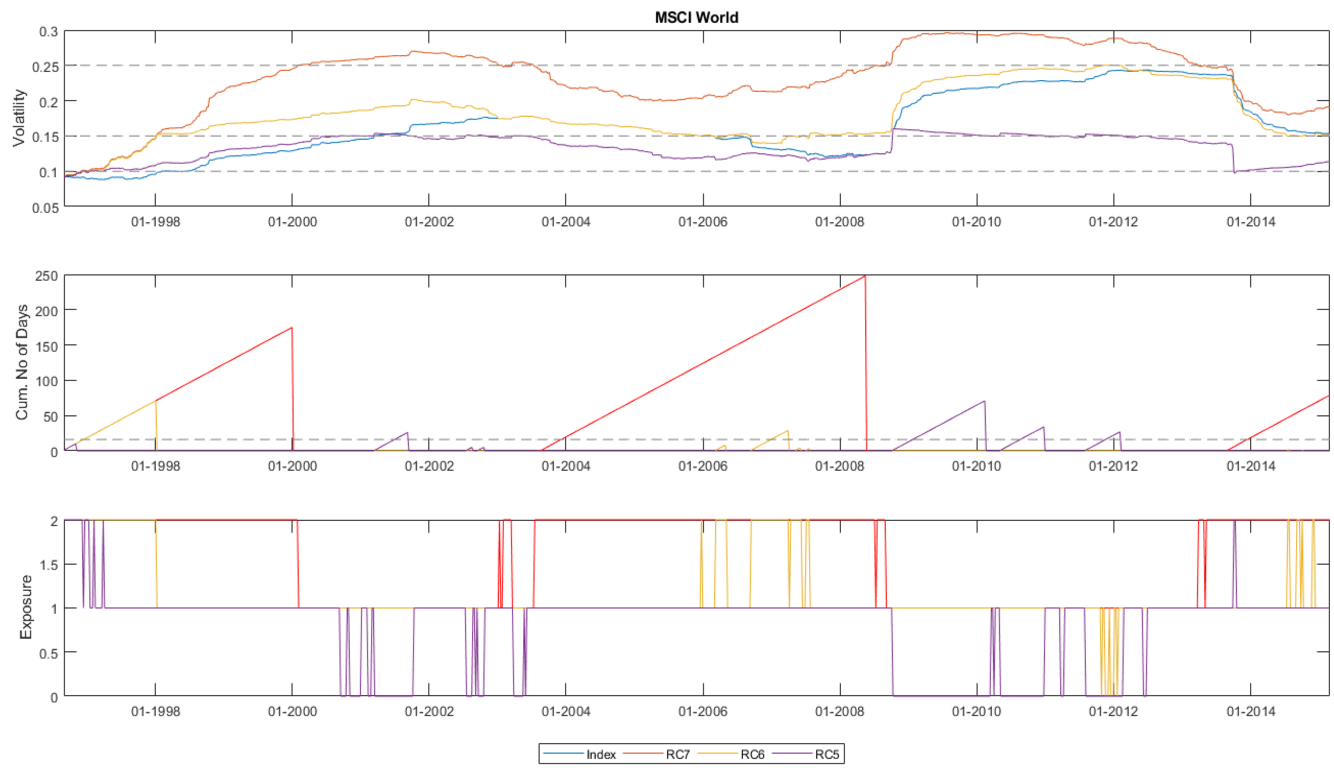

Figure 5: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the commitment approach. It is calculated as per the ESMA 10-673 guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related expsosures that the strategies take according to the trading rules based on the realized volatility.

3.1.2 VaR Portfolios

We now turn to the results for the portfolios with unlimited firepower in times of lower market volatilities. As expected the run-up times are notably lower as for the strategies with limited leverage possibilities. This result comes, however, at the cost of a larger swing back when the high contributing observations drop out. This effect is visible for risk class 6, but most pronounced on the graphs for risk class 7. It can lead to severe distortions in form of regular swings, which are either introduced by market shocks or stem from the fact that the initial risk class has not been properly chosen. The unlimited firepower unsurprisingly helps to maintain the highest risk class for most of the indices during the period studied, albeit at the cost of very high levels of leverage (levels greater than 15) and huge swings in volatility induced by observations dropping out. Two indices (S&P500/ Dow Jones) still show one migration each with 16 weeks outside the current bucket, but these are due to datapoint effects as the high levels of exposures due to the run up times are dropping out. Further to this they could have been avoided by just raising the exposure more drastically, but for the purposes of this study the results are satisfactory, as it may be interpreted as the minimum level of leverage required to keep the risk band. It should also be mentioned of course that the high level of leverage also exposes the portfolios to large swings in case of huge market movements as can be seen in figure 6 for risk class 7 applied e.g. on the CAC 40 in July 2016.

Turning to risk class 6 we also find that the portfolios with no leverage constraints perform notably better in maintaining this risk class than the strategies based on the commitment approach. The number of migrations and the maximum number of weeks outside the bucket is greatly reduced. As expected, the higher leverage levels help to avoid migrations from risk class 6 to risk class 5 in markets of lower volatilities before the Lehman event. This can e.g. be seen for the MSCI World in figure 7. In contrast to the previous set-up risk class 6 is maintained for the S&P500, FTSE, Dow Jones and the MSCI World (please refer to table 3). For the rest of the strategies it should also be noted that no clear penetration in the adjacent risk class is observable as the respective volatility hovers around the boundary in each case. Further to this all migrations would be to the upper risk class. As mentioned above, there would not be much more a fund manager could do in this case as his means to reduce volatility are limited, consequently these portfolios would be forced to change risk classes. For risk class 5 we did not expect major differences in the results as most of the migrations for this risk class are to the upside, so more capacity to raise exposures is not helpful here. Indeed this is confirmed as we find a very similar picture as for the commitment portfolios with most of the strategies being close to the upper boundary, with few exceptions e.g. MSCI World or S&P500 towards the end of the observation period (figures 7 and 8). As in the set-up above none of the strategies managed according to risk class 5 would have avoided a migration to risk class 6. This once again links to the fact that the means to reduce volatility after a shock or even a drift that proves to be persistent are limited and once again shows the limited possibilities of fund managers to avoid migrations for lower risk classes in such market environments.

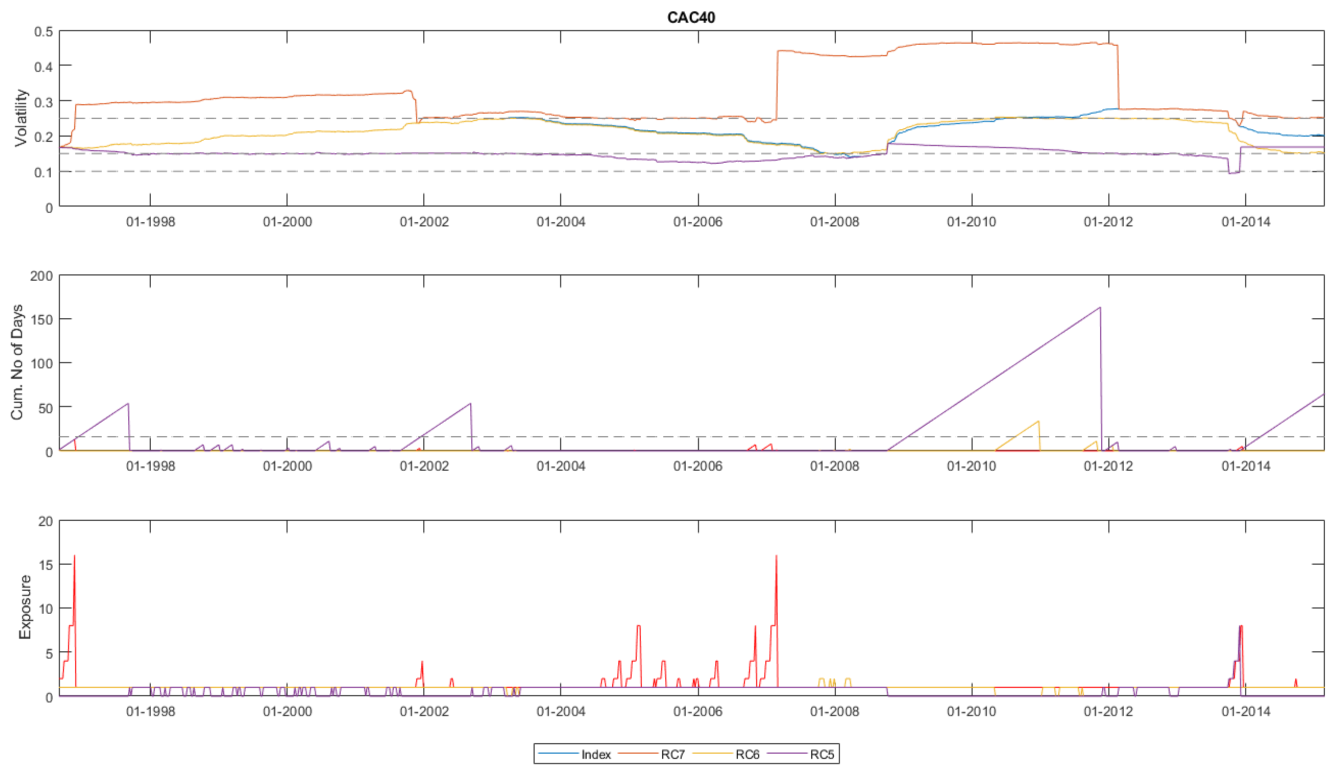

Figure 6: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the Value at Risk approach. It is calculated as per the ESMA 10-673 Guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related exposures that the strategies take according to the trading rules based on the realized volatility.

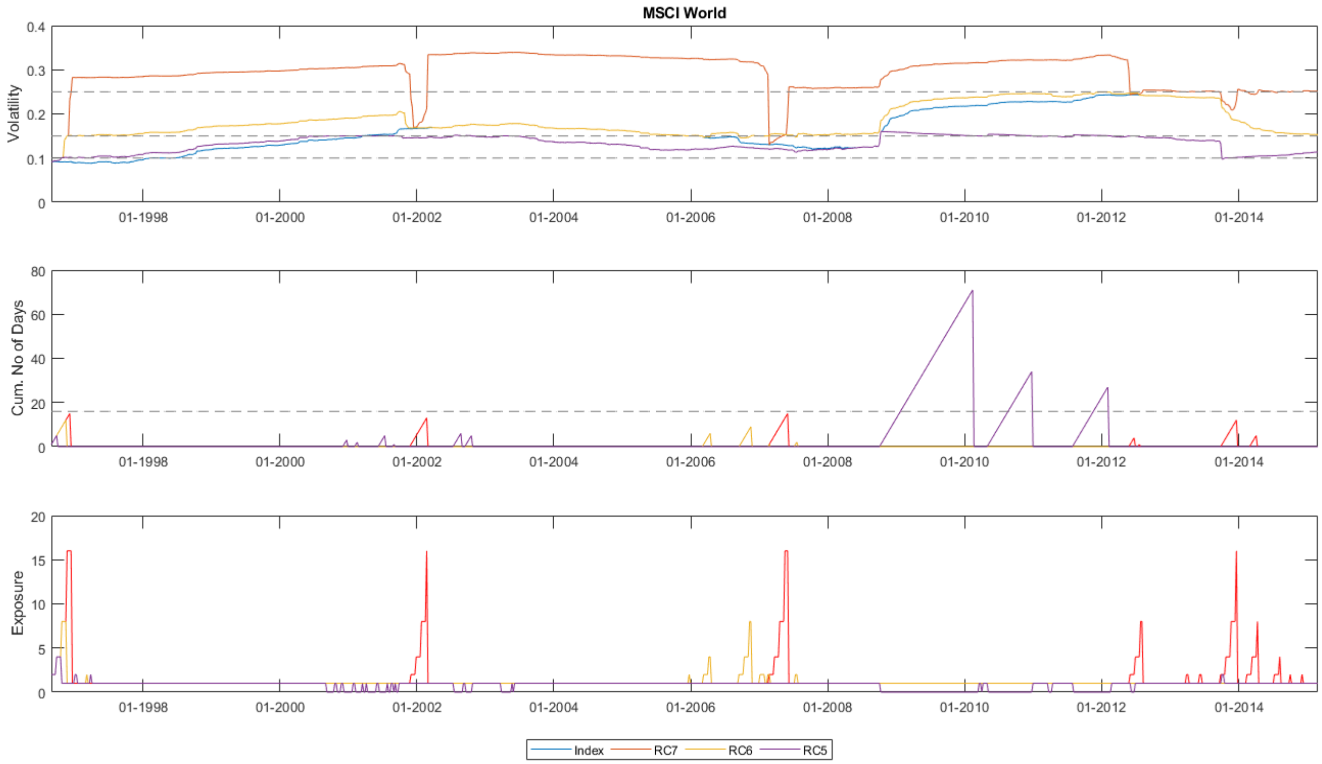

Figure 7: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the Value at Risk approach. It is calculated as per the ESMA 10-673 Guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related exposures that the strategies take according to the trading rules based on the realized volatility.

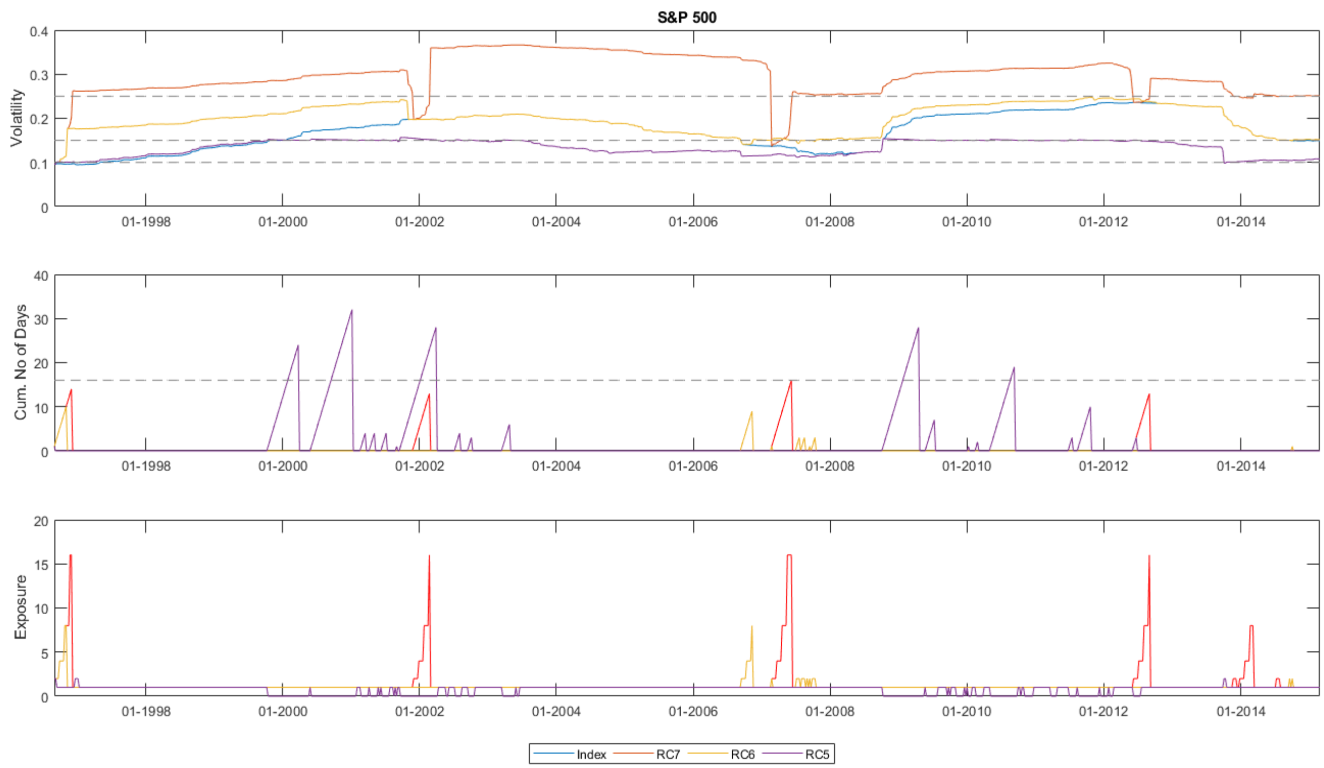

Figure 8: The upper graph shows the annual volatility of weekly returns of the portfolios managed according to the Value at Risk approach. It is calculated as per the ESMA 10-673 Guidelines. The horizontal lines indicate the upper or lower boundaries for the risk classes defined by European regulators. Below we show the cummulated number of days outside the bucket of the respective risk class and the related exposures that the strategies take according to the trading rules based on the realized volatility.

3.1.3 Robustness Checks

For robustness checks we rerun the analyses with alternative set-ups. First we rerun the VaR strategies using a theoretical alternative where the current realized mean at the time of computation is delivered instead of the risk free rate during times where realized volatility is breaching the upper band. In this set- up we examine the hypothetical scenario where the fund manager would dispose of perfect information and was able to perfectly anticipate future returns.

The results are presented in table 3, which shows the number of migrations per strategy and the maximum number of weeks outside the current bucket for the strategies.[4] Of course, for risk class 7, no changes are observable as only migrations to the downside may occur in this risk class. For risk class 6 we find, however, that no migrations would have occured for any index, so migrations to both directions would have been avoided. It can be seen that in the this set-up that the strategies manage to keep risk classes 6 and 7 for the entire period examined, so the four migrations to the upside we still observed for the VaR Portfolios in risk class 6 would have been avoided in the theoretical set-up. The biggest improvements can be seen for risk class 6 (e.g. CAC40, Ibex) and occur due to the avoidance of drifts into risk class 7 after the Lehman crisis.

The situation only changes marginally for risk class 5 without any real improvement regarding the effectiveness in keeping the desired volatility range. An exception to this is the DAX, where the number of weeks outside the relevant bucket almost doubles during the Lehmann crisis using the realized mean. This, maybe surprising result, stems from the fact that the strategy applying the realized mean was re-invested on the week ending on October

[4] The unreported details of the robustness checks are available upon request.

10th, 2008 during which the DAX experienced a loss of -21.61% whereas the strategies using the risk free rate where not invested as they required more time to bring volatilities down again. More pecisely the latter was only invested one day later which is the reason why the strategy is less exposed to the shocks markets experienced during this period. Actually, this was beneficial for the risk free rate strategy not only in terms of avoided losses, but the strategy could also profit from the rebounds in markets, which of course also lead to higher volatilities hence no further investments in the following weeks. This illustrates quite glaringly how exposed the concept of the SRRI is to datapoint effects. In this set-up we examine the hypothetical scenario where the fund manager would dispose of an investment alternative that would bring volatility down as fast as possible in case of breaches to the upside. As we have shown above even in this thought experiment risk class 5 would not have been maintained.

Another alternative to our set-up aiming to maintain the risk classes would be to use lower warning limits as a trading signal to avoid migrations, so we rerun our analyses using different warning limits below and above the actual limit. We proceed by narrowing the buckets for the remaining risk classes with migrations for the VaR portfolios where the realized mean is used gradually without material effects just up to the scenario presented in the last section of table 3. This is the case where the warning limits are set to a band from 11% to 12% for risk class 5 and at 28% for risk class 7. As you can see the situation would improve, but of course such set-up would not be practically relevant as it would literally not allow for active fund management. So within the realms of practicability warning limits based on the risk classes would not help much to maintain risk classes 5 or 7 for equity portfolios.

CA RF	S&P 500	EuroStoxx50	DAX	FTSE	CAC40	IBEX 35	Hang Seng	Dow Jones	MSCI World	NASDAQ
RC7	3 (252)	3 (236)	3 (104)	4 (223)	5 (62)	3 (149)	3 (134)	3 (253)	3 (248)	3 (101)
RC6	2 (50)	3 (34)	3 (29)	2 (44)	1 (34)	1 (51)	2 (18)	3 (44)	2 (71)	2 (42)
RC5	5 (32)	5 (134)	4 (65)	5(79)	3 (163)	3 (141)	2 (136)	3 (24)	4 (71)	4 (161)
VaR RF										
RC7	1 (16)	0 (14)	0 (13)	0 (14)	0 (13)	0 (13)	0 (10)	1 (16)	0 (15)	0 (10)
RC6	0 (10)	1 (20)	2 (29)	0 (11)	1 (34)	1 (49)	1 (16)	0 (10)	0 (12)	2 (42)
RC5	5 (32)	5 (134)	4 (65)	5 (79)	4 (163)	3 (141)	3 (136)	3 (24)	3 (71)	4 (161)
VaR Mean										
RC7	1 (16)	0 (14)	0 (13)	0 (14)	0 (13)	0 (13)	0 (10)	1 (16)	0 (15)	0 (10)
RC6	0 (10)	0 (11)	0 (9)	0 (11)	0 (2)	0 (5)	0 (9)	0 (10)	0 (12)	0 (4)
RC5	5 (31)	5 (131)	4 (127)	5 (78)	4 (163)	4 (141)	5 (137)	2 (24)	3 (71)	4 (161)
VaR WL										
RC7	0 (14)	0 (14)	0 (13)	0 (14)	0 (13)	0 (13)	0 (6)	0 (14)	0 (15)	0 (10)
RC6	0 (10)	0 (11)	0 (9)	0 (10)	0 (1)	0 (1)	0 (1)	0 (10)	0 (12)	0 (1)
RC5	0 (1)	0 (1)	0 (9)	0 (1)	1 (54)	2 (74)	1 (137)	0 (1)	1 (231)	2 (80)

Table 3: This table displays the number of migrations to adjacent risk classes and, in brackets, the maximum number of weeks that the realised volatility has fallen outside the defined range for the respective risk class, either to the upside or the downside. The first three rows show the results for the commitment approach portfolios that have limited possiblities to add variation due to leverage constraints. The following two VaR set-ups differ in the way the non-investment returns are captured in that one uses the risk free rate, whereas the other used the realized mean as the theoretically optimal alternative to reduce volatility. The last VaR set-up is one where the trading signal is set at levels narrower than the prescribed ones to avoid migrations, the limits in the case presented are 11% to 12% for risk class 5 and at 28% for risk class 7. It should be noted that for lack of clear prescriptions in the legal texts and in order to avoid overly conservative results, the hits for the counter are based on rounded values e.g. a volatility coming down to 14.5 would still be counted to risk class 6.

3.2 Problematic Aspects Induced by the SRRI

3.2.1 Limitations for UCITS Funds

We find that none of the commitment portfolios manages to keep risk class 6 during the period under review and only four of the VaR portfolios. The results are similar for risk class 7 where the commitment portfolios are clearly not able to maintain the risk classes in times of low market volatilities. For the VaR portfolios we see that the strategies work well to keep volatility up, being exposed to large swings in the results due to observations dropping out. Turning to risk class 5, we find that both strategies have difficulties in managing to keep the realized volatility in the required risk bands, more particularly this risk class is much more exposed to volatility shocks. These lead for some indices to clear migrations to risk class 6. Risk class 5 has historically not really been an option for equity only funds. The required band was not maintained in any set-up chosen and the strategies were for most of the time hovering over the upper limit of risk class 5. Robustness checks using the realized mean (as an hypothetical alternative) show that migrations to the upside could be avoided for our sample indices managed to maintain risk class 6, but not for risk class 5.

We find that fund managers are exposed to two problems with the boundaries imposed by the risk classes according to the SRRI regulation. To generate an upside movement to volatility some of them have limited firepower in terms of leverage and to the downside they can only gradually reduce the contributions to volatility. This first problem is alleviated for VaR portfolios at the cost of swing backs when high contributing observations drop out and at the systemic cost of considerably higher leverage which further exposes investors to supplementory swings. The second problem is linked to the fact that means to reduce volatility are limited. Delivering the realized mean is the most efficient, albeit theoretical alternative which may more importantly not even be desirable in cases of negative returns. We find that portfolios which are managed according to the commitment approach would not be able to avoid migrations to the upside in most of the cases. For the portfolios with unlimited firepower to bring volatility up, migrations to lower risk classes can be avoided at the cost of high leverage and swing backs displayed in the volatility patterns. The results from above suggest that in certain market environments fund managers will not be able to avoid migrations. This also means that the spectrum of risk classes for equity portfolios boils down to 6 and 7 which raises the question whether the SRRI is actually a reasonable indicator for the equity space, giving only really two options, i.e the most risky and the second risky category. These forced migrations may lead to investor outflows unrelated to any actions taken by the portfolio manager. This finding joins some of the aspects discussed by Doehrer et al. (2012) who conclude that flexible boundaries would be more beneficial. Due to the static boundaries the SRRI bears the risk of degenerating to a passive indicator which is only mirroring changes in market conditions and does not relate to the investment strategy initially chosen by investors. Furthermore it should be noted that pure data point effects may distort the judgement based on the SRRI.

3.2.2 Interference with the Investment Strategy

As shown above high variations in exposures in either direction are required to maintain the risk bands of the SRRI. Furthermore, in cases where the realized volatility of the strategies hovers around one of the boundaries this leads to phases of risk on - risk off patterns. These may be periods of non-investments, or only sporadic investments in the case of an upper bound or those alternating between higher leverage and just regular exposure to the index if a lower boundary is undercut. This would prevent the fund manager from applying a consistent strategy.

Periods of higher exposure may either be induced by periods of low market volatility, as observed e.g. in the late 1990s or prior to the Lehman event, or, simply by high contributing data points dropping out. For the sake of completeness it should also be mentioned that selecting the wrong risk class may lead to long run up times with extensive periods of higher exposures. These interventions may evoke some cyclical pattern with recurring periods of high and low exposures. We abstract from the question whether a migration to a lower risk class is a positive event for investors and should as such not create a binding investment restriction for the fund manager. Required adjustments to the upside are only temporary in nature, which is due to the design of the SRRI providing a 16 week grandfathering period to redirect a deviating strategy. They induce high contributing observations, hence themselves expose the strategies to datapoints effects. Overall, substantially higher levels of leverage are requited to keep risk classes 6 and 7 in times of low volatility, these levels would usually be associated with hedge funds. This leads to a drift in the investment style which may not be intented by the investor.

Interventions to the upside may be induced by Macro events that have a massive impact on realized volatility such as the Lehman Event or the European debt crisis. While the mechanism may generally be desirable, i.e. reducing exposures in times of high market volatility and vice versa, it will effectively prevent fund managers from delivering the strategy promised to investors for extended periods as the high contributing observations will have an impact for the next five years before they drop out and reverse the effect they caused initially. It should be noted that this second round effect may of course be anticipated by fund managers as its occurrance is well known beforehand. Being exposed to datapoint effects does nevertheless create an additional (unnecessary) factor to take into account when managing a portfolio. A smoothing mechanism, such as a weighting scheme of to limit the impact of single observations, would be helpful to avoid these complications.

The interventions range from substantially higher levels of leverage to extended periods of no investments, consequently the fund manager would not be able to do his job and deliver the strategy promised to investors during these periods. Regulation would hence impose fund managers to deviate from the expected investment strategy and interfere in the delegation relationship between fund managers and investors. This style drift obviously dilutes responsibilities when attributing performance. It would be an interesting topic for future research to examine how the volatility strategy imposed by the SRRI impacts fund performance.

4 Herding and Spillovers

4.1 Review of Literature

Spillovers between equity markets is a documented phenomenon in financial literature. Hamao et al. (1990) present evidence for price volatility spillover effects mainly originating from US markets. Liu and Pan (1997) find a similar pattern from US markets to Asian markets. Furthermore Baele (2005) documents volatility spill overs with increasing intensities between US and European equity markets. He further documents contagion from the US to local European markets in times of high volatility regimes. Diebold and Yilmaz (2009) find for nineteen global equity markets that volatility spillovers display no trend but clear bursts that occur with an associated crisis event. Looking at the volatilities calculated for the indices in our sample as shown in graph 9, one clearly sees that volatilities across markets move in very similar patterns and that they are impacted by shocks in a similar ways, the most significant being the Lehman event. As pointed out above also regional shocks such as the European Debt crisis may occur that lead to the coupling of regional markets.

Putting this into context with the SRRI one clearly sees that, if the SRRI creates an investment restriction for fund managers, these volatility spillovers may lead to herding behaviour as they will evoke the same trading directions across markets. This bears the risk of amplifying crises or shocks worldwide induced by regulation, which initially aimed at helping investors to make an informed investment decision. Particularly the finding of Diebold and Yilmaz (2009) should be considered here, as volatility will display jumps in terms of crisis which may lead to immediate required action by the fund managers as it may catapult the SRRI into a riskier class, as opposed to a smooth gradual migration. The results so far indicate that fund managers would have to alter their exposures considerably during those periods, so the resulting sell-off or shorting by fund managers may lead to further market slides. This will amplify shocks in the markets and creates more systemic risk. As per the EFAMA Q2 2017 Statistical Release the assets under management in UCITS following an equity strategy amounts to EUR 3,474 billion representing 38% of the overall volume invested in UCITS. Given this number and the results from above, which indicate that either substantial leverage or shorting may be required to maintain a risk class, it is obvious that systemic impact may arise from the SRRI.

4.2 Aggregate Exposures

We first look at how the overall leverage levels potentially induced by the SRRI for strategies that want to maintain the risk class. To assess the impact on the exposures from a systemic perspective we aggregate the exposures from the VaR portfolios across markets for each week in our sample. The standard exposure in the passive scenario without the SRRI is 10, i.e. all market participants are fully invested to a 100% in their target equity market. Figure 9 shows the aggreate exposures across the markets examined. It should be noted that we substract 10 from the overall aggregate across markets to isolate the effect induced by the SRRI. So the minimum value is -10 which means that none of the investors in the respective risk class would be invested at all in any of the indices. As we examine the portfolios with unlimited leverage opportunities, there is no limitation to the upside on the graph.

We abstract from the high peaks at the beginning as these are due to the run up times to attain the selected risk class. However, one can see that the potential leverage induced to the system by funds managed to maintain risk class seven is substantial, with levels exceeding 60 in peak times. This means that the indices in our sample (as a proxy financial system) would be leveraged 50 times only for risk class 7. The cyclical patterns are also visible at an aggregate level, so the higher levels of leverage that occur across markets due to crises events have an influence on an aggregate level. Some of the phases of higher leverage coincide with elevated levels of leverage also for risk class 6, e.g. August 2006, which further emphasises the importance of this phenomenon.

For risk class 5, we find that for substantial periods during our observation window

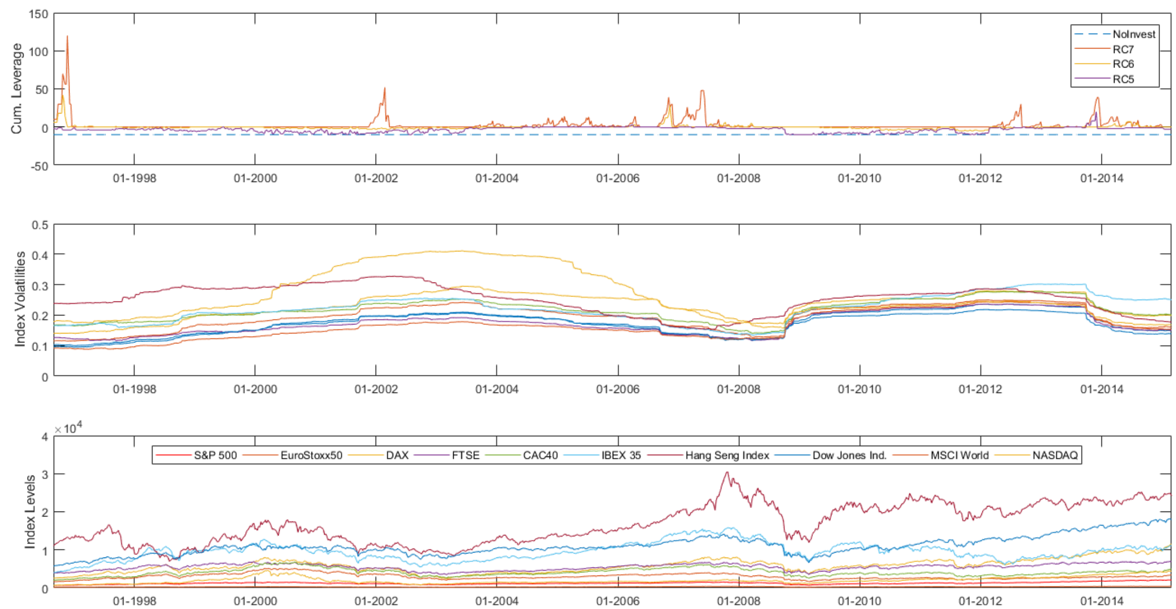

Figure 9: The first graph displays the aggregated exposures across the indices used in our analysis for each week. We substact 10 from the results to isolate the effect from the SRRI. The red line indicates the non-investment border. The two graphs below show the annual volatilities and the index levels respectively.

funds would be underinvested, which mirrors our findings from above and supports the argumentation that the SRRI may lead to downside pressure in the markets if boundaries to higher risk classes are breached.The periods of underinvestments in the years 2010 and the following years coincide with those for risk class 6, so we see that risk class 6 tends to "team - up" with either risk class 7 for leverage in times of lower volatility or risk class 5 in times of higher volatilities. The latter would have led to further downside pressure in the markets following the years of the Lehman event and the European Debt crisis. Once again the effect of systemwide shocks that lead to high contributing observations are visible on the graph, which means that the swing backs observable at index level also have an impact on a global scale. From a systemic perspective it should also be noted that the potential sell-off due to the money withdrawn from funds migrating to a higher risk class, may lead to further pressure in the market due to the portfolio re-allocation. The situation will be similar for balanced funds who will have to reduce their equity allocation as well during these periods.

To summarize there are two potential systemic dangers induced by the SRRI which may occur within specific markets or across markets due to correlation and spillover effects. The first danger is a higher level of leverage in the financial system that stems from fund managers trying to keep volatilities up to maintain a certain risk band in times of low risk levels, whereas the second is an amplification of shocks to the downside by the reduction of exposures (sell-off of assets or shorting as hedging arrangement) when volatilities spike in the wake of a crisis event. It should be noted that in both cases the corrective actions taken by fund managers to maintain the risk class may lead to herding among them. This will be the case for managers that follow the same index as they will all have to perform similar trades as their peers to keep the current risk class, but also across equity markets due to spillover effects.

5 Conclusion

European Regulation imposes volatility based fund classification and overlays the core investment strategy of a UCITS fund with a longterm volatility strategy. However, adherent to a constant grid of boundaries on a metric that may be characterised by gradual patterns as well as sudden disruptive changes entails several challenges for fund managers and further poses problems from a systemic perspective. If the SRRI creates a binding investment constraint, it will cause additional variations due to higher exposures in times of low market volatility and also due to effects induced by singular events that lead to huge swings in the market as e.g. the Lehman crisis.

Migrations to the downside require short, but intensive action by raising the exposures drastically, whereas migrations to the upside result in either long periods of underinvestments or potentially to risk on - risk off patterns. We further find that mantaining certain risk classes as defined through the SRRI is not possible for funds with limited leverage possibilities due to limited means to add varations. Furthermore any fund will have troubles reducing volatility, if its volatility is shot up to far into a higher risk class as means to reduce volatility are limited. A further problematic aspect of the concept is that the set-up chosen is highly exposed to datapoint effects that have a huge impact twice, when they occur and drop out, thus creating a cyclical pattern.

The interventions induced by regulation would result in a substantial change of the investment strategy and would lead to phases that would not allow for active management.

This leads to the question wether a change in the risk class is actually acceptable to investors, or in other words whether investors have to accept higher volatilities if they want to stick to the strategy they initially chose. This joins an aspect discussed by Döhrer et al. (2012) whether flexible boundaries might not be better suited to help investors follow the risk patterns of their investments. Another problematic aspect with the current set-up is that for equity portfolios our analyses provides evidence that the choice of the risk class boils down to either 6 and 7 which raises the question whether the SRRI is actually a reasonable indicator for the equity space, giving only really two options one already being the most risky one. In fact, it wouldn‘t even differentiate between some equity indices or leveraged investments, as both would fall into category 7.

Further analyses revealed indications that the interventions for individual indices would also be mirrored at an aggregate level across equity markets, thus creating further systemic effects. This combined with potential herding among fund managers bears the risk of an amplification of movements in stock markets, or higher volatilities.

Potential future research could focus on aspects regarding flexible boundaries also considering potential alternatives that might limit the effect of datapoints. Furthermore the impact of the SRRI on the return distribution of portfolios would be an interesting field of research.

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***Abstract**

Systemic Impact of Risk Based Fund Classification and Implications for Fund Management

Abstract

This paper examines the impact of European legislation regarding risk classification of mutual funds. We conduct analyses on a set of worldwide equity indices and find that a strategy based on the long term volatility as it is imposed by the Synthetic Risk Reward Indicator (SRRI) would lead to substantial variations in exposures ranging from short phases of very high leverage to long periods of under-investments that would be required to keep the risk classes. In some cases funds will be forced to migrate to higher risk classes due to limited means to reduce volatilities after crises events. In other cases they might have to migrate to lower risk classes or increase their leverage to ridiculous amounts. Overall we find if the SRRI creates a binding mechanism for fund managers, it will have substantial negative impact on portfolio management.

Keywords: portfolio risk, volatility, SRRI, regulation

JEL: G11,G23, G32

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