MIGRATION TO THE PRIIPS FRAMEWORK: WHAT IMPACT ON THE EUROPEAN RISK INDICATOR OF UCITS FUNDS ?

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Migration to the PRIIPs framework: what impact on the European risk indicator of UCITS funds ?

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Abstract

Since 2011, managers of European UCITS funds are required to publish a risk indicator, called SRRI, in order to communicate the risk of their investment fund to retail investors in an understandable way. However, as of mid-2022, the implementation of the new PRIIPs regulation will lead to a complete review of the calculation methodology employed to determine this risk indicator. The latter, formerly based on a traditional measure of standard deviation, will now be determined from a more sophisticated tail-risk measure, namely Value-at-Risk (or, more precisely, the modified VaR, which is an approximation based on the first four moments of the fund returns). Additional changes deal with the data frequency and history used in the estimation procedure.

In this article, we break down the changes brought by the regulation and analyze them through an empirical study in order to take a critical look on the new PRIIPs methodology, that will impact a substantial portion of the 4 500 asset management companies active in Europe[1]. Our results, built from a random selection of 200 funds, show that the impact of the change in the risk measure is not as significant as expected. By contrast, the impact resulting from the changes in the chosen frequency and length of returns history seems material. Secondly, the redefinition of volatility buckets used to map the risk measure to the risk indicator has a side effect : a loss of granularity for non-extreme funds, which are now crowded in classes 2 to 4.

[1] (EFAMA, 2020).

1 Introduction

The European UCITS regulatory framework, first introduced in 1985, has been a major driver of the development of the fund industry. In 2021, net assets managed by UCITS[2] funds exceeded 12.3 trillion EUR (EFAMA, 2021). Among others, the series of UCITS directives have contributed to strengthen the quality of information disclosure toward retail investors. The latter currently hold about 26% of total net assets of UCITS funds and AIFs[3] sold in Europe (EFAMA, 2021).

With the view of regaining investors' trust severely affected by the 2008 financial crisis, the UCITS IV directive introduced ten years ago the compulsory disclosure of the Key Investor Information Document (KIID), a two-pages information folder providing the main characteristics of UCITS funds under a standardized, transparent, and intelligible form (UE Commission Regulation 583/2010).

In order to help retail investors selecting investment funds matching their risk appetite as well as to ease the comparison process between UCITS funds, the European regulator set up a seven-level risk indicator, named Synthetic Risk and Reward Indicator (SRRI) (UE Commission Regulation 583/2010). Contained in the "risk-reward profile" section of the KIID, the SRRI is calculated by the fund provider according to a strict methodology defined by the European regulator. For most UCITS funds, the SRRI attribution currently lies on the five-year annualized standard deviation of historical weekly returns recorded by the fund.

However, the more recent European PRIIPs (Packaged Retail and Insurance-based Investment Products) framework, which aims to extend information disclosure requirements to a larger spectrum of investment products, will trigger substantial changes for UCITS funds. As of mid-2022, the new PRIIPs KID (Key Information Document) will replace the UCITS KIID. In particular, the current SRRI will be replaced by another risk indicator, named SRI (Summary Risk Indicator). Although constructed on a similar seven-level scale, the new SRI will be attributed according to a revised methodology of calculation based on a new risk measure; a volatility-equivalent to the (modified) Value-at-Risk (mVaR, also known as the Cornish-Fisher VaR), will replace standard deviation.

In the context of this change of paradigm, we examine the major changes brought by the new methodology and their respective impact on the risk figures of a representative sample of 200 UCITS funds. We also examine the repartition of UCITS funds across risk classes. By doing so, we aim to take a critical look at the PRIIPs calculation approach as well as to tackle some questions that fund managers may have regarding the evolution of the risk indicators of their UCITS funds.

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[2] UCITS funds refers to the funds governed by the Undertakings for Collective Investments in Transferable Securities (UCITS) directive. The UCITS framework, lastly updated in 2014 under the UCITS V directive, essentially allow a seamless distribution of UCITS funds (that must invest in eligible liquid assets) across EU member states and standardize information provided to investors.

[3] AIFs refers to Alternative Investment Funds regulated by the Alternative Investment Fund Managers (2011/61/EU) directive. Because they typically invest in illiquid assets, AIFs do not satisfy the UCITS IV directive criteria and encompass alternative funds such as hedge funds, private equity funds and real estate funds.

2 From UCITS to PRIIPs

2.1 Adopted risk measures

Since the implementation of UCITS IV, managers of UCITS market funds[4] are required to determine the risk indicator of their fund according to a *risk measure* converted into a *risk indicator* (SRRI).

This *risk measure* corresponds to the annualized standard deviation of returns and is given by the below formula (CESR, 2010) :

Equation 1

$$\sigma_A = \sqrt{\frac{\sum_{i=1}^{N}(r_i - \bar{r})}{N-1}} \times \sqrt{m}$$

where :

- N : the number of intervals during a five-year period (i.e., 260 in case of weekly observations or 60 in case of monthly observations).
- m : the number of observations per year (i.e., 52 in case of weekly observations or 12 in case of monthly observations).
- $\bar{r}$: the arithmetic mean of observed returns r_i of the fund.

Equation 1 actually corresponds to the maximum likelihood estimator of the annualized standard deviation of returns, typically computed from weekly observations (or monthly if unavailable) observed over a window of five years. In case of insufficient history, the fund manager must rely on a proxy to complete the dataset. A more specific approach is defined for other types of UCITS funds, namely absolute return funds, total return funds, life cycle funds and structured funds. For instance, structured funds determine their SRRI based on a Monte Carlo VaR at 99% confidence level, $VaR_{99\%}$ transformed into a standard deviation figure through the concept of VaR-equivalent volatility (described in the next section).

Once calculated, the corresponding SRRI is attributed according to *volatility buckets*. The mapping from risk measure to risk indicator is given in Table 1 (CESR, 2010) :

Table 1 - UCITS volatility buckets

Synthetic Risk and Reward Indicator (SRRI)	Volatility (σ_A)
1	$0\% - 0.5\%$
2	$0.5\% - 2\%$
3	$2\% - 5\%$
4	$5\% - 10\%$
5	$10\% - 15\%$
6	$15\% - 25\%$
7	$25\% - +\infty$

In order to obtain a risk indicator with limited swings through time, the regulator implements a smoothing method consisting of recognizing a change in SRRI when the recorded volatility consecutively falls outside of its initial volatility bucket for a period of four months (see Figure 1).

Eventually, the risk indicator is presented in the KIID and is supplemented with some explanations on its meaning as well as some disclosures on other types of risks that could be omitted by the indicator.

[4] Markets funds refer to "funds that are managed according to investment policies or strategies which aim to reflect the risk and reward profile of some pre-determined segments of the capital market" (CESR, 2010).

UCITS funds, now considered as packaged retail investment products under the more recent PRIIPs framework, currently benefit from a transition period. Yet, in July 2022, managers will be required to calculate the risk indicator of their UCITS funds according to a new methodology.

The choice of the standard deviation as risk measure is appropriate when the distribution of returns follows a Normal distribution. However, it is well known that this assumption is unrealistic in the case of financial asset returns: UCITS funds generally experience negative asymmetric returns and "fat tails", two effects that impact investors' preferences but that standard deviation fails to capture. In particular, it is widely admitted that Normality tests are rejected for most equity returns.

The regulator identifies four categories of PRIIPs. Apart from structured funds (which are considered as "category 3" products because they provide non-linear payoffs) other types of UCITS funds will usually fall in "category 2" products because they provide linear payoffs.

Unlike other types of PRIIPs that must determine their SRI through the appraisal of credit risk and market risk, UCITS funds are assumed to be immunized against credit risk and must therefore determine their SRI based on the sole appraisal of market risk. As it is the case under UCITS IV, the risk indicator is obtained from a risk-measure related to standard deviation. Under PRIIPs, the latter is obtained by converting a VaR in a volatility-equivalent risk measure.

More precisely, UCITS market funds determine their SRI according to the mVaR, also known as Cornish-Fisher VaR, following the below formula[5] (2017/653 Regulation):

Equation 2

$$CFVaR_{97.5\%}^{T} = -\frac{\sigma^2}{2}T + \left(-1.96 + 0.474\frac{S}{\sqrt{T}} - 0.069\frac{K}{T} + 0.146\frac{S^2}{T}\right)\sigma\sqrt{T}$$

where :

- σ : the standard deviation of daily log-returns observed during a five-year period.
- T : the number of non-overlapping time intervals comprised in the recommended holding period of the fund (i.e., 1764 for a recommended holding period of 7 years assuming 252 trading days per year).
- S : the skewness coefficient of daily log-returns observed during a five-year period (described in the appendix)
- K : the excess kurtosis coefficient of daily log-returns observed during a five-year period (described in the appendix).

In practice, a Cornish-Fisher VaR is calculated for a 97.5% confidence level (noted $CFVaR_{97.5\%}^{T}$) based on the daily historical log-returns of the fund (or weekly, biweekly, or monthly in case of unavailability). This mathematical development, although less common and more complex than the traditional standard deviation measure (Equation 1), consists of transforming a Gaussian critical value into an estimated non-Gaussian critical value, adjusting for skewness and excess. Hence, unlike the UCITS standard deviation calculation, Equation 2 accounts for non-normality of asset returns and is therefore better suited to price the risk of UCITS funds, which generally demonstrate asymmetric (i.e., skewed) and leptokurtic (i.e., fat-tailed) returns distributions.

In a second step, the $CFVaR_{97.5\%}^{T}$ is converted into an *equivalent volatility level* through the following formula, which corresponds to the concept of Cornish Fisher VaR-equivalent volatility (hereafter referred as VEV) (2017/653 Regulation) :

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[5] More details about the derivation of this formula can be found in the appendix.

Equation 3

$$VEV = \frac{-1.96 + \sqrt{(-1.96)^2 - 2 \times CFVaR^T_{97.5\%}}}{\sqrt{T}} \times \sqrt{m}$$

where :

- m : the number of non-overlapping time intervals per year (i.e., 252 in case of daily observations, 52 in case of weekly observations and 12 in case of monthly observations).

Equation 3, the function that maps the Cornish-Fisher VaR into an equivalent volatility level, finds his root in the geometric Brownian motion dynamics (a standard model to depict the evolution of stock prices, largely popularized by the celebrated Black-Scholes formula used in option pricing). The reader is referred to the appendix for technical details. Note that the new calculation method introduced by PRIIPs now considers the holding period recommended by the UCITS provider in the calculation of the SRI, which is ignored so far by the UCITS methodology. One can check that when the funds returns are Gaussian ($S = K = 0$), VEV (Equation 3) coincides with the standard deviation (Equation 1) and that the recommended holding period has no effect on the VEV.

Finally, the VEV is converted into a risk indicator using Table 2 (2017/653 Regulation), different from Table 1 in the former framework :

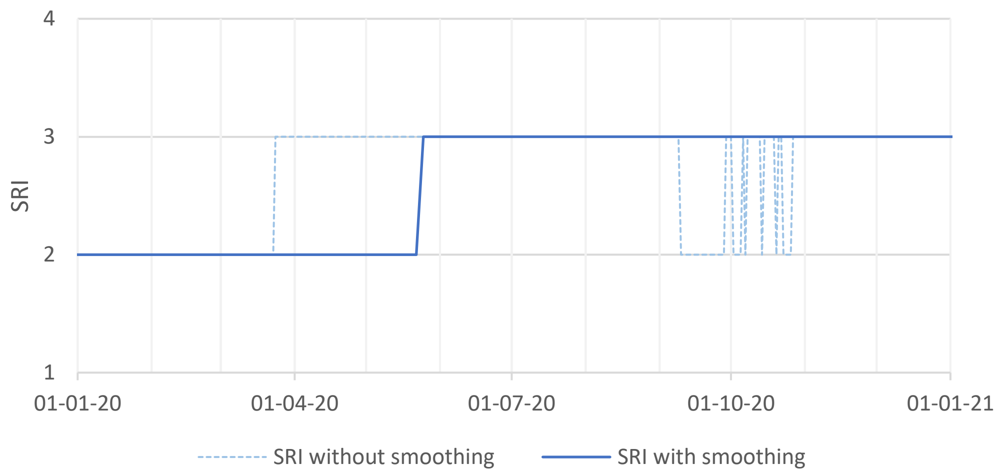
Table 2 - PRIIPs volatility buckets

Summary Risk Indicator (SRI)	Volatility (VEV)
1	$0\% - 0.5\%$
2	$0.5\% - 5\%$
3	$5\% - 12\%$
4	$12\% - 20\%$
5	$20\% - 30\%$
6	$30\% - 80\%$
7	$80\% - +\infty$

To avoid excessive reclassification of funds, a new smoothing method is considered : the SRI becomes the risk level observed in majority over the last four months.

In Figure 1, we show the impact of the smoothing technique on the SRI. The SRI with smoothing (in solid blue) is much more stable than the SRI that would have been obtained without smoothing (dashed blue).

Figure 1 - Fund in the sample experiencing excessive swings in risk indicator without smoothing method



2.2 Other changes

Apart from the change in the risk measure (from volatility to VEV, the equivalent-CFVaR volatility) which takes the recommended holding period[6] of the fund as well as non-normality of returns into account, PRIIPs brings several other important changes to consider :

- The preferred data frequency to compute the SRI is daily returns, instead of weekly returns under the UCITS approach. Moreover, UCITS fund providers will now be greatly disadvantaged when using monthly historical returns under the PRIIPs framework as they will be required to systematically markup their SRI by +1 level when using this lower frequency.
- Under UCITS, the history length (estimation window) used to compute the standard deviation is set to five years, regardless of the frequency used. If the UCITS fund has a price history inferior to five years, a representative proxy is required to complete the missing data. Although the VEV is still calculated based on a period of five years under the PRIIPs methodology, a shorter return history can be used in case of missing history (i.e., when a fund has been launched recently). Hence, from now, a proxy is only required when the available historical data is inferior to two and four years when using daily and weekly data, respectively.
- Although the risk indicator is still based on seven levels of risk, the volatility buckets used to assign SRIs are greatly modified, as visible by comparing Table 1 with Table 2. For instance, a fund experiencing a volatility level of 25% possess a SRRI of 7 under the UCITS framework, but only gets a SRI of 5 under the more recent PRIIPs methodology.
- Eventually, with the aim of limiting excessive migrations of risk scores for UCITS funds whose volatility level falls on the boundary of two volatility buckets, the UCITS framework has set up a smoothing method consisting of recognizing a change in SRRI if the fund records a different risk level than its initial risk level during four months in a row. By now, observations are not required to be consecutive anymore : the SRI becomes the risk level recorded in majority during four months of observation under PRIIPs.

The changes between UCITS IV and PRIIPs are summarized in Table 3.

[6] An analysis of the Recommended Holding Period (RHP) is available on Deloitte's website, please refer to the references at the end of the article for additional information. We also describe this concept in details in our Master's thesis referenced at the end of the article (see Clausse & Herr, 2021).

Table 3 - Comparison of UCITS and PRIIPs methodologies for market funds

<table>
<tr><th></th><th>UCITS</th><th>PRIIP</th></tr>
<tr><td>Risk indicator name</td><td>Synthetic Risk and Reward Indicator (SRRI)</td><td>Summary Risk indicator (SRI)</td></tr>
<tr><td>Risk measure</td><td>Standard deviation</td><td>Modified VaR Equivalent Volatility (VEV)</td></tr>
<tr><td>Data frequency</td><td>By order of preference :
Weekly
Monthly</td><td>By order of preference :
Daily
Weekly
Biweekly
Monthly
In case of monthly data, a markup is applied.</td></tr>
<tr><td>Use of a proxy to complete missing data</td><td>A proxy is used when the available history is inferior to five years.</td><td>Depends on the data frequency used :
If daily, a proxy is used when the available history is inferior to 2 years.
If weekly, a proxy is used when the available history is inferior to 4 years.
Else, when the available history is inferior to 5 years .</td></tr>
<tr><td>Smoothing method</td><td>The SRRI is the risk level recorded for the last four months in a row.</td><td>The SRI is the risk level recorded in majority over the last four months.</td></tr>
<tr><td>Volatility intervals of risk classes</td><td>
<table>
<tr><th>SRRI</th><th>Standard deviation</th></tr>
<tr><td>1</td><td>$0\% - 0.5\%$</td></tr>
<tr><td>2</td><td>$0.5\% - 2\%$</td></tr>
<tr><td>3</td><td>$2\% - 5\%$</td></tr>
<tr><td>4</td><td>$5\% - 10\%$</td></tr>
<tr><td>5</td><td>$10\% - 15\%$</td></tr>
<tr><td>6</td><td>$15\% - 25\%$</td></tr>
<tr><td>7</td><td>$25\% - +\infty$</td></tr>
</table>
</td><td>
<table>
<tr><th>SRI</th><th>VEV</th></tr>
<tr><td>1</td><td>$0\% - 0.5\%$</td></tr>
<tr><td>2</td><td>$0.5\% - 5\%$</td></tr>
<tr><td>3</td><td>$5\% - 12\%$</td></tr>
<tr><td>4</td><td>$12\% - 20\%$</td></tr>
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<tr><td>7</td><td>$80\% - +\infty$</td></tr>
</table>
</td></tr>
</table>

3 Empirical analysis

The purpose of this study is to analyze the impact of the migration from UCITS IV to PRIIPs in terms of risk indicators. To that end, we perform an empirical study on a sample of 200 UCITS funds, and analyze how the corresponding risk measures and risk indicators are impacted.

3.1 Data & methodology

First, we examine the marginal impact of (1) the change in risk measure, (2) the change in data frequency and (3) the change in minimal length of returns history on the risk indicator of funds comprised in our sample[7]. Next, we calculate the SRRIs and SRIs of the funds comprised in our fund sample, applying rigorously the respective methodologies provided by the European regulator. Thereafter, we analyze the discrepancies between the old and new risk indicators, and study the distribution of funds among the seven different risk classes and their stability across time.

To carry out our analysis, we collect a list of 3,721 European UCITS from Bloomberg (with the function FSRC) applying the following filter:

- Market status : Active
- Main unit class fund : Yes
- Type of fund : UCITS
- UCITS European directive : Yes
- Domiciliation : Western Europe
- Pricing frequency : daily
- First date ≤ 31/03/2011

We then select randomly 200 funds without replacement via Excel from the latter. Based on the fields retrieved presented in Table 4 from Bloomberg, we observe that the sample is rather inhomogeneous. Notice that these results support the non-Gaussian behavior of the asset returns. In particular, the mean skewness and mean excess kurtosis coefficients of the fund sample, respectively equal to -1.21 and 6.92.

Table 4 - Summary statistics of the sample retrieved from Bloomberg

	Average return	Annualized standard deviation	Skewness coefficient	Kurtosis coefficient	Sharpe Ratio
Min.	-11.56%	0.05%	-5.87	-1.17	-5.63
1st quartile	1.34%	4.10%	-1.47	1.35	0.34
Median	4.79%	9.26%	-0.78	3.78	0.55
Mean	5.79%	9.96%	-1.21	6.92	0.51
3rd quartile	9.35%	14.83%	-0.41	8.60	0.76
Max.	21.15%	30.08%	2.27	38.19	2.79

The daily adjusted prices (in the currency of the fund) of these 200 funds for the last ten years (i.e., from 31/03/2011 to 31/03/2021) are retrieved from Bloomberg, with the aim of monitoring the annual

[7] Other changes brought by PRIIPs, namely the change in smoothing method and the inclusion of the recommended holding period in the risk measure, are outside the scope of this article. For additional information, you can refer to our master's thesis referenced at the end of the article.

evolution of their SRRIs and SRIs from 2017 to 2021 calculated at the end of March. While the period from 2017 to 2019 includes a period of normal market conditions, the period from 2020 to 2021 demonstrates much higher market volatility due to the Covid-19 crisis.

For the sake of convenience, we suppose that the funds comprised in our sample are classified as "market funds" under UCITS and as "category 2" investment products under PRIIPs. We also suppose that all the funds in our sample recommend a holding period of five years to their investors.

Our computations are conducted using R Studio (RStudio Team, 2020), an open source statistical software, according to the following procedure. First, we omit missing values in prices (simply with the function "na.omit"). Then, we convert the file to an extensible time-series object to manipulate it and subsequently calculate arithmetic and log-returns with the function "periodReturn" from the R package "quantmod".

Afterwards, we calculate the sample 5-year standard deviation of each fund on an annual basis with the function "rollapply" from the "zoo" R package and the "StdDev.annualized" function from the R package "PerformanceAnalytics". For the PRIIPs methodology, we estimate skewness S and excess kurtosis K based on the "skewness" and "kurtosis" functions available in the "PerformanceAnalytics" package too. Note that we use the approximate critical value of 1.9600, in accordance with the PRIIPs methodology. Functions used to apply UCITS and PRIIPs smoothing methods have been implemented in strict accordance with the prescribed methodology. Finally, we export our result tables in Excel to proceed with their analysis and interpretation.

3.2 Results

3.2.1 Impact of the risk measure

In order to examine the impact induced by the change in risk measure on risk indicators, we compare the standard deviation calculated from five-year weekly returns with the VEV calculated based on five-year weekly log-returns and analyze their difference (in absolute value). We set the recommended holding period of all funds equal to 5 years and we omit smoothing methods. The results are shown in Table 5.

Table 5 – Difference (in absolute value) between standard deviation and VEV

	Before Covid-19			During Covid-19	
	2017	2018	2019	2020	2021
Minimum	0.00%	0.00%	0.00%	0.00%	0.00%
10%-quantile	0.01%	0.01%	0.01%	0.04%	0.03%
Median	0.05%	0.05%	0.06%	0.47%	0.43%
Mean	0.08%	0.08%	0.09%	0.56%	0.51%
90%-quantile	0.18%	0.17%	0.17%	1.20%	1.09%
Maximum	1.00%	0.88%	0.88%	2.34%	2.82%

One can see that the mean absolute adjustment brought by the new measure is inferior or equal to 0.09% for the 2017-2019 period. During the Covid-19 crisis, the mean difference between the standard deviation measure and the VEV measure reaches 0.56%. We note that 90% of the funds comprised in the sample obtain an absolute difference in volatility inferior or equal to 0.18% and 1.20% for the pre-Covid-19 and Covid-19 periods, respectively. Moreover, the maximum absolute difference recorded during the entire observed period is equal to 2.82%.

Although not visible in Table 5 that displays absolute values of changes, we note from the results that the direction of adjustments is usually upwards : during the pre-Covid period, the mean proportion of funds having a VEV superior to standard deviation equals 74.2%. During the Covid-19 period, the mean proportion of funds experiencing an increase in volatility level when using VEV instead of standard deviation reaches 95.5%

Obviously, the increasing difference from the pre-Covid-19 period to the Covid-19 period is attributable to an important increase in skewness and excess kurtosis coefficients, both respectively translating into an increase in frequency and in magnitude of negative returns during the crisis period.

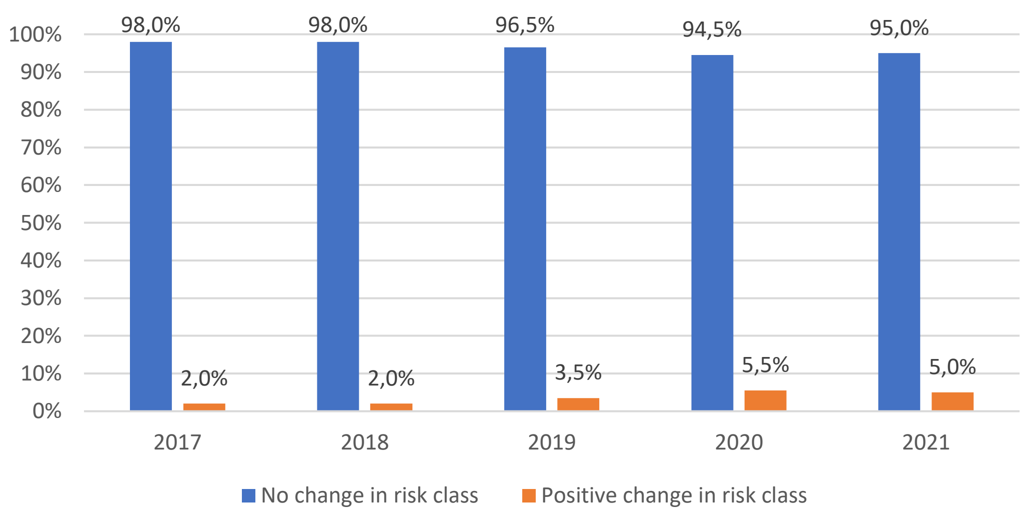
Table 6 - Evolution of skewness and excess kurtosis coefficients[8]

	Before Covid-19			During Covid-19	
	2017	2018	2019	2020	2021
Mean skewness coefficient	-0.78	-0.83	-0.82	-2.72	-2.50
Mean excess kurtosis coefficient	7.03	7.04	7.02	22.99	22.91

We conclude that in normal market conditions, the VEV figure obtained from the Cornish-Fisher is virtually identical to the plain standard deviation. To put it differently : the change in risk measure has almost no impact. Not surprisingly, the difference in results obtained in abnormal market conditions seem to provide some valuable benefits in the risk assessment of UCITS funds.

Recall, however, that the attribution of the European risk indicator lies on a categorization based on volatility buckets. Consequently, we seek to determine whether the new risk measure produces, in practice, a different risk indicator accounting for the volatility buckets. To address this question, we analyze the proportion of the sample experiencing an actual change in risk indicator when transitioning from the measure of standard deviation to the VEV measure. In order to analyze the *isolated* impact of the change of risk measure, we apply the UCITS mapping table (Table 1) to both standard deviation and VEV measures to produce the results in Figure 2.

Figure 2 - Proportion of funds experiencing a change in risk indicator when applying the new risk measure under UCITS volatility intervals



[8] Respectively calculated with functions “skewness” (method = “moment”) and “kurtosis” (method = “excess”) from the R package “PerformanceAnalytics”.

As shown in Figure 2, only a very small proportion of funds see their risk class modified when switching from standard deviation to the new VEV risk measure. Although not visible in Figure 2, results are similar when applying PRIIPs volatility intervals (Table 2) to both risk measures to allocate the risk indicators. Indeed, the highest proportion of funds experiencing a change in risk level reaches 6.5% for both 2020 and 2021. We also note that all the changes in risk classes observed correspond to an increase in one risk level.

Therefore, although the new risk measure is theoretically motivated by its ability to capture higher-order effects, our observations suggest that, for most funds, there is virtually no impact on the assigned buckets. Consequently, and given the substantial costs that a change of paradigm triggers for asset managers, the move to the new measure may not be worth the effort. While this conclusion may not hold in every future market condition, in particular during financial crises, we point out that there is very little impact in turmoil periods such as Covid-19, during which the BEL20 index experienced a -30% drop.

3.2.2 Impact of the data frequency

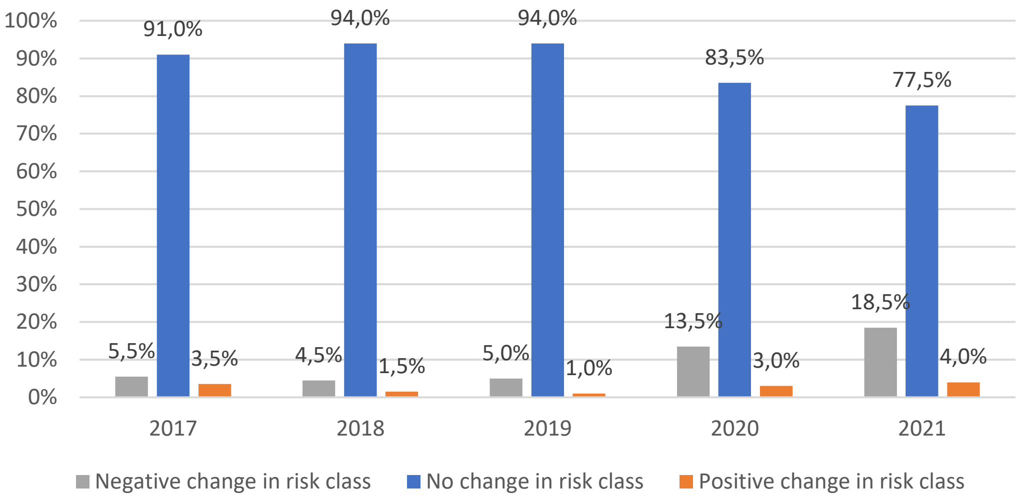
Let us now analyze the impact induced by the change in data frequency on the risk indicator. To do so, we first calculate the difference (in absolute value) between the VEV obtained via weekly returns with the VEV calculated from daily returns. Again, we set the recommended holding period of all funds equal to 5 years and we omit smoothing methods.

Table 7 - Difference (in absolute value) between weekly VEV and daily VEV

	Before Covid-19			During Covid-19	
	2017	2018	2019	2020	2021
Minimum	0.00%	0.00%	0.00%	0.00%	0.00%
10%-quantile	0.04%	0.03%	0.04%	0.07%	0.09%
Median	0.39%	0.34%	0.39%	0.88%	1.01%
Mean	0.63%	0.51%	0.56%	1.20%	1.40%
90%-quantile	1.47%	1.23%	1.31%	2.62%	3.05%
Maximum	9.57%	3.61%	5.49%	5.58%	9.89%

The results suggest that the transition from weekly to daily returns can have a significant impact on the VEV calculated, including during normal market conditions. Indeed, the mean absolute difference observed between 2017 and 2021 varies between 0.51% and 1.40%. In 2021, 10% of the fund sample experiences a change in volatility of at least 3.05%. As demonstrated by the maximum values observed, the change in data frequency can sometimes have a tremendous impact on the calculated VEV, ranging from 3.61% to 9.89% during the observed period (the most extreme change is documented in the appendix).

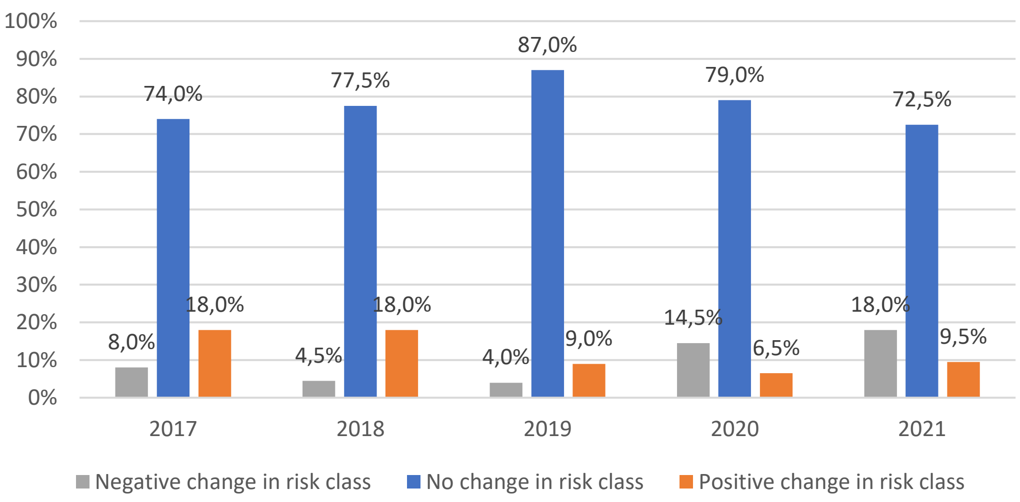
Figure 3 - Proportion of funds experiencing a change in SRI when transitioning from weekly to daily returns



When examining the proportion of funds experiencing a change in SRI due to the use of daily returns instead of weekly returns, we see that the isolated effect of a change in frequency can become important, especially during the Covid-19 stress period. Indeed, the proportion of funds facing an inferior SRI when employing daily returns reaches 13.5% and 18.5% in 2020 and 2021, respectively. Therefore, surprisingly, our results suggest that the transition from weekly to daily returns has much more weight than the change in the risk measure itself.

In order to determine whether the systematic markup of the risk indicator of funds employing monthly data is justified, we examine the proportion of funds affected by a change from monthly to daily returns.

Figure 4 - Proportion of funds experiencing a change in SRI when transitioning from monthly to daily returns



From Figure 4 and in contrast to Figure 3, we observe that a larger proportion of funds experience an increase in SRI when passing from monthly to daily returns. More precisely, the use of monthly returns conducts to an underestimation of the risk calculated based on daily returns for 18% of the sample in 2017 and 2018. Therefore, the penalization for funds using monthly returns to account for the increased sampling error risk appears to be justified, especially based on the observations from the pre-Covid-19 period.

However, when examining negative change in risk class proportions for 2020 and 2021, we see that the tendency reverses during the Covid-19 period, where both weekly and monthly VEV lead to a nearly identical proportion of funds experiencing an overestimation of their SRI with respect to results obtained from daily returns.

Finally, we observe that the use of monthly returns leads to the same SRI obtained from daily returns for at least 72.5% of the sample on the observed period. In other words, by willing to avoid an underestimation of the SRI for 12.2% on average on the observed period, the markup implemented by the regulator leads to an overestimation of the risk indicator for 87.8% of the fund sample on average for the observed period.

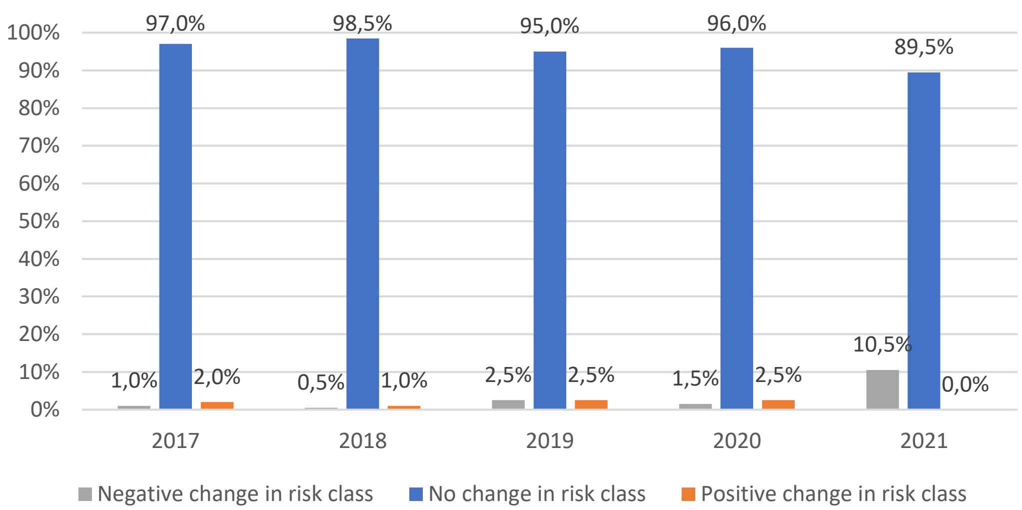
3.2.3 Impact of the history length

Recall that the methodology prevailing under the UCITS approach calls for using an historical period of five years. If the available history is inferior to five years (e.g., because the fund has been launched recently or because the past returns are not indicative anymore due to a change in the fund asset mix) the missing historical returns must be obtained via a relevant proxy. Under the PRIIPs methodology, the required use of a proxy is more nuanced.

Indeed, while the preferred historical period is still equal to five years, a shorter historical period can be employed in case of missing data. More precisely, a fund using daily data to determine its SRI must use at least two years of historical returns. When weekly returns are used, a minimum historical period of four years must be employed. If the required minimum historical period is not met, a proxy must be used.

In order to gain a better understanding of the implications of this new rule, we first compare the SRI obtained via the VEV based on four years of weekly returns with the SRI calculated based on the general rule of five years of weekly returns.

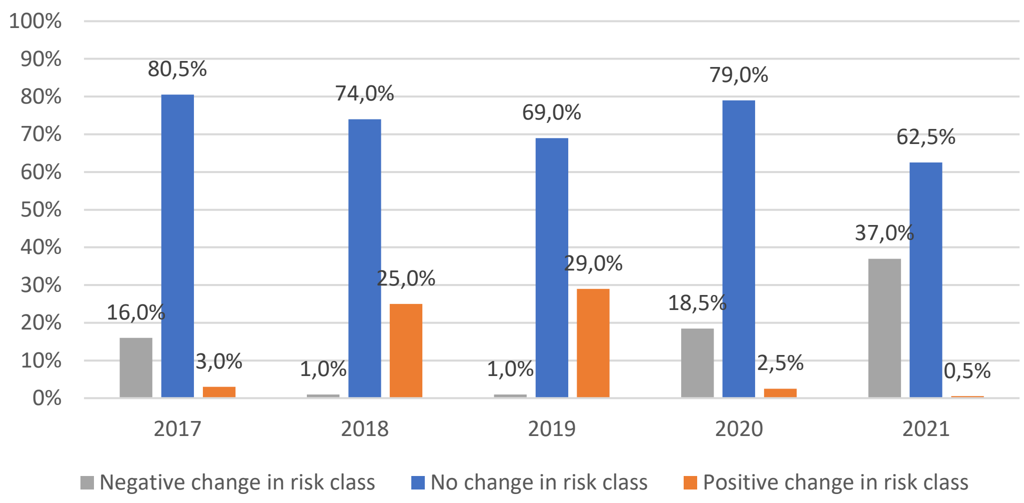
Figure 5 - Proportion of funds experiencing a change in SRI when transitioning from 4 years to 5 years



In practice, the use of four years instead of five only produces a different SRI for very few funds. However, in 2021, a larger proportion of funds go through a decrease in SRI when employing five years of history instead of four years. This observation is coherent : in case of the emergence of adverse conditions, the risk measure constructed from a longer historical period will adjust more slowly to recent data.

We now reiterate the analysis by comparing the SRI obtained from two years of daily returns and the SRI calculated from five years of daily returns. The results are shown in Figure 6.

Figure 6 - Proportion of funds experiencing a change in SRI when transitioning from 2 years to 5 years



As expected, the use of two years of history instead of five years provides significant discrepancies in SRIs, ranging from 19.5% in 2017 to 37.5% in 2021. Therefore, for a considerable proportion of the sample, using two years of data does not allow to estimate the SRI obtained based on five years of data reliably.

In period of adverse market conditions, a fund determining its SRI based on a historical period largely inferior to five years will therefore be greatly disadvantaged with respect to a fund determining its risk indicator based on five years of historical data which experienced lower-volatility levels in the past (despite the fact that both actually possess an identical risk profile). On the other hand, compared to a mature fund that has undergone a recent crisis, a recent fund having a similar risk profile could be advantaged by benefiting from an inferior risk indicator solely because its launch date is after the crisis.

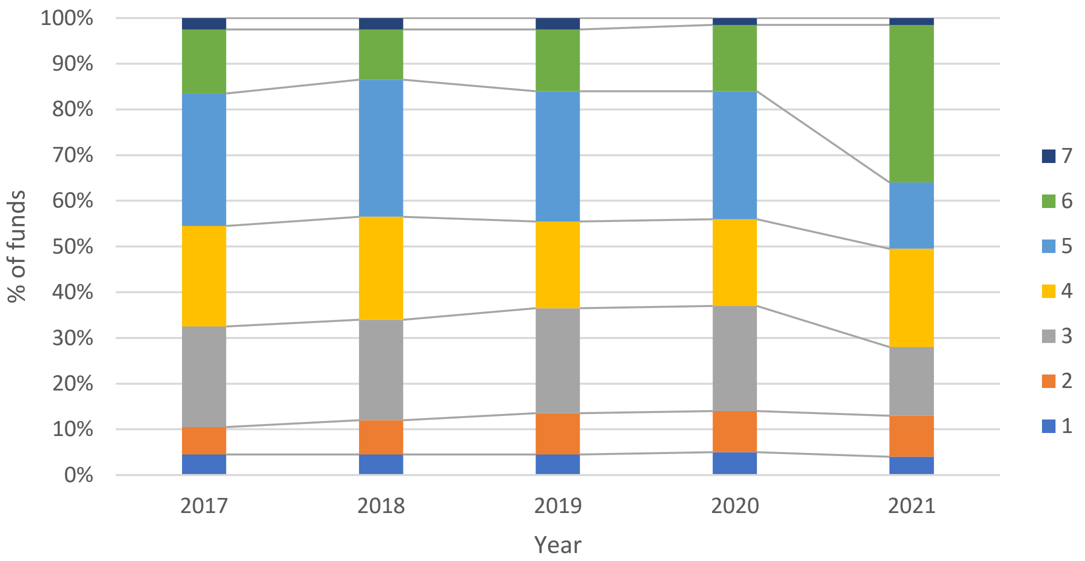
In other words, our results suggest that the measures taken in the PRIIPs approach generate a so-called "age bias"[9], that is, differences in treatment between recent funds and mature funds. In our opinion, the systematic use of proxy in order to reach an identical history length for all funds is superior because it avoids generating this bias between funds.

[9] Documented by J.A. Adkisson & Don R. Fraser in their work related to Morningstar ratings (Adkisson & Fraser, 2003).

3.2.4 Sample repartition across risk classes

While the previous sections examined the marginal impact of each change brought by PRIIPs, this section aims to provide a broader picture by comparing the repartition of funds across risk classes. To that end, we compare the SRRIs and SRIs assigned in strict accordance with their respective methodologies. Moreover, we now consider the smoothing methods and volatility buckets associated with the corresponding methodology. Given the significant reorganization of risk classes brought by PRIIPs, it is expected that most of the funds in the sample will be assigned a new risk indicator.

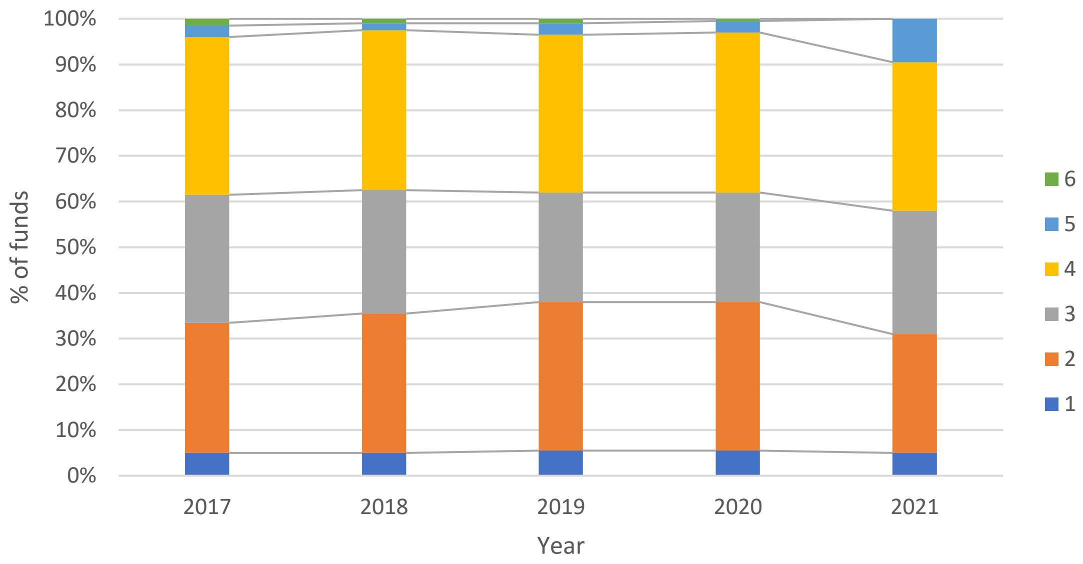
Figure 7 - Repartition of the sample across UCITS risk classes



As shown in Figure 7, the fund repartition is not equal across risk classes under the UCITS methodology. Indeed, 85% of the sample is comprised in four risk classes on average. While the repartition is stable for the first four years, we observe that the leading risk classes switches from class 5 (10% to 15% volatility) to class 6 (15% to 25% volatility) in 2021, once the larger volatility induced by the Covid-19 crisis is being recorded.

We now compare the repartition of funds across risk classes under the PRIIPs framework. In contrast to the SRRI repartition, we observe that the vast majority of the sample is now crowded in three risk classes, namely 2 to 4. We also note that the class 5 increases in 2021. Eventually, as expected, none of the funds obtains a SRI of 7 (which corresponds to volatility superior to 80%).

Figure 8 - Repartition of the sample across PRIIPs risk classes



Obviously, the larger PRIIPs volatility intervals bring an increased stability to the risk indicator but at the expense of a lower granularity. While five risk classes are needed to cover 93% of the sample on average under UCITS volatility buckets, only three risk classes now cover 90.3% of the sample on average. This make the SRI less discriminant in the context of comparisons among UCITS funds. We can observe that, in the middle of the seven-level scales, the volatility buckets under PRIIPs (Table 2) are much wider than under UCITS (Table 1). For instance, the width of the volatility bucket associated to level 3 is scaled by a factor larger than 2 and jumps from $5\% - 2\% = 3\%$ to $12\% - 5\% = 7\%$. A similar phenomenon is observed for the other two levels that encompass most funds, i.e., levels 2 and 4.

Finally, we examine the average repartition of the sample broken down by asset class for the 2017-2021 period under the PRIIPs methodology.

Table 8 - Asset class repartition

	SRI							
Fund asset class	1	2	3	4	5	6	7	Number of funds
Equity			12.15%	76.71%	9.11%	2.03%		79
Mixed		27.78%	57.41%	14.44%	0.37%			54
Bonds	9.12%	70.88%	19.95%	0.35%				57
Specialized		80.00%	20.00%					1
Money market	57.78%	42.22%						9
							Total	200

As shown in Table 8, the majority of equity UCITS funds possess a SRI of 4, which corresponds to a VEV comprised between 12% and 20%. Most mixed UCITS funds have a VEV from 5% to 12% and therefore receive a SRI of 3. UCITS funds investing in bonds get a SRI of 2, which corresponds to the volatility bucket ranging from 0.5% to 5%. Eventually, money markets funds usually receive a SRI of 1 or 2. However, similarly to specialized funds, the latter are too few in the sample to draw conclusions.

4 Conclusion

The implementation of an intelligible risk indicator to support European retail investors' investment decisions seems to be an attractive and helpful solution[10]. A similar exercise is performed by foreign financial regulators such as Australia, Canada, India, New Zealand, and Thailand. However, the implementation of such risk indicators, apart from potentially influencing the investment strategy of fund managers[11], can generate substantial adaptation costs for asset management firms.

Indeed, the change of paradigm from UCITS to PRIIPs is of great managerial importance as it will impact 34,000 UCITS investment funds accounting for 12.3 trillion EUR in net assets (EFAMA, 2021). As an order of magnitude, 4,500 asset management companies currently operate in Europe, including 70 in Belgium (EFAMA, 2020).

The major change brought by the new methodology, that is the implementation of modified VaR, aims to account for the skewness and kurtosis of returns distribution of funds. Besides this, the use of daily returns to compute the risk measure is now preferred in order to mitigate sampling error risk, coming with a penalization for funds using monthly data in their computations. Moreover, funds using daily returns and weekly returns are required to use a proxy when their history of returns is inferior to two years and four years, respectively. Finally, the volatility boundaries of the seven risk classes are reorganized to leave space for other, more risky types of PRIIPs.

Based on a detailed empirical analysis conducted on 200 funds randomly selected in a universe of 3,721 UCITS funds identified on Bloomberg, we provide a critical look on the new PRIIPs methodology implemented for the calculation of the SRI. Our results help investors and fund managers to understand how the risk indicators of UCITS funds will be impacted in the context of this transition. According to the results obtained, we provide the following key takeaways :

- The impact of the new VEV risk measure on the classification of UCITS funds is virtually negligible. During normal market conditions, the difference between standard deviation and VEV is 0.1% on average. During extreme conditions, the difference reaches 0.5% on average. From 2017 to 2021, we observe that less than 7% of the funds in our sample would experience a change in risk indicator due to the migration from the old to the new risk measure.
- In contrast, and perhaps surprisingly, the use of daily returns instead of weekly returns is far from being inconsequential and can lead to huge leaps in volatility that could penalize certain UCITS funds. For example, 10% of the funds in our sample experience a change in volatility of at least 3.05% in 2021 when employing daily returns.
- While we indeed observe that considering monthly returns provides a more optimistic view in terms of risk than when weekly returns are used, the proposed systematic markup penalty seems too severe, leading to a risk indicator that is overestimated most of the time compared to daily returns figures.
- The minimum historical length, which was previously set to five years under UCITS but has been redefined to two years under PRIIPs for funds using daily data, generates an age bias between recent funds and mature funds calculating their SRI based on five years of history. This situation is problematic because it jeopardizes the comparability between recently launched funds and mature funds.
- The reorganization of volatility limits used to define the seven-scale risk indicator leads to a jump in the risk indicator of UCITS funds, which could be wrongly interpreted as a change in the risk level of the investments by uninformed retail investors and conduct in divestments.

[10] However, note that this view is not unanimous. For instance, in the US, the Investment Company Institute sharply criticizes the adoption of such risk indicators (Olson, 2018).
[11] Documented in the article Systemic Impact of the Risk Based Fund Classification and Implications for Fund Management (Ewen & Rieger, 2019).

- Finally, the redefinition of the seven volatility buckets results in UCITS funds being crowded in only three risk classes, namely 2 to 4. This makes the new risk indicator less discriminant for funds of intermediate risk and, consequently, leads to a significant loss in granularity in the core of the funds' population.

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6 Appendix

6.1 Development of the Cornish Fisher VaR-equivalent volatility formula

The VaR of a Gaussian random variable $X \sim N(\mu, \sigma)$ at a given confidence level $1-\alpha$ is noted $VaR_{1-\alpha}$ and obtained via the following formula :

$$VaR_{1-\alpha} = \mu + \sigma z_\alpha$$

Where :

- z_α : the critical value of the standard Gaussian distribution for a confidence level $1-\alpha$. For instance, $z_{0.025} = -1.96$.

In a nutshell, the concept of "volatility equivalent" consists of computing the volatility σ of the returns that would display a given level of $VaR_{1-\alpha}$. The problem, however, is that the latter depends on the distribution of the actual returns, which is unknown. Therefore, the concept of VaR-equivalent-volatility works as follows:

- Compute a VaR estimate Z_α based on that of the Normal, z_α, but adjusted for skewness and excess kurtosis, if applicable.
- Convert the VaR into a log-return volatility.

6.1.1 Computation of the CFVaR estimate

The Cornish-Fisher VaR provides an approximation of the quantile Z_α of a random variable around that of a Normal variable, z_α, accounting for the third and fourth moments. Specifically,

$$Z_\alpha = z_\alpha + (z_\alpha^2 - 1)\frac{S}{6} + (z_\alpha^3 - 3z_\alpha)\frac{K}{24} - (2z_\alpha^3 - 5z_\alpha)\frac{S^2}{36}$$

$$S = \left(\frac{\sum_{i=1}^{N}(r_i - \bar{r})^3}{N}\right)/\sigma^3$$

$$K = \left(\frac{\sum_{i=1}^{N}(r_i - \bar{r})^4}{N}\right)/\sigma^4 - 3$$

where :

- Z_α : critical value adjusted from skewness and excess kurtosis.
- σ : standard deviation of log-returns.
- S : skewness coefficient.
- K : excess kurtosis coefficient.
- N : number of non-overlapping time intervals during the observed period (i.e., 1260 for a period of five years by assuming 252 trading days per year).

6.1.2 Conversion of the CFVaR into a volatility equivalent

We suppose that the net asset value of the fund follows a geometric Brownian motion, that is, satisfies the stochastic differential equation

$$\frac{dNAV_t}{NAV_t} = \mu dt + \sigma dW_t$$

leading to

$$\ln R_T = ln\left(\frac{NAV_T}{NAV_0}\right) \sim N\left(\left[\mu - \frac{\sigma^2}{2}\right]T, \sigma\sqrt{T}\right)$$

where :

- W is a Brownian motion.
- NAV_T: net asset value of the fund at the end of the recommended holding period.
- NAV_0: initial net asset value, equal to 1.
- μ : expected rate of return estimated based on historical log-returns over the last five years.
- σ : standard deviation estimated based on historical log-returns over the last five years.
- S : skewness coefficient estimated based on historical log-returns over the last five years.
- K : kurtosis coefficient estimated based on historical log-returns over the last five years.
- T : number of non-overlapping time intervals during the recommended holding period of the fund.

The Cornish-Fisher VaR for a given time horizon T and a confidence level $1-\alpha$, noted $CFVaR^T_{1-\alpha}$, is therefore obtained with the following formula :

$$CFVaR^T_{1-\alpha} = \left(\mu - \frac{\sigma^2}{2}\right)T + Z^T_\alpha \sigma\sqrt{T}$$

where Z^T_α accounts for scaling with time skewness $S\left(T^{-1/2}\right)$ and kurtosis K (T^{-1}), :

$$Z^T_\alpha = z_\alpha + (z^2_\alpha - 1)\frac{S}{6\sqrt{T}} + (z^3_\alpha - 3z_\alpha)\frac{K}{24T} - (2z^3_\alpha - 5z_\alpha)\frac{S^2}{36T}$$

Replacing Z^T_α with its corresponding expression, one obtains :

$$CFVaR^T_{1-\alpha} = \left(\mu - \frac{\sigma^2}{2}\right)T + \left(z_\alpha + (z^2_\alpha - 1)\frac{S}{6\sqrt{T}} + (z^3_\alpha - 3z_\alpha)\frac{K}{24T} - (2z^3_\alpha - 5z_\alpha)\frac{S^2}{36T}\right)\sigma\sqrt{T}$$

For a given confidence level of 97.5%, the critical value of the standard Gaussian distribution z_α is approximately equal to -1.96. Hence, the Cornish-Fisher VaR for a confidence level of $1-\alpha = 97.5\%$ corresponds to the following formula :

$$CFVaR^T_{0.975} = \left(\mu - \frac{\sigma^2}{2}\right)T + \left(-1.96 + 0.474\frac{S}{\sqrt{T}} - 0.069\frac{K}{T} + 0.146\frac{S^2}{T}\right)\sigma\sqrt{T}$$

The equivalent volatility is obtained by searching for the value of the volatility $\tilde{\sigma}$ of a Normal variable that would have the same VaR as the CFVaR estimate. In other words, employing the critical value of the standard Gaussian distribution z_α for a confidence interval of 97.5%, one must find the value of $\tilde{\sigma}$ such that

$$CFVaR^T_{1-\alpha} = \left(\mu - \frac{\tilde{\sigma}^2}{2}\right)T + z_\alpha \tilde{\sigma}\sqrt{T}$$

Comparing the two previous equations, it is clear that $\tilde{\sigma} = \sigma$ when $S = K = 0$, i.e., the equivalent volatility coincides with the standard deviation in the case of Normal variable. Note that because the drift term μT appears in both sides, one can simply set $\mu = 0$ when computing $CFVaR_{1-\alpha}^{T}$ and solve for

$$-\frac{\tilde{\sigma}^2}{2}T + z_\alpha \tilde{\sigma}\sqrt{T} - CFVaR_{1-\alpha}^{T} = 0$$

Given that $\tilde{\sigma} \geq 0$, the unique solution is :

$$\tilde{\sigma} = \frac{z_\alpha + \sqrt{z_\alpha^2 - 2 \times CFVaR_{1-\alpha}^{T}}}{\sqrt{T}}$$

Finally, $\tilde{\sigma}$ is annualized according to the square root of time rule :

$$\sigma_A = \tilde{\sigma} \times \sqrt{m}$$

Where :

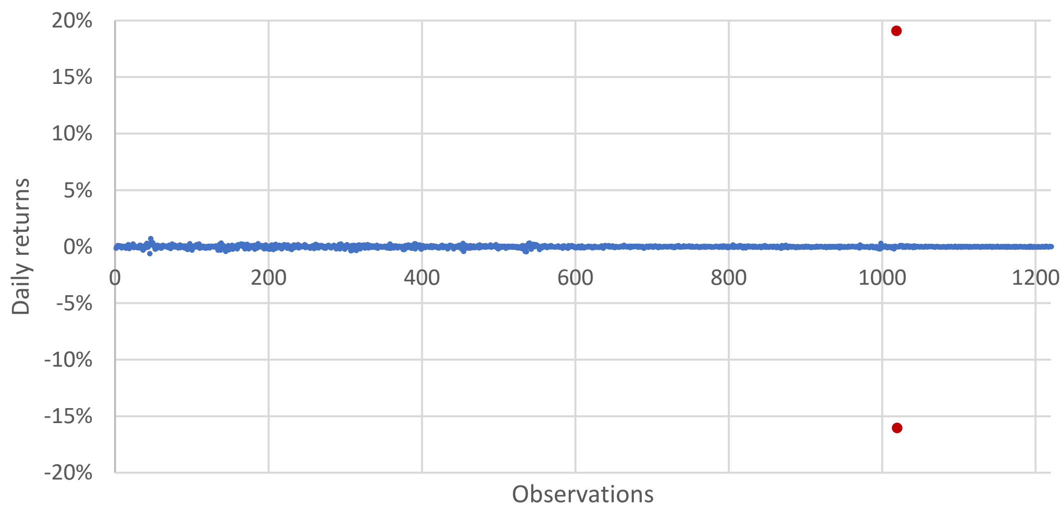
- m : number of non-overlapping time intervals comprised in a year.

VEV is finally obtained based on the following expression, where the number of n comprised in the recommended holding period T is equal to $\left(T/_m\right)$:

$$VEV = \sigma_A = \frac{z_\alpha + \sqrt{z_\alpha^2 - 2 \times CFVaR_{1-\alpha}^{T}}}{\sqrt{n}}$$

6.2 Example of leap in volatility due to the use of daily returns

Figure 9 - Fund experiencing 9.89% leap in volatility when using daily returns



As shown in Figure 9, the use of daily returns demonstrates the presence of two outliers for this fund (shown in red). We notice that the fund experienced a 19% increase on Monday, 21st of April 2020, followed by a 16% downward correction the next day. This extreme variation explains why we observe such a pronounced difference in standard deviation compared to using a weekly or monthly observation frequency. After removal of the two outliers, we obtain an annualized standard deviation of 1.41%, a skewness coefficient of -0.05 and a kurtosis coefficient of 8.61.