

# Liquidity Stress Testing of Maltese Retail Investment Funds (Update – 2023)

by

Stephanie Gauci

with contributions from

Tony Farrugia and Joseph Agius

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## Abbreviations

GPD	Generalised Pareto Distribution
HQLA	High Quality Liquid Assets
MFSA	Malta Financial Services Authority
NAV	Net Asset Value
OLS	Ordinary Least Squares
RCR	Redemption Coverage Ratio
STIFF	Stress Testing for Investment Funds Framework
UCITS	Undertakings for the Collective Investment in Transferable Securities

## Executive Summary

As of December 2022, the Net Asset Value (NAV) of the Maltese investment funds sector amounted to €19.7 billion. This marked a decrease of 6.4% when compared to December 2021. Nevertheless, it's important to note that the funds sector in Malta exhibited an average annual growth rate of 11% over the past eight years. According to the most recent EFAMA Fact Book (2023), European investment funds collectively increased their net assets by €9.6 trillion (or 101.1%) since 2012. However, similar to the Maltese investment fund industry, European investment funds also experienced a decline in net assets in 2022, primarily due to the decrease in the prices of stocks and bonds.

While the investment fund industry as a whole may not pose systemic risks, it is essential to acknowledge that its diversity makes it necessary to consider the potential for certain subsets of investment funds that may disrupt the financial system. This has prompted interest from various stakeholders, including market participants, regulators, central banks, in conducting regular assessments of the sector's resilience, particularly in relation to their liquidity positions.

Open-ended investment funds which have a sizeable portion of their investments in assets that are either illiquid or have limited liquidity, may encounter difficulties if there is a sudden rise in redemptions. In such circumstances, fund managers may be forced to conduct fire sales of investments at significant realised capital losses. Furthermore, fund managers may struggle to generate adequate cash or liquidity promptly to meet unexpected redemption demands from investors. This situation may necessitate the implementation of Liquidity Management Tools (LMTs), including measures like suspension of redemptions, imposing gates, employing anti-dilution mechanisms, amongst others.

In this report, we present the results of the liquidity stress testing framework for investment funds, referred to as STIFF, updated with data up to end 2022. We apply the same methodology adopted in the 2021 study. Our findings indicate an improvement in the liquidity positions of the sample of UCITS funds when compared to the previous stress tests carried out in the last two years. In the 1% worst-case scenario, only one fund still faces challenges meeting the redemption requests, even after fully liquidating its portfolio either through the Waterfall or the Slicing liquidation approach. When examining the second-round effects, it is evident from our analysis that these effects, both in terms of redemptions and liquidation costs, continue to remain relatively limited.

The report is structured as follows: The first section gives an overview of the sample of investment funds selected for this stress testing exercise. The second section contains an updated analysis for each of the four steps of the micro-level STIFF as defined in the 2021 study.

## Funds Sample Composition

The sample consists of 67<sup>1</sup> Malta domiciled retail investment funds that are licensed as UCITS and have a combined net asset value of €2.4 billion (49%<sup>2</sup> of the total NAV of the Maltese retail funds as at end 2022). The NAV of the funds included in the sample ranges from a minimum of €3 million to a maximum of €213.6 million, with the average NAV equal to €36.4 million as at December 2022.

In terms of investment fund strategy, bond funds account for the biggest portion of the sample NAV (49.8%), followed by equity funds (16.9%), diversified funds<sup>3</sup> (15.8%), mixed funds<sup>4</sup> (14.1%), and other funds<sup>5</sup> (3.4%).

Table 1: NAV and number of funds in the sample

Type of fund	NAV (€ bn)	% share	Number of funds	% share
Bond	1.2	49.8%	21	31.3%
Equity	0.4	16.9%	18	26.9%
Diversified	0.4	15.8%	11	16.4%
Mixed	0.3	14.1%	11	16.4%
Other	0.1	3.4%	6	9.0%
<b>Total</b>	<b>2.4</b>	<b>100%</b>	<b>67</b>	<b>100%</b>

The selected funds' weekly redemption observations range from 113 to 835, with an average of 459 observations. The average weekly historical redemption, expressed as a percentage of the funds' NAV, ranges from 0.01% to 1.42%, with a mean value across all funds equal to 0.35% of NAV. Table A.1 in the appendix contains summary statistics for the historical weekly redemptions and historical weekly net flows of the funds in our sample.

## Updating the STIFF with 2022 Data

This micro-level liquidity stress testing adopts the same methodology outlined in the 2021 Stress Testing for Investment Funds Framework (STIFF).<sup>6</sup> Results for each of the four steps of the framework are presented in the following sub-sections.

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<sup>1</sup> Only investment funds which have been in operation for at least two years are included in the sample.

<sup>2</sup> Retail funds which have been active for less than two years have been excluded from this exercise.

<sup>3</sup> Diversified funds invest in a broad set of assets.

<sup>4</sup> Mixed funds invest in both equity and bonds.

<sup>5</sup> Other funds is a residual category.

<sup>6</sup> 2021 report outlining the methodology used can be found [here](#).

## Calibration of the Redemption Shock using the Historical Approach

Redemption shocks<sup>7</sup> are estimated for each fund in our dataset by employing a historical approach. Three extreme redemption shocks are calibrated on the 10<sup>th</sup>, 5<sup>th</sup> and 1<sup>st</sup> percentiles of the historical redemptions for each fund in our dataset by fitting a Generalised Pareto Distribution (GPD) to the historical redemptions surpassing the 90<sup>th</sup> percentile (referred to as the threshold parameter  $\mu$ ).<sup>8</sup>

Similar to previous stress testing exercises, the threshold parameter  $\mu$  is below 1% for 51 funds (or 76% of the sample), with the remaining funds having a threshold parameter equal to or greater than 1%. This indicates that, historically, Maltese retail funds have generally seen a low percentage of redemptions.

In order for the first moment of the GPD to be finite, the shape parameter  $\xi$  must be statistically less than one. Among the 67 funds analysed, for 35 of them (52%) the expected worst 10% redemption can be estimated as the GPD's expected value. For the remaining funds, the redemption shock is estimated using the composite trapezoidal rule. The estimated GPD parameters for each fund in our sample can be found in Table A.2 in the appendix.

As depicted in Figure 1, the estimated redemption requests for both the 10% worst-case scenario and the 5% worst-case scenario remain limited for the majority of funds. Specifically, 96% and 81% of the sample would experience redemption requests lower than 5% of their NAV, respectively. None of the funds would face outflows exceeding 10% in the 10% worst-case scenario, except for one fund<sup>9</sup>, which under the 5% worst-case scenario can experience a redemption request of up to 13%.

Conversely, in the 1% worst-case scenario, 42% of the sample would undergo redemption requests lower than 5% of their NAV, while 55% would encounter redemption requests between 5% and 20% of their NAV. Only two funds<sup>10</sup> (or 3% of the sample) would anticipate redemption requests surpassing 20% of their NAV. The highest redemption rate in the 1% worst-case scenario is of 36%.

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<sup>7</sup> Redemptions are expressed as a percentage of NAV.

<sup>8</sup> Further details on the calibration of the extreme redemptions can be found in the [2020 STIFF report](#) (Meglioli & Gauci, 2020)

<sup>9</sup> Fund 36

<sup>10</sup> Fund 7 and Fund 36

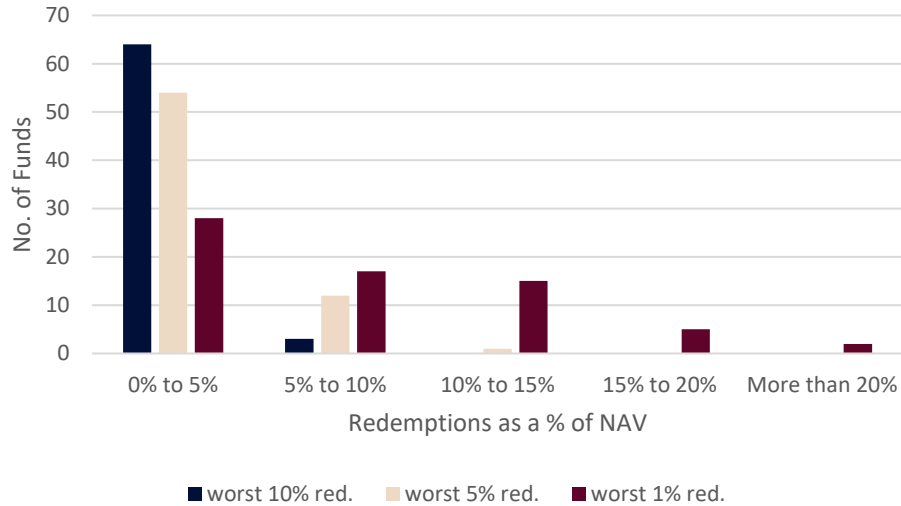


Figure 1: Extreme redemption shocks at the 10%, 5% and 1% level as a % of NAV

When analysing the projected redemptions for the most unfavourable 1% scenario at the fund strategy level, the majority of funds within each strategy would anticipate a 1% worst-case redemption rate between 0% and 10%. Specifically, 67% of funds categorized as 'other' and 62% of bond funds would anticipate a 1% worst-case redemption rate within the 0% to 5% range, with only one bond fund expecting a 1% worst-case redemption rate exceeding 35%. Likewise, 46% of funds classified as 'diversified' would face a 1% worst-case redemption rate within the 0% to 5% range. Regarding equity funds, 67% would expect a 1% worst-case redemption rate of up to 10%.

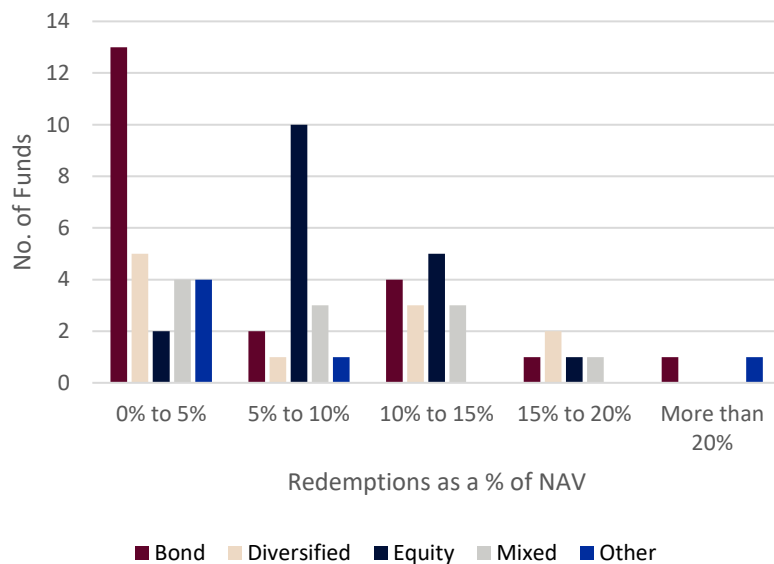


Figure 2: Extreme redemption shock at the 1% level by strategy



## Measuring Asset Liquidity and Liquidation of Assets<sup>11</sup>

This micro-level liquidity stress testing follows a tiered approach to asset liquidation as outlined in the 2021 STIFF. Assets are categorised into distinct liquidity buckets where each bucket is assigned fixed liquidity weights<sup>12</sup> which are used to compute the haircuts suffered by a fund should assets belonging to that portion of the portfolio need to be liquidated. Cash and short-term deposits (highly liquid assets) are incorporated into the liquidity buffers either in full or partially, depending on the chosen liquidation method. Similar to previous stress testing exercises, we apply two of the primary liquidation methods, namely the waterfall approach and the slicing approach.

Table A.3 in the appendix displays the highly liquid assets as a percentage of the NAV for each fund, along with the calculated liquidity shortfall<sup>13</sup>. When compared to 2021, 36 funds (or 54% of sample) saw a decrease in the proportion of highly liquid assets they hold relative to their 2022 NAV. Conversely, 30 funds (or 45%) reported an increase in highly liquid assets as a percentage of their NAV.

The number of funds encountering a liquidity shortfall has remained consistent with the previous studies. However, there are 10 funds which did not have a liquidity shortfall in the prior assessment and now have a liquidity shortfall as a result of a decline in the proportion of highly liquid assets that they hold. Among these, six funds would face a liquidity shortfall exclusively under the 1% worst-case scenario, three under both the 1% and 5% worst-case scenarios, and one fund under all three scenarios. Conversely, six funds that had a liquidity shortfall under the 1% worst-case scenario in the previous study have now accumulated enough highly liquid assets to meet redemption requests under all three worst-case scenarios.

In total, when considering the 10% worst-case redemption scenario, nine funds would experience a liquidity shortfall. This number increases to 17 funds for the 5% worst-case redemption scenario and 30 funds for the 1% worst-case redemption scenario. At the fund strategy level, a substantial portion of bond, equity, and other funds face a liquidity shortfall in all three scenarios, as indicated in Table 2.

Table 2: Funds with a liquidity shortfall

	Average redemption shock (% NAV)			% of funds with a liquidity shortfall		
	worst 10% redemption	worst 5% redemption	worst 1% redemption	worst 10% redemption	worst 5% redemption	worst 1% redemption
<b>Bond</b>	1.7	2.7	7.5	19.0	33.3	47.6
<b>Diversified</b>	2.9	4.3	9.3	0.0	0.0	27.3

<sup>11</sup> Only securities reported on a security-by-security basis have been considered. The minimum portfolio coverage is equal to 45% of total assets.

<sup>12</sup> The assigned liquidity weights can be found in the [2021 STIFF report](#), Table 2 (Meglioli & Gauci, 2021).

<sup>13</sup> Liquidity Shortfall = Expected Redemptions <sub>$\alpha$</sub>  – Highly Liquid Assets where  $\alpha$  refers to the three levels of expected redemptions, that is, the 10%, 5% and 1% worst case redemptions and the highly liquid assets refer to cash and short-term deposits.

<b>Equity</b>	2.5	3.7	8.9	16.7	22.2	50.0
<b>Mixed</b>	1.9	3.0	7.9	0.0	27.3	45.5
<b>Other</b>	1.9	2.9	8.3	33.3	50.0	50.0

In Figure 3, the liquidity shortfall in the 1% worst-case scenario is plotted against the Redemption Coverage Ratio (RCR)<sup>14</sup>, which represents the highly liquid assets relative to expected redemptions. For all these funds, in the event that a redemption shock occurs, fund managers would be required to initiate the process of selling their asset portfolios to fulfil the redemption requests. Figure 3 illustrates that among the funds with a redemption coverage ratio of less than one in the 1% worst-case scenario, 80% of them have a liquidity shortfall of less than 10%.

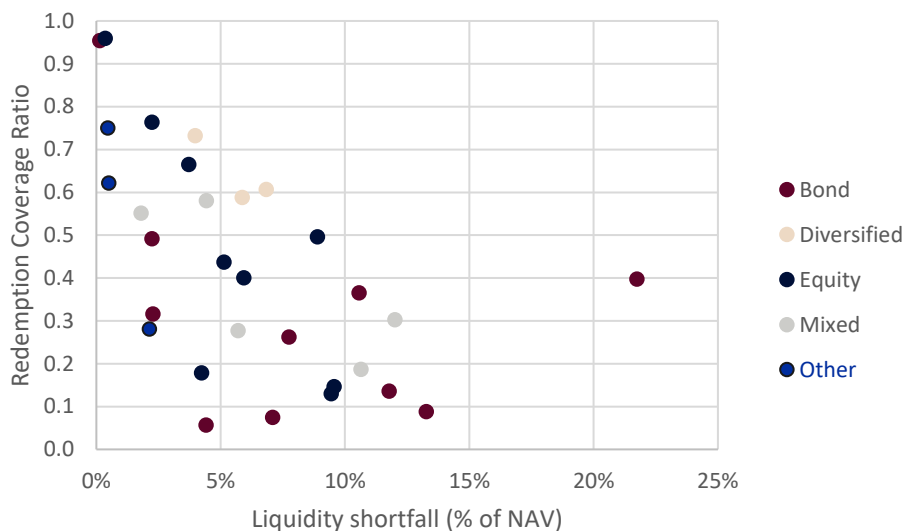


Figure 3: Liquidity shortfall and redemption coverage ratio for the 1% worst case scenario

Under the slicing approach, more funds are projected to experience losses from asset liquidation compared to the waterfall approach since all funds are expected to sell a portion of their portfolio to accommodate redemption requests in order to maintain the portfolio's composition.

In fact, under the slicing approach, only two funds would avoid incurring any losses from asset liquidation due to their investment portfolio composition at the end of 2022. For one of these funds<sup>15</sup>, it would be necessary to liquidate only short-term deposits and government bonds with a high credit rating (G1), both of which are assigned a liquidity weight of one to meet redemption demands. The other fund<sup>16</sup> primarily holds its assets in the form of corporate bonds with a low credit rating (C4), which are assigned a liquidity weight of zero.

<sup>14</sup> A redemption coverage ratio less than one would imply a liquidity shortfall.

<sup>15</sup> Fund 62

<sup>16</sup> Fund 59

Only a single fund<sup>17</sup> remains unable to fulfil the redemption requests in the 1% worst-case scenario after selling off its portfolio using both liquidation approaches. An analysis of the investment portfolio of this particular fund shows that about half of its portfolio is invested in corporate bonds with a credit rating of BB+ or lower. This part of the portfolio is therefore below investment grade and although yields may be higher, the risk of default is higher and the liquidity is lower, possibly much lower, depending on how much the rating is below investment grade. Notably, this fund has consistently been unable to meet redemption demands in all previous stress testing exercises under the 1% worst-case scenario.

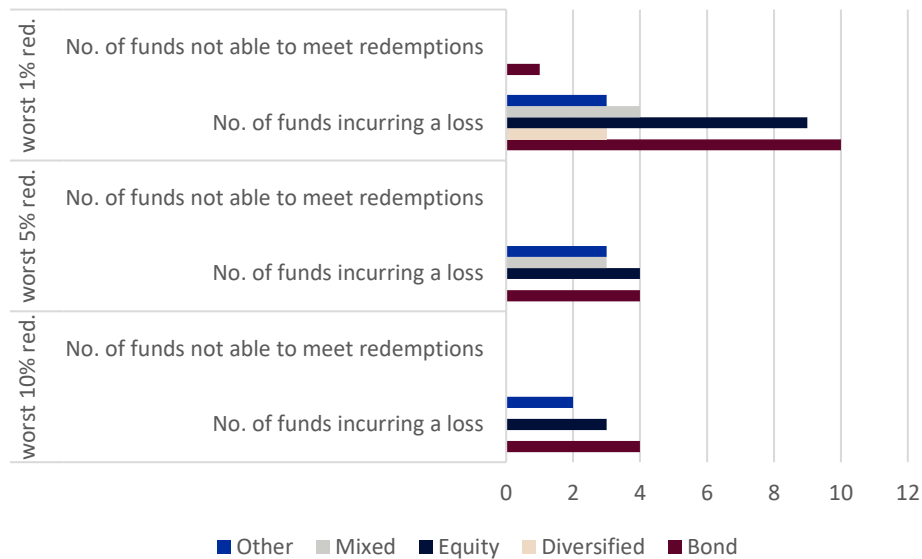


Figure 4: Liquidation of assets under the Waterfall approach

<sup>17</sup> Fund 36

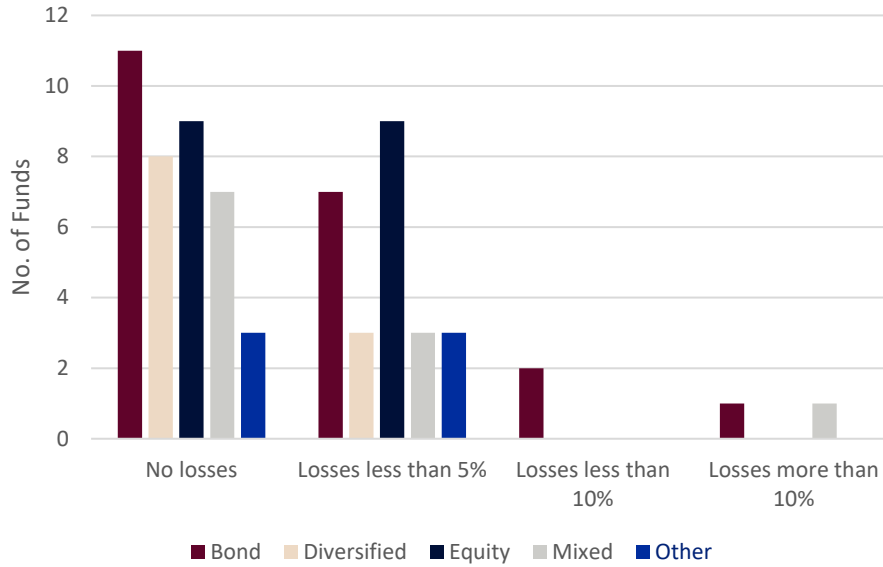


Figure 5: Losses suffered to meet the 1% worst redemption under the Waterfall approach

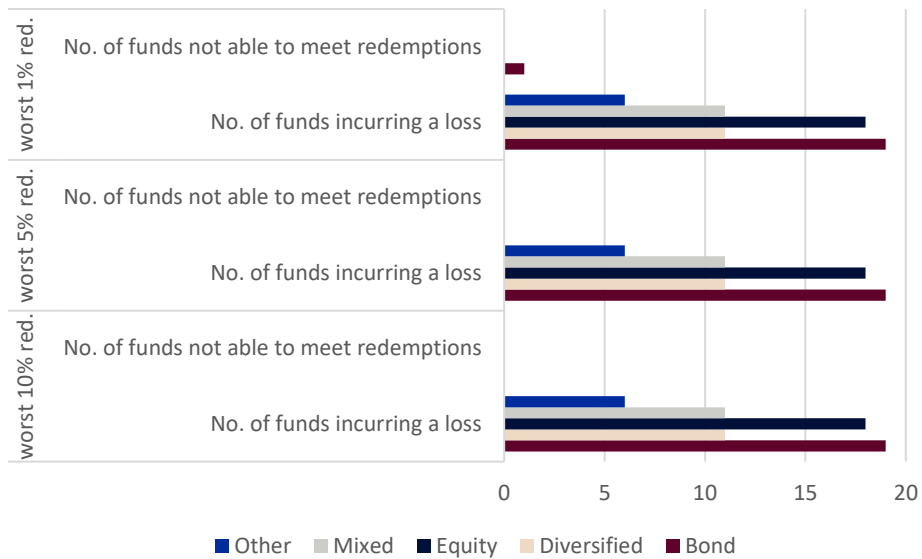


Figure 6: Liquidation of assets using the Slicing approach

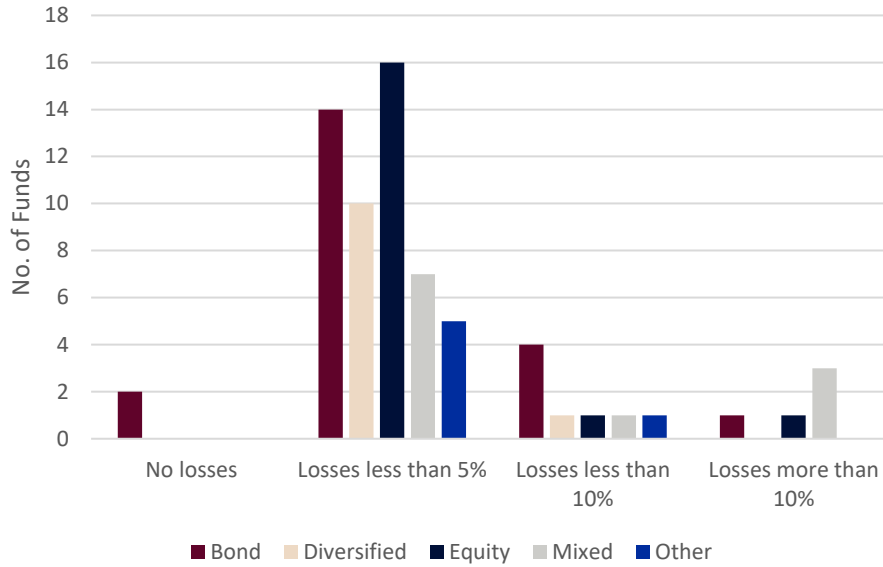


Figure 7: Losses suffered to meet the 1% worst redemption using the Slicing approach

Figure 8 shows that when we analyse the strategies collectively, equity funds endure the most substantial impact across all three of the worst redemption scenarios. Similar results were obtained in the previous stress testing exercises. Specifically, if the 1% worst-case redemption scenario were to happen simultaneously across all equity funds, the combined NAV of these funds would contract by 9.3%. Additional losses due to liquidation when employing the waterfall approach would cause the NAV to further diminish by 0.7%. If we utilise the slicing approach, the NAV will further decline by 2.6%.

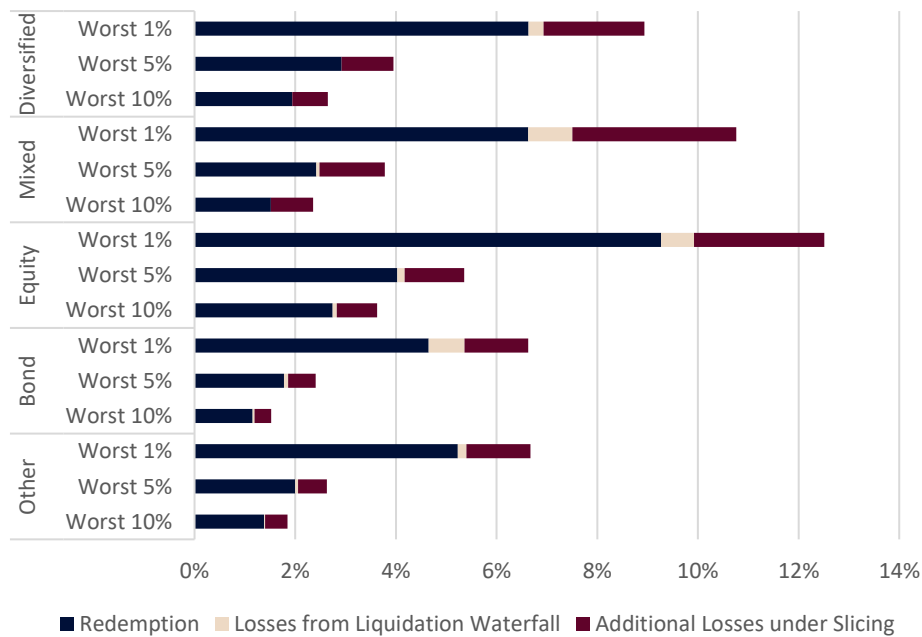


Figure 8: Impact of extreme redemptions on the NAV by strategy

## Second-Round Effects

To estimate the second-round redemptions, we apply a Bayesian methodology. An Ordinary Least Squares (OLS) regression is fitted on the lagged net flows and lagged log returns in relation to current net flows for each individual fund. Thereafter, the estimated coefficients are grouped by strategy, calculating both the mean and standard deviation of these coefficients for each respective strategy. These computed statistics serve as the prior distributions for our Bayesian regression. Table 3 provides an overview of the mean and standard deviation values for each parameter, split by strategy.

Table 3: Bayesian coefficients' prior distribution parameters

	Mean			Standard Deviation		
	$\alpha$	$\beta_1$	$\beta_2$	$\alpha$	$\beta_1$	$\beta_2$
<b>Bond</b>	0.0192	0.1639	0.0384	0.2296	0.2238	0.0554
<b>Equity</b>	0.1552	0.1276	0.0173	0.2882	0.1541	0.0413
<b>Mixed</b>	-0.0314	0.1081	0.0363	0.2169	0.1853	0.0271
<b>Other</b>	0.0553	0.0706	-0.0030	0.3039	0.0979	0.0505

After fitting a Bayesian model for each sampled fund, the first-round redemptions and liquidation losses are integrated into the regression equation to predict the expected second-round redemptions. Figure 9 presents the chart exclusively for the waterfall approach, as the anticipated second-round redemptions following the initial liquidation round are similar for both the waterfall and slicing approaches.

Consistent with findings from previous stress testing exercises, the expected second-round redemptions are predominantly below 2% across all three worst redemption scenarios. Only one fund is projected to face a second-round redemption of approximately 5% of its NAV under the 1% worst-case scenario.

The occurrence of liquidation losses resulting from the sale of assets during the second round of redemptions continues to depend on the chosen liquidation method. However, under both liquidation approaches, these losses would be limited. The only fund unable to meet second-round redemptions in the 1% worst-case scenario is the same fund<sup>18</sup> that was unable to fulfil the first round of 1% extreme redemptions.

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<sup>18</sup> Fund 36

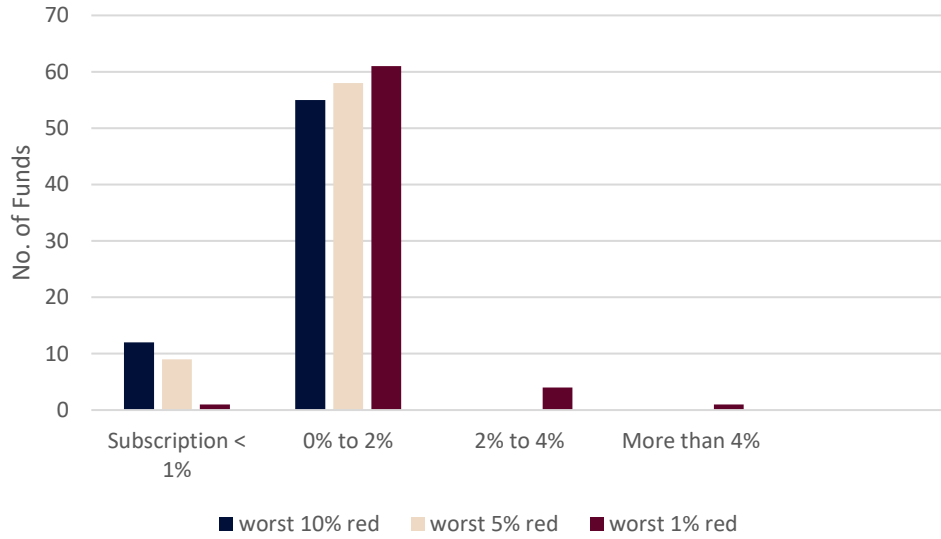


Figure 9: Second-round redemptions following liquidation under the Waterfall approach

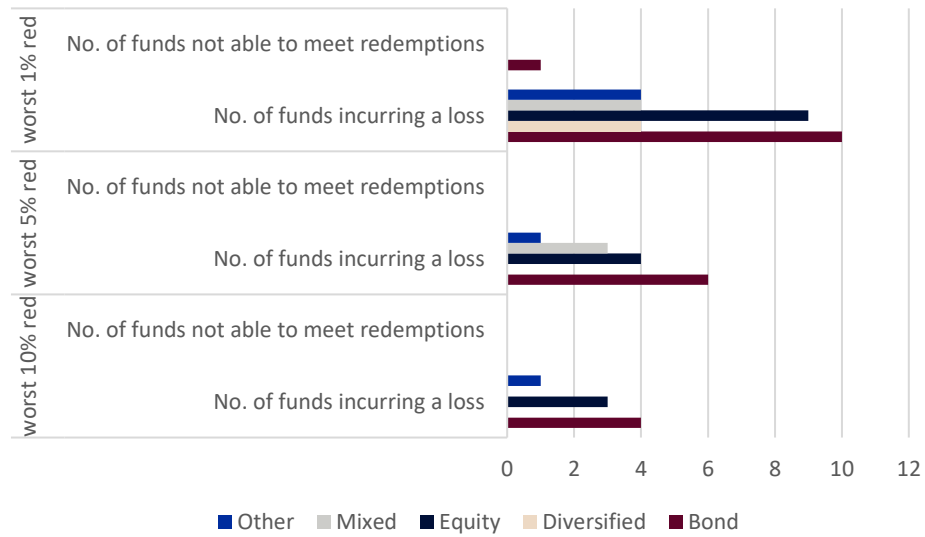


Figure 10: Liquidation of assets due to second-round redemptions under the Waterfall approach

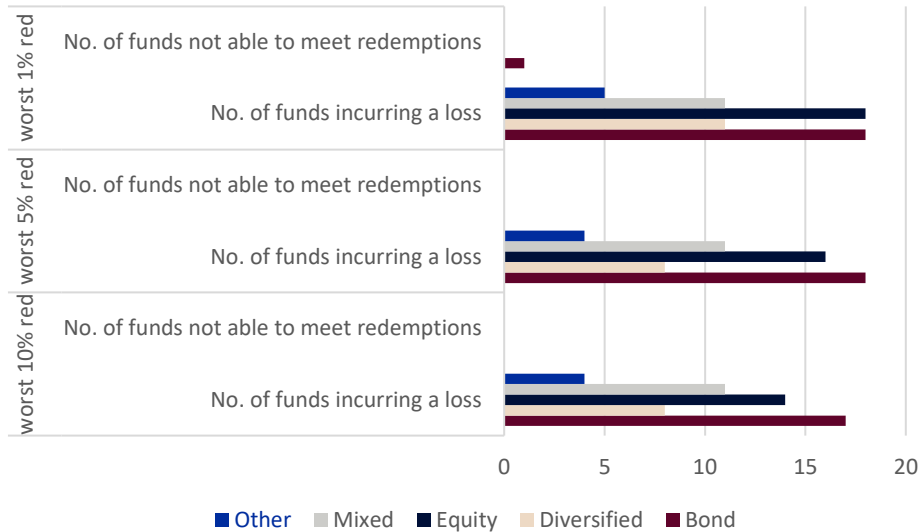


Figure 11: Liquidation of assets due to second-round redemptions under the Slicing approach

When consolidating the second-round redemptions and losses at the strategy level, both the waterfall and slicing approaches yield highly comparable outcomes. Just as observed in the initial round of redemptions, equity funds bear the brunt under the 1% worst-case redemption scenario. However, it's worth noting that the decline in NAV attributed to second-round redemptions and liquidation losses is somewhat less pronounced, hovering around 1.5%.

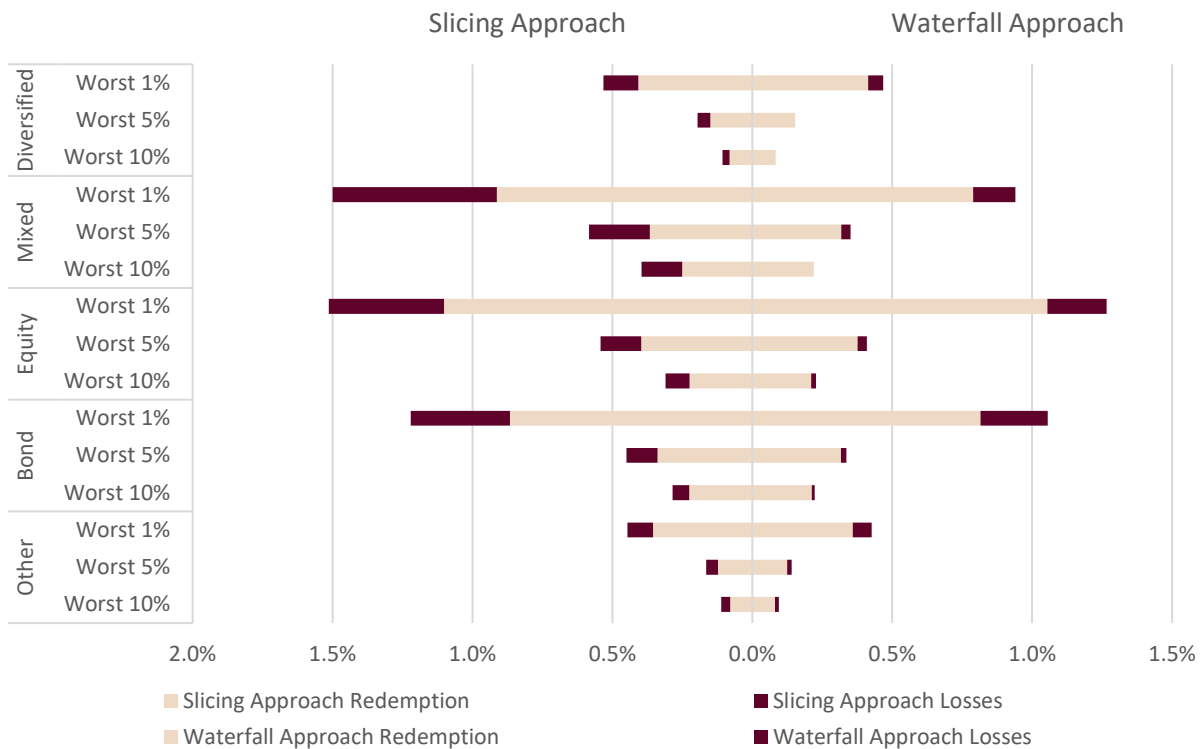


Figure 12: Impact of the second-round extreme redemptions on the strategy NAV



## Conclusion

This report provides an update of the liquidity stress testing exercise for retail investment funds in Malta for year 2022. The study was conducted on a sample of 67 Maltese UCITS funds which have an aggregate NAV of €2.4 billion, and which represents 49% of the total NAV of the Maltese retail funds as at end 2022.

The results of the liquidity stress testing exercise for year 2022 demonstrate again encouraging results. Under the worst-case scenarios of 10% and 5%, the estimated redemption requests amount to less than 5% of the funds' NAV for 96% and 81% of the sample, respectively. In the 1% worst-case scenario, only two funds anticipate redemption requests exceeding 20% of their NAV. When comparing the proportion of highly liquid assets held by these funds relative to their NAV over the period 2021 - 2022, one observes that 54% of the funds witnessed a decrease in holdings of highly liquid assets. Only one fund remains unable to meet its redemption requests in the 1% worst-case scenario after liquidating its portfolio using any of the two liquidation approaches used for this study. This shows that there was an improvement when compared to the previous stress testing exercise where two funds were unable to meet the redemption requests under the 1% worst case scenario. Furthermore, in line with previous stress testing exercises, it is notable that the expected second-round redemptions are primarily below 2% across all three worst redemption scenarios.

## Limitations

This stress testing framework has a number of limitations, as outlined in the 2020 stress testing report, which are replicated below for ease of reference.

- The STIFF uses an adjusted HQLA approach, which is a modified version of the standard HQLA approach developed under Basel III. The adjusted HQLA assigns different liquidity weights to asset types. However, some of these haircuts can be seen as excessive for certain asset classes. Moreover, some instruments are classified as illiquid, while they could instead be liquidated under normal circumstances.
- The STIFF does not take into account the time to liquidation of the assets within the funds' portfolios.
- The results of the second-round effects estimate only an expected redemption scenario, conditional to the previous worst-case redemption and liquidation losses. Therefore, the results give no indication with regards to the loss magnitude caused by an additional worst-case redemption, should the distressed situation persist over time.
- This liquidity stress testing exercise is assuming no spill-over effects from the funds onto the financial markets when liquidating their holdings to satisfy the redemption requests. This assumption is supported by the relatively small size of the disposed holdings compared to the normally traded quantities in the financial markets. While this can be considered as a valid assumption when dealing with a large and very liquid stock exchange, it would not be the case if the assets liquidated are traded, for example, on the Malta Stock Exchange. This risk is partially mitigated by the fact that, due to the small market capitalisation of the Maltese public companies, most of the Maltese assets would be classified under the lowest liquidity classes by the adjusted-HQLA approach used, and therefore, the probability of such holdings being disposed is very low.
- The fund categories' series are obtained by aggregating the funds according to a classification which is based on the investment policies disclosed by the fund managers in the Offering Supplement. However, these investment policies often include a wide range of instruments which the funds can invest in, while they could be targeting only one asset type. Therefore, this may create bias in the classification adopted.

- This study does not take into consideration the liquidity stress tests conducted by UCITS which they are required to undertake as part of their regulatory obligations.

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## Appendix

Table A.1: Summary statistics

Fund	No. of Weekly Obs.	% of NAV				
		Average Red.	Average Net Flow	Max Red.	Max Net Outflow	Max Net Inflow
Fund 1	316	0.24	-0.16	11.19	-11.19	5.94
Fund 2	387	0.37	0.31	18.54	-18.54	104.33
Fund 3	269	0.01	30.64	0.52	-0.50	8099.22
Fund 4	113	0.01	0.71	0.35	-0.13	5.43
Fund 5	769	0.08	5.47	4.84	-4.79	3930.82
Fund 6	545	0.08	0.27	9.30	-9.28	7.00
Fund 7	203	0.76	0.48	99.35	-10.35	43.93
Fund 8	325	0.08	0.89	4.56	-4.15	221.60
Fund 9	312	0.39	0.31	8.19	-7.99	39.53
Fund 10	396	0.27	0.21	9.15	-8.17	26.94
Fund 11	352	0.23	0.29	12.76	-7.86	80.39
Fund 12	359	0.20	1.04	10.53	-10.53	121.33
Fund 13	209	1.03	1.21	11.31	-11.09	27.04
Fund 14	212	1.01	0.34	11.63	-7.46	12.40
Fund 15	269	0.64	0.34	11.50	-11.50	39.74
Fund 16	307	0.26	1.00	1.98	-1.43	54.50
Fund 17	307	0.22	1.18	1.41	-1.16	99.62
Fund 18	307	0.25	1.29	3.30	-2.56	120.80
Fund 19	270	0.26	1.01	13.45	-4.52	110.72
Fund 20	382	0.27	0.26	2.84	-2.25	9.00
Fund 21	479	0.51	0.48	15.92	-5.98	105.07
Fund 22	591	0.17	0.71	9.22	-1.53	77.00
Fund 23	298	0.11	1.99	12.07	-11.08	100.00
Fund 24	247	0.13	1.23	3.03	-2.68	18.44
Fund 25	359	0.71	0.38	7.96	-7.96	16.00
Fund 26	359	0.83	-0.22	20.64	-20.47	4.19
Fund 27	359	0.72	0.46	20.32	-15.14	19.88
Fund 28	287	0.79	0.71	34.87	-11.06	29.99
Fund 29	223	0.47	1.04	7.91	-7.91	100.00
Fund 30	232	0.17	0.29	2.63	-1.85	18.53
Fund 31	835	0.18	0.11	4.50	-4.34	56.40
Fund 32	835	0.21	0.10	4.63	-4.60	53.02
Fund 33	835	0.25	-0.11	5.27	-5.22	0.68
Fund 34	835	0.32	-0.22	5.61	-5.51	0.66
Fund 35	835	0.22	-0.09	3.93	-3.68	1.77
Fund 36	582	1.13	1.58	66.86	-66.86	477.81
Fund 37	198	0.35	0.98	14.25	-14.25	98.56

<b>Fund 38</b>	195	0.32	0.70	7.41	-6.97	14.33
<b>Fund 39</b>	320	0.35	0.61	5.97	-5.97	37.45
<b>Fund 40</b>	433	0.16	0.61	5.61	-2.30	13.06
<b>Fund 41</b>	497	0.19	0.67	3.33	-2.75	13.32
<b>Fund 42</b>	336	0.06	0.09	3.62	-3.62	33.33
<b>Fund 43</b>	300	0.09	0.54	3.28	-1.27	22.90
<b>Fund 44</b>	300	0.13	0.64	2.55	-1.34	18.65
<b>Fund 45</b>	359	0.06	0.24	3.41	-3.31	5.90
<b>Fund 46</b>	279	0.62	0.86	15.46	-15.46	56.81
<b>Fund 47</b>	409	0.46	-0.03	16.27	-16.27	8.01
<b>Fund 48</b>	409	0.24	-0.08	23.84	-23.84	9.76
<b>Fund 49</b>	260	0.18	-0.16	18.34	-18.34	1.52
<b>Fund 50</b>	582	0.36	0.14	18.00	-17.99	35.95
<b>Fund 51</b>	582	0.31	0.29	32.55	-29.50	35.91
<b>Fund 52</b>	259	0.63	0.01	21.83	-21.83	29.18
<b>Fund 53</b>	785	0.32	-0.03	19.26	-19.26	116.40
<b>Fund 54</b>	787	0.46	-0.06	20.28	-20.25	68.65
<b>Fund 55</b>	700	0.32	-0.13	21.25	-11.68	3.05
<b>Fund 56</b>	700	1.42	-0.38	21.99	-21.99	22.16
<b>Fund 57</b>	771	0.41	0.07	11.83	-10.88	35.88
<b>Fund 58</b>	700	0.33	0.09	13.44	-11.78	23.34
<b>Fund 59</b>	771	0.17	0.25	3.45	-3.43	2.84
<b>Fund 60</b>	700	0.26	0.11	11.13	-2.79	7.68
<b>Fund 61</b>	700	0.24	0.05	4.35	-4.07	2.40
<b>Fund 62</b>	700	0.26	0.13	4.34	-1.51	2.82
<b>Fund 63</b>	700	0.27	-0.06	11.23	-11.10	11.88
<b>Fund 64</b>	700	0.23	-0.09	10.27	-10.24	1.95
<b>Fund 65</b>	700	0.14	0.06	3.41	-0.80	3.03
<b>Fund 66</b>	459	0.24	0.45	2.61	-2.59	17.81
<b>Fund 67</b>	362	0.13	0.04	5.24	-5.24	5.17

Table A.2: GPD parameter estimates

Fund	$\mu$	$\sigma$	$\xi$	Fund	$\mu$	$\sigma$	$\xi$
Fund 1	0.24	0.99	0.52	Fund 35	0.47	0.18	0.38
Fund 2	0.49	1.75	0.51	Fund 36	2.18	2.42	0.79
Fund 3	0.03	0.05	0.51	Fund 37	0.58	1.57	0.36
Fund 4	0.00	0.00	2.69	Fund 38	0.59	1.85	-0.08
Fund 5	0.17	0.10	0.82	Fund 39	0.89	0.86	0.29
Fund 6	0.14	0.09	0.93	Fund 40	0.44	0.20	0.74
Fund 7	0.51	0.44	1.68	Fund 41	0.43	0.24	0.58
Fund 8	0.00	0.26	1.17	Fund 42	0.04	1.62	-0.35
Fund 9	1.10	1.15	0.43	Fund 43	0.21	0.35	0.38
Fund 10	0.66	1.31	0.24	Fund 44	0.32	0.29	0.35
Fund 11	0.18	0.97	0.65	Fund 45	0.11	0.17	0.61
Fund 12	0.19	0.91	0.56	Fund 46	1.73	2.42	0.25
Fund 13	2.41	1.91	0.17	Fund 47	1.30	1.07	0.41
Fund 14	2.83	1.62	0.21	Fund 48	0.47	0.28	0.78
Fund 15	1.78	1.43	0.11	Fund 49	0.03	2.96	0.33
Fund 16	0.85	0.49	-0.33	Fund 50	0.96	1.27	0.29
Fund 17	0.68	0.16	0.09	Fund 51	0.81	0.75	0.52
Fund 18	0.75	0.43	0.22	Fund 52	1.47	0.86	0.77
Fund 19	0.48	0.31	0.82	Fund 53	0.52	0.42	1.15
Fund 20	0.83	0.71	-0.20	Fund 54	1.02	1.12	0.60
Fund 21	1.15	0.71	0.45	Fund 55	0.54	0.16	0.81
Fund 22	0.33	0.18	0.58	Fund 56	3.18	2.06	0.18
Fund 23	0.02	0.02	2.31	Fund 57	0.81	0.29	0.63
Fund 24	0.29	0.27	0.48	Fund 58	0.56	0.26	0.96
Fund 25	1.52	1.73	-0.02	Fund 59	0.31	0.23	0.30
Fund 26	1.63	0.86	0.67	Fund 60	0.45	0.30	0.46
Fund 27	1.76	1.37	0.44	Fund 61	0.42	0.15	0.78
Fund 28	1.91	1.97	0.41	Fund 62	0.48	0.18	0.50
Fund 29	1.24	1.09	0.40	Fund 63	0.42	0.32	0.88
Fund 30	0.52	0.66	-0.02	Fund 64	0.36	0.19	1.00
Fund 31	0.36	0.30	0.70	Fund 65	0.28	0.12	0.35
Fund 32	0.50	0.28	0.38	Fund 66	0.47	0.23	0.22
Fund 33	0.50	0.18	0.75	Fund 67	0.34	0.64	0.28
Fund 34	0.70	0.25	0.52				

Table A.3: Simulated worst redemptions and liquidity shortfall at the 10%, 5% and 1% levels<sup>19</sup>

Fund	Worst 10% Red.	Worst 5% Red.	Worst 1% Red.	Liquid Assets	Shortfall Worst 10%	Shortfall Worst 5%	Shortfall Worst 1%
Fund 1	2.31	3.83	10.52	6.10	-3.80	-2.27	4.41
Fund 2	4.04	6.49	17.20	5.20	-1.16	1.30	12.00
Fund 3	0.13	0.22	0.56	4.27	-4.14	-4.05	-3.71
Fund 4	0.97	2.00	11.05	7.34	-6.37	-5.34	3.71
Fund 5	0.57	0.90	2.85	2.72	-2.15	-1.81	0.13
Fund 6	0.64	1.09	3.77	5.14	-4.50	-4.05	-1.37
Fund 7	4.11	7.97	34.36	35.10	-30.99	-27.13	-0.75
Fund 8	1.67	3.27	13.06	2.43	-0.76	0.84	10.63
Fund 9	3.10	4.71	10.81	11.28	-8.18	-6.57	-0.46
Fund 10	2.38	3.68	7.65	0.57	1.81	3.11	7.09
Fund 11	2.52	4.53	13.61	1.84	0.67	2.68	11.77
Fund 12	2.09	3.69	10.49	2.75	-0.66	0.94	7.74
Fund 13	4.71	6.41	11.20	1.64	3.07	4.77	9.56
Fund 14	4.86	6.38	10.85	1.41	3.45	4.97	9.44
Fund 15	3.38	4.54	7.57	19.65	-16.27	-15.11	-12.08
Fund 16	1.22	1.45	1.82	1.37	-0.15	0.08	0.46
Fund 17	0.85	1.00	1.31	0.82	0.04	0.18	0.50
Fund 18	1.30	1.72	2.95	0.83	0.47	0.89	2.12
Fund 19	1.59	2.58	7.86	8.36	-6.78	-5.79	-0.50
Fund 20	1.43	1.81	2.52	9.93	-8.50	-8.12	-7.41
Fund 21	2.44	3.46	7.46	10.78	-8.34	-7.32	-3.32
Fund 22	0.76	1.11	2.72	4.04	-3.28	-2.93	-1.32
Fund 23	1.39	2.80	14.82	23.09	-21.70	-20.29	-8.27
Fund 24	0.80	1.21	2.90	6.18	-5.38	-4.97	-3.28
Fund 25	3.21	4.37	6.99	9.89	-6.68	-5.52	-2.90
Fund 26	3.78	5.64	14.21	8.35	-4.56	-2.70	5.86
Fund 27	4.19	6.03	13.25	34.15	-29.96	-28.12	-20.91
Fund 28	5.28	7.78	17.31	10.49	-5.21	-2.71	6.82
Fund 29	3.04	4.48	9.80	16.25	-13.21	-11.77	-6.45
Fund 30	1.17	1.61	2.62	13.50	-12.33	-11.89	-10.88
Fund 31	1.23	1.99	5.77	13.87	-12.64	-11.88	-8.11
Fund 32	0.95	1.31	2.61	11.31	-10.36	-10.00	-8.70
Fund 33	1.10	1.62	4.37	2.15	-1.04	-0.53	2.23
Fund 34	1.23	1.66	3.50	5.19	-3.95	-3.52	-1.68
Fund 35	0.76	1.00	1.83	7.14	-6.38	-6.14	-5.31
Fund 36	7.97	13.20	36.06	14.32	-6.35	-1.12	21.74
Fund 37	3.04	4.94	11.69	18.32	-15.28	-13.39	-6.63
Fund 38	2.30	3.45	5.89	15.24	-12.94	-11.79	-9.36
Fund 39	2.09	3.01	6.00	10.56	-8.47	-7.55	-4.56

<sup>19</sup> Red figures indicate a liquidity shortfall.

Fund 40	1.08	1.64	4.55	4.80	-3.72	-3.16	-0.25
Fund 41	0.99	1.46	3.59	3.96	-2.97	-2.50	-0.37
Fund 42	1.24	1.98	3.14	5.04	-3.80	-3.06	-1.90
Fund 43	0.78	1.23	2.88	12.18	-11.40	-10.95	-9.31
Fund 44	0.77	1.12	2.35	5.85	-5.08	-4.73	-3.50
Fund 45	0.53	0.89	2.56	3.73	-3.19	-2.84	-1.16
Fund 46	4.94	7.35	14.82	10.85	-5.91	-3.50	3.97
Fund 47	3.12	4.54	9.88	3.96	-0.83	0.58	5.93
Fund 48	1.42	2.26	6.70	9.72	-8.31	-7.46	-3.02
Fund 49	4.35	7.69	18.82	29.75	-25.41	-22.06	-10.94
Fund 50	2.75	4.12	8.59	9.03	-6.28	-4.91	-0.44
Fund 51	2.36	3.54	8.67	8.31	-5.95	-4.77	0.35
Fund 52	3.93	6.10	16.64	6.07	-2.15	0.03	10.56
Fund 53	2.77	4.92	17.62	8.74	-5.97	-3.81	8.89
Fund 54	3.79	5.56	14.54	1.28	2.51	4.28	13.26
Fund 55	1.17	1.69	4.67	0.26	0.90	1.43	4.40
Fund 56	5.68	7.52	12.76	53.39	-47.72	-45.88	-40.63
Fund 57	1.60	2.18	5.14	0.92	0.68	1.26	4.22
Fund 58	1.79	2.92	9.42	7.19	-5.39	-4.26	2.23
Fund 59	0.64	0.90	1.75	2.50	-1.85	-1.60	-0.75
Fund 60	1.02	1.48	3.32	1.05	-0.03	0.43	2.27
Fund 61	0.97	1.43	3.99	2.20	-1.23	-0.77	1.79
Fund 62	0.84	1.14	2.38	4.05	-3.21	-2.91	-1.67
Fund 63	1.67	2.82	9.10	3.97	-2.30	-1.16	5.12
Fund 64	1.38	2.31	7.87	2.18	-0.80	0.13	5.69
Fund 65	0.46	0.61	1.10	4.17	-3.71	-3.56	-3.07
Fund 66	0.75	0.98	1.62	1.76	-1.01	-0.79	-0.14
Fund 67	1.23	1.92	4.13	15.14	-13.90	-13.22	-11.00

Table A.4: Expected second-round redemptions

Fund	2 <sup>nd</sup> Round Redemptions - Waterfall Approach			2 <sup>nd</sup> Round Redemptions - Slicing Approach		
	Worst 10% Red.	Worst 5% Red.	Worst 1% Red.	Worst 10% Red.	Worst 5% Red.	Worst 1% Red.
Fund 1	0.26	0.39	1.00	0.29	0.43	1.06
Fund 2	0.40	0.64	1.75	0.50	0.78	2.01
Fund 3	-0.05	-0.04	0.04	-0.05	-0.03	0.04
Fund 4	-0.22	-0.08	1.17	-0.21	-0.07	1.21
Fund 5	0.11	0.17	0.54	0.14	0.22	0.70
Fund 6	0.07	0.12	0.42	0.07	0.13	0.48
Fund 7	0.21	0.50	2.42	0.21	0.49	2.39
Fund 8	0.22	0.42	1.87	0.27	0.50	1.94
Fund 9	0.31	0.45	0.99	0.34	0.50	1.11
Fund 10	0.35	0.55	1.17	0.37	0.57	1.19
Fund 11	0.30	0.59	1.94	0.36	0.65	1.99



<b>Fund 12</b>	0.18	0.33	1.08	0.24	0.44	1.28
<b>Fund 13</b>	0.67	0.94	1.69	0.68	0.94	1.70
<b>Fund 14</b>	0.55	0.77	1.42	0.56	0.78	1.43
<b>Fund 15</b>	0.45	0.54	0.75	0.45	0.53	0.75
<b>Fund 16</b>	-0.06	-0.04	-0.02	-0.06	-0.04	-0.02
<b>Fund 17</b>	0.09	0.10	0.12	0.09	0.10	0.12
<b>Fund 18</b>	-0.03	-0.01	0.08	-0.04	-0.01	0.08
<b>Fund 19</b>	0.30	0.53	1.77	0.31	0.55	1.89
<b>Fund 20</b>	0.33	0.42	0.58	0.35	0.44	0.61
<b>Fund 21</b>	0.26	0.37	0.83	0.27	0.39	0.87
<b>Fund 22</b>	0.10	0.14	0.34	0.11	0.15	0.39
<b>Fund 23</b>	0.06	0.18	1.27	0.06	0.19	1.34
<b>Fund 24</b>	-0.03	0.04	0.35	-0.02	0.09	0.53
<b>Fund 25</b>	0.36	0.52	0.89	0.38	0.55	0.93
<b>Fund 26</b>	0.25	0.38	0.99	0.25	0.38	0.98
<b>Fund 27</b>	0.25	0.51	1.51	0.27	0.53	1.56
<b>Fund 28</b>	0.27	0.44	1.10	0.26	0.43	1.09
<b>Fund 29</b>	0.20	0.36	0.95	0.22	0.38	0.99
<b>Fund 30</b>	-0.02	0.03	0.15	-0.01	0.04	0.16
<b>Fund 31</b>	0.10	0.19	0.64	0.10	0.20	0.67
<b>Fund 32</b>	0.13	0.18	0.35	0.14	0.19	0.36
<b>Fund 33</b>	0.46	0.66	1.75	0.47	0.67	1.78
<b>Fund 34</b>	0.63	0.81	1.57	0.63	0.81	1.58
<b>Fund 35</b>	-0.03	-0.01	0.05	-0.03	-0.02	0.04
<b>Fund 36</b>	1.00	1.68	5.03	1.09	1.89	5.03
<b>Fund 37</b>	-0.05	0.05	0.42	-0.04	0.08	0.47
<b>Fund 38</b>	0.33	0.47	0.78	0.35	0.50	0.84
<b>Fund 39</b>	0.25	0.37	0.73	0.26	0.38	0.76
<b>Fund 40</b>	-0.06	-0.02	0.18	-0.06	-0.02	0.18
<b>Fund 41</b>	0.05	0.08	0.23	0.04	0.08	0.23
<b>Fund 42</b>	0.14	0.19	0.27	0.14	0.19	0.26
<b>Fund 43</b>	-0.15	-0.09	0.13	-0.14	-0.08	0.14
<b>Fund 44</b>	0.15	0.23	0.49	0.16	0.24	0.51
<b>Fund 45</b>	-0.08	-0.06	0.06	-0.08	-0.06	0.06
<b>Fund 46</b>	0.33	0.50	1.04	0.33	0.50	1.03
<b>Fund 47</b>	0.37	0.58	1.39	0.38	0.60	1.41
<b>Fund 48</b>	0.28	0.37	0.88	0.29	0.40	0.95
<b>Fund 49</b>	0.31	0.55	1.31	0.31	0.54	1.30
<b>Fund 50</b>	0.15	0.24	0.55	0.15	0.24	0.54
<b>Fund 51</b>	0.15	0.28	0.87	0.16	0.30	0.91
<b>Fund 52</b>	0.45	0.70	2.02	0.47	0.74	2.23
<b>Fund 53</b>	0.33	0.68	2.77	0.34	0.70	2.82
<b>Fund 54</b>	0.57	0.86	2.32	0.58	0.86	2.33
<b>Fund 55</b>	0.19	0.24	0.56	0.19	0.25	0.56
<b>Fund 56</b>	0.42	0.55	0.93	0.42	0.55	0.92
<b>Fund 57</b>	0.19	0.26	0.58	0.20	0.26	0.59

<b>Fund 58</b>	0.13	0.26	1.01	0.14	0.27	1.05
<b>Fund 59</b>	-0.05	-0.02	0.09	-0.05	-0.02	0.09
<b>Fund 60</b>	0.14	0.20	0.44	0.15	0.21	0.46
<b>Fund 61</b>	0.12	0.17	0.42	0.18	0.25	0.66
<b>Fund 62</b>	0.26	0.34	0.68	0.26	0.34	0.68
<b>Fund 63</b>	0.17	0.30	1.07	0.25	0.44	1.52
<b>Fund 64</b>	0.15	0.22	0.65	0.27	0.42	1.37
<b>Fund 65</b>	0.07	0.09	0.14	0.08	0.09	0.14
<b>Fund 66</b>	0.15	0.17	0.22	0.15	0.17	0.22
<b>Fund 67</b>	0.11	0.17	0.36	0.12	0.18	0.39

Malta Financial Services Authority

Triq L-Imdina, Zone 1

Central Business District, Birkirkara, CBD 1010, Malta

[communications@mfsa.mt](mailto:communications@mfsa.mt)

[www.mfsa.mt](http://www.mfsa.mt)