ARE AGE-BASED LIFE-CYCLE SAVING STRATEGIES FOR FUNDED PENSION SCHEMES A GOOD OPTION?

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Sú sporivé stratégie založené na veku vhodným riešením pre kapitalizačné dôchodkové schémy?

Abstract: *Searching for the optimal saving strategy is often limited to life-cycle strategies, where only the age of a saver is considered for setting the allocation profile between equities and bonds. Our article contributes to the debate by looking at the performance and adequacy risks arising from applying age-based saving strategies for savers in funded pension schemes. Using the resampling simulation technique, we compare the fixed and age-based strategies from the point of performance, maximum draw-down occurring during the saving horizon and adequacy risk arising from applied saving strategy. We conclude that age-based life-cycle saving strategies, where the remaining saving horizon is the only factor defining the allocation profile is not the optimal saving strategy and other factor should be considered as well when searching for optimal predefined saving strategy.*

Keywords: *Funded pension, life-cycle strategy, microsimulation, performance, adequacy.*

JEL Classification: J26, J32, E17, C53

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1 Introduction

The goal of life-cycle portfolio allocation problems is to determine the optimal consumption and investment choices of an investor with total wealth consisting of human capital, financial wealth and other real assets, such as housing property. Without devoting much space to the introduction of the life-cycle investment strategy concept, we rather refer to seminal papers of Samuelson (1969) or Merton (1971), which perfectly present key aspects of building optimal life-cycle portfolios under various constraints.

There is an increasing consensus that the risk of a pension plan's investment portfolio should be decreased towards the retirement age, but the strategies to implement this are still under debate. Several countries in Central Europe which have introduced 1bis pension pillars based on defined contributions has recently started to refine the investment strategies set-up to better cope with the age profile of savers and mismatch between the savers' remaining investment horizon and pension funds' portfolio structure.

2 Literature Review

According to Malkiel (1996), life-cycle investment strategy is built on the idea of "age-based investing", or the notion that investors should allocate a larger portion of their long-term investment to equities or other risky assets when they are young and have a relatively long investment horizon, gradually shifting this allocation towards less risky assets as they approach retirement.

A life-cycle strategy does not keep its target mix constant over time. Instead, it deterministically changes the target mix that is held in equities and bonds according to a predefined "glide path", which gradually tilts the assets mix away from equities and other risky assets towards less risky assets such as bonds and cash as investors approach retirement. This concept is discussed in papers from Merton (2007), Ayres and Nalebuff (2008), Basu, Byrnes and Drew (2009), Pfau (2010), Ayres and Nalebuff (2013) and Wang, Li and Liu (2017).

Blanchett (2015) states in his article that determining the right allocation ratio over time depends on age, because with older age and shorter saving horizon the saver becomes more conservative and reduces the share of savings invested in riskier financial instruments. One reason for this is the risk of volatility, which is higher in the case of equity investments than in the case of bond investments.

Recent studies by Kitces and Pfau (2014) and Delorme (2015), however, take a different approach to determining the allocation ratio in pension savings schemes. It is based on the assumption that the older a person gets and the closer he is to retirement; the higher proportion of savings should be allocated to equities and less to bonds. This approach has a design constraint and is recommended especially for savers who know that when they reach retirement age, they will not immediately annuitize the entire portfolio (buying a lifetime annuity for a substantial part of the savings). They thus have the opportunity to use the strategy also for the decumulation phase and extend the "saving" horizon from the retirement age till the life expectancy.

Manor (2017) presented in his article the most efficient strategies for the implementation in Israel's pension system, according to mean vs. risk of returns and net replacement rates. Risk measurement was carried out using CVaR, which is superior for the measurement of extreme risk, while most of the former research has used VaR for this purpose. Simulations were based on the Monte Carlo method and efficiency frontiers for fifteen investment strategies and for each of six representative agents were defined. The first conclusion of the study was that a life cycle of dynamic strategies with a high portion of equities, switching gradually to a full bonds portfolio at retirement, produced the highest returns and replacement rates for a given risk. The second conclusion was that the gap between genders during the working period expands during the retirement period. Reducing the gap requires dealing with the salary gap created during the working period and raising the retirement age of females.

A similar analysis has been performed by Fodor and Cenker (2019), who analyzed saving habits of participants in the Slovakia's private pension scheme and discussed optimal default investment strategies. Contrary to other studies, instead of the Monte Carlo simulation method, they applied the resampling simulation method based on historical asset returns. They found that an optimal default life-cycling strategy consists of initially investing entirely into equities for the first half of individual's career, and later switching new contributions to bonds.

Recently, under the development of pan-European pension products regulation, EIOPA (2020) has launched open discussion on its stochastic model. The model serves for the analysis of performance of saving strategies that should serve as default options for life-cycle allocation profiles. The stochastic model derives uncertainty about financial and labor market risks by generating 10 000 Monte Carlo simulations of possible realisation of the world during the accumulation phase for the asset returns, discount rates, inflation rates, unemployment spells and real wage-growth profiles. The model simulates stochastic nominal interest rates, inflation rates, equity returns and bond returns (risk-free and credit risky). Similar to Korn and Wagner (2018), the analysis uses the G2++ model to generate interest rates, where two stochastic factors determine the future evolution of interest rates. Inflation follows the Vasicek process and is calibrated to reach the central bank's target inflation in distribution. Equity returns are assumed to follow a geometric Brownian motion with a constant equity risk premium of 6% on top of the interest rate. The equity premium of 6% follows from estimations using Damodaran's implied method. Ten-year government bond returns are projected directly from the risk-free interest rate term structure, following a rolling down the yield curve strategy. Finally, for the labor market risks, the model generates stochastic unemployment spells and real wage-growth profiles. This permits to obtain the distribution of the lump sums produced by different investment strategies. Authors have created sixty-four saving strategies in total; out of which fourteen strategies were solely based on the factor of age; while additional eleven strategies work with the factors of age, risk aversion and level of savings. Additional eleven strategies follow the fixed allocation profile from 0% up to 100% in equities. This approach gives us a solid ground for the comparison of results.

3 Methodology

In order to have the results be comparable among mentioned study of EIOPA (2020), we have created a respective saver, who contributes on his/her account in funded pension scheme offering various fixed and life-cycle strategies for. The saver starts contributing into the pension scheme at the age of 25 and contributes monthly 6% of his salary for a forty-year period. His salary follows life-cycle income path for a secondary education level, including the labor market risk (unemployment). Estimation of life-cycle income under the labor market risk is performed by curve fitting technique to estimate the regressors of age (x) for a secondary education level income functions that should follow the polynomial function (see Lagos et. al., 2018):

$$y_x = a + b_j x + c_j x^2 + \varepsilon \tag{1}$$

We use the data on income of secondary level employees from the study of Fodor and Cenker (2019), where the future expected levels of labor productivity are taken from the Ageing Report 2018 (EC, 2018). Income function is influenced by the temporary labor market risks. According to Cooper (2014) and Guvenen et al. (2015), if an economic agent drops out of the labor market for a certain period, his wage departs from a full uninterrupted income function, since the skills, working habits, and experience during the period of unemployment do not improve. In order to estimate nominal values of projected income, we incorporate also projected inflation from the macro scenarios. Given the existence of unemployment risk and inflation, the nominal wage (*w*) could be expressed as:

$$y_t = \left\{ \begin{matrix} y_t;\ t = 1 \\ y_{t-1} \times (1 + \tau_t); U_t = 1, t \in < 1, T > \\ y_{t-1} \times g^*_{x;\,t} \times (1 + \tau_t); U_t = 0, t \in < 1, T > \end{matrix} \right\} \tag{2}$$

Where $g_{x;t}^*$ represents monthly real wage growth on the estimated life-cycle income functions at age $x; \tau_t$ represents the inflation in time *t*. $U_t = 1$ means that the economic agent is unemployed at time t, while $U_t = 0$ means that the economic agent is employed at time t. If an economic agent is employed ($U_t = 0$), his income function depends on the development of inflation and the increased labor productivity over time that influences the $g_{x;t}^*$. In the case that the economic agent is unemployed ($U_t = 1$), his lifetime income function changes over time only by the impact of inflation and the labor capital remains constant.

Let the variable contribution rate be the percentage of saver's salary *y* at time *t* be defined as $c(y)_t$. Than the monetary value of a contribution *C(y)* shall be defined as:

$$C(y)_t = y_t * c(y)_t \tag{3}$$

Let us also consider the possibility of distributing the contributions into two pension funds with different risk-reward profile, where equity pension fund is defined as *s* and bond pension fund as *b*. The weighting *w* defines the proportion of contributions directed towards the pension fund (vehicle). Therefore:

$$C(y)_t = w_{s,t}^c * C(y)_t + w_{b,t}^c * C(y)_t \tag{4}$$

where $w_{s,t}^{c}$ represents the share of contributions directed into the equity pension fund (vehicle) at time t and $w_{b,t}^{c}$ represents the share of contributions allocated into the bond pension fund (vehicle) at time t according to the following conditions:

$$w_{s,t}^{c} + w_{b,t}^{c} = 1 \tag{5}$$

$$w_{s,t}^{c}; w_{b,t}^{c} \in \langle 0, 1 \rangle \tag{6}$$

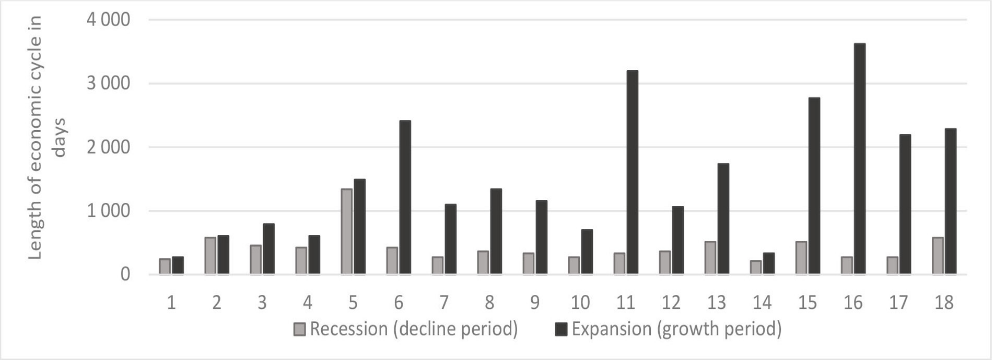
It is obvious that the salary tied contributions would be influenced significantly by two factors – labor productivity and inflation, as both have impact on nominal value of salary. The value of savings at the end of saving period for specific saving strategy is represented by S_T and can be calculated as follows:

$$S_{i;\,T=} \sum_{t=1}^{T} C(y)_t \left(1 + \left(r_{s,t}^{*} * w_{i\,s,t} + r_{b,t}^{*} * w_{i\,b,t}\right)\right)^{T-t+1} \tag{7}$$

and i indicates the saving strategy. We assume that new contributions $C(y)_t$ are invested at the beginning of each saving period *(t)*. It means that the first contribution is invested for a period of 480 months, second contribution is invested for 479 months and the last one is invested only for one month.

To simulate the saving horizon over the 40-year period, we employed moving-block bootstrap (resampling) method, which allows the increase of a number of simulations by pseudo-randomly generated macroeconomic scenarios while preserving correlations among macroeconomic indicators (k_k) using historical (empirical) data. Data on monthly macroeconomic indicators for the period of 1919 until 2018 (100 years) include unemployment, inflation, GDP change, labor productivity, equity total returns and 3-7-year bonds with constant maturity returns. The empirical time series of macroeconomic variables (k_k) contain 1200 monthly values. Since we want to obtain monthly changes for each macroeconomic variable, in total we have 1,199 monthly changes ($\Delta k_{j;t)}$), where $t \epsilon$ 1;2;…..;1199. Resampling techniques require to set the data blocks, in our case dividing 100 years of empirical time-series into up-trending (Up^i) and down-trending periods ($Down^i$). We used the approach of NBER (2020) on economic cycles and mark each period with the appropriate index value (i). Altogether, we have 18 up-trending and 18 down-trending periods. Figure 1 illustrates up-trending and down-trending economic periods between 1919 and 2018.

Figure 1: US Business Cycle Expansions and Contractions (1919 – 2020)



Source: NBER (2020), available at: http://www.nber.org/cycles/cyclesmain.html

Each period (i) has a precisely identified time series of macroeconomic variables (Δk). Let us define a vector of time series of monthly changes in macroeconomic variables ($\Delta k_{k;t}$) where the lower index k represents the observed macroeconomic variable (in the range *1 to K* variables). Let us call the generated vector as a simulation block (r_N). The first simulation block (r_1), which consist of empirically measured values of monthly changes in observed macroeconomic variables ($\Delta k_{k;t}$), and contain all up-trending and down-trending periods in a sequential order from 1 up to 18, has the following form:

$$\boldsymbol{r_1} = \begin{bmatrix} \Delta k_{1;1} & \cdots & \Delta k_{1;1199} \\ \vdots & \ddots & \vdots \\ \Delta k_{K;1} & \dots & \Delta k_{K;1199} \end{bmatrix} \tag{8}$$

In order to increase the number of simulations, we have created new simulation blocks using a resampling procedure. We combined up-trending and down-trending periods without repetition while maintaining the rule that each period (i) can only occur once. Applying the resampling technique, we have got a total of 150 simulation blocks (r_N, where $N \epsilon\ 1;\ldots;150$). For each simulation, the resampling method generates the set of monthly equity and bond returns, labor productivity changes, inflation and unemployment rates for the period of 40 years (500 months).

Finally, we can expose life-cycle income of our representative saver to the randomness of external macroeconomic development. The simulation is performed as follows. For each simulation block (r_N), we start from the first month ($t = 0$) with the empirically gathered data on average wage and respective unemployment rate for the 25-year old savers with secondary education level at the end of the year 2019. Each month the values of the macroeconomic indicators change, which affects the wage growth and the probability of being employed of a saver. We continue with simulations until the saver reaches the age of sixty-five years (the length of one block is five hundred monthly data) and until all blocks of resampling data are used. In total we perform 9 000 simulations.

3.1 "Aging" based saving strategies

We have constructed two life-cycle strategies with decreasing allocation of savings in riskier equity pension funds and that takes into account only the age of a saver and ignores the price of underlying assets or their development over time. To complement these two risk-decreasing life-cycle strategies, we turned the logic upside down and constructed two inverse life-cycle strategies with increasing allocation of savings into the equity pension fund to see, whether the key logic of the glide path is valid. In total, we present four life-cycle strategies based solely on the factor of age.

The first life-cycle strategy, called *Aging1*, is based on the well-known "rule of thumb", where the allocation weight ($w_{s,t}$) into the riskier equity pension fund is based on the rule "*100 – age*" or:

$$w_{s;t}^{Aging1} = \frac{100 - x_t}{100} \tag{9}$$

Where:

$w_{s;t}^{Aging1}$ represents a portion of savings allocated into the equity pension fund;

x represents the age of an economic agent (saver/investor) at time t, while $t \in \{1,T\}$, where T is the total saving horizon in years.

The remaining portion $(1 - w_{s,t})$ is allocated into the bond pension fund.

Aging2 strategy is slightly modified version of previous strategy and reduces the proportion of savings invested into the equity pension fund relatively to the ratio of the number of years t a saver has already saved to the years of a total saving horizon (T):

$$w_{s;t}^{Aging2} = 1 - \frac{t}{T} \tag{10}$$

Comparing to the *Aging1* strategy, the *Aging2* strategy allocates higher proportion of saving into the equity pension fund at the beginning of the saving horizon, but the decrease rate is steeper.

The remaining two ageing strategies are inverse in their logic. The *Aging3* strategy increases the exposure to the equities with the raising age:

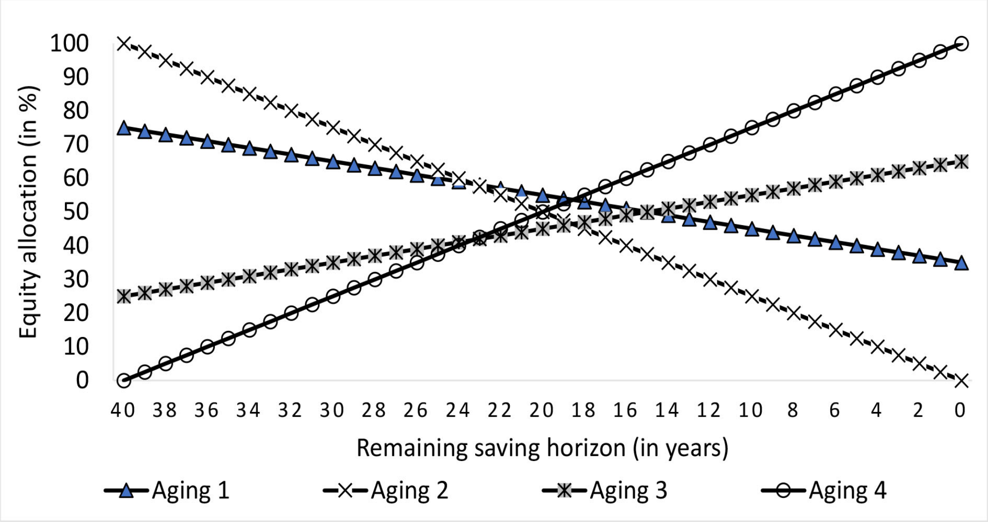
$$w_{s;t}^{Aging3} = \frac{x_t}{100} \tag{11}$$

Aging4 strategy increases the exposure to the equity pension fund based on the ratio of the number of years *t* a saver has already saved to the years of a total saving horizon (*T*):

$$w_{s;t}^{Aging4} = \frac{t}{T} \tag{12}$$

The allocation profile for all the four ageing strategies over the saving horizon of a saver could be visualized as follows.

Figure 2: Equity allocation of "aging" saving strategies



Source: Own elaboration, 2020

In order to compare the dynamic ageing saving strategies, we have added eleven fixed saving strategies. The weight of equities in the portfolio is fixed over time, with a yearly rebalancing of the portfolio. The strategies differ in the fixed equity weight, from 0% to 100%, similar to the approach of EIOPA (2020). The allocation profile of fixed saving strategies is presented below.

Table 1: Allocation profile of Fixed saving strategies

Fixed saving strategy	Proportion of savings in equity pension fund (in %)	Proportion of savings in bond pension fund (in %)
Conservative (Bond)	0	100
Aggressive (Equities)	100	0
90:10	90	10
80:20	80	20
70:30	70	30
60:40	60	40
50:50	50	50
40:60	40	60
30:70	30	70
20:80	20	80
10:90	10	90

Source: Own elaboration, 2020

The following sub-chapter presents the way how the presented saving strategies are assessed based on the performance, short-term investment risk and adequacy risk.

3.2 Assessment of life-cycle saving strategies

In order to compare our results with the EIOPA study (2020), we compare the performance at the end of the saving horizon. Further on, we analyze the short-term investment risk a saver could suffer during the saving horizon. The last indicator complements the pension economic theory by expressing the long-term risk expressed is literature as adequacy risk.

The first indicator ($Perf_T$) compares the volume of accumulated savings (S_T) at the end of the savings horizon T and the volume of contributions (C_t) paid over the entire saving period ($\sum_{t=1}^{T} C_t$). The savings performance indicator is calculated as follows:

$$Perf_T = \frac{S_T}{\sum_{t=1}^{T} C_t} - 1 \tag{13}$$

The indicator ($Perf_T$) expresses the rate of appreciation of contributions made by a saver under the chosen savings strategy during the whole saving period. In essence, it represents an individual rate of appreciation of savings due to the existence of a saving strategy and an individualized lifetime income function. In other words, the performance indicator shows, whether the saving strategy can preserve at least the invested contributions if the indicator is higher than 0. However, to obtain a picture on expected saving performance of saving strategies in the 5% of the worst cases, we also compare the mean performance and performance at the fifth percentile of all simulations. This is in line with the approach of Fodor and Cenker (2019) and allows us to see, whether the saving strategies are too risky or are able to deliver constant performance regardless the development of macroeconomic conditions.

Secondly, we assess what kind of short-term investment risk a saver must undergo in order to achieve above mentioned savings performance. In most cases, the investment risk is viewed as a short-term risk represented by volatility or VaR (value-at-risk), which in short is the ninety-fifth percentile of all down-side movements. In our case, we want to see what maximum loss an individual could suffer during the saving horizon measured as an average maximum loss suffered during the saving period in all simulations. *MaxDD* can is calculated as follows:

$$MaxDD(\%)_t = MIN_t\left\{\frac{[S_t - MAX(S_{\hat{t}})]}{MAX(S_{\hat{t}})} \times 100, MaxDD(\%)_{\hat{t}*}\right\}; \hat{t} \in \langle 1, t\rangle, t \in \langle 2, T\rangle \qquad (14)$$

The third indicator focuses on individual long-term risk of pension schemes. This risk is quite neglected in the pension theory as well as practice. In fact, the long-term risk of any funded pension scheme could be viewed from the angle of Barr and Diamond (2006), who claim that the funded scheme provides adequate income if the pension scheme delivers annualized return (r) higher than the average growth of saver's labor income (g) over the saving period. In other words, pension scheme is adequate under the condition $g \leq r$. This implies that the same saving strategy could be adequate for a saver with lower labor income growth rates and inadequate for savers with higher labor income growth rates. Therefore, following this logic, we calculate the targeted value of savings ($TargetS_T$). The targeted value of savings is calculated using returns equal to the average annual growth of an individual saver's nominal wage (g_T) over the saving horizon (working career). To obtain the adequacy risk, for each simulation we divide the final value of savings (S_T) by targeted value of savings ($TargetS_T$):

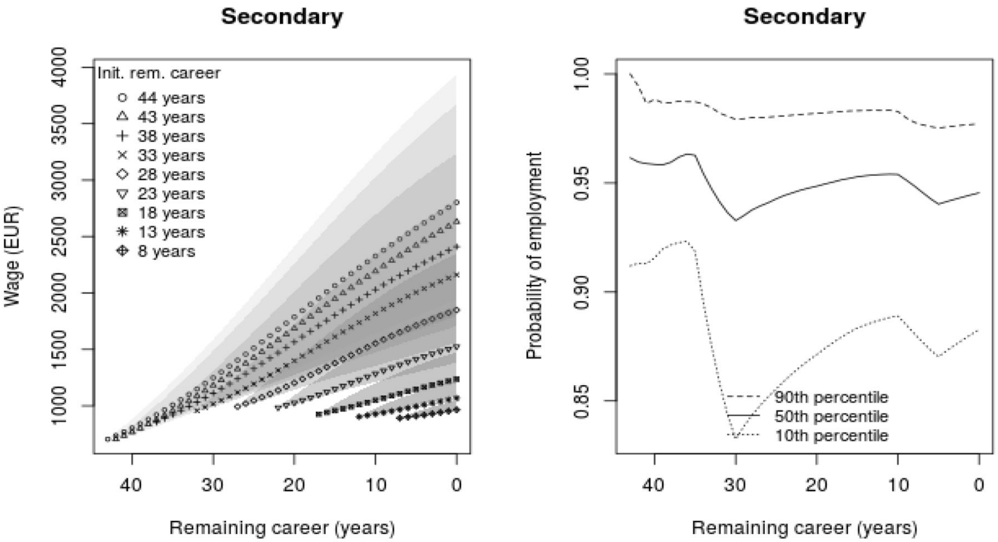
$$Adequacy\ risk_T = \frac{S_T}{TargetS_T} - 1 \tag{15}$$

The value of $Adequacy\ risk_T \geq 0$ indicates that a saver has achieved the desired outcome, or the level of final savings exceeded the targeted level of savings using the expected rate of return for the equity based portfolio. Conversely, a value of $Adequacy\ risk_T < 0$ indicates that a saver has not achieved the targeted level of savings, and hence by applying a savings strategy, the saver was not able to accumulate sufficient level of savings and the adequacy risk occurs in the form that a saver would need to accept lower income flow at retirement or increase the short-term risk during the retirement.

4 Results and Discussion

First, we present the estimated life-cycle income for savers with secondary education level and various years of working career (left side of the figure below) and expected probability of being employed at certain age (right side of the figure below).

Figure 3: Estimated life-cycle nominal labor income for secondary education



Source: Own estimation using Fodor and Cenker (2019) data, 2020

Applying the estimated life-cycle income, contribution rate and analyzed saving strategies, the estimated savings performance is presented in the table below.

Table 2: Performance (Perf) of saving strategies

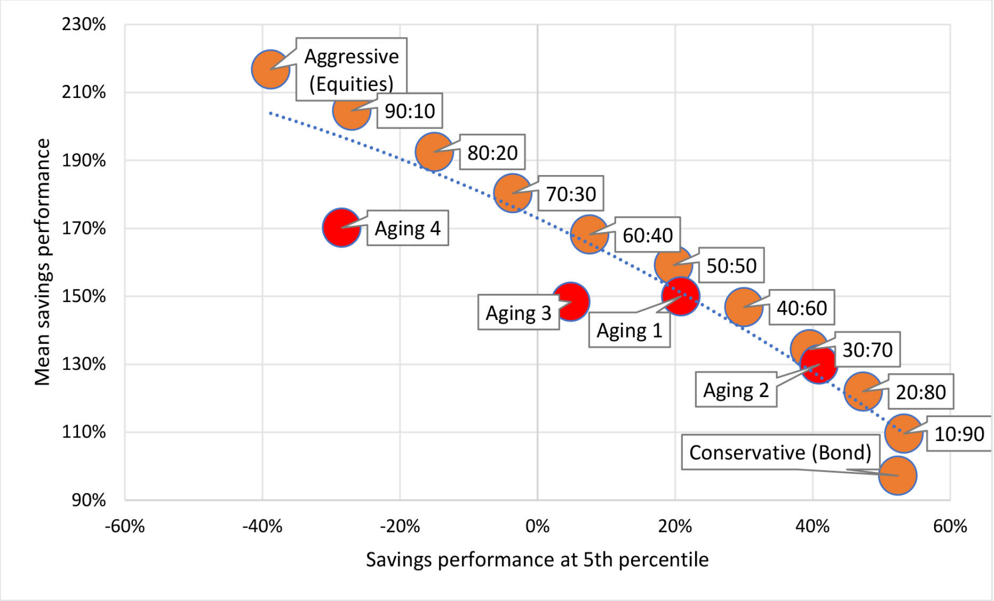
Savings Performance	Mean	Std. Dev.	5th per-centile	25th per-centile	50th per-centile	75th per-centile	95th per-centile	Max.	Min.
Conservative (Bond)	**97%**	36%	52%	69%	91%	118%	167%	239%	27%
Aggressive (Equities)	**217%**	228%	-39%	51%	169%	310%	677%	1784%	-79%
90:10	**205%**	206%	-27%	55%	161%	288%	623%	1621%	-64%
80:20	**192%**	184%	-15%	59%	154%	267%	566%	1458%	-49%
70:30	**180%**	163%	-4%	62%	146%	246%	511%	1295%	-37%
60:40	**168%**	141%	8%	65%	138%	227%	450%	1132%	-26%
50:50	**159%**	122%	20%	70%	133%	213%	402%	992%	-15%
40:60	**147%**	101%	30%	73%	126%	193%	345%	825%	-4%
30:70	**134%**	80%	40%	76%	119%	174%	289%	658%	8%
20:80	**122%**	61%	47%	76%	110%	156%	233%	491%	19%
10:90	**110%**	44%	53%	74%	102%	137%	191%	324%	30%
Aging 1	**150%**	97%	21%	77%	137%	206%	327%	665%	-19%
Aging 2	**130%**	66%	41%	80%	121%	167%	249%	465%	7%
Aging 3	**148%**	99%	5%	75%	138%	208%	329%	568%	-45%
Aging 4	**170%**	144%	-28%	65%	149%	251%	446%	824%	-75%

Source: Own calculations, 2020

When inspecting the savings performance indicator, logically, the lower risk allocation strategies delivered the lowest performance (Conservative saving strategy and the fixed strategies investing low proportion of savings into the riskier assets). This is in line with the EIOPA (2020) findings on fixed saving strategies, where for investment strategies with very low equity exposures (fixed portfolio strategies with less than 20% in equities), the 5% worst scenarios would produce a lump sum representing between 74% and 80% of the total contributions or less. A little surprisingly, *Aging1* and *Aging2* strategies, which are admired by many researchers and policy-makers did not deliver exceptional returns and could not beat even the fixed strategy that constantly invests 50% of the portfolio into the equities.

Considering both the average performance and the performance achieved at the fifth percentile, the picture might look little different.

Figure 4: Performance of savings strategies – Mean vs. 5th percentile

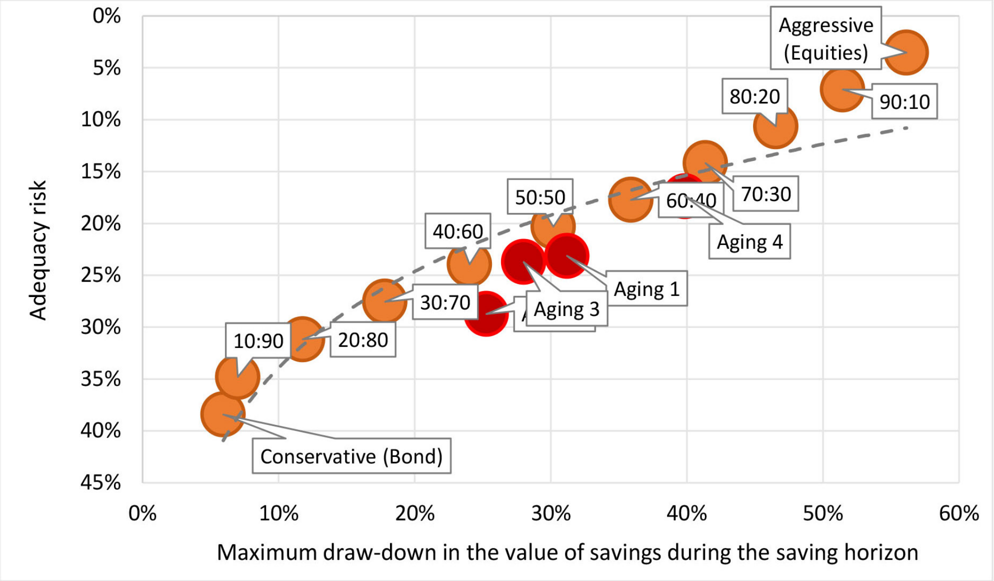


Source: Own calculations, 2020

One can see that most of the fixed saving strategies delivered proportionally higher mean savings performance (vertical "y" axis) and lower performance at the fifth percentile (horizontal "x" axis) of all simulations. Generally recommended *Aging1* strategy delivered below average results both on the average as well as at the fifth percentile. Basically, all age-based saving strategies delivered results below the average efficient frontier line.

Secondly, we present the mutual relationship of short-term and long-term risks using the indicators of maximum draw-down and adequacy risk. By doing so, we can easily examine the trade-off between the short and long term risk and assess both the potential down-side risk a saver can expect to suffer and the adequacy risk or the probability that he/she will not be able to save enough. To present the adequacy risk within the graph, the formula (15) has been multiplied by (-1).

Figure 5: Maximum draw-down and adequacy risk of saving strategies



Source: Own calculations, 2020

Logically, the full equity saving strategy has the lowest adequacy risk over the entire saving horizon and leads the group of analyzed saving strategies. In order to achieve this objective on the long-term, one has to be prepared to suffer more than 50% draw-down of his/her savings during the saving horizon, which can be quite hard to sustain. On the other side of the spectrum, the full bond strategy leads that delivers the lowest short-term risk (maximum draw-down of savings), but it leaves the saver with huge adequacy risk of almost 40% or in other words, full bond strategy is capable to deliver (on the average) only 60% of expected or targeted value of savings. Surprisingly, all "aging" strategies performed below average and delivered higher adequacy risks as well as short-term investment risks compared to the fixed saving strategies.

5 Conclusions

When constructing for optimal life-cycle saving strategy taking into account various life-cycle income paths and individual unemployment risk, one would expect that conventional recommendation on derisking with age would deliver better results than fixed saving strategies, where the allocation profile do not change over time.

Our research results suggest that applying simple age-based saving strategies, where the allocation profile between equities and bonds changes solely based on the age of a saver, should not be a first-best option for all savers. All analyzed age-based saving strategies delivered results that were below the fixed peers. This is in line with the findings of the EIOPA study (2020), which consider age-based strategies "Aging 1" and "Aging 2" tested in our paper as poorly performing and suggest more aggressive age-based strategies. The results are also in line with Fodor and Cenker (2019), who claim that their strategies "Stepwise (1, 0)" and "Stepwise (0.8, 0.4)" that are similar to the strategies "Aging 1" and "Aging 2" are always dominated by other strategies if the expected saving performance or the performance at the fifth percentile is considered.

This leads us to the conclusion that general application of saving strategies that would take into account only the saver's age or the remaining saving horizon would harm the saver and expose him/her to the higher adequacy risk as well as potential short-term losses comparable to fixed saving strategies. Therefore, the search for an "one-size-fits-all" predefined life-cycle saving strategy could be the road to nowhere and more strategies should be considered for predefined options taking into account not only the age of a saver, but additional parameters, such as the expected wage growth and level of savings at certain age determining the adequacy risk or short-term investment risk and individual risk aversion of a saver.

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