



# Goal-Based Financial Planning: using the deposit Calculator

*Boosting cashflow  
projections using  
stochastic scenario  
analysis*

Proper financial planning starts by creating a personal balance sheet, projecting future cashflows and comparing outflows with expected income. Such financial plans project future cashflows in great detail and can include, among others, future salaries, savings, housing costs and pension schemes, whilst taking all of the relevant tax regulations into account. The level of sophistication at which the cashflow projection takes place often strongly contrasts with the way investment returns are projected.

Traditionally only the expected return or a few deterministic return scenarios are taken into account for the investment decisions. As future incomes heavily depend on uncertain investment returns, not taking stochastic scenarios into account heavily undermines the overall quality of the financial advice. In this article, we demonstrate the use of stochastic scenario analysis, and demonstrate how the quality of financial advice can be greatly improved by properly balancing risk and return in order to align with the client's desired risk appetite and the priority given to the investment goals.

## Private Asset Liability Management (ALM)

Global financial institutions have been applying stochastic scenarios for decades in order to align the assets with the liability side of the balance sheet. For instance, banks carefully balance the risk and return of their loan and mortgage books with their own assets. Insurers and pension funds employ asset liability management studies to make an optimal trade-off between the risks and returns they need to make in order to meet their long-term (pension) cashflows and indexation objectives, whilst balancing this against their maximum allowable down-side risks.

The investment decisions faced by large institutions are in essence very comparable to those of private households; both seek a trade-off between maximizing the upside, whilst ensuring crucial goals to be met with high level of certainty, even in situations of adverse market conditions. Due to the comparability of these scenarios, it is not a surprise that ALM studies have nowadays also become a popular tool for enhancing the financial planning and decision making of individuals. One often-used application is to align the client's desired risk appetite and goal horizons, with his or her investment portfolio.

## Economic Scenario Generator

The basis for any ALM study lies in using suitable real-world economic scenarios for stochastically projecting future investment returns. The so-called economic scenario generator is typically calibrated based on historical time series of investment returns and should at the minimum allow for historically observed risk and return characteristics to be captured in the projected scenarios. For instance, modelling of equity and high yield bonds should properly take skewness and heavy tailed characteristics of such investment categories into account.

Supported by academic research, within the banking and insurance industry the use of stochastic volatility models with jumps has become the de facto standard for realistic modelling of risky index- based assets. These models allow for short-term jump properties to be combined with long-term stochastic volatility risks. Furthermore, stochastic volatility jump diffusion models provide a good trade-off between model realism and flexibility, whilst being sufficiently transparent for performing consistent calibrations between risk factors.

Next to properly modeling individual assets, realistic comovements between risk factors have to be accounted for in order to realistically take diversification benefits within investment portfolios into account. This addresses the question of how much offset on average can be expected when a certain risk factor is exposed to an adverse event, e.g. how much diversification can be expected from medium yield corporate bond investments when European equities fall.

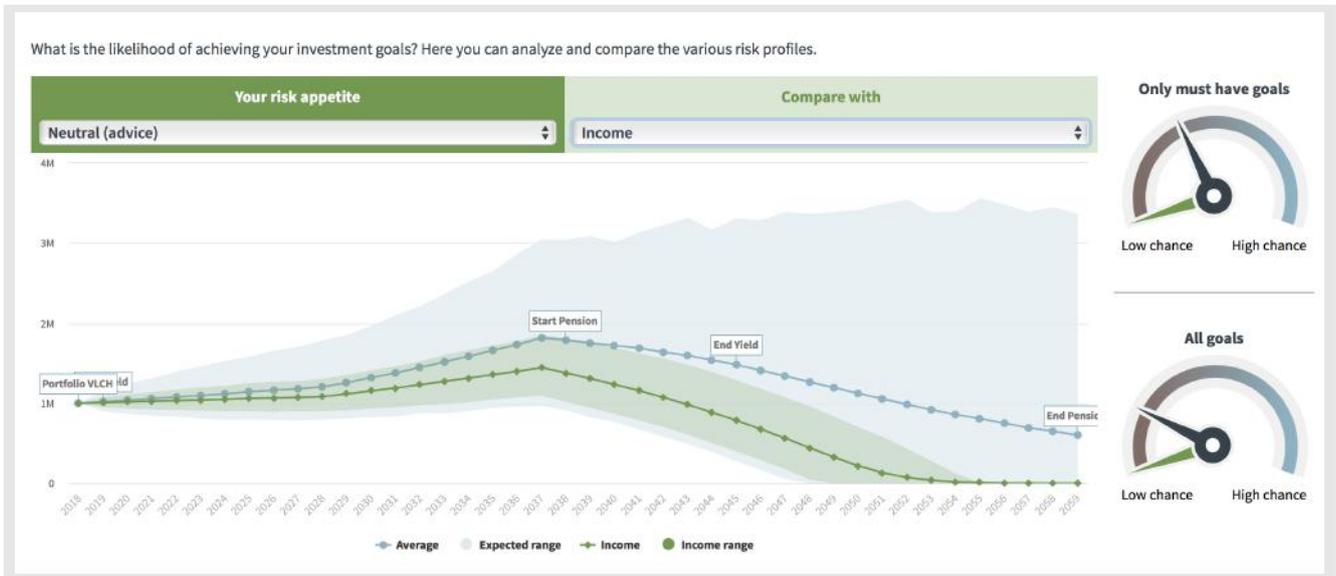


Figure 1. Scenario Analysis tool Van Lanschot Switzerland

In empirical return data, it is observed that dependencies, often referred to as “correlations”, behave differently during normal economic periods as they do during crises. In particular, during periods of distress, when diversification is most needed, risky assets tend to co-move more than during normal periods and consequently diversification benefits are greatly diminished. This was for instance observed in 2008 when all global equity indices decreased by more than 40%, and real estate, commodities and corporate bond investments also went down simultaneously.

Suitable real-world economic scenario generators hence:

- Allow for historically observed returns to be captured in projected scenarios.
- Take heavy-tailed characteristics and skewness of risky assets into account.
- Allow for time-varying stochastic volatility and jumps.
- Realistically model diversification benefits, behaving differently during crises periods.

Once equipped with a realistic real-world economic scenario generator, goal-based analysis based on the client's incomes, investment accounts and goal objectives can take off;

## Case Study: Goal Based Planning

In this case study, we will consider the situation where a client wishes to secure additional net income after the retirement date. To this end different investment strategies are considered, and a risk return analysis is performed for meeting the pension goal. More concretely, for each investment category the required initial deposits are calculated which ensures the probability of meeting the pension objective is in line with the desired client's risk appetite.

In order to analyze the effects of long compared to shorter term investment decisions, two types of clients are considered; a client with a long investment horizon of 30 years and a client with a shorter- term horizon of 10 years. Both clients wish to secure additional pension income

### Long-term investment horizon

In the first case, we consider a client with a long-term investment horizon who requires 1,500 euro per month to be available during his retirement phase. Taking tax regulations and state pensions into account, this translates to having to save up for an additional 111k euro to be available at the retirement date.

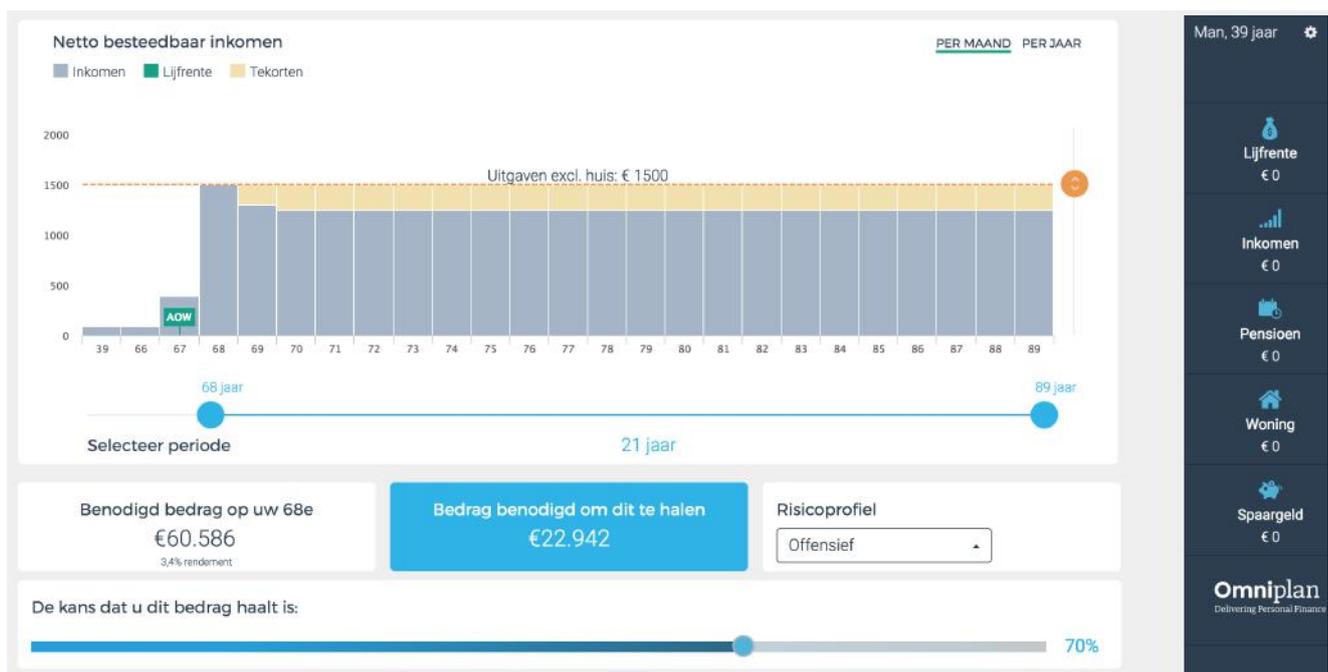


Figure 2. Advanced pension planning by Omniplan

The client would like to know how much he has to set aside now, in order to meet his investment goals. Here he would like to make a balanced decision for the trade-off between:

- The higher returns associated with more risky investments.
- The higher risks associated with more risky investments.

First the client's risk appetite is derived based on his current financial position, investment objectives and risk willingness using questionnaires. For the scope of this analysis we will assume three different probabilities; a "normal" probability which assumes a 50/50 chance, a "high" probability which assumes an 85% chance and a "very high" probability which assumes a 95% chance.

Consequently, for various investment strategies, the required initial deposit is calculated in order to meet the return objective for any given probability. The results can be found in the below table;

Required Deposit	Normal Probability	High Probability	Very High Probability
• <b>Very Defensive</b>	45,095	57,584	67,249
• <b>Defensive</b>	32,868	48,603	60,989
• <b>Neutral</b>	25,245	43,159	<b>60,054</b>
• <b>Aggressive</b>	20,260	40,175	61,956
• <b>Very Aggressive</b>	<b>16,366</b>	<b>38,784</b>	67,431

*Table 1. Required deposit for different investment strategies and risk appetites (Long Term Horizon)*

From the table we can observe that, given a normal or high probability, the most aggressive investment fund requires the smallest deposit for a given likelihood of reaching the objectives. Only in case of a very high probability, does a neutral investment strategy require a smaller deposit compared to a more aggressive portfolio. In all cases the optimal portfolio consists of a certain amount of risky assets.

These results are in line with expectations and correspond to the intuition that given a long investment horizon the higher returns outweigh potential downside risks; due to the long nature of the investments, there is ample time for recovery in case of adverse market conditions.

### Medium-term investment horizon

The second case is similar as before, only the investment horizon in this case is 8 years, reducing the ability to recover from market crashes and consequently affecting the downside risks of the investment goal. Again, we calculate the required initial deposit needed to meet the objective within the client's risk tolerance, see below table;

Required Deposit	Normal Probability	High Probability	Very High Probability
• <b>Very Defensive</b>	98,724	112,009	<b>119,075</b>
• <b>Defensive</b>	92,108	<b>110,806</b>	124,414
• <b>Neutral</b>	86,161	112,271	132,030
• <b>Aggressive</b>	81,498	116,098	139,943
• <b>Very Aggressive</b>	<b>77,880</b>	121,032	150,941

*Table 2. Required deposit for different investment strategies and risk appetites (Medium Investment Horizon)*

As the investment horizon is now much shorter we see that only clients who do not give particular importance to the investment goal are advised a very aggressive investment strategy. A client who wants a high certainty of reaching the investment goal can best chose a somewhat defensive strategy, whereas a client who hardly wants any risk at all, should opt for a very defensive investment profile. In fact, given that the investment needed for a near certain outcome is more than the actual investment goal, such a client is probably better off not investing at all. This corresponds to the intuition that recovery capabilities are much more limited for shorter investment horizons and reduction of risks and/or life-cycle based investment strategies should potentially be considered.

Secondly, we note that required deposits increase significantly as function of the required certainty levels. This effect is higher for aggressive investment strategies compared to more defensive ones. The 8-year period is too short to make up for a big market crash and hence a large deposit would be required when following a risky investment strategy is followed whilst having a goal that has to be met with high certainty.

## Balancing volatility risk with goal related risk

As can be seen from the above analysis, the importance a client attaches to the achievability of an often long-term goal is not always aligned with the client's risk appetite, which focuses on the short-term volatility risk of a portfolio. The challenge for advisors is to properly illustrate the various risks, so the client can get a full understanding of the likely behavior of the investment portfolio. Generating scenario clouds, showing various possible outcomes and showing some historical stress scenarios, for example, can be useful strategies. These allow an advisor to give a client an idea of what to expect and to ascertain whether the client is comfortable with the shown possible scenarios. These very visual methods are by far superior to the very one-dimensional approach taken by most traditionally used risk questionnaires.

## Conclusion

In this article, we have demonstrated the use of stochastic economic scenarios for performing goal based financial planning. Using realistic economic scenarios in conjunction with goal-based financial planning allows return objectives to be balanced against downside risks, as well as taking short and long-term risks consistently into account. Results demonstrate that alignment of the investment strategy with both the client's risk tolerance and investment horizons are found to be of crucial importance for a proper financial investment advice.

## About the Authors

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Years of Experience: 10



Alexander is Assistant Professor of Finance and Risk Management at the Vrije Universiteit Amsterdam. He holds a MSc Econometrics from the Vrije Universiteit and a PhD in Financial Mathematics from the University of Amsterdam. Next to this, Alexander is the owner of Risk at Work consultancy, which aims to come up with state-of-the-art solutions for complex risk management matters.

He combines several years of practical experience in risk management with comprehensive academic knowledge. This enables him to quickly come up with suitable solutions for complex risk management issues.

His research has been published in high-ranked actuarial and financial mathematics journals such as the International Journal of Theoretical and Applied Finance, Insurance: Mathematics and Economics, and Quantitative Finance.

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### Bart Koolhaas, CFA

Years of Experience: 20



Bart has spend over 20 years in the world of international private banking and asset management.

He frequently authored articles and provided training on various investment related subjects. He has lead the product development efforts of leading Dutch Private Banks both in Asia as in Switzerland, where he was responsible for the implementation of MIFID I and II throughout the bank.

Bart is passionate in translating highly complex investment problems and concepts into easy to understand articles, tooling and solutions for clients.

He co-founded Finbotx in 2016.

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## About Finbotx

Finbotx was founded with the aim to offer superior, flexible and cost efficient financial modeling services.

It currently offers the most advanced economic scenario generator for personal financial planning available; latest state of the art academic insights are incorporated in close collaboration with the VU University in Amsterdam

## Contact us!

Contact us for more information about our services and goal based investing.

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