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# Robo-advisor Industry Portfolio Risk: Efficiency or Corner-cutting?



Robo-advisor investing uses algorithms (instead of humans) for portfolio selection and rebalancing. Its affordable ways have opened up wealth management options to the masses, but its means of quantifying risk need more sophistication and tailoring to individual circumstances.

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Robo-advisors have risen to prominence over the past decade, with the fintech sub-sector encouraging more active involvement from younger investors and the masses in saving and investment. Robo-advisors aim to democratize financial advice and bring high-quality services, previously available exclusively to wealthy, sophisticated investors. In a nutshell, robo-advising is a form of investment management that outsources portfolio strategy to an algorithm. Portfolio construction and rebalancing is automated with the help of computers, providing more affordable wealth management solutions and potential reduction in human error and bias.

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Many startups in the field struggle to break even and show brand [differentiation](#). What is the best way for robo-advisors to continue to democratize investing and turn a profit while conveying the true risks of a portfolio?

## Where Did Robo-advising Come from?

Betterment and Wealthfront are two of the most prominent robo-advisors, with the former being the first to launch in 2008. By 2019, the sector was estimated to have [\\$440 billion](#) of assets under management globally, and over time, traditional wealth managers, like Vanguard, have also adopted such techniques. While completely different from execution-only trading platforms, like Robinhood, both sectors' message of financial empowerment has been embraced by younger investors, who traditionally have not taken an active interest in retirement savings until later on in their careers.

One of the key value propositions of popular robo-advisors is that they help clients understand risks and costs associated with portfolios, instead of focusing only on returns. Arguments against traditional financial advisor-led wealth management is the misalignment of incentives, where expensive and poorly performing assets are funneled to investors, who are unable to parse the numbers objectively to gain line of sight on performance. For that, robo-advisors have been proponents of passive investing, shunning expensive actively managed funds for economical index funds and exchange traded funds (ETFs).

## Risk Management and Robo-advisors

While most robo-advisors typically employ modern portfolio theory (sometimes in conjunction with other well-researched methodologies) to construct investor portfolios, they use different ways to express risk levels associated with those portfolios. Most investment professionals agree that risk is as important a consideration as return in portfolio selection. In fact, the vast majority of practitioners continue to be inspired by the mean-variance optimization framework illustrated by Nobel Prize winner Harry Markowitz's 1952 [dissertation](#) on portfolio selection.

However, risk is usually not as well understood by the average investor as expected returns. This is because an individual's risk tolerance is driven not only by past performance and rational expectations but also by unique personal circumstances and other emotional factors such as hopes and fears. Also, an individual's risk tolerance is hardly a static measure. Most individuals would decidedly perceive their risk tolerance to be lower in 2020, due to uncertainties presented by COVID-19, than any time during the past decade. The desirability of a recommended portfolio is assessed by an investor partly by their own perception of the portfolio's riskiness. This is why it is vital for a robo-advisor to clearly illustrate risk so that investors can understand the riskiness and relate it to their own tolerance, goals, and emotional preferences.

Robo-advisors use quantitative or qualitative measures to help clients understand risk. Each measure has its advantages and limitations.

## Qualitative Risk Levels: Aggressive or High Growth?

Most robo-advisors assign a qualitative risk rating based on how investors answer a predefined list of psychometric questions. This will generally range on a numerical scale from "Very Conservative" to "Very Aggressive."

A qualitative risk rating has obvious advantages, in that it makes perceiving riskiness of various portfolios relative to each other easy for an investor. For example, a portfolio assigned an "Aggressive" rating may be inherently riskier than one labeled "Conservative." The psychometric questions help narrow down investor tolerance for losses and identify the appropriate risk level.

However, a qualitative rating may not provide a clear understanding with respect to expected variability of the portfolio. It may not be obvious how much more volatile an aggressive portfolio is, compared to a moderate portfolio. Most likely, a risk rating of 6 may not mean that the portfolio is twice as risky as one rated 3. Also, the perception of risk may vary based on how the risk rating is verbalized. Investors may view a high-risk portfolio differently, depending on whether it is labeled "High Growth" or "Very

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Aggressive.” Hence such categorization introduces a layer of subjectivity to the perceived attractiveness of a portfolio.

My concern with robo-advisors over-emphasizing qualitative risk is that it may give investors a false sense of security as to the ongoing performance of their portfolios. An arbitrary risk score across an aggressive/conservative range may be too broad and ultimately end up in suboptimal financing planning decisions by investors whose circumstances may be more complex than previously thought. The concerns regarding over-simplified risks are echoed in regulatory calls about robo-advisors engaging in [systemic mis-selling](#), with investors failing to understand the true nature of the product.

Increased adoption of institutional quantitative risk measures (used by banks, funds, and family offices) with customer education could be the key to the next stage of robo-advising. This could really move the industry forward and correspond with national [movements](#) for increased financial literacy education.

#### **Quantitative Risk Measures for Investment Portfolios**

### **Taming Volatility: Value at Risk**

Value at Risk, or VaR, is the most popular measure of volatility of a portfolio. Simply put, VaR is a measure of minimum expected losses as a certain probability level (also known as confidence level or percentile). For example, if a portfolio’s 99% VaR is 12%, it means that there is a 99% chance that losses from the portfolio will not exceed 12% during a given period. In other words, there is a 1% chance that portfolio losses will be more than 12%. VaR is already applied by some robo-advisors, with one such example of usage being from Singapore’s StashAway, which brands a 99% guideline into a measure called the “[Risk Index](#).”

VaR can be calculated using different methods. The historical method sorts historical returns of a portfolio by magnitude and identifies the return observed at a certain percentile (typically 95% or 99%). The variance-covariance method assumes that returns are normally distributed and uses the portfolio’s standard deviation to estimate where the worst 5% or 1% returns will lie on the bell curve. VaR can also be estimated using [Monte Carlo](#) simulation, which generates the worst 5% or 1% returns based on probabilistic outcomes.

The popularity of VaR arises from the fact that it makes it easy for an investor to understand the variability of a portfolio and relate it to their personal tolerance for losses. However, we can obtain different results depending on inputs and methodology used to calculate VaR, affecting the reliability of the measure. Also, VaR relies heavily on numerous assumptions, such as returns being normally distributed and aligned to historical returns. Finally, a 99% VaR of 12% (described above) does not inform the investor regarding the amount of losses that can be expected in the worst-case scenario.

The various caveats behind VaR may be limiting its prominence in robo-advising platforms, with it being seen as a complicated metric for users to understand. The example of StashAway branding it into a more digestible metric shows how these barriers can be broken down more cogently.

### **Conditional Value at Risk**

Addressing one of the shortcomings of VaR, the conditional value at risk, or CVaR, provides the expected loss to an investor in the worst-case scenario. At a confidence level of 99%, CVaR is calculated as the average portfolio returns in the worst 1% of scenarios. CVaR is estimated using similar methods as VaR. While it may help give a clearer picture of the worst-case scenario compared to VaR, it may suffer from similar shortcomings due to the assumptions and methodologies used in estimation.

Market disconnects of 2020 tend to rip up normal distribution patterns, demonstrating that adding more “3-dimensional” portfolio risk measures, like CVaR, can be advantageous. In conjunction with standard VaR measure, CVaR data would enhance the risk management offerings of a robo-advisor and be well-suited, considering that the majority of robo-assets are index funds (baskets of stocks).

## Best and Worst Returns

The best and worst returns relate to rolling periodic returns of a security or portfolio during a given time horizon. The return can be calculated on a daily, monthly, or yearly basis, depending on the investor’s time horizon. The time frame is usually determined by the availability of data, but it can impact the best and worst observed returns if we do not use a long enough time horizon.

### Best and Worst Returns for US Assets: 1973–2016

The measure uses historical returns to give investors an indication of best and worst-case scenarios. One clear advantage is that, unlike VaR, it distinguishes between positive and negative returns, instead of assuming a normal distribution. Investors tend to not mind positive volatility and mostly worry about absolute downside risks. Also, unlike CVaR, it shows the absolute worst observed returns instead of taking an average of returns, which may underestimate the worst-case scenario. However, like other quantitative measures, this tends to be backward-looking and is also dependent on the dataset of observed results.

Best and Worst Return risk measures are well-suited for robo-advisor platforms as they communicate clearly to investors without relying on intimidating financial ratios. One such risk, though, is that they may play to [irrational](#) biases and encourage panic selling into a falling market or stubbornly holding onto losers.

## Measuring Quantitative Risk Yourself

Let’s take a look at how VaR, CVaR, and Best and Worst returns can be calculated for a single-asset portfolio. The asset taken into consideration is SPY, which is an ETF that tracks large-cap US stocks.

Data used for the below calculations pertains to NAV and monthly returns of SPY from July 2007 until June 2020. The calculations can be performed using Excel or Google Sheets functions.

**VaR** – 11.8% VaR implies that the probability of SPY losing more than 11.8% in a given month is 1%. In other words, SPY provided better monthly returns than a loss of 11.8% in 99% of the months. Steps (Google Sheets/Excel):

1. Calculate the historical monthly returns from share price/NAV data.
2. Use PERCENTILE.INC function using the array of historical returns and desired percentile (e.g., 1% for a 99% interval) as inputs.

**CVaR** – 14.5% CVaR implies that the expected monthly loss in SPY during the 1% worst outcomes is 14.5%. This can be determined in Google Sheets/Excel by using the AVERAGEIF function to calculate the average of returns less than the VaR outcome.

**Best and worst returns** - As shown in the table, the best and worst monthly returns observed in SPY during the 2007-2020 period were +13% and -16% respectively. These can be calculated quickly using the `MIN` and `MAX` functions.

As mentioned, it is important to note that these measures may yield different values, depending on the method as well as the period of observation. Choice of methodology and period should be based on factors such as availability of data, expected investment time horizon, and personal judgment.

## Differentiation Through Quantitative Measures

The bedrock of traditional wealth management is tailoring portfolios to individual needs, be it on timespan, ethical, risk appetite, and income-based needs; for that, every approach is bespoke. What makes robo-advising appealing is how its automated methods can function across swathes of customer bases.

However, robo-advisors need to help clients clearly understand the risk return tradeoffs of their portfolio offerings so that they can choose the right portfolios that meet their personal needs. Qualitative risk measures are an easy-to-understand “on ramp” to robo-advising, but over time, their parameters can become redundant. However, when used in conjunction with the quantitative risk measures outlined here, they help provide more holistic risk management guidelines and awareness toward portfolio performance.

## UNDERSTANDING THE BASICS

- ⤴ What are the disadvantages of using a robo-advisor?
- ⤵ What are the advantages of using a robo-advisor?
- ⤵ What is the best method for measuring quantitative investment risk?

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