Investing: For the short term

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While "Investing: Risk and return" focused on long-term investments, this paper considers shorter time scales. One difference is that portfolios will no longer be purely stocks and bonds, as cash can be a valuable addition for shorter time horizons.

Finding efficient stock–bond–cash allocations

Figure 3 shows all possible combinations of stocks, bonds and cash in 10% increments. The red, middle bar is the median, i.e. the value such that half the outcomes will be above and half below this value. The blue bar, on the left, is the downside risk: there is a 5% probability of doing worse than this value. Conversely the green bar is the upside, with 5% chance of doing better.

For two-year investments, adding equity or bonds to a cash portfolio increases both the median and the scale of the downside. However, for larger equity contents, the downside is relatively independent of the bond allocation, so that reducing the cash exposure increases the return without increasing the downside risk — a good choice in any case (bearing in mind that a more extreme risk, e.g. something happening 1% of the time, may still worsen with more equity).

Figure 1 represents the downside as a function of the median. It shows that different allocations yielding the same median return can have different levels of risk, and allocations with the same downside can have different medians. For instance a pure bond portfolio has a median of 6 700 € over 2 years and a 5% probability of losing about 13 500 €. A portfolio with 40% stocks and 60% bonds has the same downside risk but a median return of 9 500 €. The former portfolio is therefore unappealing: it is possible to have a higher return for the same downside risk. Only allocations along the top right envelope can be of interest to investors. Figure 2 shows some allocations that may be optimal (see "Investing: Four misconceptions on risk" for the 30 year case).

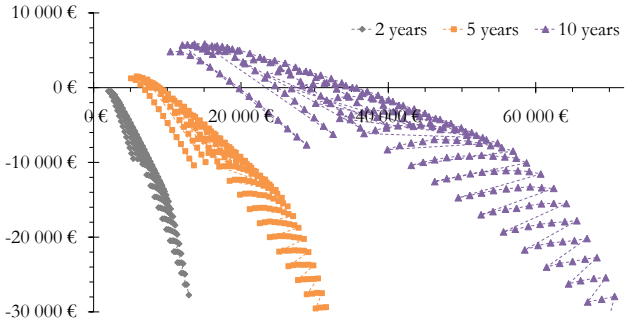

FIG. 1: The bottom 5% as a function of the median for an investment of 100 000 €.

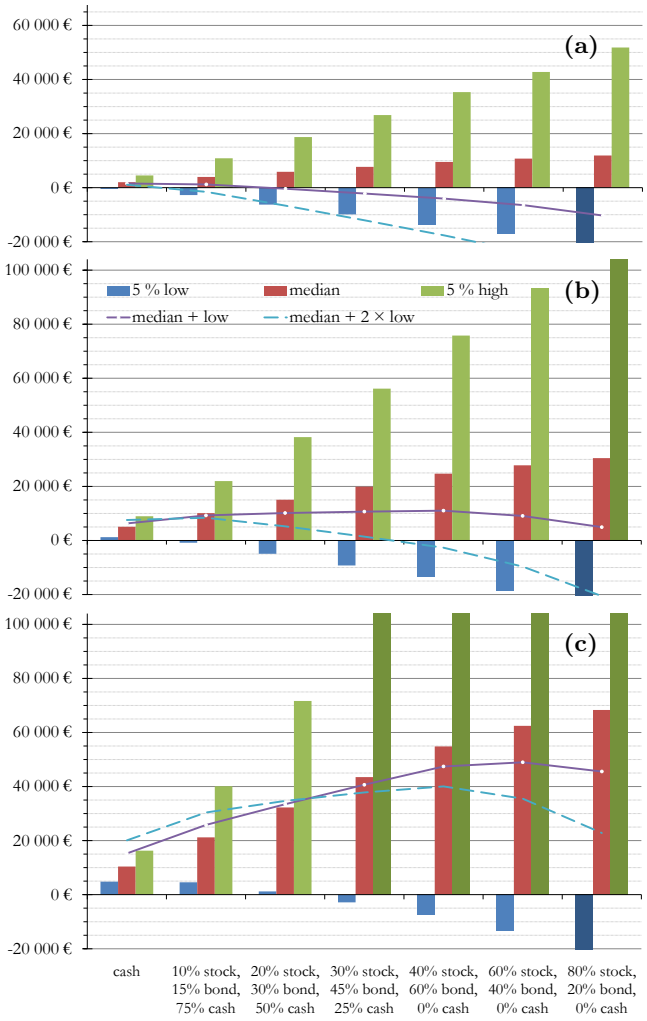

FIG. 2: Median and the top and bottom 5% of gains (after inflation) over 100 000 € invested for 2 years (a), 5 years (b) and 10 years (c). Darker bars have been truncated.

Quantifying prudence

An investor who cares only about the possibility of growth would seek to maximize the average or median return. But most investors do care about the downside of their investments, so they look for a trade-off between

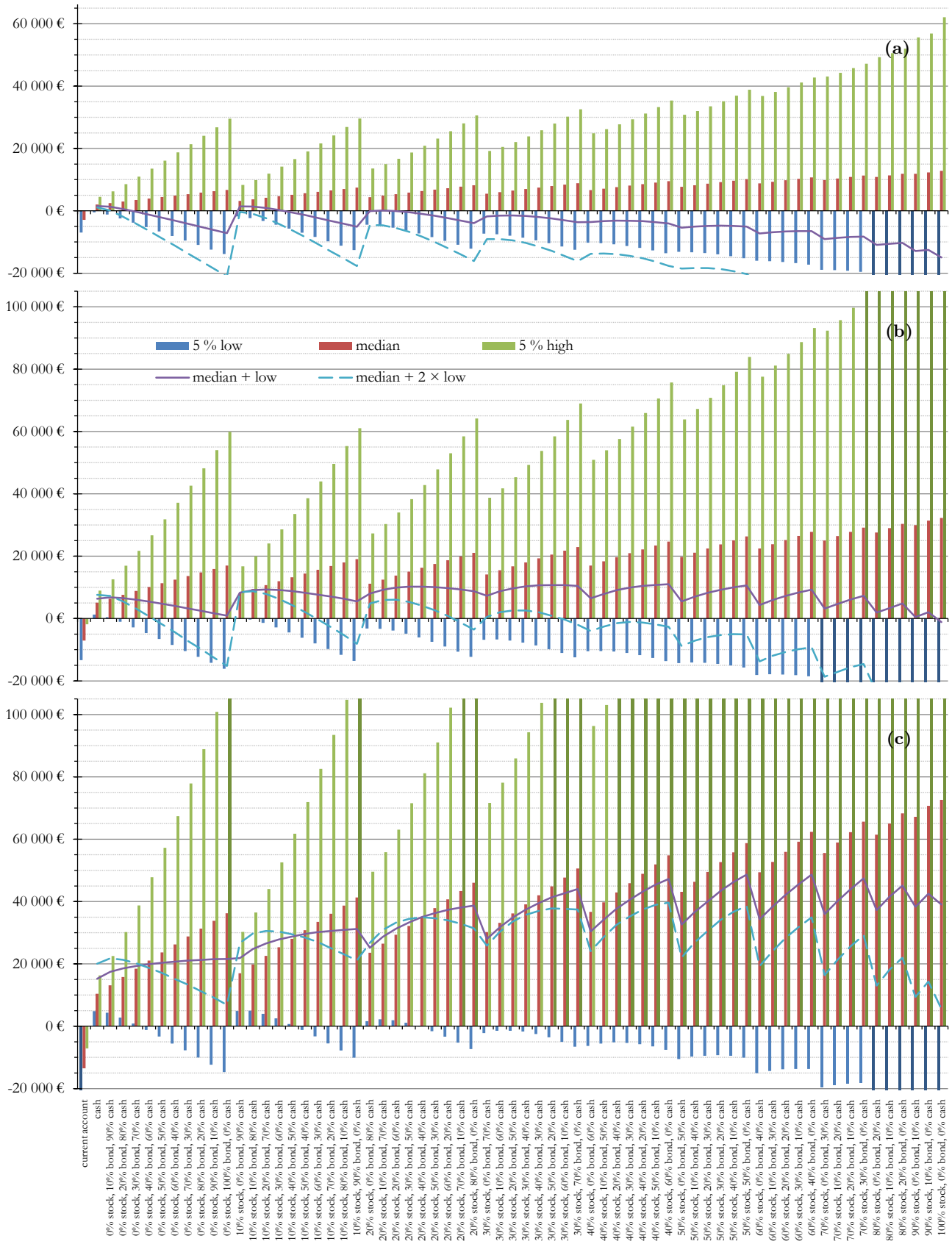

FIG. 3: Median and the top and bottom 5% of gains (after inflation) over 100 000 € invested for 2 years (a), 5 years (b) and 10 years (c). Darker bars have been truncated.

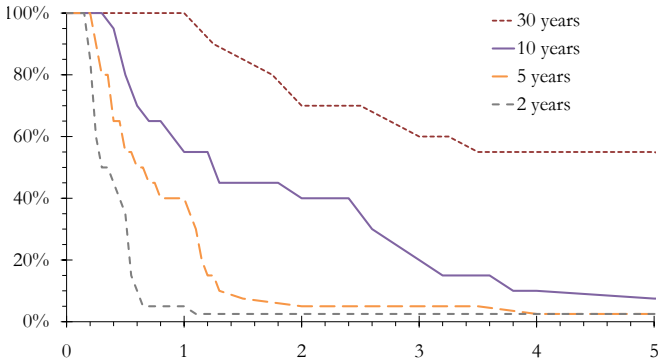

FIG. 4: The optimal equity allocation as a function of the prudence coefficient.

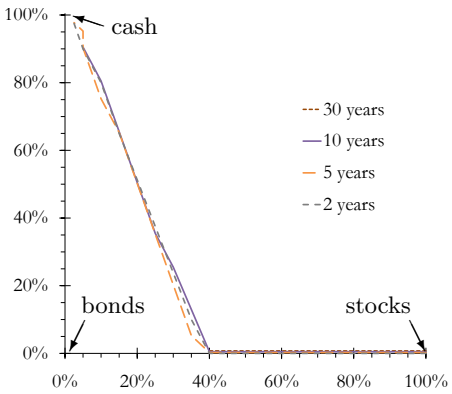

FIG. 5: Cash allocation as a function of stock allocation, optimal for prudence coefficients decreasing from left to right.

return and risk. The solid purple line in Fig. 3 corresponds to the median plus the downside: a riskier portfolio is deemed better if it improves the median return more than it worsens the downside. The general trend is that more conservative portfolio fare better over two years (the line goes down) but the most conservative investments are inadequate over ten years. The dashed blue line gives more weight to the downside and thus favours more conservative portfolios.

More generally, one can try to maximize the sum of the median and the downside multiplied by a prudence coefficient. Figures 3 and 2 show results for prudence coefficient values of 1 and 2. Figure 4 shows the equiy allocation for the portfolio that is optimal for a given prudence coefficient. Zero corresponds to risk neutrality: only the median gain counts, not the downside. This naturally leads to investing only in stocks. When one wishes to be more prudent, the stock allocation decreases (sometimes dramatically). For a two-year horizon, even for a low value of 0.65, one would invest nearly purely in cash. One can note that even for two years, even the most conservative portfolios hold some equity (if only a few percents). On the other hand, at five years, the optimal

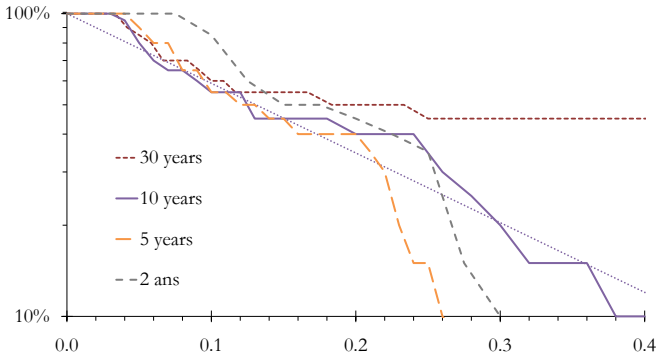

FIG. 6: The equity allocation of optimal portfolios as a function of the prudence coefficient divided by the time frame in years. The dotted line is $y = 0.005^x$.

portofolio has at least 2/3 cash for prudence coefficients higher than (not so wild) 1.2. Over thirty years, even a quite conservative prudence coefficient of 3.5 yields an investment 2/3 in shares and even the most conservative optimal portfolios contain no cash.

Figure 5 shows that the set of optimal allocations does not change between two and thirty years: either stock–bond portfolios with 40–100% equity or stock–bond–cash with 50% more bonds than stocks. (Note that bonds are never optimal alone: their maximum allocation is 60%.) What changes is the prudence coefficient corresponding to each portfolio, and the fact that the portfolios with more cash are not optimal over longer periods.

Figure 6 is a dedimensionalized version of Fig. 4. It shows that for prudence coefficients lower than about a quarter of the investment length in years, investments over two to thirty years show great similarities. The dotted line shows that for five years, the optimal equity allocation is close to 1/200 to the power (prudence coefficient divided by investment length).

Applications

Figures 4 and 5 give the optimal portfolio for a given time horizon and level of risk. So if one can quantify one's willingness to take risks in the form of a prudence coefficient, then this provides an objective and quantitative way of picking an asset allocation, without guesswork or arbitrary, round portfolios such as 50–50 or 2/3–1/3.

This also makes it possible to compare portfolios with different time horizons. Is a 80–20 stock–bond portfolio meant for 30 years more or less conservative than a five-year portfolio with 50% cash, 30% bonds and 20% stocks? The former is optimal for prudence coefficients between 1.5 and 1.75, whereas the latter corresponds to 1.15–1.2. So, quite surprisingly, the portfolio half in cash is less conservative than the investment with 80% equity.