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The Long-term Strategist

Long- versus short-term risk

- **The ability to forecast long-term returns relatively accurately implies that longer-term investors should hold more risky assets such as equities.**
- **The standard efficient markets assumption implies that the ultimate risk on the annual return on a long-term portfolio equals short-term volatility divided by the square root of time, or the years in your investment horizon.**
- **The classic Samuelson time invariance result shows that under typical risk aversion preferences, efficient markets imply that the optimal equity-bond allocation is the same, irrespective your holding period, as risk simply expands with time.**
- **Long-term risk is significantly lower, though, not so much because of any mean reversion in returns on bonds and equities, which is very weak, but because knowing today's asset price allows us to make quite accurate predictions on 10-year out returns.**
- **Our simple current IRR-based models of US bond and equity 10-year out returns have a forecast RMSE just 3/10th of annual vol divided by √10.**
- **We thus confirm market practice to hold more equities, the longer one's investment horizon, with one major nuance. As important as investment horizon is, so too is whether you can ignore or absorb shorter-term volatility and drawdowns. Leverage or uncertainty about when you need the funds requires even long-term investors to pay attention to short-term risk. This likely implies that investors should use a weighted average of short- and long-term risk estimates, depending on the uncertainty over when funds are needed.**
- **A USD based investor who can truly ignore or absorb shorter-term market volatility and drawdowns and who has no need for funds over the next 10 years has little reason to invest in much else than equities, with minimal if any allocation to bonds, given today's pricing and expected returns.**
- **We have argued that we are in a world of higher macro and market volatility. Higher shorter-term risk likely also raises longer-term return uncertainty. To us, this means that investors should at the margin give up some long-term strategic risk in favor of more short-term tactical risk.**
- Video.

Long-term Strategy
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What is risk?

In Finance, we couch most investment decisions in terms of risk and return. *Return* stands for what one can objectively expect to earn on different assets over one's investment horizon and *Risk* means the probability and magnitude of underperforming these expectations. Risk exists because the future is uncertain and shocks can emerge from many different places.

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The most common way to measure risk is the standard deviation, or **volatility**, of past returns, measured over a period long enough to produce statistical significance. **For the long-term investor**, which is our focus, risk should by this metric be measured by the standard deviation of returns over longer holding periods. This creates a problem, in particular for our target 10-year investments, when we do not have long enough time series data, and where we have them, there may be concerns that they relate to times when volatility was structurally different.

The solution to this problem has been to "bootstrap" higher-frequency data through the **square-root-of-time** rule. A return over 10 years can be seen as the sum of 10 annual returns, ignoring compounding. If markets are efficient, these returns will be uncorrelated over time, and the expected future return at any time should not be affected by past market movements. Assuming additionally that volatility does not change over time, this makes asset returns independent and identically distributed random variables, or **i.i.d.** in our jargon. By implication, the expected *cumulative* return and variance over 10 years will be 10 times the 1-year expected return and variance, and its volatility, which is the square root of the variance, will be annual volatility times √10. The expected *average annual* return will be the same as the one for 1 year out, and the expected standard deviation around it will equal the volatility of annual returns divided by √10.

In short, our industry has been happy to take the square-root-of-time approach as a handy way to come up with measures of long-term risk since they are easy to calculate and alleviate the problem of not having enough long-term return data.

Long-term risk when markets are not efficient and thus not i.i.d.

There is plenty of empirical evidence that **some asset class returns are not purely random but are partially predictable** because their prices tend to revert to historic means, and/or because we have other information beyond past return distributions to help us assess the mean and risk of future returns. Both of these factors are most relevant over longer holding periods and each allows us to make more accurate predictions about future returns than simply using past volatility, and to lower our assessment of long-term investment risk relative to the square-root-of-time rule applied to short-term volatility.

We have discussed and analyzed both of these forces – **mean reversion** and **using asset class IRRs** – to assess long-term risk, in papers on Time Diversification in hybrid assets and on forecasting long-term bond and equity returns (see the most recent update in Long-term forecasts: Update January 2023, January 6, 2023). These papers all lead to a conclusion that **10-year out investment risk is much lower than short-term volatility times √10.** We will call short-term risk "**volatility" or "vol"** and risk on our long-term return forecasts "**uncertainty**".

Table 1: Three measures of risk on US bonds and equities
%, 1982-2022, quarterly, standard deviation of 1-year returns; standard deviation of 10-year compound annual returns times √10; RMSEs of our IRR based recursive forecasting models times √10.

	1yr	10yr	RMSE
US Agg	7.1%	8.5%	2.2%
SPX	17.5%	17.0%	5.0%

Sources: J.P. Morgan, Bloomberg Finance L.P.

Table 1 shows the difference between short- and long-term risk for the two US benchmarks: The US Aggregate Bond Index (the "AGG") and the S&P500 since 1982. The first column is simply the standard deviation of 1-year returns. The second column is the standard deviation of 10-year compound annual returns, multiplied by √10 to make them comparable with short-term volatility. It aims to measure whether the historic record reveals any mean reversion in annual returns. The third column is the root mean squared error (RMSE) of our bond and equity 10-year out return models based on current IRRs (see the recent update) also multiplied by √10 for comparability. This is our preferred measure of long-term risk to your price-based expected return on these asset classes over the next 10 year.

The first two columns show 1- and 10-year past return volatility are very close to another, indicating **there was little historic mean reversion within 10-year holding periods in the past on the broad US bond and equity market**[1]. In recent papers, however, we did find significant mean reversion in past annual returns for US Hybrids, that live on the border world between pure bonds and equities – equity-like bonds and bond-like equities – such as high-yield bonds, convertible bonds, utility stocks, preferred shares and REITs[2].

[1] Jeremy Siegel, in his well-known *Stocks for the Long Run* (2014, 5th edition), shows that since 1802 and in *real*, inflation-adjusted terms, US stocks did show modest mean reversion over periods of 10 years and more, while US bonds did not.

[2] See 60/40 in a zero-yield world, June 30, 2020; and The International 60/40 problem and US Hybrids, Sep 29, 2020.

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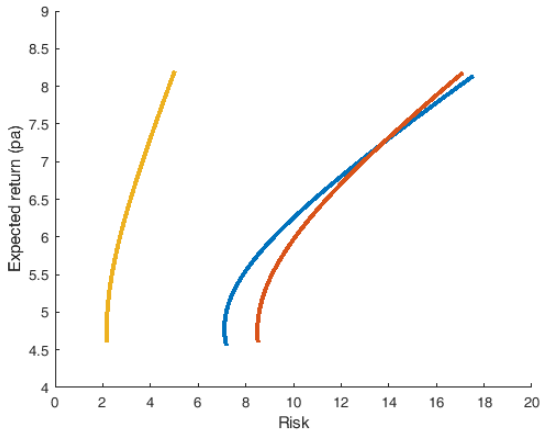
In contrast, our preferred measure of long-term risk – the accuracy of our return forecasts – show **much lower long-term risk** than the simple volatility of 10-year returns over the past. For both the broad US equity and bond markets, forecasting accuracy shows us that 10-year out returns are only about one third as risky as an uninformed look at past return volatility suggests or as indicated by applying the square-root-of-time rule to 1-year return volatility.

Figure 1: US efficient frontiers based on three measures of risk
%, 1982-2022. Return is pa based on IRR based forecasts and is thus the same for each. Risk is standard deviation of 1-year returns (blue); standard deviation of 10-year compound annual returns times $\sqrt{10}$ (red), and RMSE of our IRR based recursive forecasting models times $\sqrt{10}$ (yellow).



Sources: J.P. Morgan, Bloomberg Finance L.P

To see the dramatic impact of this lower long-term risk, Figure 1 uses the risk measures of Table 1 to create three different efficient frontiers across US equites and bonds since 1982. Each uses the same 10-year out expected return – 4.6% on US bonds and 8.2% in equities – from our update earlier this month. The ones based on past 1-year return volatility or annualized 10-year return volatility are indistinguishable from each other, but the third based on forecast accuracy has moved dramatically to the left, with both bond and equity return uncertainty reduced by 2/3rd. In percentage point terms, this move to the left has more impact on equity risk and thus significantly steepens the risk return trade of line, setting us up for a larger equity allocation for the long-term investor.

How should bond-equity allocations depend on investment horizon?

To most investors and advisors, it is obvious that the long-term investor should have a higher allocation to risky assets than the short-term one. After all, both in principle and empirically, we find that the probability of risky equities beating safer bonds increases steadily as the holding period lengthens. Jeremy Siegel, in his well-known *Stocks for the Long Run*, shows that since 1802, US equities have beaten US Treasuries 60% of the time over 1-year holding periods, but 74% over 10-year and 84% over 20-year holding periods.

These empirical observations have been used by many to support the classic *Rule of 100*, according to which one's portfolio should have an equity allocation equal to 100 minus one's age. Target-date funds, which make equity allocations a function of how far one is from one's chosen retirement age, are a practical application of this rule.

Despite the near universal consensus of financial advisors for allocating more to risky assets as one's investment horizon lengthens, the more academic finance literature has long resisted this notion with **Paul Samuelson** famously challenging Time Diversification in his 1963[3] paper. Samuelson argued that given certain plausible utility functions and an assumption that asset returns are uncorrelated over time, both expected cumulative portfolio returns and return variances will simply expand linearly with the number of years, but will in effect not change shape, thus making one's optimal portfolio invariant to the investment horizon.

How does this result square with the observation that, even with i.i.d. returns, the probability of equities beating bonds increases with the investment horizon? The main insight from Samuelson is that while the probability of equity outperformance grows with time, any losses from underperformance also grow cumulatively with time. Such higher losses are not enough to prevent the "expected loss" of equity underperformance – probability times magnitude of loss – from still falling with time. However, when combined with standard risk-averse utility functions, the greater disutility of higher potential cumulative losses due to equity underperformance are enough to convince such an

[3] Paul Samuelson, Risk and Uncertainty: A Fallacy of Large Numbers (1963) *Scientia* 1-6.

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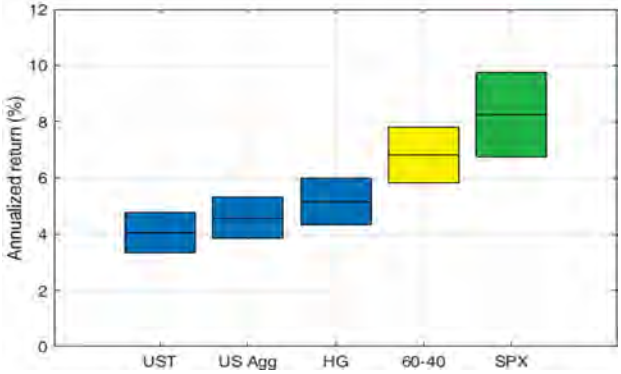
investor to keep their equity bond allocation unchanged when looking at longer investment horizons.

To show this, consider risk-averse investor with a **standard power utility function** who needs to choose how much to allocate to bonds and equities to maximize their utility. For any given level of relative risk aversion, the equity allocation of a utility maximizing investor remains the same over different investment horizons, despite the fact that equities beat bonds more commonly over longer horizons. That is because a risk-averse investor with a power utility function derives greater "disutility" from the larger potential underperformance of equities versus bonds over longer holding periods, even if these occurrences are less probable over the longer run[4].

What happens now when we allow investors to recognize that using current IRRs on bonds and equities allows them to get a better picture of what return they are set to earn 10 years out, thus reducing their long-term risk? For this, we use our own measure of long-term returns risk derived from the forecasting errors of the forecasting models discussed above. As shown in Figure 1, this moves the risk return efficient frontier to the left with both equity and bond long term risk falling proportionally versus short term risk. **Both the reduction on overall risk on one's portfolio and the larger percentage point drop in equity risk produce now a higher optimal equity allocation for our risk averse investor**. As can be seen from the steep risk return trade-off line in Figure 1, an investor who can afford to look only at the downside to their portfolio in 10 years' time, should have almost all in equities and very little on bonds.

Figure 2 shows this differently with long-term risk ranges around our 10-year out return forecasts. Notice how the 1-sigma *downside* to US equities still exceeds the 1-sigma *upside* on US bonds, creating a higher than 90% probability that equities will beat bonds at the end of 10 years, despite a much lower probability of equities doing better in any given year.

Figure 2: Expected return and risk ranges 10 years out on US equities and bonds
%, as of end 2022, as in January update. Midpoint in each bar is expected return and top and bottom of bars are expected return plus/minus 1-sigma long-term risk.



Sources: J.P. Morgan, Bloomberg Finance L.P

In short, we find **good support for the classic recommendation that investors with a longer investment horizon, such as younger people who are further away from retirement than older people, should indeed hold a larger share of their savings in equities**.

Our results do suggest an **important nuance** to this classic result, namely that it is not just the length of one's investment horizon that matters, but also whether one can ignore, or absorb, short-term volatility. To the long-term investor, short-term volatility is also known as **drawdown risk** – the risk that one's portfolio sees sudden drawdowns in value. The long-term investor who is still far away from needing these funds ought not panic at that point when they recognize that the lower prices on their asset holdings improve their future expected returns, allowing them to recover their losses to some extent before the funds are needed.

There are quite a few circumstances that might not permit the investors to ignore short-term drawdowns. These include **leverage**, forcing the investors to cut their holdings early; a small **portfolio size**, a drawdown from which could seriously endanger one's standard of living; **uncertainty about when the funds are needed**; or probably most frequently, the existence of **multiple investment horizons** when one needs to fund a retirement income over 2-3 decades.

Overall, it is quite likely that **not that many investors, who consider themselves long-term strategic, can**

[4] For both a more in-depth mathematical treatment and discussion of the Samuelson invariance result see John Campbell and Luis Viceira, *Strategic Asset Allocation: Portfolio Choice for Long-Term Investors* (2002) Oxford University Press. An excellent non-mathematical review of these issues can be found in Mark Kritzman, What practitioners need to know … About Time Diversification, Financial Analyst Journal, 2015, pp 29-34.
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fully ignore short-term drawdown risk. How do they decide then what the right risk exposure and equity/bond mix should be? Optimizing across three variables – one return and two different measures of risk – with a complex utility function is not easy. We think that the simplest approach would be for any investor to perform in effect a two-dimensional optimization, as with the efficient frontier on Figure 1, where risk is a weighted average of short-term volatility and long-term return uncertainty. The weights an investor would put on long- versus short-term risk would be a function of investment horizon, portfolio size, uncertainty about when one needs the funds, any leverage, and the length of time over which one needs to spread withdrawals to funds one's spending.

Does a longer than 10-year horizon imply even higher equity allocations?

Probably yes, though not one-for-one. We have found that a 10-year out horizon dramatically lowers the uncertainty on the ultimate value of one's equity and bond holdings. Does it, therefore, follow that if your investment horizon is, say 20 years, or even several generations out, you should hold even more equities and less fixed income? Our prior is yes, even as we may not have the data to show this categorically. For one, the tight relation between the starting yield and 10-year out returns of standard bond indices is largely due to the fact that most of these indices have a duration around 5-6 years, with "bond math" dictating that the starting yield will equal the future return on a bond portfolio as long as the holding period is just under twice the duration of the portfolio. Over 20 years, the second 10-year holding period return will be driven by the index yield 10-year from now on which has a lot more uncertainty. Hence, bond portfolio return uncertainty starts rising significantly when the holding period rises beyond 10 years.

For **equities**, forecasting errors could also rise but this could be offset by rising mean reversion of equity returns as holding periods grow from 10 to 20 and 30 years, as highlighted by Jeremy Siegel in his *Stocks for the Long Run*. Partly offsetting these return uncertainty arguments is that the longer one's investment horizon, the more uncertainty there will probably be about this horizon and the more likely it will be that the investor will have intermediate liquidity needs.

In short, we suspect indeed that investors with longer than 10-year horizons will hold even more equities, although this will likely rise only slowly.

Does long-term uncertainty rise when shorter-term risk volatility goes up?

We have argued in Where are we in Regime Change? Macro volatility, deglobalization, and secular rise in yields, Nov 8, 2022, that there is a good case to be made that we have seen the **end of the Great Moderation**, a period since the mid-1980s when central banks focused on controlling inflation and keeping expansions going for longer. The objective of the inflation policy regime was to reduce long-term uncertainty in order to boost long-term investing and therewith economic growth. In the event, both inflation and macro volatility did fall dramatically, but we did *not* see better growth and capital spending – on the contrary. Today, this analyst thinks policy makers will ultimately be less focused on just inflation control and will pay more attention than before to keeping the economy closer to full employment. Together with the sudden instability of the monetary forecasting models (Phillips and Beveridge curves, NAIRU, and probably r*[5]) and any inflationary impulse of de-globalization, this should **shorten business cycles and raise macro-economic volatility.**

Should one expect higher short-term macro volatility then to also raise longer-term uncertainty on the average rate of growth, inflation and asset returns over the coming decade or will time diversification or our forecasting models offset this?

In principle, **one would expect higher short-term vol to raise long-term uncertainty**. For one, assets such as equities that have higher short-dated vol than bonds also produce higher long-term uncertainty as shown by their higher forecasting error, as shown above. Table 1 shows that moving from shorter volatility to using forecasting risk (RMSE) lowers our measure of long-term risk proportionally (by ~70%) for both bonds and equities. It is thus not implausible that higher short-dated volatility will also raise long-term uncertainty.

This should in turn move the efficient frontier in Figure 1 somewhat to the right, implying at a margin a lower equity allocation. We have discussed in our regime change papers that higher macro volatility and thus higher short-term risk create a necessary, though not sufficient, condition for active managers, such as hedge funds, to outperform that market. Hence, we conclude here that **higher short-term volatility should at the margin induce the investor to take more tactical risk and less strategic risk.**

[5] We have argued in Long-term forces point to higher US bond yields, April 4, 2022, that a variety of factor will likely push real interest rates up over the coming decade. This will affect not just bond yields but also the equilibrium short rates that the Fed calls r*.

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