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Beyond Bond Bias: Perspectives from a Systematic Trader

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Thoughts on Long Bias

A bias is defined as an irrational assumption or belief that affects our ability to make a decision based on facts and evidence. In finance we often focus on bias because it leads us to make both good and bad decisions in a range of different scenarios. One of the most well-known investment biases is a long bias to equities (that is, a tendency to hold long positions in equity markets). Over long horizons this bias may be theoretically justified given the assumption that the equity risk premium is positive. Here lies the issue: a long equity bias requires a specific time horizon and market regime. If we are in a market regime or investing over an interval where this assumption is not valid, this bias may be hazardous to our wealth. For example, during the period of 2000 to 2010 the equity risk premium was close to zero; in 2022 equity returns were volatile and often negative. Because many of us focus on equities, bond bias was largely forgotten—until 2022.

For most investors, bonds have been a tried-and-true anchor in portfolios over the recent decades. Since bonds have positive yields, obviously we should always hold them long. Enter bond bias! Unfortunately, history has often been less kind to fixed cash flows. During various periods of time, particularly when inflation has been higher, bonds have experienced extreme cycles in value with long periods of less than stellar performance. But few investors have experienced that underperformance in recent memory. 2022 was a rough year for fixed income as central banks around the world began raising interest rates to combat inflation. However, certain strategies are meant to have little-to-no bias, including trend-following strategies, which have the ability to go long and short in many asset classes and are usually designed to have low correlation to traditional asset classes. Since 2022 was a year in which shorting bonds was the trend to follow, now is a great time to step back and contemplate whether long bond bias has crept its way into systematic strategies like trend following.

For many years, investors have made the claim that trend following only makes money when it is long bonds. Trend followers usually reply that bonds prices have generally increased over this period, so if we weren't long bonds most of time we wouldn't be following the trend. 2022 is our counter-example and a perfect time to consider the potential for long bias in fixed income from the perspective of a trend follower. As a result, we first estimate the level of short bond exposure CTAs were willing to take in 2022; the varied results of this analysis demonstrate the potential for some long bias in the space. Second, we take a moment to investigate how either intentionally or unintentionally long bond bias might creep into a seemingly unbiased strategy like trend following.

Estimating Long Bond Bias in Trend Following

The stellar performance of following the short fixed income trend in 2022 allows us to examine the bond exposure of CTA managers over the course of the year.

Figure 1 plots the time-varying beta exposure to fixed income in 2022 for:

- The ten largest U.S. CTA trend managers in the '40 Act mutual fund space;
- The SG Trend Index (an index of the largest trend following CTAs in any vehicle by AUM); and
- A representative trend-following system (a simplified representation of a standard trend strategy)

We note that despite the high short beta exposure during parts of 2022, several managers seem to have substantially lower fixed income exposure. This figure also shows that some managers took larger short positions in fixed income than others (for example, M7 versus M3).

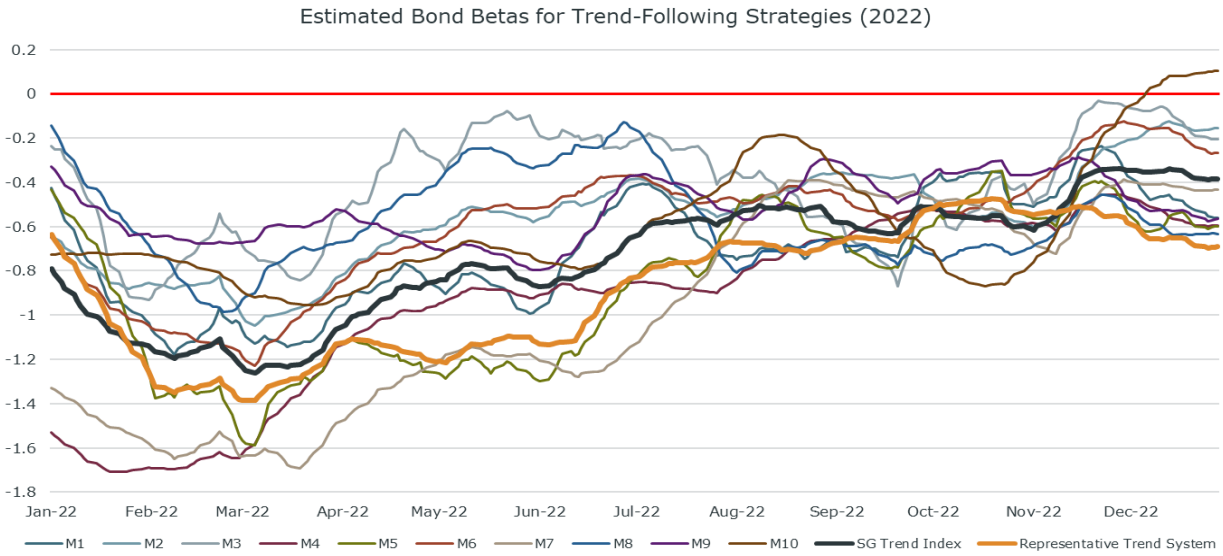

Figure 1: Estimated Bond Beta exposure for the ten largest '40 Act mutual fund trend-following managers, the SG Trend Index, and a representative trend system during 2022. The bond betas are estimated using spline regression and are volatility-adjusted. The ten largest '40 Act mutual fund managers are the largest funds in the Morningstar Managed Futures category, determined by the fund's AUM as of December 2022, excluding duplicate managers. Source: AlphaSimplex, Bloomberg. Past performance is not necessarily indicative of future results.

To examine this further, Figure 2 displays a box plot of fixed income betas during 2022. From Figure 2, we note that a simple representative trend system had, on average, a beta of around –1 during the year with some range; quite a few managers seemed to have less fixed income exposure, while a few had slightly higher but more volatile fixed income exposures including M4, M5, and M7. Several managers had average exposure of roughly –0.5 including M2, M3, and M9.

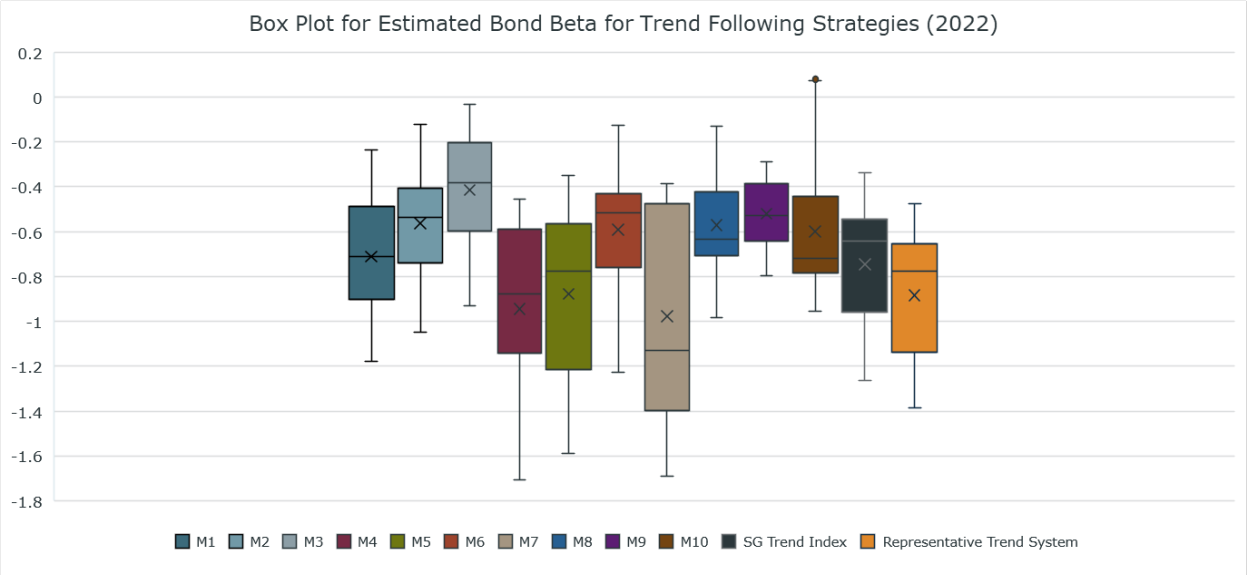

Figure 2: Estimated bond beta for the ten largest '40 Act mutual fund managers, a representative trend system run at a 10% volatility, and the SG Trend Index (daily returns) for the period January 1, 2022 – December 31, 2022. The bond betas are estimated using spline regression and are volatility-adjusted. The ten largest '40 Act mutual fund managers are the largest funds in the Morningstar Managed Futures category, determined by the fund's AUM as of December 2022, excluding duplicate managers. Source: Bloomberg, Morningstar, and AlphaSimplex. Past performance is not necessarily indicative of future results.

This figure demonstrates that many managers have a lower average bond exposure during 2022, which may demonstrate a certain amount of long bond bias even in systematic managers. This opens the door to questions about how this kind of long bond bias can be incorporated into systematic trading strategies.

Investigating Bond Bias in Systematic Trading

When something has worked for a long time, why not just keep doing it? Because that is the best way for any trend-follower to fail. The goal of a systematic trading system is to follow opportunities as measured by the strength of trend signals. In their simplest form, these trend signals are designed to be unbiased so they can take advantage of price trends wherever they occur. In this section, we investigate three ways that systematic managers can accidentally incorporate bias.

Selection Bias and Diversifying the Diversifier

Like any strategy, trend following has good and bad times. Over longer time horizons it is tempting to consider adding additional futures trading strategies to smooth out returns, but in exchange a strategy may have different results during periods of market stress. Adding strategies such as carry and mean reversion may reduce fixed income exposure, but may also dilute a manager's potential to take short positions in bonds, even when that position may be

rewarded. To examine this, we can perform a simple experiment: comparing the fixed income betas for the SG Trend Index, which is comprised of specifically trend-following managers, and the SG CTA Index, which includes managers with a wider dispersion of managed futures styles. Figure 3 plots the estimated bond exposure for the two indices from 2020 to 2022. From this figure, we can see that more diverse strategies reduced the overall fixed income exposure only slightly in 2022. In simple terms, during 2022 it does not seem that adding other managed futures styles materially reduced the fixed income exposure when compared to trend-following strategies.

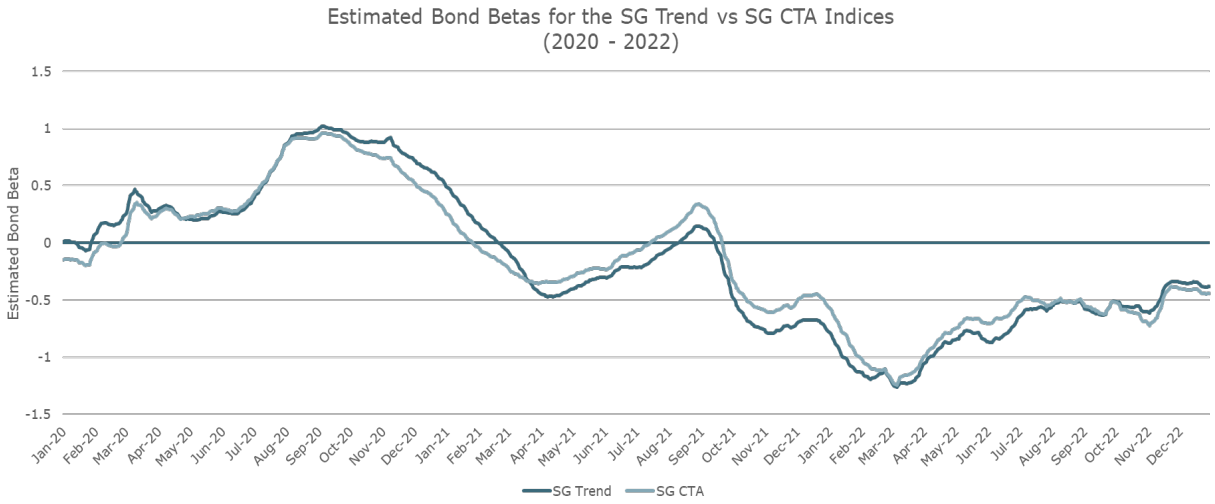

Figure 3: Estimated bond beta for the SG Trend Index and the SG CTA Index for the period January 1, 2020 – December 31, 2022. The SG CTA Index calculates the daily rate of return for a pool of major Commodity Trading Advisors (CTAs); the SG Trend Index is a subset of the SG CTA Index that includes traders of specifically trend-following methodologies. Source: Bloomberg and AlphaSimplex.

Recency Bias or Backtest Bias

In a 2022 paper, "The Short on Shorting Bonds," we demonstrated that trend signals had been predominantly long and that long trend signals have outperformed short signals in bonds for almost four decades (see Kaminski and Sun 2022). After four decades of failed short signals, it could be tempting for any investment manager to add constraints, filters, or other methods to reduce a systematic trading system's inclination to go short in fixed income. Although this could be implemented in a number of ways, we consider a simple 50% reduction of short signals for a trend system and compare the impact of this adjustment both over time and during 2022. Figure 4 plots the estimated bond betas for a representative trend system with and without reduced short signals. Figure 5 plots the relative performance of the two systems pre-2022 and in 2022. From these figures, we see that reducing the short bond signals has a small but positive impact on long-term historical performance, but negatively affected performance in 2022. In addition, we can see that the impact of constraints could explain a 30% to 40% reduction in short bond positioning in 2022.

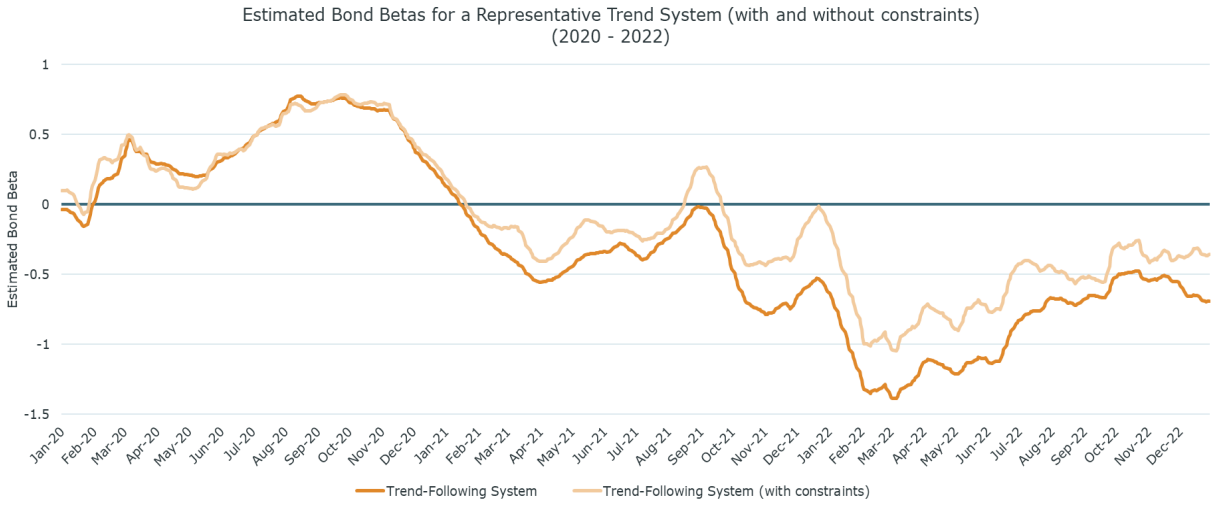

Figure 4: Estimated bond beta for a representative trend system run at a 10% volatility for the period January 1, 2020 – December 31, 2022. The trend-following system with constraints limits the size of short positions within the system by halving any short signal indicated by the models. Source: Bloomberg and AlphaSimplex. Past performance is not necessarily indicative of future results.

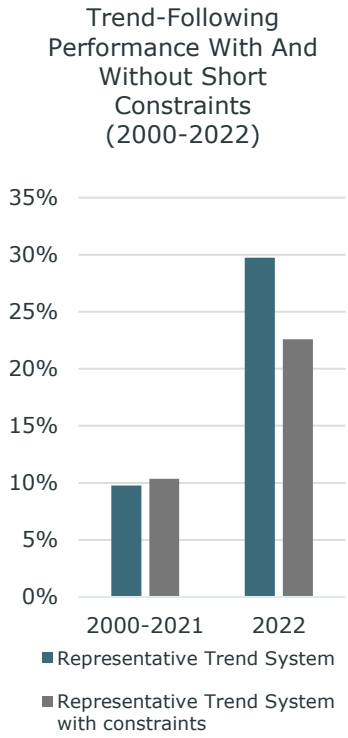

Figure 5: Difference in performance between two trend following systems, one with and one without long bias in fixed income. Source: AlphaSimplex, Bloomberg. Past performance is not necessarily indicative of future results.

Data- or Method-Based Bias via Machine Learning

Machine learning has been an industry buzz word for the last few years. Although it sounds fancy, machine learning simply provides us with a range of methods to learn from data in ways that are less linear. The exciting side of machine learning is that we can use new methods to incorporate data, while the less exciting side is that machine learning approaches are also fraught with bias, lack of transparency, and other data-dependency issues. To demonstrate how this works, we will review a simple example. Consider a trend following signal based on 6-month moving averages. This might result in a linear trend signal based on the moving average; this filter would indicate that the strategy should go long an asset when the six-month moving average is positive and more long when it is more positive (or to go short an asset when the average is negative). This classic filter has no long bias, and would look something like figure 6.

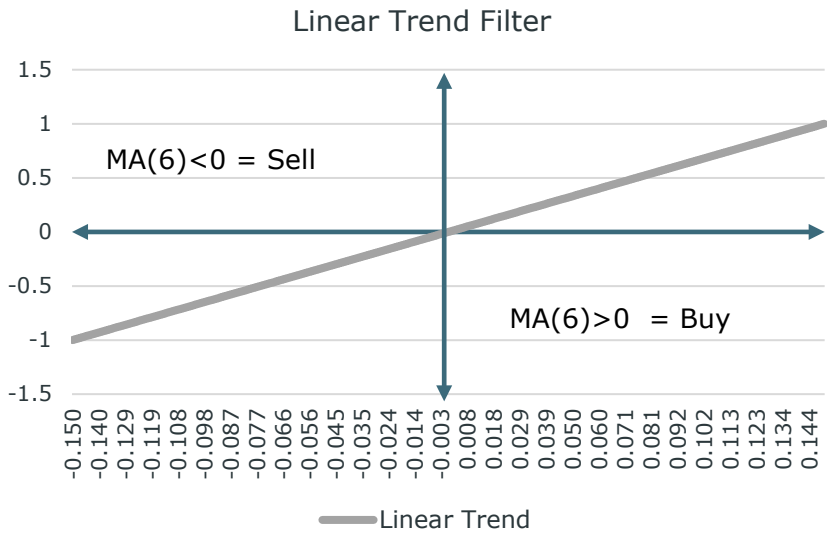

Figure 6: Example of a simple unbiased linear filter in trend as a function of the moving average return for an asset over 6 months.

Decision Tree example

A decision tree is one application of using machine learning to make decisions based on data. It allows for interpretable decisions and creates a non-linear filter of data in contrast to the classic linear trend filter. In the following pages, we use a simple "Depth 1" decision tree, which indicates only whether we should buy or sell above or below a certain level.

In Figure 7 we plot the two types of a Depth 1 decision tree, one positive and one negative. To construct a filter on the data, we simply estimate the decision rule and then resample the data using bootstrapping methods to create a basket of rules to be combined into one overall filter.

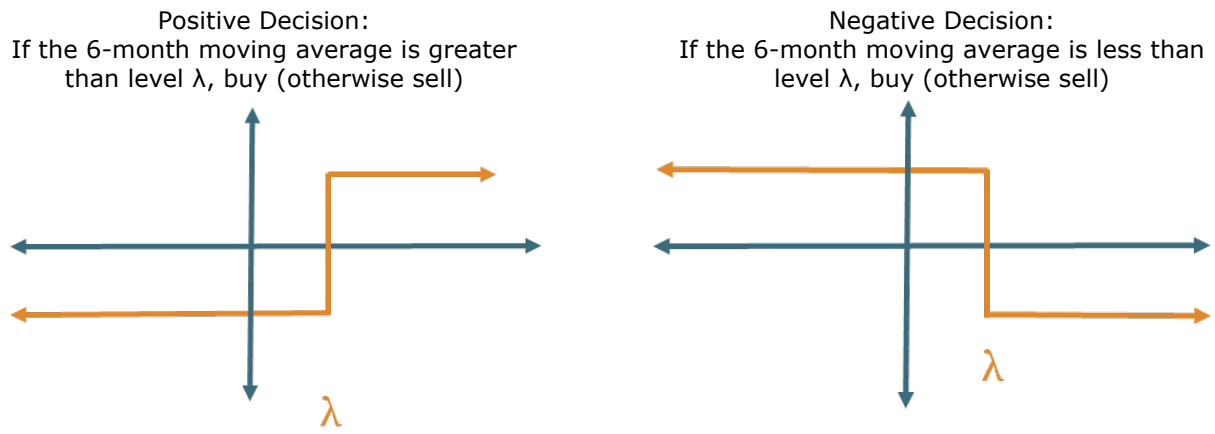

Figure 7: Two examples of a simple Depth 1 decision tree (one negative and one positive).

Consider a scenario where we want to learn how to trade U.S. 10-Year Treasury Note Futures given the data since the futures became available in 1982. Figure 8 plots the 6-month moving average for this period and the subsequent return for the futures contract. These values are very noisy, there are more positive observations than negative and the magnitude is larger.

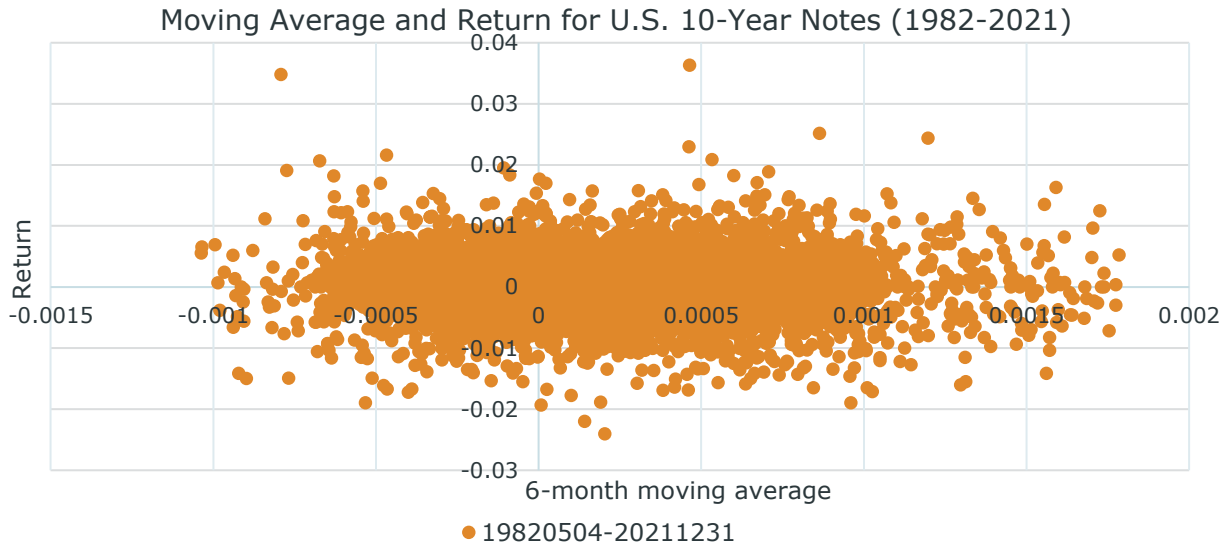

Figure 8: Moving average and return for U.S. 10-Year Notes for the period May 4, 1982 – December 31, 2021. Source: Bloomberg and AlphaSimplex. Past performance is not necessarily indicative of future results.

Using 50 bootstrapped samples of this data, Figure 9 plots the learned decision rule for trading U.S. 10-Year Notes. This learned rule is very long-biased, with the guidance to short bonds only when the returns have been outstanding in the last 6 months. On one hand, the machine learned not to short bonds based on the positive performance in bonds during the learning period; on the other hand, the data of this period didn't give the machine the chance to learn from the scenario where the 6-month moving average is very negative.

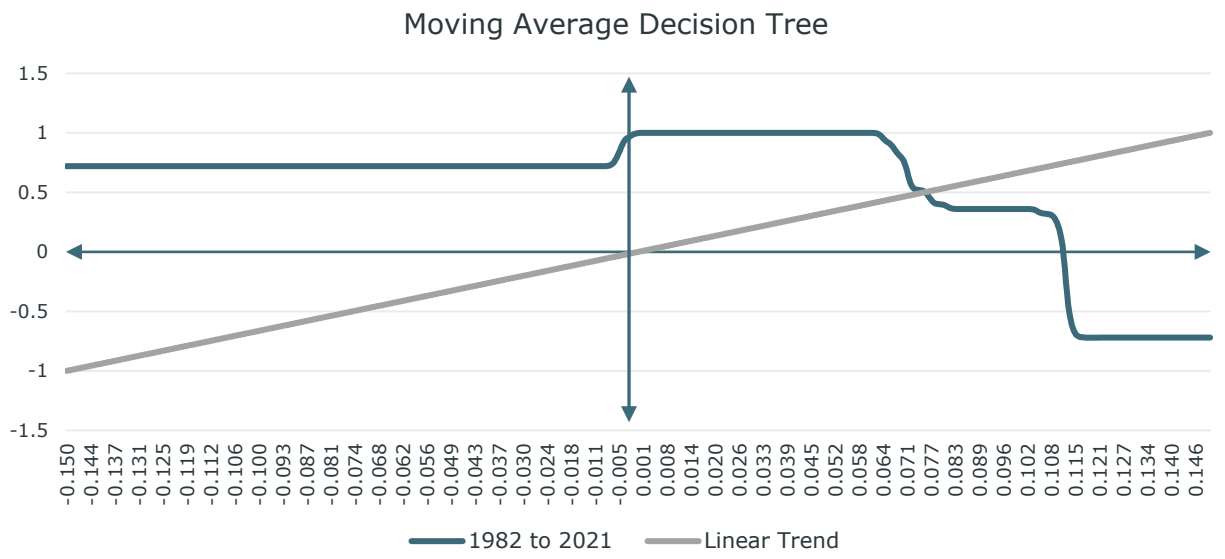

Figure 9: Potential decision rules for a 6-month moving average of U.S. 10-Year Notes based on data from 1982-2021. For comparison a simple linear trend filter is plotted. Source: AlphaSimplex, Bloomberg.

The next question we might ask is what happens to the same learning models if we add just one more year of data to the sample; specifically, 2022. Figure 10 plots the 6-month moving average and the subsequent returns of U.S. 10-Year Note Futures, with 2022 labeled in black.

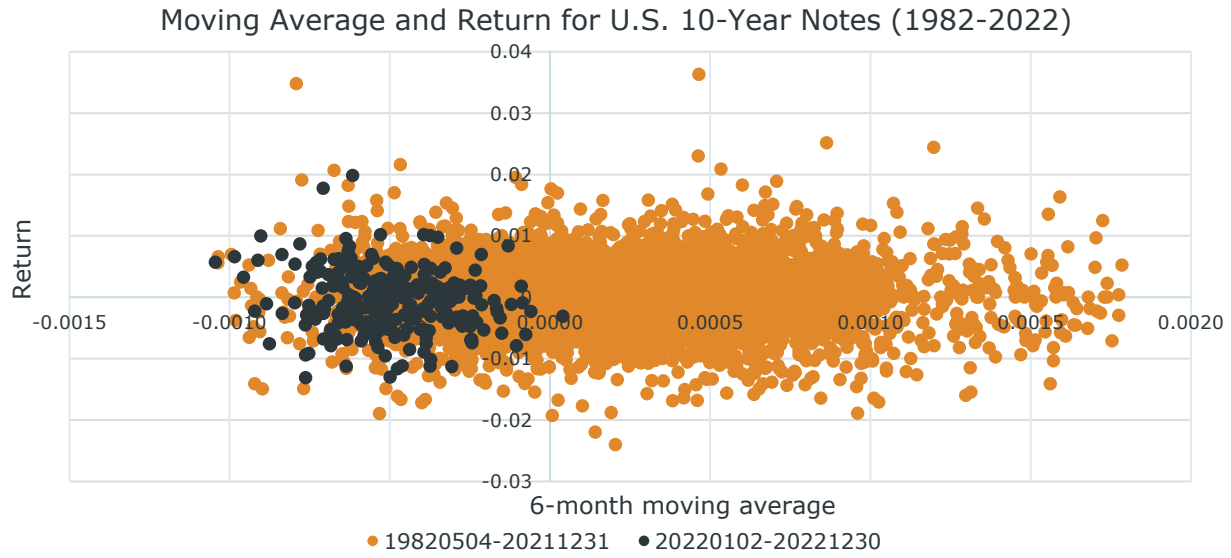

Figure 10: Moving average and return for U.S. 10-Year Notes for the period May 4, 1982 – December 31, 2022. Source: Bloomberg and AlphaSimplex. Past performance is not necessarily indicative of future results.

The new data from 2022 adds some additional information about how to trade bonds. Figure 11 plots the impact on the learned filter given the new data. We can see that the data is so different in 2022, it does reduce some of the long bias. In general, though, the long period of good bond returns dominates the bond filter.

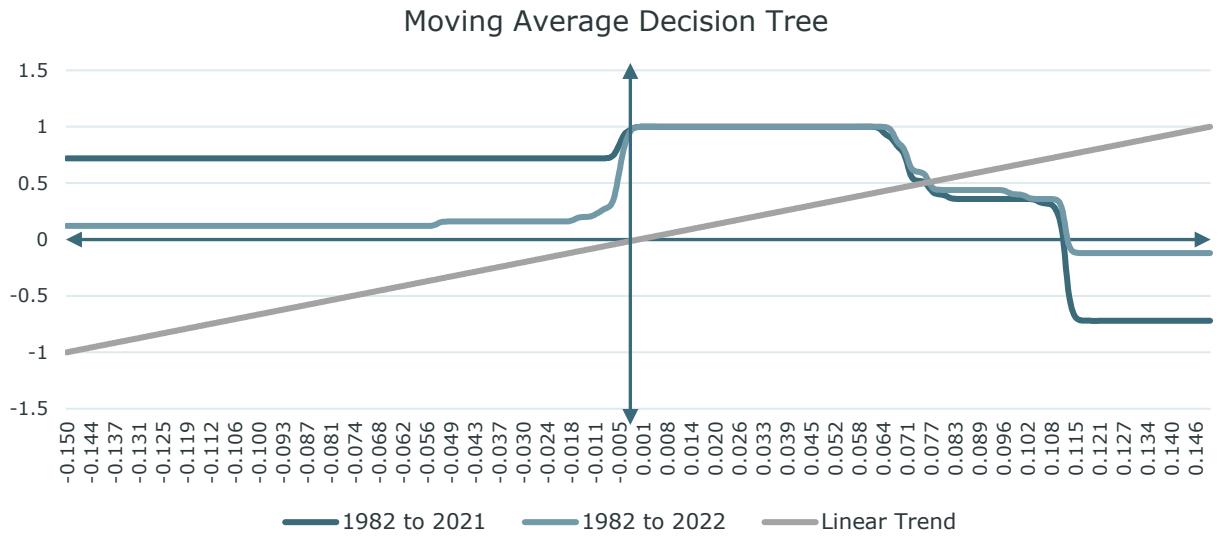

Figure 11: Potential decision rules for a 6-month moving average of U.S. 10-Year Notes, based on data from 1982 to 2021 and 1982 to 2022. For comparison a simple linear trend filter is plotted. Source: AlphaSimplex, Bloomberg.

We are estimating how to trade bonds over a prolonged period of falling rates, and even one year of rising rates changed the picture. If we extend our learning period back to 1962, we include a rising rate environment that lasted for almost 2 decades (Figure 12). In order to extend our study back to 1962, we use the U.S. 10-Year Treasury Rate to proxy the U.S. 10-Year Treasury Note Futures return from 1962 to 1982, before the futures became available. Figure 13 plots the 6-month moving average and the subsequent returns of the U.S. 10-Year Note Futures from 1962 to 1982. Figure 14 plots the learned decision rule. We can see that if the machine learns only from a decades-long rising-rate environment, it would have a short bias and never go long in bonds.

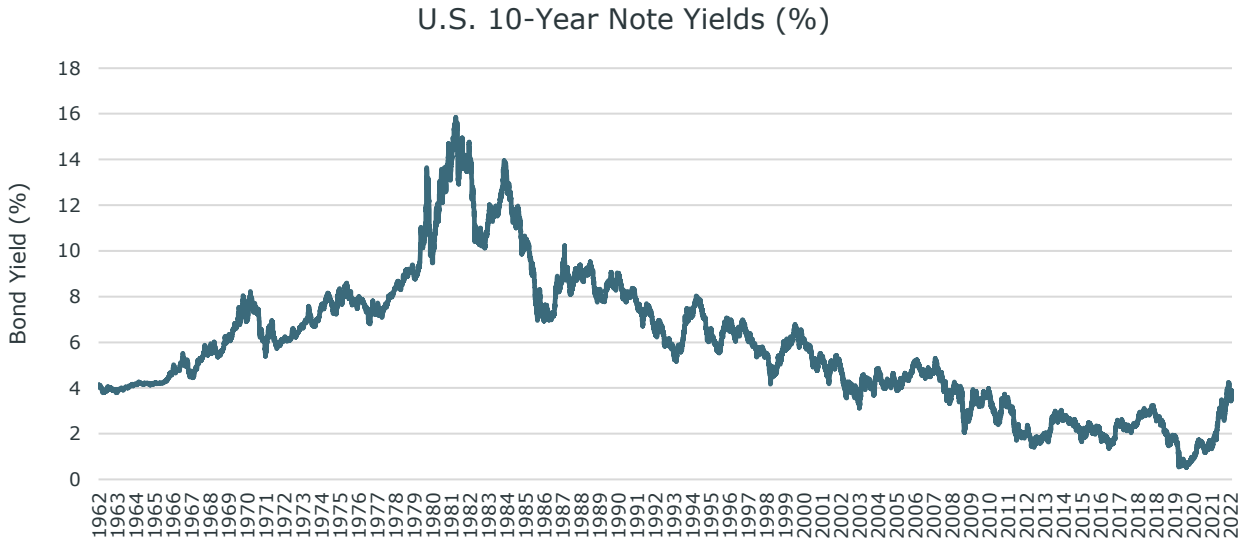

Figure 12: Yields for the U.S. 10-Year Note from 1962 through 2022. Source: Bloomberg. Past performance is not necessarily indicative of future results.

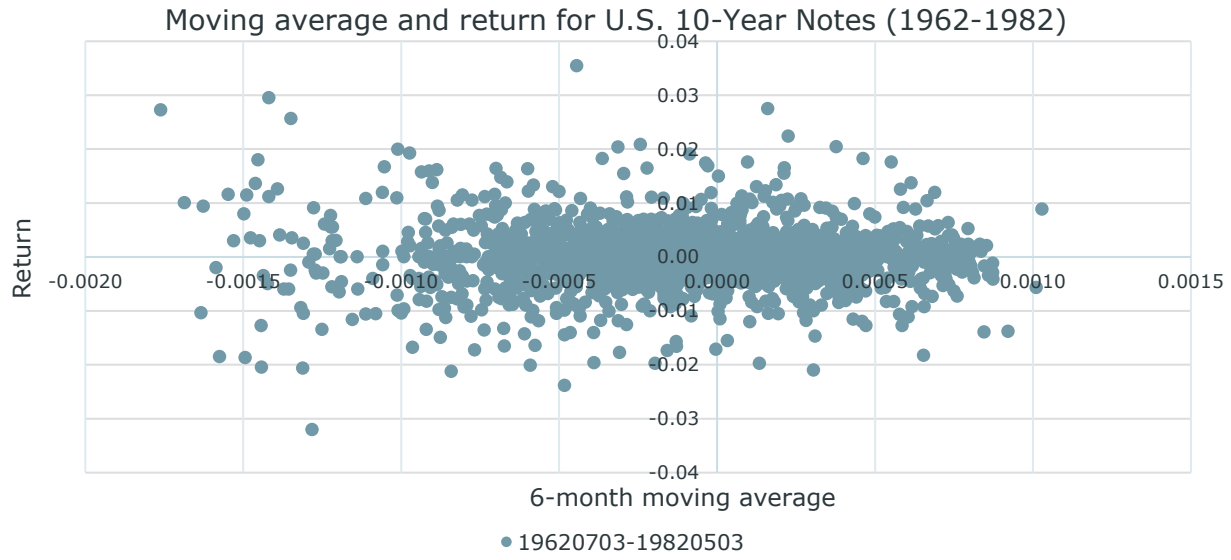

Figure 13: Moving average and subsequent daily returns for U.S. 10-Year Notes for the period July 3, 1962 to May 3, 1982. Source: Bloomberg and AlphaSimplex. Past performance is not necessarily indicative of future results.

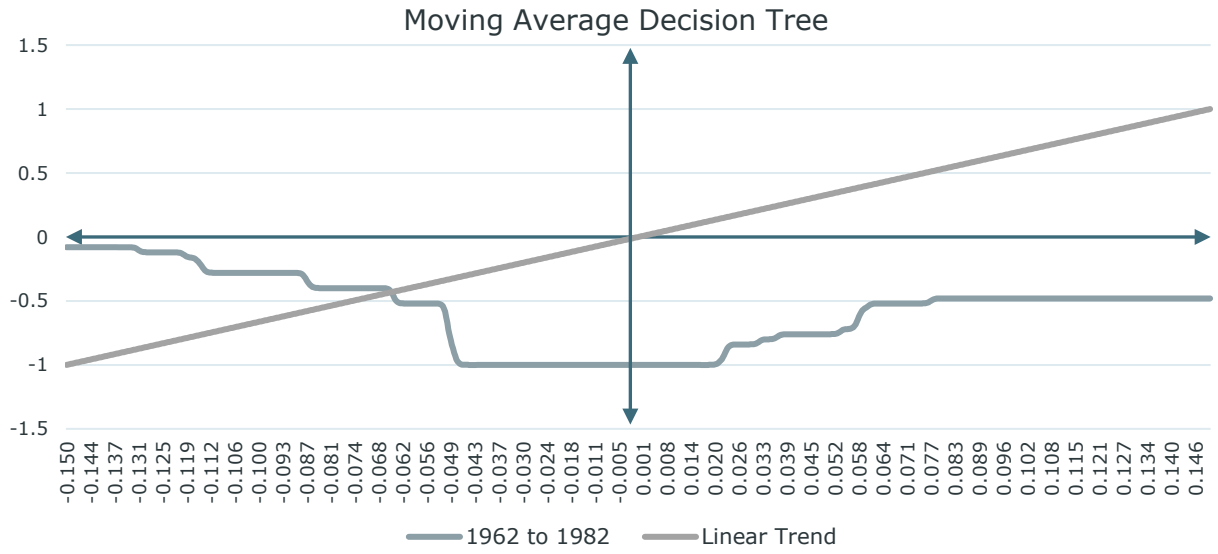

Figure 14: Potential decision rules for a 6-month moving average of U.S. 10-Year Notes 1962 to 1982. For comparison a simple linear trend filter is plotted. Source: AlphaSimplex, Bloomberg.

Finally, we can ask what happens if the machine learns from data for the full period from 1962 to 2022. Figure 15 plots the 6-month moving average and the subsequent returns of the U.S. 10-Year Treasury Note Futures from 1962 to 2022. Figure 16 plots the learned decision rule. We can see that it looks very similar to a trend following filter and only has mild long bias.

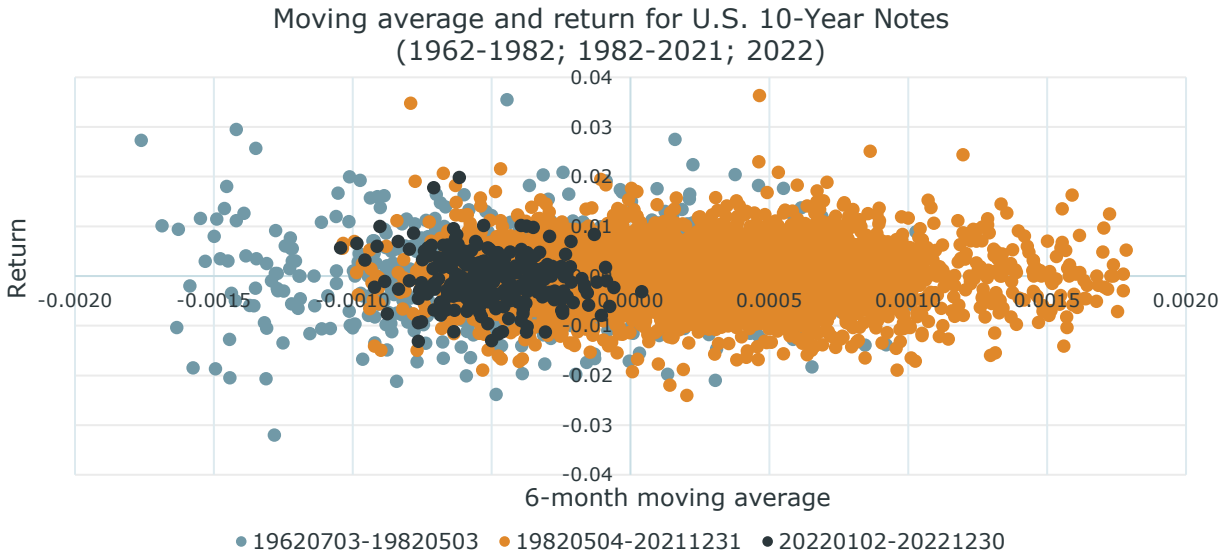

Figure 15: Moving average and return for U.S. 10-Year Notes for the period July 3, 1962 to December 31, 2022. Source: Bloomberg and AlphaSimplex. Past performance is not necessarily indicative of future results.

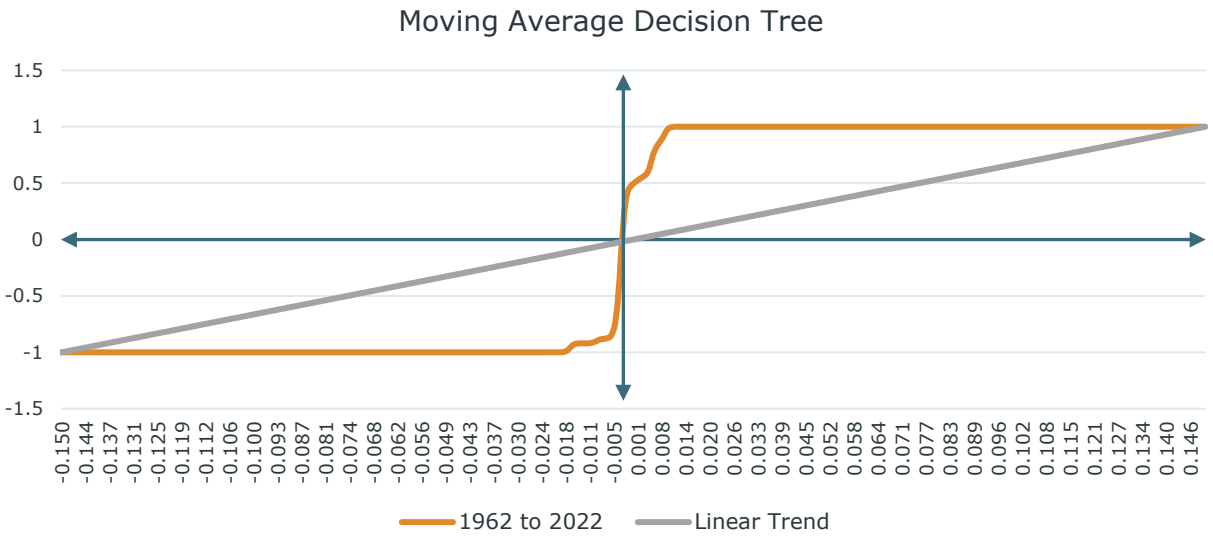

Figure 16: Potential decision rules for a 6-month moving average of U.S. 10-Year Notes from 1962 to 2022. For comparison a simple linear trend filter is plotted. Source: AlphaSimplex, Bloomberg.

The difference between the decision trees in Figures 9, 11, 14, and 16 demonstrates the importance of the data we include in the learning period for machine learning algorithms.

Summary

In this paper, we examined the estimated fixed income betas for trend-following managers in 2022, which was a counterexample to a very long period of falling rates. Finding that a few managers seemed to be less exposed to short positions in fixed income, we discussed different ways that long bond bias may creep into systems, including: adding new strategies, filtering positions, and even applying non-linear techniques such as machine learning. Our analysis reminds us that long bond bias is real and that even systematic managers may have it.

References

- Kaminski, Kathryn M., and Jiashu Sun. 2022. "The Short on Shorting Bonds." *AlphaSimplex Insights*. https://www.alphasimplex.com/articles/the-short-on-shorting-bonds.

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