Lumber: Worth Its Weight in Gold

Offense and Defense in Active Portfolio Management

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Abstract: Prior academic research focuses on commodities in isolation as leading economic indicators, ignoring the message price behavior may have on other asset classes. We find that the relative movement of Lumber to Gold provides important information on economic growth and inflation expectations, which gradually diffuses with a lag to stock and bond markets. Lumber's sensitivity to housing, a key source of domestic economic growth in the U.S., makes it a unique commodity as it pertains to macro fundamentals and risk-seeking behavior. On the opposite end of the spectrum is Gold, which is distinctive in that it historically exhibits safe-haven properties during periods of heightened volatility and stock market stress. We find that the relationship between Lumber and Gold helps to answer the critical question of when to "play defense" and when to "play offense" within the context of active portfolio management. In this paper, we show that a strategy using the signaling power of Lumber and Gold results in stronger absolute and risk-adjusted returns than a passive buy-and-hold index. This outperformance stems from being more aggressive in a portfolio during periods when Lumber is leading Gold and being more defensive during periods when Gold is leading Lumber. The results are robust to various time frames and across multiple economic and financial market cycles.

Introduction

Active portfolio management rests on the belief that it is possible to outperform the "market," either on an absolute or risk-adjusted basis, by executing a strategy that in some way deviates from a passive buy-and-hold portfolio. The Efficient Market Hypothesis (EMH) states that such outperformance through active management is largely impossible because prices incorporate and reflect all relevant information.[1] However, there are a number of market studies that have disproven the null hypothesis of this theory. Two of the strongest and most well-known anomalies are the "value" effect and the "momentum" effect.[2]

Such studies tend to be asset-class specific, documenting potential outperformance by looking for unique factors specific to the asset class being analyzed. In this paper, we take a different approach and look across asset classes to determine if there is information contained in one area of the investable landscape (commodities) that can be applied to another (equities). Specifically, we show how Lumber and Gold contain important information on macro fundamentals and how their relative movement/momentum impacts risk-seeking and risk-averse behavior in stocks.

We propose that the factors which impact Lumber and Gold spillover to equity investors and traders who, with a lag, respond to that information in a consistent and repeatable way over time. As Lumber outperforms Gold, equities tend to exhibit an upward bias and have lower volatility. These are conditions that are conducive towards maintaining higher exposure to risk assets. As Gold outperforms Lumber, the opposite tends to be true, whereby the inclusion of lower beta assets in a portfolio increases overall return and lowers volatility at the time it is needed most.

The relationship between Lumber and Gold helps to answer the most critical question for active asset managers: when to take more risk ("play offense") and when to take less risk ("play defense") in an investment portfolio - before it's too late.

Lumber as a Cyclical Leading Indicator

Lumber futures receive little attention as compared to industrial metals such as Copper which are often viewed as leading indicators of economic growth. Investors may be underestimating Lumber's importance, though, as housing and construction tend to be major components of the business cycle.[3] Housing greatly "influences the level of consumer spending" and is the "primary store of wealth for most Americans."[4]

It should come as no surprise, then, that housing permits are one of the key leading economic indicators in the U.S., ranking ahead of the S&P 500 in their ability to signal a turn in the economy.[5]

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[1] See Malkiel (2003).

[2] See Asness, Moskowitz, and Pedersen (2013).

[3] According to the National Association of Homebuilders, housing contributes 15% to 18% of GDP. See https://www.nahb.org/News-and-Economics/Housing-Economics/Housings-Economic-Impact/Housings-Contribution-to-Gross-Domestic-Product.

[4] See Belsky and Prakken (2004).

[5] See Levanon, Ozyildirim, Schaitkin, and Zabinska (2011).

Leamer (2007) showed that housing is "the most important sector in our economic recessions" and residential investment is often "the first item to soften and the first to turn back up" before and after recessions. We can readily observe these leading characteristics in Chart 1.

Chart 1: US Building Permits (1960 - 2020)

Given that an average new home built in the U.S. contains over 16,000 board feet of lumber, the demand for Lumber is uniquely sensitive to housing activity.[6] By extension, this makes Lumber futures highly responsive to anticipated construction activity. Rucker, Thurman, and Yoder (2005) confirm this, showing that lumber futures react quickly to housing starts data released on a monthly basis. Clements, Ziobrowski, and Holder (2011) also find that timberland market values are strongly influenced by six-month lumber futures and building permits. The efficiency with which Lumber reacts to such data suggests that its price movement can be important as a leading indicator of cyclical growth and rising inflation expectations.

In addition to Lumber's sensitivity to planned construction and actual building, the commodity is unique in terms of regulation's impact on its available supply. The Endangered Species Act of 1973 was passed to protect species at risk of extinction due to economic activity.[7] Logging and deforestation has been reduced over time due to court rulings which protected not only endangered species but also their ecosystems.[7] It is estimated that one-third of the forestland in the United States is publicly owned and has been withdrawn from production of the Nation's timber output."[8]

Regulation which prevents significant new *supply* suggests that Lumber will be highly sensitive to housing activity and economic *demand* fluctuations. This in turn makes it a cyclical leading

[6] *Home Preservation Manual. https://www.homepreservationmanual.com/how-many-trees-to-build-a-house/*

[7] See Ruker, Thurman, and Yoder (2005).

[8] *USDA.* https://www.fs.usda.gov/speeches/forest-management-experience-united-states

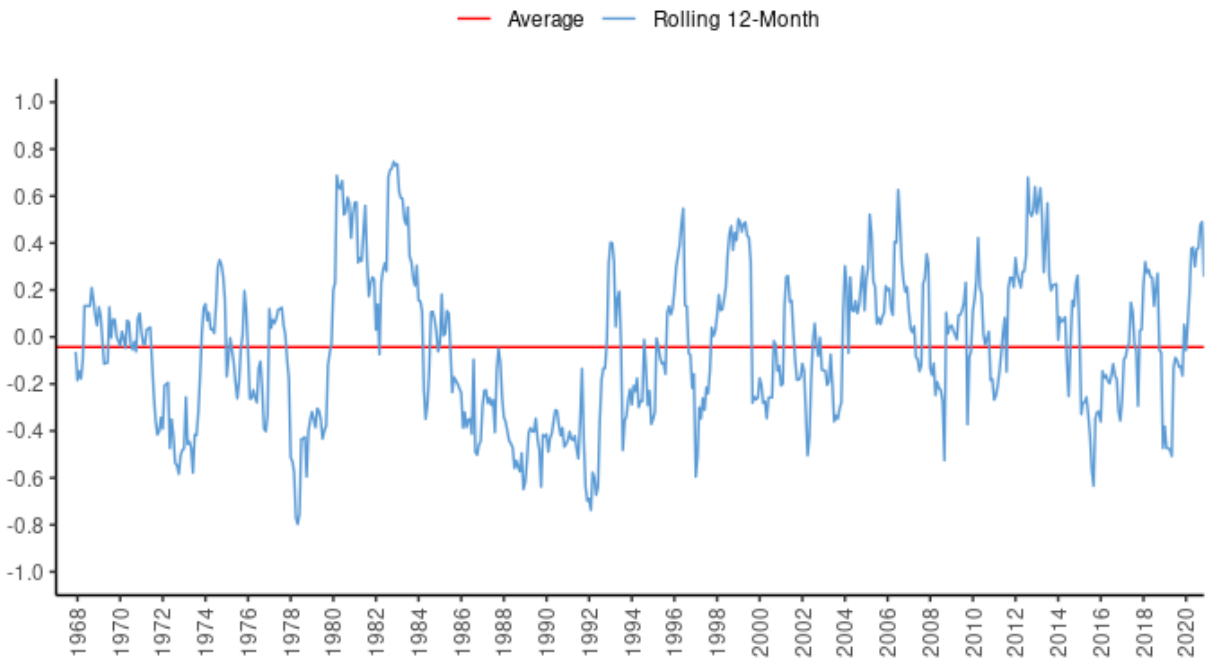
indicator of not only the economy but also the stock market which experiences expansionary phases that are tied to cyclical growth and consumer demand. That consumer demand is driven in large part by housing and construction activity which is reflected in the price of Lumber in real time.

Gold as a Non-Cyclical and Uncorrelated Commodity

Gold is a particularly interesting commodity in the context of its historical role as a store of value and given the unique properties the precious metal has in terms of being an alternative asset. Lawrence (2003) showed that there is "no statistically significant correlation between returns on gold and changes in macroeconomic variables such as GDP, inflation, and interest rates…[and that] returns on Gold are less correlated with returns on equities and bond indices than are returns on other commodities." This makes Gold unique relative to cash which has more consistent counter-cyclical properties in bear markets or contractionary economic environments.

Since January 1976, Gold's monthly correlation with the Barclays US Aggregate Bond Index is .12 while its correlation with the S&P 500 is .01. Chart 2 illustrates the lack of any consistency in Gold's correlation with U.S. equities.

Chart 2: Gold vs. S&P 500 Correlation



In addition to the historical non-correlation Gold has to stocks and bonds, the precious metal also tends to exhibit safe-haven characteristics. Baur and Lucey (2010) show that Gold "is a hedge against stocks on average and a safe haven in extreme stock market conditions...Furthermore, gold is not a safe-haven for stocks at all times but only after extreme negative stock market shocks." Additional studies show that "Gold...has a positive relationship with [stock market] implied volatility, supporting the idea that investors perceive precious metals as safe havens, to be purchased in anticipation of rising equity market volatility."[9]

The risk-aversion characteristics of Gold make for a natural baseline to which we can assess changes in the price of cyclical Lumber. While seemingly at the opposite ends of the economic

[9] See Jubinski and Lipton (2013).

spectrum, the yin and yang of Lumber and Gold are actually highly complementary as we will soon see.

The Lumber-Gold Trading Rule

Combining cyclical Lumber with non-cyclical Gold provides key information on when to "play offense" and when to "play defense" in an investment portfolio.

Using weekly data available on Lumber and Gold going back to November 1986, we developed the following trading rule:[10]

> *If **Lumber** is **outperforming** Gold over the prior 13 weeks, take a **more aggressive** stance in the portfolio for the following week.*
>
> *If **Gold** is **outperforming** Lumber over the prior 13 weeks, take a **more defensive** stance in the portfolio for the following week.*
>
> ***Re-evaluate weekly** and make changes to the portfolio only when leadership between Lumber and Gold changes.*

Research has shown that commodities exhibit momentum in various time frames from 1 month through 12 months, with the strongest momentum exhibited in the 3 month period.[11] Three months equates to 13 weeks which is the timeframe used in this paper.[12]

The Market Environment and the Volatility Signal

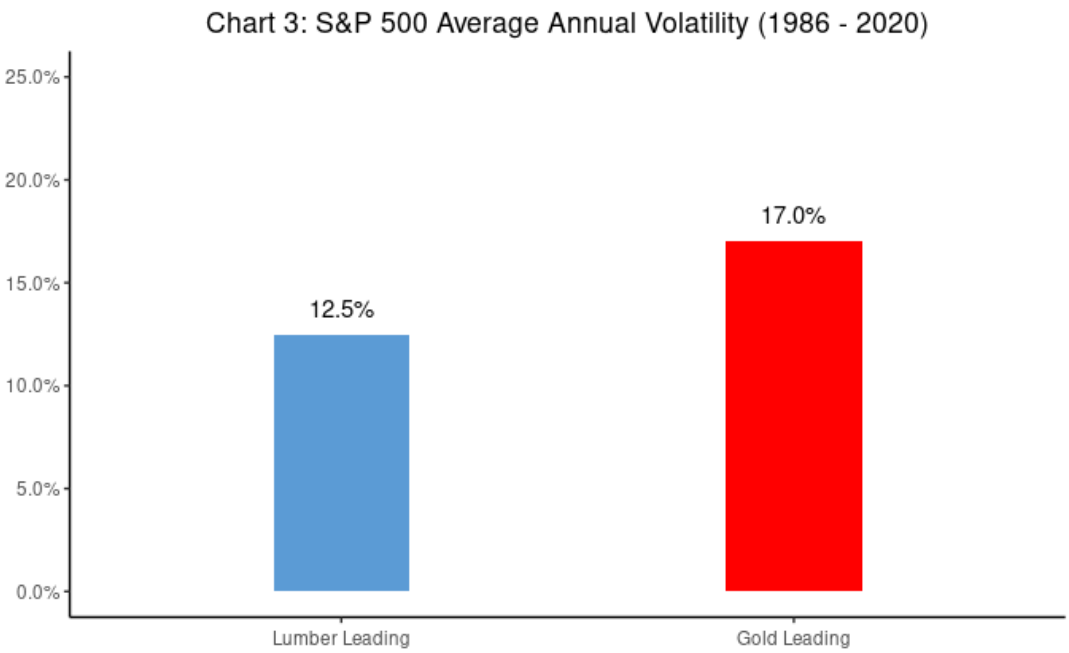
Before we examine active strategies based on the Lumber-Gold trading rule, it is important to understand why a more aggressive position is warranted when Lumber is outperforming and why a more defensive position is warranted when Gold is outperforming. The critical factor is volatility, whereby Lumber's leadership is forecasting lower volatility in the stock market while Gold leadership is signaling higher volatility.

We can observe this in examining the actual S&P 500 volatility in the week following Lumber and Gold outperformance. When Lumber is leading, the average annualized S&P 500 volatility (standard deviation) is 12.5% in the following week versus 17% when Gold is leading (see Chart 3).

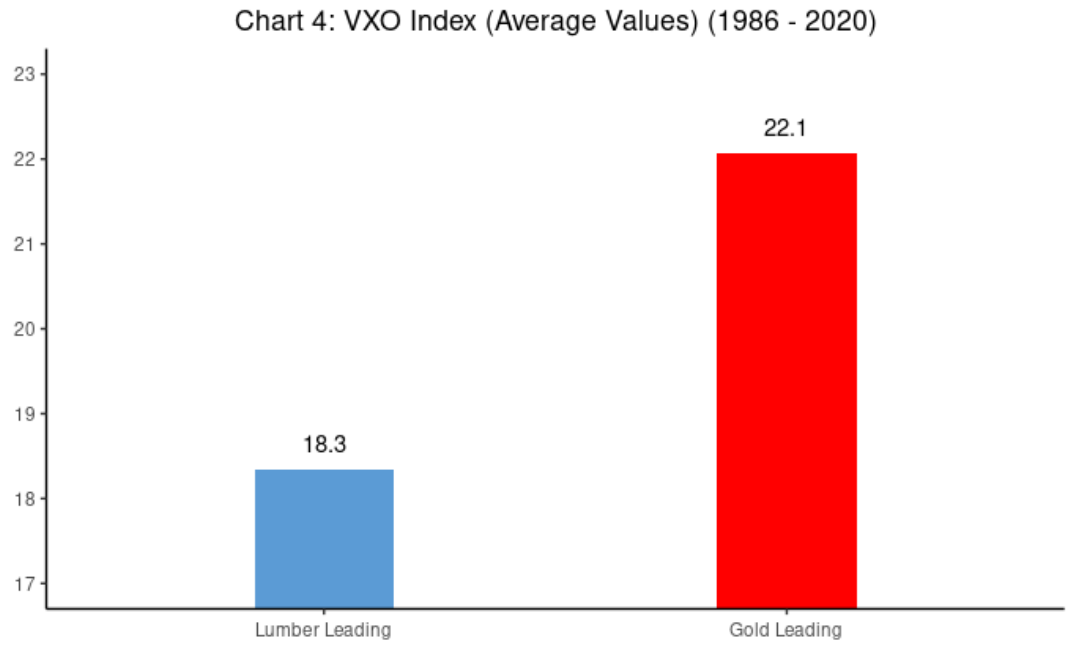
[10] The data source for Lumber and Gold: Bloomberg. Lumber (Ticker: LB1 Comdty) is the random length lumber futures contract, which specifies 110,000 board feet of random length 8-20 softwood 2 x 4s, the type used for rehabbing and construction. Gold (Ticker: XAU Curncy) is the gold spot price quoted as US Dollars per Troy Ounce.

[11] See Miffre and Rallis (2007).

[12] We found that time frames as short as 3 weeks and as long as 21 weeks also have predictive power. Due to the higher turnover on shorter time frames we decided to focus on the 13 week time frame for the purposes of this paper. A lower turnover strategy is more applicable to a broader group of investors.



We also observe a meaningful difference in implied volatility (VXO Index) depending on whether Lumber or Gold is leading.[13] When Gold is outperforming, the average VXO Index value was 22.1 in the following week versus 18.3 when Lumber is leading (see Chart 4).



[13] The VXO Index is the CBOE S&P 500 Volatility Index. It was the original VIX index with price history dating back to 1986. Source: www.cboe.com/micro/vxo

Finally, we looked at the largest weekly percentage declines for the S&P 500 during the sample period. We found that in the worst 5% of weeks, Gold was outperforming in advance 73% of the time and in the worst 1% of weeks Gold was outperforming in advance 89% of the time. This is significantly higher than the percentage of time Gold was outperforming overall at 49%.

The impact that substantial differences in volatility can have on a portfolio cannot be overstated. Low volatility environments tend to be more favorable for risk assets and more conducive towards offensive positioning. On the other hand, higher volatility environments are the enemy of beta and risk, making defensive positioning more desirable.

Defense vs. Offense: Developing Objective Criteria

The concept of "playing defense" and "playing offense" in active portfolio management can be subjective and is highly dependent on one's overall risk tolerance. To make the decision making process more objective, we illustrate a spectrum of indices (moving from more defensive to more offensive) in Table 1 based on their volatility and beta to the S&P 500.

Table 1: Asset Class Volatility and Beta

Asset Class	Annualized Volatility	Beta to the S&P 500
CRSP Treasury 5 Year Total Return Index	4.2%	-0.04
CBOE S&P 500 Buy Write Index	13.3%	0.65
S&P 500 Low Volatility Index	14.5%	0.69
S&P 500 Index	18.6%	1.00
Russell 2000 Index	21.1%	0.96
Morgan Stanley Cyclicals Index (discontinued 2015)	22.7%	1.07
Russell 2000 Growth Total Return Index	25.4%	1.10
S&P 500 High Beta Index	32.0%	1.57

Within this paper, we will focus on strategies using some combination of the above asset classes. We recognize this is a limited list and there are many more ways to play defense and offense within a portfolio.

Playing Defense When Gold is Outperforming Lumber

When Gold is outperforming Lumber, you want to play defense on average. There are a number of ways that investors can express a more defensive stance in an investment portfolio. If we assume that the starting point is a 100% equity portfolio invested in the S&P 500, a more defensive portfolio can be achieved by: 1) rotating into Treasury bonds, 2) introducing hedges or employing a buy-write strategy, or 3) rotating into lower beta/volatility equities.

1) The Lumber-Gold ("LG") Bond Strategy

In our research, we found that the single best way to consistently play defense over time is to rotate into a low or negatively correlated asset class in which you are not highly penalized when you are wrong. U.S. Treasury bonds satisfy both of these criteria. The reason why we do not use shorting or cash as a defensive play is due to false positives that are inherent in any risk management strategy. In this case, a false positive arises when Gold is leading Lumber without a concurrent

increase in volatility or a decline in stocks. Sitting in cash or using short positions during such times would be highly damaging to returns while being in bonds of some duration can still provide a positive expected return on average.

Since November 1986, the weekly correlation between the S&P 500 Index and the CRSP Treasury 5 Year Total Return Index is -.16.[14] During weeks in which the S&P 500 returns are negative, this correlation moves down to -.36. This negative correlation is important because it provides the opportunity to generate positive absolute returns when stocks are declining, something few asset classes can do on a consistent basis.

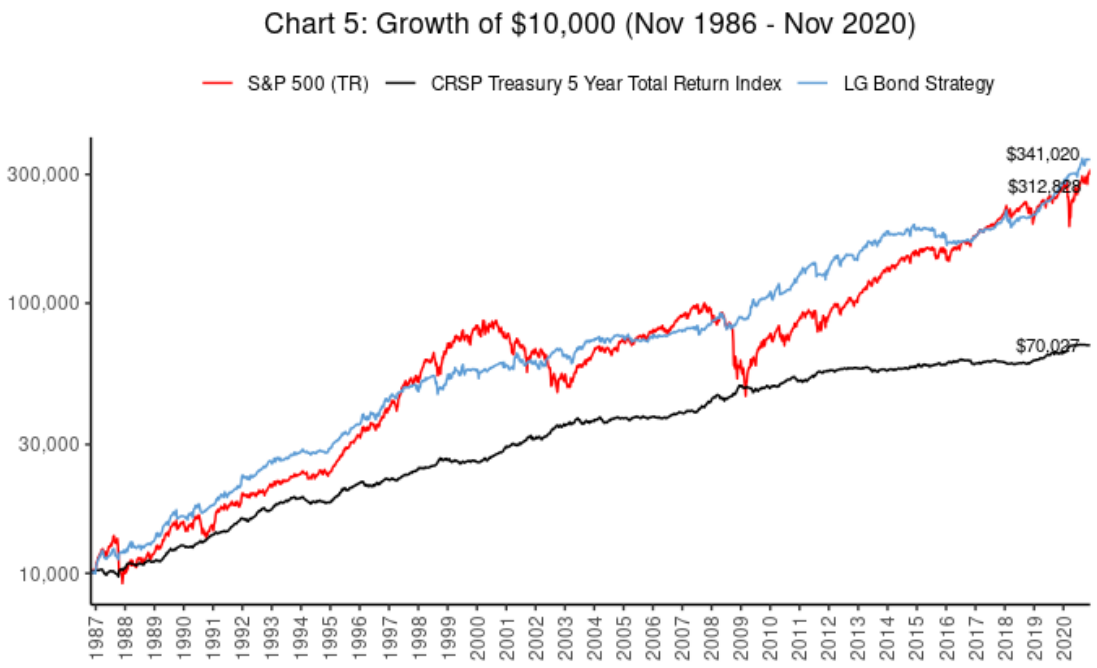
Rotating into the 5 Year Treasury Index when Gold is outperforming Lumber and maintaining stock exposure when Lumber is outperforming Gold (the "LG Bond Strategy") improves both absolute and risk-adjusted return metrics. Annualized returns are slightly higher (10.9% vs. 10.6%), but more importantly the Sharpe and Sortino ratios are significantly higher with lower volatility (10.0% vs. 16.8%) and drawdowns (-16.1% vs. -54.7%) than a buy-and-hold S&P 500 portfolio. This is illustrated in Table 2 (note: all performance data in this paper is total return. The S&P 500 index is only available as total return (TR) since January 1988. Prior to this, the returns from the S&P 500 price index are used.).

Table 2: LG Bond Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

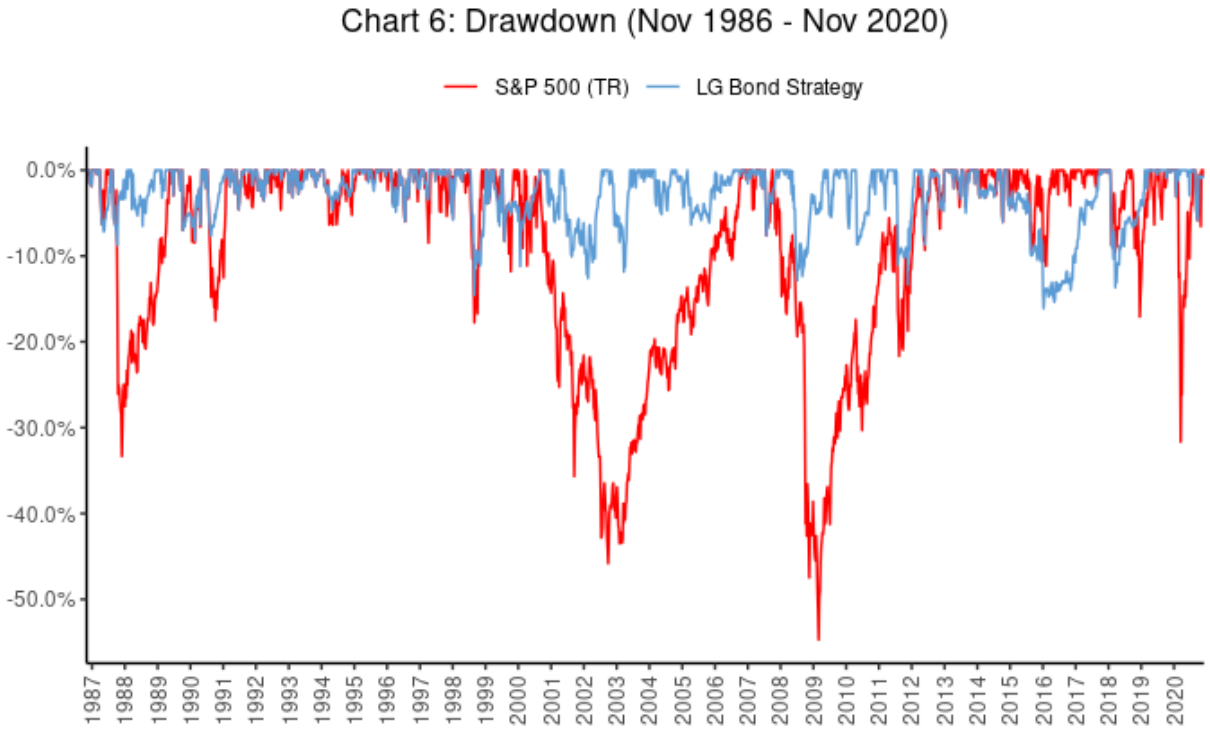
	LG Bond Strategy	S&P 500 (TR)	Differential
Cumulative Return	3310.0%	3028.0%	282.0%
Annual Return	10.9%	10.6%	0.3%
Annual Volatility	10.0%	16.8%	-6.9%
Sharpe Ratio	0.77	0.44	0.33
Sortino Ratio	0.23	0.14	0.1
Max Drawdown	-16.1%	-54.7%	38.6%
Beta	0.29	1	-0.71
Annual Alpha	7.8%	0.0%	7.8%
Rotations/Year	6.8	0	6.8

The consistency of the lower volatility profile can be observed more readily in Chart 5, which shows the growth of $10,000 over time. The smoothness of the LG Bond Strategy's return path relative to the S&P 500 is critical for investment managers and their clients as the ability to stick to a strategy often matters more than the strategy itself. High drawdowns and volatility increase the likelihood of selling an investment at the worst possible time.

[14] We use the 5 Year Treasury Index from CRSP due to the long historical availability (back to 1962). In the previous version of this paper, the BofA Merill Lynch 5-7 Year Treasury Index was used. We find that the newly chosen data from CRSP is a near perfect match. We chose the 5 year Index as it best approximates the duration of the average U.S. bond fund and mitigates the impact (relative to longer duration indices) of interest rate swings.



We can also see this in viewing a chart of drawdowns over time, where the LG Bond Strategy has consistently lower drawdowns during periods of equity market stress (see Chart 6).



Another way to confirm this is in looking at the largest drawdowns (on a weekly basis) for the S&P 500 since 1986 (see Table 3). Market historians will recognize each of these instances which include four recessionary (1990-91, 2001, 2008-09, and 2020) and four non-recessionary (1987, 1998, 2011, and 2018) periods of market stress. In each of these occasions, the LG Bond Strategy

protected capital with a significantly lower drawdown than a buy-and-hold position in the equity market.

Table 3: Largest S&P 500 Drawdowns (Nov 1986 - Nov 2020)				
Start Date	End Date	LG Bond Strategy Max Drawdown	S&P 500 (TR) Max Drawdown	Differential
08/23/87	11/29/87	-8.8%	-33.3%	24.6%
07/15/90	10/07/90	-7.7%	-17.5%	9.9%
07/19/98	08/30/98	-14.5%	-17.8%	3.3%
09/03/00	09/29/02	-12.6%	-45.8%	33.2%
10/14/07	03/01/09	-12.9%	-54.7%	41.9%
05/01/11	08/14/11	-11.0%	-17.0%	6.0%
02/16/20	03/15/20	-1.2%	-31.7%	30.4%

2) The Lumber-Gold ("LG") Buy-Write Strategy

For investors that would prefer to maintain a position in the S&P 500 rather than rotating into bonds, another way to achieve a more defensive position is to use options to hedge a portfolio when Gold is outperforming Lumber. To replicate such a strategy, we used the CBOE S&P 500 BuyWrite Index which is a total return index based on (1) buying a S&P 500 stock portfolio and (2) "writing" or (selling) the near-term S&P 500 "covered" call option, generally on the third Friday of each month.[15]

As illustrated in Table 4, executing the LG BuyWrite Strategy improves risk-adjusted returns and lowers volatility and drawdown, but not nearly to the same extent as shifting into bonds. This should be intuitive as the weekly correlation between the BuyWrite Index and the S&P 500 is still very high at .89. When stocks go down, then, your expectation in using the BuyWrite Index as a hedge is to simply lose less money as it does not give you the opportunity to generate a positive absolute return.

Table 4: LG BuyWrite Strategy vs. S&P 500 (May 1988 - Nov 2020)			
	LG BuyWrite Strategy	S&P 500 (TR)	Differential
Cumulative Return	2208.0%	2866.0%	-658.0%
Annual Return	10.1%	10.9%	-0.8%
Annual Volatility	13.7%	16.6%	-3.0%
Sharpe Ratio	0.51	0.47	0.04
Sortino Ratio	0.15	0.14	0.01
Max Drawdown	-43.1%	-54.7%	11.6%
Beta	0.76	1	-0.24
Annual Alpha	1.6%	0.0%	1.6%
Rotations/Year	6.7	0	6.7

[15] The SPX call written will have about one month remaining to expiration, with an exercise price just above the prevailing index level (i.e., slightly out of the money). The S&P call is held until expiration and cash settled, at which time a new one-month, near-the-money call is written. Source: Bloomberg, CBOE

3) The Lumber-Gold ("LG") Low Volatility Strategy

For investors that would prefer to lower their beta to the market as their expression of risk management, a more defensive position could be achieved by rotating into lower volatility stocks. The S&P 500 Low Volatility Index and measures the performance of the 100 least volatile stocks in the S&P 500.

Rotating into the Low Volatility Index ("LG Low Vol Strategy") when Gold is outperforming Lumber improves absolute and risk-adjusted returns, lowers overall beta, and generates 2.7% alpha per year (see Table 5).

Table 5: LG Low Vol Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	LG Low Vol Strategy	S&P 500 (TR)	Differential
Cumulative Return	4076.0%	3028.0%	1048.0%
Annual Return	11.5%	10.6%	0.9%
Annual Volatility	15.1%	16.8%	-1.7%
Sharpe Ratio	0.55	0.44	0.11
Sortino Ratio	0.16	0.14	0.02
Max Drawdown	-44.36%	-54.7%	10.34%
Beta	0.82	1	-0.18
Annual Alpha	2.7%	0.0%	2.7%
Rotations/Year	6.8	0	6.8

It is interesting to note that the LG Low Volatility strategy has a similar risk profile to the LG BuyWrite Strategy but with improved risk-adjusted return metrics and higher alpha. This suggests that rotating into lower volatility equities may provide a more effective hedge than employing a buy-write strategy.

Playing Offense When Lumber is Outperforming Gold

When Lumber is outperforming Gold, you want to play offense on average. There are a number of ways that investors can express a more aggressive stance in an investment portfolio. If we again assume that the starting point is a 100% equity portfolio invested in the S&P 500, a more offensive portfolio can be achieved by: 1) rotating into small cap equities, 2) rotating into higher beta stocks, or 3) rotating into cyclical sectors.

1) The Lumber-Gold ("LG") Small Cap Strategy

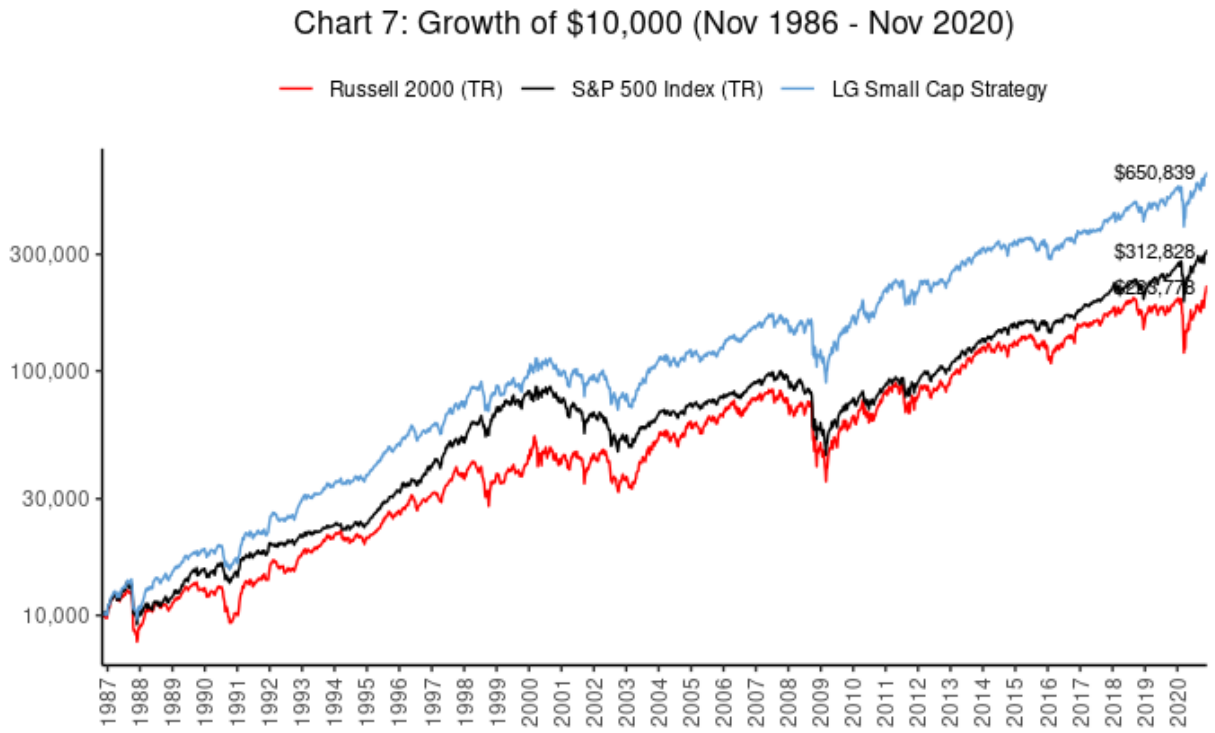
Small caps are traditionally higher beta and higher volatility equities and tend to perform better during expansionary periods. Their revenues are also more domestically focused than multinational large caps and by extension tend to be more sensitive to cyclical swings in housing and the U.S. economy. When Lumber is outperforming, then, we would expect on average to see small cap leadership.

By rotating into the Russell 2000 Index when Lumber is outperforming Gold, an investor would have picked up an additional 2.4% per year of annualized returns over the S&P 500 with improved risk-adjusted metrics as well. Volatility is higher for this strategy than the S&P 500 (17.9% vs. 16.8%) but given the alpha of 2.5% per year you are being compensated for this higher volatility (see Table 6).

Table 6: LG Small Cap Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	Russell 2000 (TR)	S&P 500 (TR)	LG Small Cap Strategy	Differential (LG - S&P 500)
Cumulative Return	2138.0%	3028.0%	6408.0%	3380.0%
Annual Return	9.5%	10.6%	13.0%	2.4%
Annual Volatility	20.7%	16.8%	17.9%	1.1%
Sharpe Ratio	0.31	0.44	0.54	0.1
Sortino Ratio	0.11	0.14	0.15	0.02
Max Drawdown	-58.0%	-54.7%	-47.6%	7.2%
Beta	1.05	1	0.99	-0.01
Annual Alpha	-0.9%	0.0%	2.5%	2.5%
Rotations/Year	0	0	6.8	6.8

Chart 7 shows the growth of $10,000 for the strategy which is significantly higher than both the Russell 2000 and the S&P 500.



2) The Lumber-Gold ("LG") High Beta Strategy

For investors with a high risk profile, rotating into high beta stocks when Lumber is outperforming Gold is a second option. The S&P 500 High Beta Index measures the performance of the 100 constituents in the S&P 500 that are the most sensitive to changes in market returns.

Going back to November 1990, rotating into the High Beta Index during periods when Lumber is outperforming results in an annualized return that is 1.1% higher than the S&P 500. There is no free lunch with high beta stocks, though, as volatility in this strategy is significantly higher as is the maximum drawdown (see Table 7).

Table 7: LG High Beta Strategy vs. S&P 500 (Nov 1990 - Nov 2020)

	LG High Beta Strategy	S&P 500 (TR)	Differential
Cumulative Return	2898.0%	2096.0%	802.0%
Annual Return	11.9%	10.8%	1.1%
Annual Volatility	22.8%	16.8%	6.0%
Sharpe Ratio	0.4	0.48	-0.08
Sortino Ratio	0.13	0.14	-0.01
Max Drawdown	-67.5%	-54.7%	-12.8%
Beta	1.2	1	0.2
Annual Alpha	-0.1%	0.0%	-0.1%
Rotations/Year	6.8	0	6.8

3) The Lumber-Gold ("LG") Growth and Tech Strategies[16]

For investors preferring to use stocks tied to the business cycle as the offensive position, growth stocks are a natural choice. Using the Russell 2000 Growth Index , we find that the absolute and risk-adjusted returns improve relative to a constant buy-and-hold of the S&P 500. Similar to the High Beta Index, though, using the growth index as the aggressive position increases overall volatility and maximum drawdown. With annualized alpha of 1.7% per year, you are being compensated for this additional risk.

Table 8: LG Growth Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	LG Growth Strategy	S&P 500 (TR)	Differential
Cumulative Return	5522.0%	3028.0%	2494.0%
Annual Return	12.5%	10.6%	1.9%
Annual Volatility	19.2%	16.8%	2.3%
Sharpe Ratio	0.48	0.44	0.04
Sortino Ratio	0.14	0.14	0.01
Max Drawdown	-48.9%	-54.7%	5.8%
Beta	1.04	1	0.04
Annual Alpha	1.7%	0.0%	1.7%
Rotations/Year	6.8	0	6.8

A further approach to play offensively is to move to technology stocks when the Lumber-Gold signal indicates risk-on conditions are present. For this, we use the NASDAQ Composite. We find yet stronger alpha of 2.4% and an outperformance of 2.8% per year, however at the cost of larger drawdowns (down to -57% in 2000-02).

Table 9: LG Tech Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	LG Tech Strategy	S&P 500 (TR)	Differential
Cumulative Return	6722.0%	3028.0%	3694.0%

[16] In the previous version of this paper, we presented the LG Cyclical Strategy in this section. The then used MS Cyclicals Index has been discontinued. We take this opportunity to now build the strategy using the Russell 2000 Growth Index which has a very similar performance characteristics as the previously used Cyclical index.

Annual Return	13.1%	10.6%	2.5%
Annual Volatility	18.9%	16.8%	2.0%
Sharpe Ratio	0.52	0.44	0.08
Sortino Ratio	0.15	0.14	0.02
Max Drawdown	-57.0%	-54.7%	-2.3%
Beta	1.04	1	0.04
Annual Alpha	2.2%	0.0%	2.2%
Rotations/Year	6.8	0	6.8

Putting It All Together: Combining Defense and Offense

Now that we have explored playing offense and playing defense individually, the next step for an active investment manager is to employ a strategy that combines the two.

There are various combinations that can be utilized depending on the desired risk profile of the portfolio and use of instruments. For investors targeting a lower drawdown, lower volatility, and lower beta while maintaining simplicity in a portfolio, the strongest combination is to use either Small Cap or Growth/Technology stocks when Lumber is outperforming Gold and Treasury bonds when Gold is outperforming Lumber.

1) The Lumber-Gold ("LG") Small Bond Strategy

In Table 10, we see that a strategy that rotates between Small Caps on offense and 5 year Treasuries on defense produces a return that is 2.7% higher than the S&P 500 with 5.1% lower volatility. The maximum drawdown of --24.9%, while higher than the LG Bond Strategy, is still less than half of the S&P 500 (-54.7%).

Table 10: LG Small Bond Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	LG Small Bond	S&P 500 TR	Differential
Cumulative Return	6995.0%	3028.0%	3967.0%
Annual Return	13.3%	10.6%	2.7%
Annual Volatility	11.7%	16.8%	-5.1%
Sharpe Ratio	0.85	0.44	0.41
Sortino Ratio	0.24	0.14	0.1
Max Drawdown	-24.9%	-54.7%	29.9%
Beta	0.27	1	-0.73
Annual Alpha	10.5%	0.0%	10.5%
Rotations/Year	6.8	0	6.8

2) The Lumber-Gold ("LG") Tech Bond Strategy

In Table 11, we see that a strategy that combines offense and defense using the NASDAQ Composite and Treasury bonds produces a return that is 2.8% higher than the S&P 500 with 3.8% lower volatility compared to the S&P 500. The maximum drawdown of -28.6%, while higher than the LG Bond Strategy, is also less than half of the S&P 500 (-54.7%).

Table 11: LG Tech Bond Strategy vs. S&P 500 (Nov 1986 - Nov 2020)

	LG Tech Bond	S&P 500 TR	Differential
Cumulative Return	7337.0%	3028.0%	4309.0%
Annual Return	13.4%	10.6%	2.8%

Annual Volatility	13.1%	16.8%	-3.8%
Sharpe Ratio	0.77	0.44	0.34
Sortino Ratio	0.22	0.14	0.08
Max Drawdown	-28.6%	-54.7%	26.2%
Beta	0.33	1	-0.67
Annual Alpha	10.2%	0.0%	10.2%
Rotations/Year	6.8	0	6.8

In Chart 8, we see that the LG Small Bond and LG Cyclical Bond Strategies outperform both stocks and bonds with lower volatility than the equity indices.

Up Capture, Down Capture, and False Positives

What is the key to the 10+% annualized alpha generated by the LG strategies that combine defense and offense? Is it participation on the upside or protecting on the downside? Looking at the up capture and down capture ratios in Table 12, we see that while both are contributors, "playing defense" is the more critical factor.

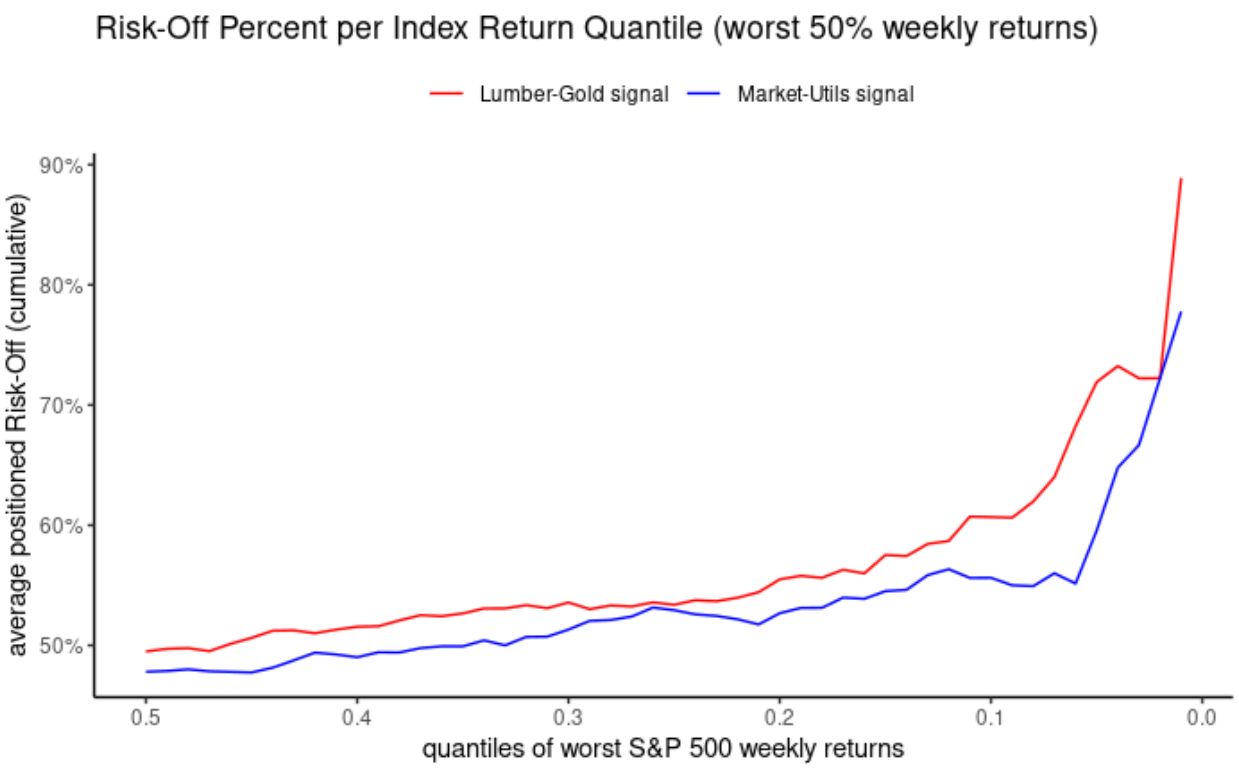
Table 12: Up Capture vs. Down Capture (Monthly, Nov 1986 - Nov 2020)

	LG Tech Bond	LG Small Bond
Up Capture	64%	60%
Down Capture	25%	18%
Up/Down Ratio	2.61	3.32

We know this because the strategies generate absolute outperformance of approximately 3% per year but only participate in 60-64% of the upside. Limiting the downside to only 18-25%, however, was more than enough to overcome the lack of full participation on the upside.

Interestingly, the Lumber to Gold risk-off trigger has similar timing characteristics as other leading intermarket indicators of stock market volatility. In the S&P 500's top 1% of its worst weeks, the Lumber-Gold relationship indicated risk-off in 89% of times before those declines took place helping to sidestep significant drawdowns experienced by buy and hold investors. Chart 9 compares the positioning in risk-off in the 50% worst returning S&P 500 weeks. The signal has similar capability in avoiding extreme market crashes as the Utilities-Market signal presented in the 2014 Dow Award winning paper "An Intermarket Approach to Beta Rotation: The Strategy, Signal, and Power of Utilities" (2014 and updated 2020).[17] Because Utilities are the most bond like sector of the stock market, and Lumber is a leading indicator of Housing, the common link of interest rate sensitivity may be the ultimate driver of why each signal's respective movement provides early risk-off warning signs that the broader stock market does not necessarily notice until it's too late.

[17] The Utilities-Market signal is based on the 4-week relative strength of the Utilities sector to the broad market. In a nutshell, Utilities on average outperforming the market over the last rolling 4 weeks indicates switching to risk-off (and vice versa).



This again brings up the important concept of false positives in any trading strategy that incorporates risk management. It is not that every time Gold is leading Lumber you should expect to see a decline in stocks, just that the *probability* has increased and that you must move to a defensive asset class *in advance* because you don't know when a large decline is going to ensue. In order to protect on the downside, then, you have to be willing to give up some upside in return; there is no other way. This is why the up capture of any risk management strategy must fall short of 100%.

For active managers this is a tradeoff that pays off in the end but can prove frustrating during periods of unrelenting advance, such as the late 1990's technology bubble and the 2013/2014 Quantitative Easing 3 (QE3) period. During such periods, small sample bias often gets the better of many investors. This is precisely why we believe your ability to stick to a strategy often matters more than the strategy itself.

What about the 1970s?

We have seen that the Lumber-Gold relationship was a highly reliable indicator to avoid all major market corrections, crashes, and bear markets since November 1986. This is the historical timespan covered with Lumber and Gold data from Bloomberg. Using Quandl.com as an alternative source for Lumber prices allows us to go back to December 1972.[18] Gold "XAU" is available since 1975 (before that monthly only).

[18] Quandl.com / Wiki Continuous Futures: Random Length Lumber Futures, Continuous Contract #1 (LB1), see https://www.quandl.com/data/CHRIS/CME_LB1-Random-Length-Lumber-Futures-Continuous-Contract-1-LB1-Front-Month

Between March 1975 and October 1986, the LG Bond Strategy outperformed the S&P 500 by 2.8% annually at a lower volatility of 10.8% (14.3% in the S&P 500) (See Table 13). This is important given the unusually difficult market environment of that time period which was dominated by a stagflationary economic cycle.

Table 13: LG Bond Strategy vs. S&P 500 (Mar 1975 - Oct 1986)

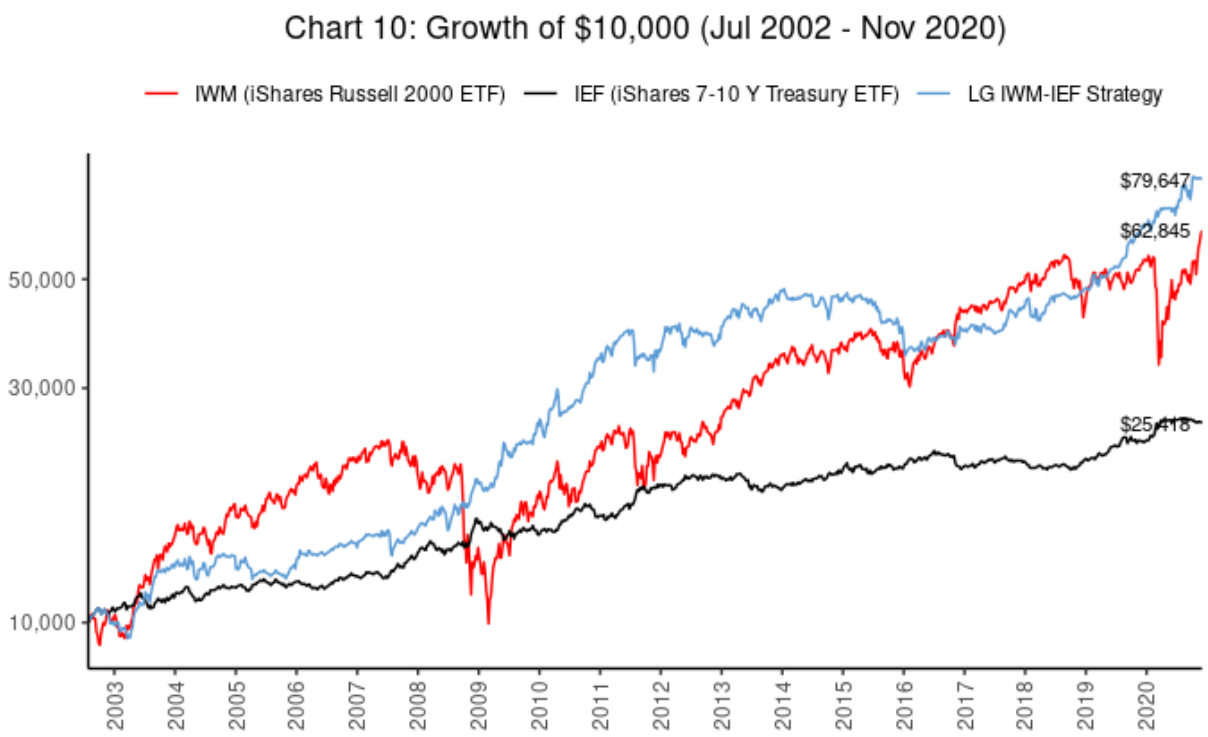
	LG Bond Strategy	S&P 500 (TR)	Differential
Cumulative Return	291.0%	191.0%	100.0%
Annual Return	12.4%	9.6%	2.8%
Annual Volatility	10.8%	14.3%	-3.6%
Sharpe Ratio	0.33	0.07	0.26
Sortino Ratio	0.26	0.15	0.1
Max Drawdown	-12.8%	-26.2%	13.4%
Beta	0.52	1	-0.48
Annual Alpha	7.3%	0.0%	7.3%
Rotations/Year	7.6	0	7.6

Practical Implementation Using ETFs

We have seen that the strategies relying on the Lumber-Gold indicator deliver astonishing returns at considerably lower volatility than the market benchmark. The various strategies required on average 6.6 rotations per year, meaning you had to do two trades (sell and buy) on less than 7 out of 52 annual end of trading week days.

Chart 10 shows the performance of the LG Small Bond Strategy implemented using the iShares Russell 2000 and the iShares 7-10 Year Treasury ETFs.[19] As we have discussed before the strategy's return is mostly unaffected by the bear markets of 2008 and 2020, resulting in a annualized volatility of just 13% (compared to the SPY "SPDR S&P 500" with 17.8% in the same timespan). The strategy required on average 6.3 rotations per year since 2002.

[19] We use the 7-10 Year Treasury ETF (and not shorter term iShares 3-7 Year Treasury Bond ETF "IEI") as it's available since July 2002. Due to the wide availability of ETFs on all kind of indices any of the above outlined strategies can be replicated quite easily.



Conclusion

Housing activity is one of most important leading economic indicators in the United States. Lumber is the commodity most sensitive to changes in the housing market and by extension it provides a real-time gauge of demand in the sector. On the other end of the spectrum is Gold, which is uncorrelated to the business cycle with safe-haven characteristics.

The unique combination of Lumber and Gold is an intermarket relationship that has been anticipatory of future economic activity and risk appetite across asset classes outside of commodities. We find that when Lumber is leading Gold over the prior 13 weeks, expansionary conditions pre-dominate and volatility tends to fall going forward. Such an environment is favorable to taking more risk in a portfolio or "playing offense." We also find that when Gold is leading Lumber over the prior 13 weeks, contractionary conditions pre-dominate and volatility tends to rise. In this environment, it pays to manage risk in a portfolio or "play defense."

The gradual diffusion of information generated from the relationship of Lumber and Gold can help active investors manage risk and enhance returns. We find that executing a strategy that positions into defensive-leaning Treasuries when Gold is leading Lumber and aggressive-leaning Small Caps or Cyclical stocks when Lumber is leading Gold results in higher absolute and risk-adjusted returns with lower volatility and lower drawdowns than a buy-and-hold portfolio. The strategy is robust to multiple time frames, through multiple economic cycles, and multiple periods of market stress.

For active managers, there is no more important question than when to play defense and when to play offense. Using the cyclical and non-cyclical relationship of Lumber and Gold provides an actionable answer that has been consistently effective over time.

Further Research

The findings in this paper have important implications on a number of areas of interest for traders and investors, particularly in the use and timing of leverage. The greatest enemy of leverage is volatility. If the relationship between Lumber and Gold is predictive of future volatility, then a strategy can be developed to adjust leverage or gross exposure accordingly. This is an important topic for many traders and asset managers that we will explore in detail in an upcoming research paper.

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