Yield Curve and S&P Returns

Luka KUCER[a], Denis ALAJBEG[b], Tomislav KESIC[c]

[a] Zagreb School of Economics and Management, Filipa Vukasovića 1, 10000 Zagreb, Croatia

Abstract

The objective of this paper was to explore the predictive power of the US Treasury yield curve spread for subsequent short- to medium term S&P 500 returns (holding periods of 1-36 months), over the past 35 years. Stock returns were lowest (and even negative) when the yield curve inverted, especially if the spread was increasing - a situation that usually coincided with monetary policy changing from restrictive to expansionary (the so-called "Fed pivot"). On the other hand, a positive yield curve was typically followed by positive stock returns in mostly all examined holding periods. The highest average returns were recorded when the yield curve was normal and the spread decreasing – i.e., when the economic and stock market recovery was well underway and when the steep yield curve gradually started to flatten and normalize. Regression analysis indicated that, in the short-term, yield curve spreads and stock market returns are uncorrelated, but also that the relationship strengthened in longer time frames (although only to moderate levels). In this regard, using the 12-month MA spread instead of the current spread is perhaps worth further investigating, since it produced more consistent and statistically significant returns (especially for time frames of 12 months and longer).

Keywords: S&P 500, stock returns, yield curve, yield curve spread, yield curve inversion

JEL Classification: G10, G11, G12, G14

1. Introduction

The term structure of interest rates is the relationship between interest rates (yields) on bonds with the same risk but different terms to maturity (Mishkin & Eakins, 2018). Since investors in long-term securities are seeking a premium for bearing higher risk than buyers of short-term securities, long-term rates are typically above short-term rates and the term spread is usually positive. But sometimes short-term rates rise above long-term rates, and the term spread turns negative. The line that plots these interest rates or yields is called the yield curve, and its slope is used to predict future interest rate changes.

According to the liquidity premium theory, the interest rate on a long-term bond will equal the average of short-term interest rates expected to occur over the life of the long-term bond plus a liquidity premium (Mishkin & Eakins, 2018). This would imply that the shape or slope of the yield curve could reveal market expectations

about the future movement of short-term rates, since the yield curve is derived from the actual buying and selling activities of bond and money market investors. These investors, often formidable entities controlling substantial financial resources (such as pension funds), possess access to some of the most comprehensive information available. The slope of the yield curve thus emerges as a collective manifestation of market expectations, or the amalgamated wisdom of investors.

So, when the yield curve is steep, i.e. when long-term rates are significantly above short-term rates, future short-term rates are expected to increase; when it is only moderately steep or normal, short-term rates are expected to stay more or less the same. But when the yield curve inverts or turns negative, i.e. when long-term rates go below short-term rates, a severe drop in short-term interest rates is expected.

The inverted yield curve on US government bonds has demonstrated an excellent track record in accurately predicting US recessions throughout the 20th and 21st centuries, which is why the slope of the yield curve holds a prominent position among the key components of the Index of Leading Economic Indicators and various other economic forecasting tools (Bodie et al., 2014). The shape of the yield curve will change as the economy progresses through the business cycle. When the economy operates above its long-term sustainable growth rate, monetary policy typically responds by raising short-term interest rates to curb lending and, consequently, economic activity. The primary objective of central banks is not to intentionally cause a recession (although that outcome often occurs), but rather to steer the economy toward a more sustainable long-term trajectory. During the process of increasing short-term interest rates, the yield curve will shift from a normal or moderately positive one to an inverted or negatively sloping one. In a stagnating or recessionary environment, the reverse happens: monetary policy loosens in order to stimulate the economy and short-term interest rates drop significantly below long-term rates, thus steepening the yield curve.

This paper seeks to explore possible insights different shapes of the US Treasury yield curve have provided regarding subsequent stock market returns over the past 35 years. The time period of 1988 to 2023, which covers four recessions, was chosen in order to determine the relevance of the term spread for stock investors in more recent history. The focus is centred on short- to medium term returns (holding periods of 1-36 months), in order to estimate whether the yield curve slope can give stock investors an early enough signal for timely guidance - indicating when to buy stocks to maximize profits and when to sell them to minimize or even evade huge losses. Or is the stock market efficient enough to quickly absorb all information embedded in the yield curve, prohibiting the majority of investors to profit from it?

2. Literature Overview

The term structure of interest rates is the relationship between interest rates (yields) on bonds with the same risk but different terms to maturity (Mishkin & Eakins, 2018). Since investors in long-term securities are seeking a premium for bearing higher risk than buyers of short-term securities, long-term rates are typically above short-term rates and the term spread is usually positive. But sometimes short-term rates rise above long-term rates, and the term spread turns negative. The line that plots these interest rates or yields is called the yield curve, and its slope is used to predict future interest rate changes. The slope of the yield curve, particularly its inversion, has been documented to be one of the most successful leading economic indicators. Estrella and Hardouvelis (1991) and Estrella and Mishkin (1996 and 1998) show that historically, the spread between the ten-year and three-month maturity has exhibited a positive statistical relationship with odds for a recession in subsequent quarters. More specifically, the lower (or more negative) the interest rate spread between long (10-year T-note) and short-term (3-month T-bill) interest rates, the greater the probability of a recession four quarters ahead. For example, the inversion of the 10-year and 3-month yield curve to a spread of -2,4 percentage points increases the likelihood of a recession to 90%. The term spread is thus a measure of the stance of monetary policy relative to long-run expectations. The more negative the term spread, the more restrictive is the current monetary policy, and the more likely a recession is in subsequent quarters. Furthermore, Estrella and Mishkin (1998) compare the term structure as a predictor of recessions with a large number of alternative indicators, and find that it is among the best in tests of statistical significance, particularly at horizons of about one year. The same is true if the spread is constructed with bonds of different maturities used for the short term (1-year and 2-year maturities).

Bauer & Mertens (2018) conclude that a 10-year and 1-year yield curve inversion predicts a recession within two years. This signal correctly predicted all recessions since 1955, and had only one false positive, in the mid-1960s, when an inversion was followed by an economic slowdown, but not an official recession.

Chen, Roll, Ross (1986) determined that the slope of the yield curve and the growth rate in industrial production are important economic variables in explaining historical stock market performance. Resnick and Shoesmith (2002) found that an inversion between 10-year US T-bond and three-month T-bill yields holds relevant information about the probability of a bear market in stocks. They constructed a market timing strategy based on switching between short-term money market instruments and stocks one month before a bear or bull market, ultimately showing a compound annual return of 16,46% versus a 14,17% return for a buy and hold approach. The strategy was tested on the S&P 500 between January 1960 and December 1999. A bear market was defined as a six-month or more consecutive decline in the stock market. Yield spreads were either negative or historically low during bear markets, and

the most robust results were achieved by yield curve inversions forecasting stock market returns 1-2 months in advance.

Yu, Fuller, and Didia (2008) investigated the connection between the inverted yield curve and the performance of small, mid, and big-cap stocks for the 2005-2007 period, where the returns of 3 differently constructed S&P indexes (small-cap, mid-cap, and S&P 500) were taken as representations of company sizes. They did not find any significant relationship between stock market returns and yield curve inversions, but the findings are somewhat limited because of the short time period investigated; in and of itself yield curve inversions are relatively rare.

Fama and French (2019) reassessed the problematics of the yield curve as a predictor of stock returns and tested monthly stock returns from January 1975 to December 2018 in 12 countries divided into three larger segments: the US, World (including the US), and World ex-US. They analyzed subsequent stock returns for up to 5 years and didn't find evidence that yield curve inversions can be used to avoid poor stock returns. The investor who would shift the portfolio from stocks to 1-month Treasury bills when the yield spread is negative, would not achieve a better result and instead would sacrifice the reliably better equity premium (for a lower T-bill premium).

On the other hand, Faria, Goncalo, Verona, and Fabio (2020) extracted cycles from the term spread and concluded that the trend of the term spread is a strong and robust out-of-sample equity premium predictor, both from a statistical and an economic point of view.

Quinn, Zhang and Mi (2021) explored short-term stock reactions to yield curve inversions. Inversion was tested in 41 countries; yield curves were constructed with several maturities and on multiple timeframes (immediate response, six months, 12 months), but the results were not conclusive. Only 13 of 41 countries showed significantly negative stock returns when yield curves inverted. Stocks in the US and other developed nations (Germany, Canada, France, Netherlands, United Kingdom) exhibited immediate (3-day) strong negative price responses to inversion of the 10y-3m yield curve. No such evidence could be found for holding periods of 6 to 12 months after the inversion.

Lee (2021) states that yield curve inversions are statistically significant predictors of stock returns 3-24 months after the inversion. Yield curves calculated on the spread between 10-year and 3-month US treasuries are best suited for forecasting real economic output (or its slowdown), while yield curves that use the Federal Funds Rate as a proxy for short-term interest rates produce the best results for forecasting subsequent stock market returns.

The literature review indicates that the primary focus of researchers was the yield curve inversion. The inversion was tested in various ways and with varying results, but mainly as an indicator for recognizing bear markets in stocks. In this regard, yield curve inversions seem to be a relatively reliable gauge for future downturns. Still, further

research is needed to test how the stock market reacts to other shapes of the yield curve, which is the aim of this paper.

3. Data & Methodology

The S&P 500 index was selected as the representative of the US stock market. Historical index values were taken from the website Investing.com; only price data was used in the calculations, dividends were not included. Yield data for 10-year US Treasury notes and 3-month US Treasury bills were obtained from FRED – the official website of the Federal Reserve for economic data. Monthly closing values were extracted from January 1, 1988 to December 29, 2023, for both the S&P 500 and Treasury yields.

For the S&P 500 index, price returns were calculated with the single-period return formula:

$$Return\ in\ n\ time\ periods = \frac{(Period\ n)}{Period\ 0} \text{-}1$$

Where Period 0 represents the beginning value of the index and Period n the ending value, while n stands for holding periods of 1, 3, 6, 12, 18, 24, 30 and 36 months.

The term spread was determined monthly as the difference between the 10-year US-T note yield and the 3-month US-T bill yield (constant maturities). The current term spread was then arranged into five numerical categories (<0; >=0 and <1%; >=1% and <2%; >=2% and <3%; >=3%) and subsequent average stock returns for every category were calculated. For example, whenever the current spread was in the range of 0-1%, subsequent average returns were computed for holding periods from 1-36 months. This was repeated for all five categories and for all eight holding periods, with the purpose of revealing what returns the stock investor could expect on average when the yield curve is sloped in a particular way.

But absolute levels of the current spread do not indicate whether the spread is increasing or decreasing, and this is why a 12-month simple moving average (SMA) was applied to the current spread. An SMA is an equally weighted mean of the previous n data:

$$SMA_k = \frac{p_1 + p_2 + \cdots + p_n}{k}$$

Where pn are data values and k the lookback period. The next data point in the moving average would drop the earliest price p1, add the new price for period pn+1, calculate the average, and so on.

In the context of this study, the moving average concept was employed to answer questions like the following one: if the spread is between 0-1%, and if it is above its

12-month MA, what are the average subsequent 6-months returns for the S&P 500? The first part of the condition would capture the absolute level of the current spread, while the second part would determine its upward or downward trend. A spread above 0 indicates a positive yield curve, but it is also important to know whether the current spread is increasing (in that case, it would be above its 12-month MA), or if it is decreasing (it would be below its 12-month MA then). The primary reason for the emphasis on the trend of the yield curve spread, was to avoid comparing equal absolute spread levels during very different macroeconomic conditions: the spread can be between 0 and 1% when it is falling during periods of monetary tightening (which should be negative for stock returns), but also when it is recovering from an inversion during periods of monetary easing (which should be positive for stock returns).

For example, the current value of the spread was between 0 and 1% in both 2000 and 2001, but monetary conditions were very different (Figure 1). In 2000 monetary policy was tightening and the current spread was below its MA, hinting at a potential recession; in 2001 monetary policy was easing and the current spread was above its MA, pointing to an expected economic expansion. This duality had to be taken into account. Therefore, average stock returns were also calculated for different holding periods regarding the absolute level of the current spread, as well as the trend of the spread (i.e. whether the current spread is above or below its 12-month moving average).

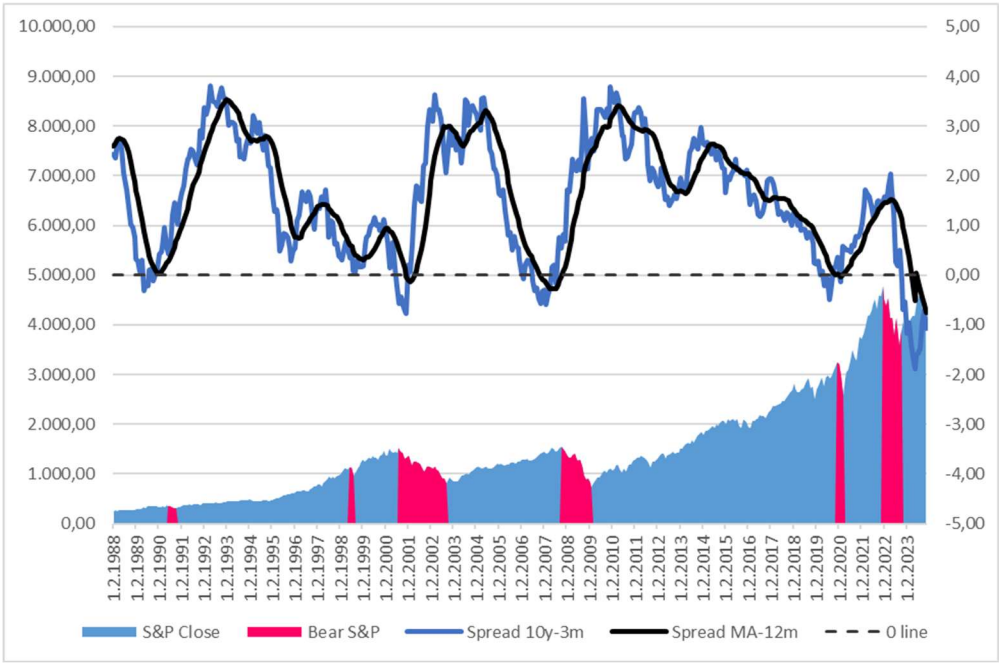

Figure 1. S&P 500 Price Index, Yield Spread and 12-month MA Yield Spread (Source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Additionally, it was tested whether the 12-month MA in itself is actually a more appropriate tool in forecasting subsequent stock returns than the current spread. The purpose of a moving average is to smooth out oscillations in the underlying time series, as to potentially gain insight about data characteristics that have perhaps been clouded by short-term volatility. Figure 1 shows that the current spread (blue line) is much more volatile than its 12-month MA (black line). So, the same methodology as described above for the current spread, was conducted again, but this time for the MA spread instead. Results from both approaches are then compared.

Lastly, the strength of the relationship between stock returns and the yield spread was examined. A simple linear regression was performed, with average stock returns in different holding periods as the dependent variable and the current spread (the MA spread) as the independent variable.

4. Results & Analysis

The yield curve spread has been divided in five different numerical ranges and stock returns were calculated for the predetermined holding periods. The results are presented in Table 1.

Table 1. YC Spread Ranges and 1 to 36-month S&P Price Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Lower Range	Upper Range	Average Return Holding Period (in months)							
YC Spread (%)		1	3	6	12	18	24	30	36
	<0	*0,9%*	*2,0%*	*3,2%*	*2,5%*	*0,4%*	*-4,9%*	*-5,1%*	*-3,6%*
>=0	<1	*1,0%*	*2,6%*	*5,3%*	*10,8%*	*14,6%*	*18,2%*	*19,9%*	*20,1%*
>=1	<2	*1,2%*	*3,6%*	*7,1%*	*12,4%*	*18,0%*	*26,1%*	*35,3%*	*43,4%*
>=2	<3	*0,4%*	*1,7%*	*3,7%*	*9,2%*	*16,0%*	*23,0%*	*30,2%*	*39,0%*
>=3		*0,3%*	*0,3%*	*1,3%*	*6,1%*	*11,7%*	*16,9%*	*24,2%*	*34,7%*

highest return in holding period

second highest return in holding period

lowest return in holding period

second lowest return in holding period

The only negative returns were recorded when the yield curve was inverted, for holding periods of 24 to 36 months. A negative term spread also led to notably lower returns in the time frame of 12 to 18 months than for any other yield curve shape. It seems that once the yield curve inverts, stock investors are not rewarded for patience: the longer they hold stocks, the lower their returns. But when the yield curve was positive, average stock returns were unquestionably positive across every investment horizon; the longer the time frame, the higher the returns. The highest returns in all holding periods were recorded when the yield curve was normal, i.e. when the term spread was between 1-2% (the average term spread from 1988 to 2023 was 1,52%).

As previously stated, a yield curve spread of 0-1% can determine two very different economic realities: one of monetary tightening nearing its maximum, and one of monetary easing just getting started. To correct for this, the trend of the yield curve spread had to be determined. If the current term spread is above its 12-month MA, financial conditions are improving and the spread is increasing in the anticipation of an expansion, while if it is below its MA, financial conditions are deteriorating and the spread is decreasing because recessionary expectations prevail. The results can be seen in Table 2.

Table 2. YC Spread Ranges, YC Trend, and 1 to 36-month S&P Price Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Lower Range	Upper Range	Trend	Average Return Holding Period (in months)							
YC Spread (%)		Spread >= MA	1	3	6	12	18	24	30	36
	<0	1	*1,3%*	*6,5%*	*-5,3%*	*-12,9%*	*-43,2%*	*-32,1%*	*-26,2%*	*-24,3%*
>=0	<1	1	*1,0%*	*0,8%*	*2,0%*	*7,9%*	*5,9%*	*4,8%*	*4,6%*	*5,7%*
>=1	<2	1	*0,8%*	*3,7%*	*6,2%*	*9,4%*	*13,3%*	*20,5%*	*29,8%*	*38,6%*
>=2	<3	1	*0,1%*	*-0,1%*	*0,6%*	*5,5%*	*11,1%*	*16,2%*	*21,5%*	*26,4%*
>=3		1	*0,5%*	*0,4%*	*0,9%*	*6,0%*	*12,4%*	*17,4%*	*23,6%*	*33,7%*
	<0	0	*0,9%*	*1,9%*	*3,5%*	*3,0%*	*2,0%*	*-3,9%*	*-4,4%*	*-2,9%*
>=0	<1	0	*1,0%*	*3,6%*	*7,1%*	*12,3%*	*19,4%*	*25,7%*	*28,5%*	*26,9%*
>=1	<2	0	*1,5%*	*3,6%*	*8,0%*	*15,4%*	*22,7%*	*31,4%*	*39,9%*	*47,0%*
>=2	<3	0	*0,6%*	*3,0%*	*6,0%*	*11,9%*	*19,7%*	*27,9%*	*36,5%*	*48,0%*
>=3		0	*-0,8%*	*0,1%*	*3,9%*	*7,0%*	*7,7%*	*13,6%*	*27,7%*	*40,7%*

highest return in holding period

second highest return in holding period

third highest return in holding period

lowest return in holding period

second lowest return in holding period

third lowest return in holding period

Predominantly, the lowest returns on most investment horizons were recorded when the spread was negative, irrelevant of the fact whether the spread was decreasing or increasing. Still, it has to be noted that the absolute worst returns are experienced when the spread was negative but increasing. This usually coincides to a yield curve that is just starting to rise, which happens when monetary policy is changing its stance and goes from restrictive to expansionary. So, while on average investors with a time frame of 6 to 36 months should scale out of the stock market once the yield curve turns negative, they should be especially wary once the central bank starts lowering short-term interest rates in order to stimulate the economy (the Fed pivot). Although not entirely intuitive (one would expect that lower rates are beneficial to the market), this seems to be the worst time to own stocks.

On the other hand, when the yield curve is positive, average returns for up to 36 months are mostly positive. In this category, the lowest returns are recorded when the spread is only slightly positive (between 0 and 1%) and increasing, which can be related to the already mention change in monetary conditions after the Fed starts a new cycle of lowering interest rate and the yield curve in the process of steepening. In contrast, returns are generally higher when the spread is normal (between 1-3%), and decreasing, meaning that the yield curve is flattening. The yield curve first flattens and turns from a steep to a normal shape after a recession. In the early and mid-part of the economic cycle, growth rates and inflation are stable and monetary policy normalizes. This seems to be the "sweet spot", the optimal environment for higher stock returns. Because later, as the economy heats up, with growth and inflation

accelerating, monetary policy will begin tightening and uncertainties about the economic cycle with start to creep up into market participant expectations.

In order to obtain a more thorough statistical understanding of the relationship between stock returns and yield curve spreads, returns of different holding periods were regressed against the current spread. Table 3 summarizes the basic statistic parameters of these regressions.

Table 3. Basic Statistics of the YC Spread and S&P Price Returns Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Measures		Average Return Holding Period (in months)							
f	YC Spread	1	3	6	12	18	24	30	36
MIN	*-1,88*	*-16,9%*	*-30,1%*	*-42,7%*	*-44,8%*	*-50,1%*	*-47,7%*	*-45,6%*	*-43,4%*
MAX	*3,82*	*12,7%*	*25,0%*	*38,8%*	*53,7%*	*66,7%*	*80,6%*	*102,9%*	*120,1%*
Mean	*1,52*	*0,8%*	*2,3%*	*4,6%*	*9,5%*	*14,5%*	*19,7%*	*25,4%*	*31,6%*
Median	*1,54*	*1,2%*	*2,9%*	*5,0%*	*11,2%*	*16,0%*	*20,1%*	*26,9%*	*33,4%*
Variance	*1,49*	*0,2%*	*0,5%*	*1,1%*	*2,5%*	*4,1%*	*6,0%*	*8,2%*	*11,4%*
Slope	\	-0,0019	-0,0051	-0,0073	0,0008	0,0139	0,0315	0,0528	0,0847
Intercept	\	0,0106	0,0305	0,0577	0,0939	0,1219	0,1457	0,1680	0,1761
R2	\	0,0029	0,0072	0,0068	0,0000	0,0061	0,0211	0,0439	0,0831
Correlation	\	-0,0534	-0,0850	-0,0824	0,0056	0,0778	0,1453	0,2095	0,2883
P-value	\	0,2682	0,0787	0,0894	0,9094	0,1138	**0,0033**	**0,0000**	**0,0000**

Table 3 shows that the relationship between yield spreads and subsequent stock returns is largely nonexistent or relatively weak. Correlation coefficients for up to 18 months are basically zero, suggesting that the movement of these two variables is uncorrelated. Only for the 24-36 holding periods there is an increasing, albeit relatively weak association, with correlation coefficients going from 0,145 to 0,288. The relationship for these longer time periods is statistically significant (p-value < 0.05), but probably of little practical use, since the r-squared (coefficient of determination) is very low. Only 2,11% to 8,31% of subsequent stock return variations in holding periods of 24 to 36 months can be explained by the yield curve spread.

In the next part of the analysis, the 12-month MA yield spread will be used instead of the current spread, because it will be tested whether the smoothing of term spread volatility can enhance and/or give additional insights about subsequent stock returns. For this purpose, the exact same methodology was employed as in Tables 1 to 3, only substituting the current spread with the MA spread. First, the MA spread has been divided in different ranges and stock returns were calculated for the designated holding periods, as shown in Table 4.

Table 4: MA Spread Ranges and 1 to 36-month S&P Price Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Lower Range	Upper Range	Average Return Holding Period (in months)							
MA Spread (%)		1	3	6	12	18	24	30	36
	<0	*-0,3%*	*0,2%*	*-1,6%*	*-7,2%*	*-21,2%*	*-27,5%*	*-19,8%*	*-15,0%*
>=0	<1	*1,0%*	*2,5%*	*4,8%*	*7,8%*	*11,1%*	*13,5%*	*12,4%*	*13,1%*
>=1	<2	*0,9%*	*2,6%*	*5,0%*	*11,2%*	*19,2%*	*27,2%*	*36,4%*	*41,0%*
>=2	<3	*0,6%*	*2,1%*	*4,9%*	*12,3%*	*19,7%*	*26,9%*	*34,7%*	*43,8%*
>=3		*0,8%*	*2,3%*	*5,2%*	*8,9%*	*11,4%*	*17,6%*	*27,8%*	*40,1%*

highest return in holding period

second highest return in holding period

lowest return in holding period

second lowest return in holding period

Negative MA spreads are followed by negative returns in all holding periods bar one, which is similar as when current spreads were employed, but more consistent in hinting at expected losses for stock investors. Positive MA spreads are associated with positive stock returns, and the highest average returns are generated when the MA spread is relatively normal, i.e. when it ranges from 1 to 3%, much like with the current spread analysis in Table 1.

Next, the MA spread will be tested whether it is increasing or decreasing. The criterion is the same as previously mentioned: if the current spread is above its 12-month MA it is increasing, if it is below the MA the spread is decreasing. The results are given in Table 5.

Table 5: MA Spread Ranges, YC Trend, and 1 to 36-month S&P Price Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Lower Range	Upper Range	Trend	Average Return Holding Period (in months)							
MA Spread (%)		Spread >= MA	1	3	6	12	18	24	30	36
	<0	1	*-1,0%*	*-1,5%*	*-9,0%*	*-15,3%*	*-38,4%*	*-32,9%*	*-22,9%*	*-20,1%*
>=0	<1	1	*1,1%*	*2,5%*	*5,3%*	*8,0%*	*10,7%*	*13,0%*	*13,4%*	*18,8%*
>=1	<2	1	*0,4%*	*1,0%*	*0,5%*	*6,8%*	*14,0%*	*20,3%*	*31,1%*	*34,9%*
>=2	<3	1	*0,6%*	*1,3%*	*3,8%*	*9,7%*	*17,2%*	*22,6%*	*28,3%*	*36,3%*
>=3		1	*0,4%*	*0,4%*	*2,2%*	*10,2%*	*10,1%*	*14,5%*	*21,8%*	*36,1%*
	<0	0	*0,2%*	*1,4%*	*5,1%*	*1,9%*	*-2,1%*	*-21,4%*	*-16,5%*	*-9,2%*
>=0	<1	0	*1,0%*	*2,6%*	*4,3%*	*7,6%*	*11,5%*	*14,0%*	*11,3%*	*8,2%*
>=1	<2	0	*1,4%*	*3,8%*	*8,5%*	*14,5%*	*23,4%*	*32,4%*	*39,7%*	*44,7%*
>=2	<3	0	*0,5%*	*2,7%*	*5,9%*	*14,4%*	*21,8%*	*30,4%*	*39,9%*	*49,9%*
>=3		0	*1,1%*	*3,7%*	*7,3%*	*7,9%*	*12,3%*	*19,9%*	*32,1%*	*43,0%*

highest return in holding period

second highest return in holding period

third highest return in holding period

lowest return in holding period

second lowest return in holding period

third lowest return in holding period

Here, the results from Table 2 are confirmed: the lowest returns on most investment horizons were recorded when the spread was negative, irrelevant of the fact whether the spread trend is decreasing or increasing. Again, the absolute worst returns are experienced when the spread is negative, but increasing, after the Fed pivot. Additionally, when using the MA spread instead of the current spread, returns are more consistently negative, sending a clearer signal to stock investor when to start abandoning their positions.

When the MA spread is positive, all holding periods recorded exclusively positive returns, and these were also more stable than the results obtained with the current spread. Otherwise, the findings in Table 5 and Table 2 are very similar: returns are consistently higher when the spread is positive but decreasing, than when it is positive but increasing, meaning that stock returns are highest when the yield curve flattens throughout the early and mid-part of the business cycle.

A regression analysis was also performed, with stock returns in different holding periods as dependent variables and the MA spread as the independent variable. The results are summarized in Table 6.

Table 6: Basic Statistics of the MA Spread and S&P Price Returns (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

Measures		Average Return Holding Period (in months)							
f	MA Spread	1	3	6	12	18	24	30	36
MIN	*-0,91*	*-16,9%*	*-30,1%*	*-42,7%*	*-44,8%*	*-50,1%*	*-47,7%*	*-45,6%*	*-43,4%*
MAX	*3,52*	*12,7%*	*25,0%*	*38,8%*	*53,7%*	*66,7%*	*80,6%*	*102,9%*	*120,1%*
Mean	*1,59*	*0,8%*	*2,3%*	*4,6%*	*9,5%*	*14,5%*	*19,7%*	*25,4%*	*31,6%*
Median	*1,52*	*1,2%*	*2,9%*	*5,0%*	*11,2%*	*16,0%*	*20,1%*	*26,9%*	*33,4%*
Variance	*1,16*	*0,2%*	*0,5%*	*1,1%*	*2,5%*	*4,1%*	*6,0%*	*8,2%*	*11,4%*
Slope	\	-0,0003	0,0012	0,0067	0,0242	0,0442	0,0682	0,0980	0,1331
Intercept	\	0,0081	0,0207	0,0355	0,0554	0,0720	0,0846	0,0921	0,0914
R2	\	0,0000	0,0003	0,0046	0,0258	0,0530	0,0863	0,1320	0,1756
Correlation	\	-0,0065	0,0185	0,0679	0,1606	0,2303	0,2938	0,3633	0,4190
P-value		0,8929	0,7024	0,1621	**0,0010**	**0,0000**	**0,0000**	**0,0000**	**0,0000**

The major difference in using either the MA spread or the current spread (as in Table 3) is that the relationship between the MA spread and subsequent stock returns is stronger. Admittedly, in the short-term of 1 to 6 months the correlation coefficients are low and statistically insignificant (p-value > 0.05). But starting from 12 months onwards, correlation coefficients increase with the length of the holding period from 0,16 to 0,419 and are also statistically significant (p-value < 0.05). This is a notable improvement and implies that the 12-month MA spread is perhaps a better tool for assessing subsequent returns than the current spread (especially for time frames from 12 months and longer). Still, one needs to be careful about the implementation of such a finding. Even the highest correlation coefficient in the 36-month holding period of 0,419 does not indicate a particularly strong relationship between the MA spread and stock returns. This can be also seen in the relatively low value of r-squared, which is 0,1765 for this period, meaning that on average only 17,65% of subsequent 36-month stock returns can be explained by the variations in the MA term spread.

5. Conclusion

Being invested in stocks when the yield curve turns negative seems like a bad proposition historically: from 1988 through 2023 returns were generally well below average or even negative for holding periods of up to 36 months. Returns were even worse when the term spread was negative but increasing, suggesting that stocks should be avoided (at least in the short- to medium-term) after the so-called Fed pivot, when the central bank starts a new cycle of lowering interest rates. However, the clear

conclusion that active market participants should exit their stock positions after the yield curve inverts, is being questioned with recent reality. As the time of this writing at the start of 2024, the yield curve has been negative for 15 straight months (from October 2022 through December 2023). Equity price returns of 23% in this period are nothing short of outstanding. It still remains to be seen if longer holding periods of 24-36 months will maintain such stellar performance. Also, sometime in 2024 the Fed will most likely lower interest rates for the first time since 2019, shifting from extraordinary monetary tightening in 2022-23 to a more moderate monetary policy. This Fed pivot point has historically been very unfavorable for stock returns, so the market is not yet in the clear.

On the flip side, a positive yield curve is typically followed by positive stock returns in mostly all examined investment horizons. And since the yield curve is positive most of the time, just holding stocks throughout this is probably the best advisable course of action. Average returns were even higher when the yield curve was positive and normal: i.e. when the spread between long-term and short-term rates was around 1-3%. More so, the highest returns were recorded when the term spread was normal and decreasing - in other words, when the economic and stock market recovery was well underway and when the steep yield curve gradually started to flatten and normalize. From a market timing perspective, this looks like the best set-up to enter positions.

There is no significant statistical relationship between the yield curve spread and stock market returns in the short term, and the association in longer time frames is at best moderate, although it does seem to increase with the expansion of holding periods. In this regard, using the 12-month MA spread instead of the current spread is perhaps worth further investigating, since it produces more consistent and statistically significant returns (especially for time frames of 12 months and longer).

This study, of course, is not without its limitations. The time period covered only the last 35 years, while future research could benefit from a more extended timeline, which could improve the robustness of the findings. Also, the primary reason for focusing exclusively on the US was the pure size of the American capital market: its share is 40% of the global market. But additional confirmation might be gained by examining the yield curve-stock returns relationship on multiple international markets. Lastly, the comprehensiveness of this research could be further enhanced by testing different lookback periods for the moving average trend of the current spread. The 12-month window seams of adequate length to smooth the yield curve line, but different lookback periods tested for an extended time horizon on more international markets might give a better insight about the relationship examined in this paper.

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Appendix

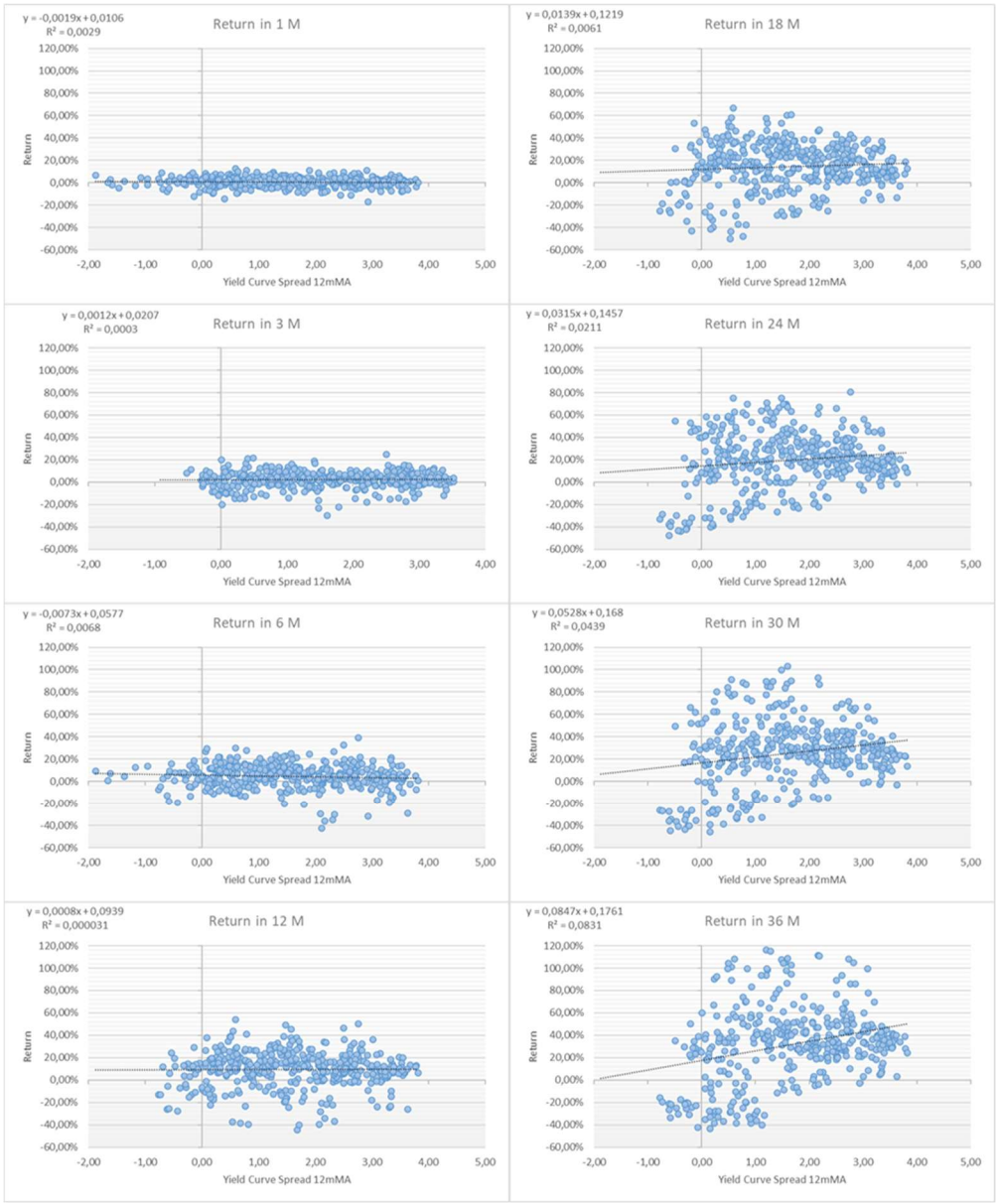

Figure 2. Scatter Plot and Regression Line – S&P 500 Price Returns in 1-36month holding periods and YC Spreads 1988-2023 (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)

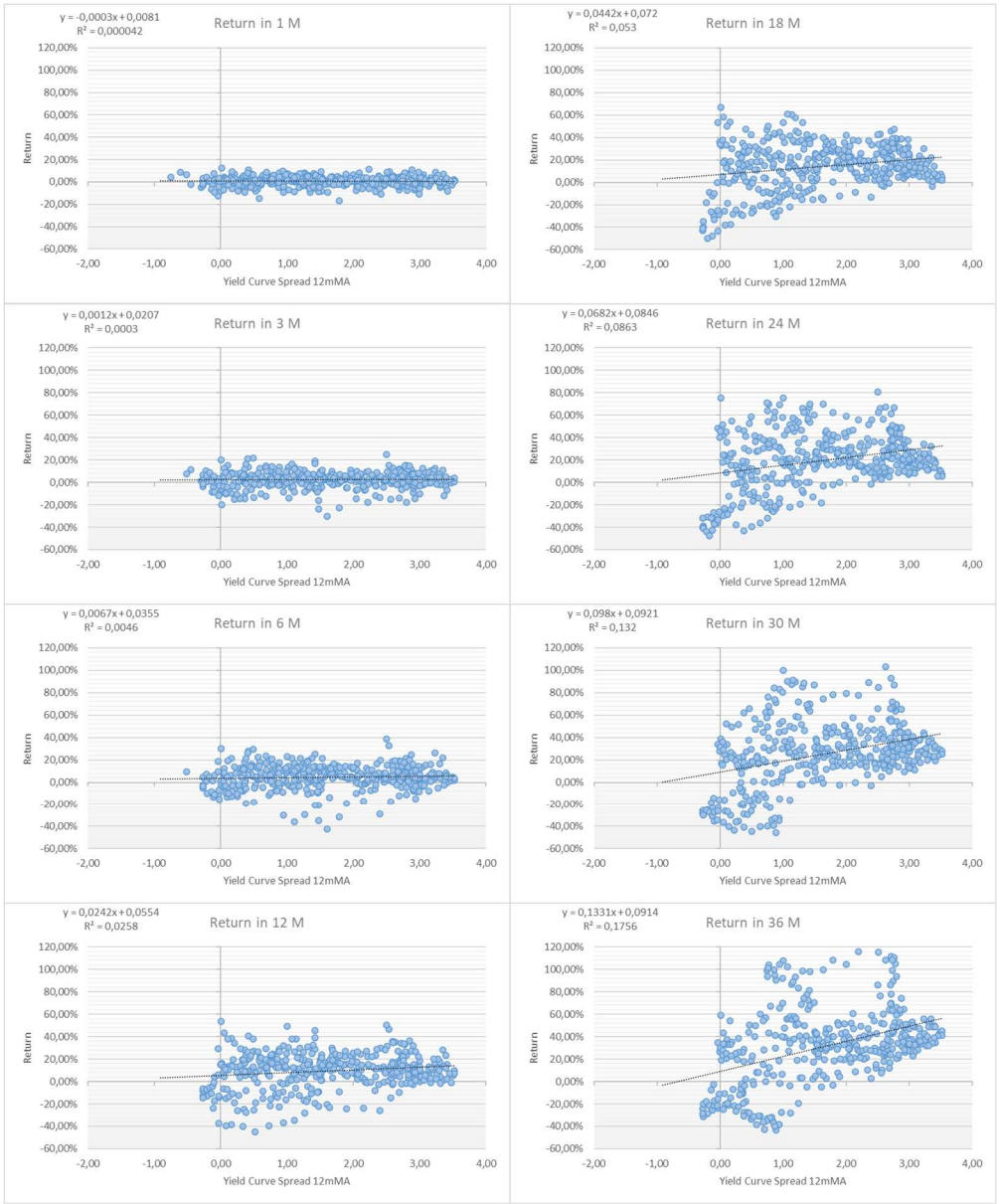

Figure 3. Scatter Plot and Regression Line – S&P 500 Price Returns in 1-36 month holding periods and MA Spreads 1988-2023 (source: author's calculation based on data from https://www.investing.com/ and https://fred.stlouisfed.org/)