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A FLAT YIELD CURVE STRATEGY FOR LEVERED PROFUNDS

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ABSTRACT

The purpose of this paper is to illustrate how important the yield curve is to stock index price movements. Simple yield curve based strategies are proposed that provide investment returns that far exceed the Nasdaq 100 index and virtually all mutual funds in the seven year study (a greater than 32500% return apparently results). While conclusive cause and effect evidence is not provided (there are curvilinear relationships involved), the results suggest that a yield based investment strategy is particularly effective when the yield curve is nearly flat, positively or negatively. More research to demonstrate cause and effect using curvilinear techniques is certainly encouraged before any investor puts money at risk using the tested strategies.

Many financial professionals recommend that their clients seek capital appreciation by buying and holding a diversified portfolio of stocks and other asset classes for intervals lasting several years. Simply stated, their logic is that a buy-and-hold diversification strategy will provide positive returns while reducing risk and the transaction costs that would be incurred if investors tried to "time the market". However, economists have long recognized that an inverted yield curve (one where short-term yields exceed long-term yields on United States government securities) is generally associated with reduced bank lending, reduced stock market prices, and often economic recession. This paper provides a preliminary analysis of the impact of the yield curve on a volatile index designed to encourage further empirical research. The results illustrate how the sign and flatness of the yield curve apparently influence NASDAQ 100 index values. The yield curve is a plot of a few interest rates against the duration of the associated interest-bearing debt instruments (http://www.smartmoney.com/onebond/index.cfm?story=yieldcurve). In a growing economy, short-term interest rates are generally lower than long-term interest rates because holders of long duration debt securities require a higher return than holders of short duration debt securities to offset the increased likelihood of inflation.

THEORY

The Federal Reserve Board Open Market Committee (FOMC) is charged with balancing the conflicting objectives of price stability and positive economic growth. Price stability is especially important to retired or disabled people on fixed incomes because inflation erodes the buying power of their income and they are less able to earn more to afford the necessities of life. Moreover, inflation is like an insidious tax to working people and investors because it erodes the buying power of wages and investment income as it increases individual's tax burden through "bracket creep".

Positive economic growth, on the other hand, is important because many people may feel their jobs and incomes are jeopardized by a stagnant or contracting economy.

When economic growth exceeds productivity, there is a risk that price inflation may eventually exceed 3% per year. In that circumstance, the FOMC is likely to raise the targeted Fed Funds and Discount Rates and to announce its bias is to be concerned about inflation. To avoid destroying consumer confidence, the FOMC usually acts in a series of small "measured" steps until the economy slows to a growth rate it can sustain without 3% or greater inflation. An increase in short-term interest rates serves to reduce the level of business activity thereby reducing the demand for goods and services and inflation. Moreover, as short-term rates increase, long-term rates generally increase at a lower rate because lenders do not need as high an interest rate to earn a satisfactory real rate of return when the risk of inflation is being constrained. When the FOMC raises short-term rates several times consecutively to slow the economy, the yield curve can become inverted (meaning short-term rates exceed long-term interest rates) relatively quickly because investors are likely to sell some economically sensitive assets such as stocks before their returns precipitously decline in order to buy bonds that yield high real returns during a period of declining inflation risk.

A trough in the economic cycle may last a long time if corporations wait to see if consumers resume spending before resuming capital investment programs. In turn, stock market investors may wait for profits to improve before they shift funds from debt instruments into stocks. Lags occur between occasions when the FOMC cuts rates and the time that business activity, consumer spending, and stock prices increase. The lags make it difficult to predict the duration of the trough after the FOMC has put on the brakes. However, two economists at the New York Federal Reserve Bank published a study that indicates the probabilities of recession *nine months* following various levels of the yield curve spread between 10-year and 3-month US Treasury securities (Estrella and Mishkin, 1986) with large negative yield curve differences associated with high probabilities of subsequent recession. Cleveland Fed economists (http://www.clev.frb.org/Research/Et96/0196/yiecur.htm) observe that the spread between the 10-year Treasury note and Fed Funds has averaged nearly 100 basis points in non-recession years since 1954. They also observe "Nearly all post-1950s recession were preceded by significant declines in the difference between, for instance, the 10-year Treasury rate and the fed funds rate. In all but one instance, this spread was actually negative prior to the downturn."

Collectively, this yield curve information suggests a simple trading strategy for personal investment. If an inverted yield curve is associated with a slowing economy and reduced corporate cash flow and profit expectations, it follows that an investor should invest "short" to profit during the expected decline of stock market prices. On the other hand, if the slope of the yield curve is positive, an investor should invest "long" to profit as stock market prices are expected to increase. A refinement is suggested by observing the relationship between Standard and Poors 500 stock index prices and the yield curve on the "Dynamic yield curve" function shown at http://stockcharts.com/charts/YieldCurve.html . Prices apparently spike upward just before the yield curve slope changes from slightly positive to flat. Then, when the yield curve becomes negative, prices fall precipitously. Accordingly, I theorize that most index price movement may take place when the yield curve is relatively flat.

METHODOLOGY

I model the daily independent variable that I call the "yield curve difference reciprocal" (YCDR) in three steps. First, I compute the yield curve difference by subtracting the average of the 3-month Treasury-bill rate and the 5-year Treasury note rate from the 10-year Treasury note rate.

Second, to include a nine-month lag (Estrella and Mishkin, 1986) if and only if the FOMC has been reducing the Fed Funds rate, I subtract from the average yield curve difference of the last four days the difference between the Fed Funds rate of 198 days past and today's Fed Funds rate (9 months x approximately 22 trading days per month equals 198 days). On the other hand, if the Fed Funds rate of 198 days past is less than the Fed Funds rate of today, I simply use the average yield curve difference of the last four days. Third, and finally, to calculate the YCDR, I take the reciprocal of the value determined in step two. I take the reciprocal because a barely positive yield curve is plausibly associated with steeply rising stock prices and a barely negative yield curve is plausibly associated with steeply falling stock prices. The reciprocal makes tiny fractions into large values. omputing YCDR requires four interest rates. The Fed Funds data are available on the Internet at the Federal Reserve Bank of New York Internet website at http://www.ny.frb.org/markets/omo/dmm/fedfundsdata.cfm .

The 3-month (^IRX), 5-year (^FVX), and 10-year (^TNX) rates are available for download at Yahoo Finance at http://finance.yahoo.com/q?s=^IRX&d=t, http://finance.yahoo.com/q?s=^FVX&d=t, and http://finance.yahoo.com/q?s=^TNX&d=t or at http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield.html . The Profund Net Asset Values (NAV) for the UOPIX and USPIX mutual funds are available for download at https://www.profunds.com/prices/historical.asp .

I model the dependent variable with the daily return of a levered long and a levered short mutual fund. The first is the Ultra OTC fund (UOPIX) which is designed to provide approximately twice the daily return of the Nasdaq 100 (NDX) stock market index. The second is the UltraShort OTC fund (USPIX) which is designed to provide approximately twice the inverse of the daily return of the Nasdaq 100 index (NDX). The NDX represents the return of the largest (in terms of market valuation) 100 stocks traded on the NASDAQ exchange. Thus, if the NDX increases 1% today, the UOPIX net asset value (NAV) will increase approximately 2% and the USPIX net asset value will decrease approximately 2 percent. Both funds are in the Profunds mutual fund family that facilitates trading by not charging transaction costs when trades are made. (Transaction costs and fund management fees are collected over the course of the year regardless of the extent of an individual investor's interfund trading). I use levered funds rather than unlevered funds because a levered fund strategy, if viable, should return higher compounded returns. The time frame for the study is the seven year period from June 1, 1998 through May 31, 2005.

For comparison, I report sets of return results and selected statistics for five independent variable strategies. First, I assume buy-and-hold investment in the UOPIX for the entire seven-year period. Second, I assume investment in UOPIX only when the prior day's YCDR is positive and assume a return of 0 when YCDR is not positive. Third, I assume investment in the USPIX only when the prior day's YCDR value is negative and assume a return of 0 when YCDR is not negative. Fourth, I assume investment in UOPIX when the prior day's YCDR value is positive and investment in USPIX when the prior day's YCDR value is negative. Fifth, to illustrate how much of the results

relate to those times when the yield curve is relatively flat, periods when the absolute value of YCDR is relatively large, I assume investment in UOPIX only on those days when the value of the prior day's YCDR is greater than .73 (an optimized value selected using trial and error), investment in USPIX only on those days when the value of the prior day's YCDR is less than -.073, and no investment otherwise. Finally, to compare to the active strategy results with the passive buy-and-hold strategy using the NDX index, I report cumulative and compounded returns assuming investment directly in the NDX (an optimistic standard as index fund N.A.V.s generally yield lower returns than the index because of fund incurred transaction costs and fund management fees).

RESULTS

Correlations and selected statistics for the five active strategies are provided in Table 1.

Table 1. Correlations and Statistics

Statistics	UOPIX Returns	UOPIX when YCDR > 0	USPIX when YCDR < 0	UOPIX if YCDR>0; USPIX if YCDR<0	UOPIX if YCDR>0.73; USPIX if YCDR<-.73
Correlation with YCDR	0.001701	-0.01337	-0.0299	-.01767	-0.02141
Mean	0.000625	0.002470	0.001775	0.004245	0.004255
Standard Error	0.001218	0.000950	0.000765	0.001218	0.001039
Median	0.002225	0	0	0.038935	0
Mode	0	0	0	0	0
Standard Deviation	0.051106	0.039881	0.032117	0.051120	0.043607
Sample Variance	0.002612	0.0015905	0.001032	0.002613	0.001902
Kurtosis	3.288074	3.292236	24.170495	3.580197	8.108582
Skewness	0.354935	0.381764	-0.701860	-0.113130	-0.18953
Range	0.604087	0.443483	0.595734	0.602632	0.602632
Minimum	-0.22747	-0.227470	-0.386620	-0.386620	-0.38662
Maximum	0.376616	0.216912	0.209115	0.206012	0.216012
Observations	1761	1427	334	1761	1761
Confidence Level(95.0%)	0.002389	0.001863	0.001501	0.002389	0.002038
Number of Gains	934	784	184	968	856
Percentage Gains if Invested	53.0%	54.9%	55.1%	55.0%	57.7%
Sum of Returns	110.12%	435.00%	312.61%	747.61%	749.35%
Average Return	0.06%	.30%	0.94%	0.42%	0.88%
Compounded Return	-69.41%	1828.25%	793.39%	17126.73%	32569.15%

Assuming investment in the UOPIX for the seven year period, the number of gains in that sample of returns was 934 making the percentage of gains 53.0%. The average return was .06% and the standard deviation was .0511. The compounded return over the seven years is -69.41% reflecting the impact of the recent bear market on buy and hold returns. Timing of gains and losses affects compounded returns. There were 40 months in the 84 month sample with positive compounded returns. In comparison, the seven year return on the Nasdaq 100 was 29.4%.

Assuming investment in UOPIX only when the value of the prior day's YCDR value was positive, and a zero return otherwise, there were 1427 trading days that funds were at risk in the seven year time interval. Among the days that funds were at risk, there were 784 gains, or 54.9% gains. The average return was 0.30% with a standard deviation of .0399. The compounded return over the seven years was now 1828.25% reflecting fewer large losses in the bear market. There were 42 months in the 84 month sample with positive compounded returns.

Assuming investment in USPIX only when the value of the prior day's YCDR value was negative, and a zero return otherwise, there were 334 trading days that funds were at risk in the seven year time interval. Among the days that funds were at risk, there were 184 gains, or 55.1% gains. The average return was 0.94% with a standard deviation of .0321. The compounded return over the seven years was now 793.39% reflecting large short gains in the bear market. There were 15 months in the 84 month sample with positive compounded returns (however, several months had 0% returns).

Assuming investment in UOPIX when the prior day's YCDR was positive and USPIX only when the prior day's YCDR negative, and a zero return otherwise, there were 1761 trading days that funds were at risk in the seven year time interval. Among the days that funds were at risk, there were 968 gains, or 55.0% gains. The average return was 0.42% with a standard deviation of .0511. The compounded return over the seven years was now 17126.73%. There were 50 months in the 84 month sample with positive compounded returns.

Assuming investment in UOPIX when the prior day's YCDR was greater than 0.73 and USPIX only when the prior day's YCDR was less than -0.73, and a zero return otherwise, there were 856 trading days that funds were at risk in the seven year time interval, all of which preceded January 2, 2002. Among the days that funds were at risk, there were 494 gains, or 57.7% gains. The average return was 0.88% with a standard deviation of .0436. The compounded return over the seven years was 32569.15%. The sum of the returns between June 1, 1999 and March 31, 2000 (22 months) was 232.60%. The sum of the returns between April 1st, 2000 and December 31, 2001 (20 months) was 516.75%. There were 34 months among the 43 months when funds were at risk with positive compounded returns (79%). In comparison, for the Nasdaq 100 (NDX), the sum of the returns between June 1, 1999 and March 31, 2000 (22 months) was 143.39%. The sum of the NDX returns between April 1st, 2000 and December 31, 2001 (20 months) was -74.19%. Finally, the sum of the NDX returns from January 2, 2002 to May 31, 2005 was 12.44%. The seven year return on the Nasdaq 100 was 29.4%. There were 45 months among the 84 month period with positive compounded returns (53.6%).

The return results suggest that the reciprocal of the slope of the yield curve difference is a much better predictor of the trend in stock prices when the yield curve slope is nearly flat, whether positive or negative (YCDR > 0.73 or YCDR < -0.73). Including more steeply sloped observations

in the strategy (-0.73 < YCDR < 0.73) only dissipates the timing benefits as shown by the reduced returns.

CONCLUSION

This paper offers a simple, prescriptive model that investors could implement in about 1 hour per day that plausibly could provide above market returns with below market risk when the yield curve is nearly flat. The bond markets close at 3:00 PM Eastern Standard Time so the analysis and transactions should be performed on a trading day between 3:00 PM and 3:55 PM E.S.T., the cut-off time when Profunds ceases to process mutual fund transactions through the Internet.

REFERENCES ON REQUEST

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