THE IMPACT OF YIELD SLOPE ON STOCK PERFORMANCE

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ABSTRACT

This study investigated the linkage between the effects of yield slope and the performance of stocks for the period, 2006-2012. The paper found a significant link between the two variables. The sharp increase of yield slope positively affected stock market performance of small, mid and big cap stocks examined. When 12 month lagging effects were considered, the linkage was statistically significant at 2% level of 2-tailed test for all sample groups of stocks. **JEL classification:** G11

INTRODUCTION

Given an opportunity to make a profitable investment, investors are assumed to exercise due diligence in identifying good investment opportunities by comparing opportunities in light of relative performance and risk. Due diligence enables investors to pinpoint assets that provide adequate returns based on their risk tolerances. Changes attributed to the economy, relative performance of investments, investors' goals, lifestyles, responsibilities, risk tolerances, etc. compel investors to make tactical decisions about the allocation of funds among individual investments and investment classes. It is not unusual for investors to sell an individual stock because of changes in the economy. Correspondingly, it is not unusual for investors to prefer one asset group over another depending on the economic environment.

This paper attempts to find a link between the small, mid, and big cap stock groups and the different degrees of yield slope during the period, 2006-2012. The second half of the sample period is unique in that US stock market in general experienced relatively excellent performance. For example, during the period between January 2, 2009 and August 24, 2012, S&P 500 index gained 51.4% (having risen from 931.80 to 1,411.13), or 12.1% annualized average, which was much better than the historical norm of 7.2% annualized average holding period yield of last 62 years between 1950 to 2011. The stock performance during the 2009-2012 period is impressive in that the previous three years and eight months (May 2, 2005 to Dec 31, 2008) experienced a dramatic decline in stock performance. For example, the S&P 500 index declined

from 1,162.16 to 903.25 that resulted in a loss of 22.3%, or -4.9% annualized average.

A yield curve shows the relationship between interest rates and maturities of the debt instruments. Long-term interest rates are normally higher than short-term interest rates, making the yield curve upward sloping. According to expectations hypothesis, an inverted or flatter sloping yield curve means short-term rates are expected to rise less than normally. Therefore, an inverted or flattening yield curve is an indication of sluggish economy on the horizon.

Some investors expect that big cap stocks outperform mid or small cap stocks when the yield curve is inverted or flatter sloping. Rational investors may perceive that larger firms will be better able to weather economic downturns than smaller firms. The perception may be based on the assumptions that, in general, larger firms: 1) have better access to capital, 2) are more diversified than smaller firms, and 3) have benefits of economies of scale.

On the other hand, some investors believe that smaller cap stocks are preferred over larger cap stocks when the yield curve slope steepens. This belief could be based on the expectation that steeper yield curves could precede an economic recovery. Some investors believe that small firms tend to outperform larger firms during economic recovery. The perception is based on the assumptions that, small firms under economic recovery: 1) are more sensitive to immediate availability of cheaper capital, 2) can adapt and adjust their business quicker, and 3) can take advantage of greater creative business opportunities.

Do yield curve slopes impact the performance of stocks of different market capitalization? Even though there has been a great deal of discussion of cyclical nature of stock performance in terms of small firm effect, there has been no specific attention paid to the degree of yield slope with respect to a possible link to different degrees of stock performance. The findings of this study not only could shed some light on a possible link to the cyclical nature of the small firm effect, but also could help us understand a possible big firm effect associated with a flatter yield slope.

The remainder of the paper is organized as follows: the Literature Review section takes up the review of relevant research papers; the Research and Investigative Questions section deals with the primary issues with specific focuses; the Methodology and Data section explains formulas for operational definitions, statistical methods and data used; the Test Results and Findings section explains the quantitative answers to the investigative questions; the Conclusion section summarizes the paper.

LITERATURE REVIEW

A conspicuous small firm anomaly, or the small firm effect, has been documented in efficient market research. Strong (2006) explains the small firm anomaly as follows: the theory of the small firm effect maintains that investing in firms with low market capitalization (the number of outstanding shares multiplied by the current stock price) will, on average, provide superior risk-adjusted returns. The small firm anomaly was well documented by Banz (1981).

A yield curve slope is a graphical display of levels of yield on the vertical dimension with different maturities on the horizontal dimension for interest rate securities by the same issuer. An example of the yield curve slope is the difference between a long-term Treasury bond rate and a short-term Treasury bill rate.

Yu (2007) examined historical price data of small cap proxies such as Russell 2000 Index. He found that small cap stocks in general outperformed large cap stocks in the late 1970s, early 1980s and early 1990s, but not during the following periods: 1984-87, 1989-90, and 1995-99. However, the superior performance of small cap stocks recurred in the period 2000-2005. Yu, Fuller, and Didia (2008) examined the inverted yield curve and stock market performance during the period 2005-2007. They found that on average, small and mid-cap stocks outperformed big cap stocks before the yield curve was inverted. But, big cap stocks outperformed both small and mid-cap stocks during the period of inverted yield curve. In particular, the biggest cap stock cluster performed best when the yield curve was inverted.

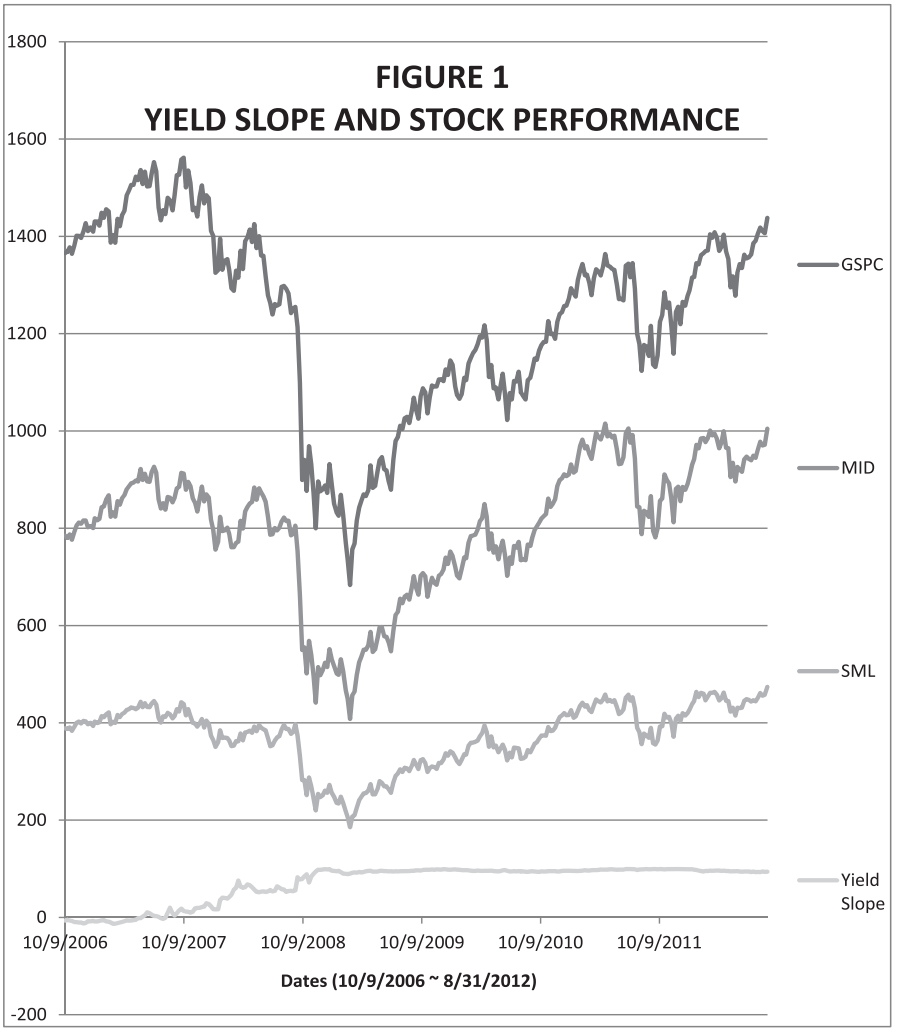
Historically, the slope of the yield curve has demonstrated the power of predicting future changes in real output of economy. Estrella and Harouvelis (1991) used the quarterly sample of 10-year Treasury bond rates, 3-month Treasury bill rates, and real GNPs from 1955 through 1988 to observe that the forecasting accuracy of SPREAD (the difference between the 10-year T-bond and 3-month T-bill rates) in predicting the real GNP was highest 5 to 7 quarters ahead. In particular, an inverted yield curve has been considered as an indicator of a pending economic recession. Estrella and Trubin (2006) found that if the spread was calculated from ten-year and three-month bond equivalent rates, an inversion (even a slight one) had been a simple and historically reliable benchmark for predicting recessions in real time. Estrella and Trubin (2006) showed that yield curves were inverted twelve months before each recession from 1968 through 2006, with the estimated, matched probability of recession exceeding 30 percent.

RESEARCH AND INVESTIGATIVE QUESTIONS

Considering the significant link between yield curve slopes and the economic conditions suggested in the literature, this paper attempts to find the effects of yield slope on stock groups of different sizes of capitalization. The primary research question of this paper is: Do the effects of yield curve slope on performance differ among stock groups of different cap sizes? This is an issue that has not been examined in the literature, so this research attempts to fill the void. In order to answer this research question, this paper addresses the following specific investigative questions:

1) Is the performance of big cap stocks during the period of flatter yield slope significantly different from the performance during the period of steeper yield slope?
2) Is the performance of mid cap stocks during the period of flatter yield slope significantly different from the performance during the period of steeper yield slope?
3) Is the performance of small cap stocks during the period of flatter yield slope significantly different from the performance during the period of steeper yield slope?
4) Is there any particular stock group that outperformed significantly during either the period of flatter yield slope or the period of steeper yield slope?

The degrees of significance levels found in response to these questions could validate the superior performance of particular group(s) of stocks compared to the performance of others during different stages of yield slope as shown in Figure 1, which displays historical trends of three stock index groups, big, mid, small cap stock indexes along different stages of yield slope.



Note:
GSPC = S&P 500 index (the top line chart)
MID = S&P 400 MidCap index (the second line chart)
SML = S&P Small Cap 600 index (the third line chart)
Yield Slope = (YS/TEN)*100, where
YS = Yield Spread based on 10-year U.S. Treasury bond rate minus 3-month U.S. Treasury bill rate;
TEN=10-year U.S. Treasury bond rate;
100 = Multiplication factor to convert a fraction to a percentage.

METHODOLOGY AND DATA

Using the differences between the rates of 10-year U.S. Treasury bonds and 3-month U.S. Treasury bill rates as measures of yield spreads, this study premises that yield spreads and firm size affect performance of stocks. This study uses the daily data from three market indices, 1) S&P 600 Small Cap, 2) S&P 400 Midcap, and 3) S&P 500 as proxies of small cap, mid cap, and large cap stocks, respectively.

The holding period yield at time t (HPYt) in the study is defined as follows:

$$HPY_t = (V_t / V_{t-1}) - 1 \quad (1)$$

where V_t = Value of Index or Stock at time t;
V_t-1 = Value of Index or Stock at time t-1.

This study's null hypothesis is that there are no significant differences in the effects of different degrees of yield slope on performance of small, mid and big cap stocks during the sample period of 2006-2012. This would imply that the market perceives the effects of yield slope as neutral. The alternative hypothesis is that there are significant differences in the effects of yield slope on performance of small, mid and big cap stocks during the sample period. This would imply that steeper yield slope would have caused differential relationships on stock groups of different market capitalization. Since the difference could be either positive or negative, two-tailed significance tests are conducted.

This study uses Standard & Poor's indices: S&P Small Cap 600, S&P 400 MidCap, and S&P 500. Index Methodology (2007) describes these three indices as follows:

1. The S&P 500 focuses on the large-cap sector of the market; however, since it includes a significant portion of the total value of the market, it also represents the market. Companies in the S&P 500 are considered leading companies in leading industries. Firms with unadjusted market capitalization of US$5 billion or more are included in the S&P 500.
2. The S&P MidCap 400 represents the mid-cap sector of the market. Firms with US$ 1.5 billion to US$5.5 billion are included in the S&P MidCap 400.
3. The S&P Small Cap 600 focuses on small-cap sector of the economy. Firms with market capitalization from US$300 million to US$2 billion are included in the S&P Small Cap 600.

The yield slope, slope of yield curve, is defined as follows:

$$\text{Yield Slope} = (YS/TEN)*100 \quad (2)$$

where YS = Yield Spread based on 10-year U.S. Treasury bond rate minus 3-month U.S. Treasury bill rate;
TEN=10-year U.S. Treasury bond rate;
100 = Multiplication factor to convert a fraction to a percentage.

In search of a more conspicuous impact of yield curve slopes on stocks of different sizes of capitalization, this study uses judgmental samples of 12 smallest cap stocks (SMALLEST), 12 middle cap stocks (MIDDLE), and 12 biggest cap stocks (BIGGEST). More specifically, the SMALLEST group includes twelve

stocks of smallest market capitalization between $501,872,433 and $507,200,794 among 6,500 stocks. The MIDDLE stock cluster consists of twelve stocks of middle market capitalization between $4,419,017,438 and $ 4,483,792,544 among 6,500 stocks. The BIGGEST group represents twelve stocks of biggest market capitalization between $188,933,939,179 and $637,848,538,640 among 6,500 stocks.

All thirty-six sample stocks are cluster groups screened from 6500 stocks by the stock screener program of Wall Street Journal website on September 8, 2012. It is noteworthy to mention that the SMALLEST cluster group used in the sample was the cluster group of smallest cap stocks with all 308 weeks of data available. Some in the initially screened stocks are dropped from selection due to the fact that some of the stocks in the smallest cluster do not have historical data back to 2006. So, only those stocks with sufficient historical data all the way back to October 9, 2006 are selected. Some of stocks in MIDDLE cluster group which do not have sufficient historical data were also dropped. Therefore, the SMALLEST and the MIDDLE stock clusters consist of seasoned stocks only. The BIGGEST cluster group in the sample is the top 12 big cap stocks screened from the pool. Included in the sample, AAPL (Apple, Inc.) is the largest cap stock with capitalization of $637,848,538,640. On the other hand, NEWP (Newport Corporation) is the smallest cap stock with capitalization of $501,872,433.

Wilcoxon Matched Pairs Signed Ranks Test

This study uses Wilcoxon Matched-Pairs Signed-Ranks Test of SPSS© to handle the investigative questions. The Wilcoxon test is useful for a partial equilibrium analysis to examine the effects of yield curve slope change. Stock index and individual stock data are collected from historical data provided by Commodity Systems, Inc. Both the indexes and individual stock data are adjusted for stock splits and dividends for the sample periods. This study collects weekly data of rates of 10-year U.S. T-bonds and 3-month U.S. T-bill rates based on H.15 Selected Interest Rates series of the U.S. Federal Reserve website (accessed on September 8, 2012). The sample period was 308 weeks ranging from October 9, 2006 to August 31, 2012.

The Wilcoxon signed-ranks test applies to "before" and "after" measures. This study uses a set of paired values of X_a and X_b:

X_a = Holding period yield for 154 weeks before September 18, 2009.

X_b = Holding period yield for 154 weeks after September 18, 2009.

As described by Lowry (2007), the algorithm:

1) takes the absolute difference $|X_a - X_b|$ for each pair;
2) omits from consideration those cases where $|X_a - X_b|=0$;
3) ranks the remaining absolute differences, from smallest to largest, employing tied ranks where appropriate;
4) assigns to each such rank a "+" sign when $X_a - X_b>0$ and a "-" sign when $X_a - X_b<0$.

For each case i, as explained by SPSS Statistical Algorithms (1985), the ranked difference of case i (D_i) of holding period yields is calculated using the following formula:

$$D_i = X_{a,i} — X_{b,i} \quad (3)$$

The sum of the ranks corresponding to positive differences (Sp) and negative differences (Sn) are calculated. The test statistic is:

$$Z = [\min (Sp, Sn) — (n(n+1)/4)]/[n(n+1)(2n+1)/24]^{1/2} \quad (4)$$

where n = number of cases with non-zero differences.

TEST RESULTS AND FINDINGS

Table 1-A describes the performance differences of three market indexes. It compares the average holding period yields for two separate periods of 154 weeks before and after the benchmark date of September 18, 2009, one year after which the yield curve slope became sharply positive. The one-year lagging was chosen based on the findings by Estrella and Trubin (2006). The mid cap stocks of S&P 400 index performed better than both small and big cap stocks during the entire period examined (10/09/2006~8/31/2012), as shown in the second column. All three indexes fell during the first period (10/09/2006~9/18/2009), but all three indexes sharply rose during the second period (9/18/2009~8/31/2012). However, in terms performance differences between two periods (shown in the last column), the small cap index performed best among the three (+69.7% improvement).

TABLE 1-A
COMPARATIVE HOLDING PERIOD YIELDS (HPYs)
DURING DIFFERENT STAGES OF YIELD SLOPE, 2006-2012

STOCK INDEXES/CLUSTERS	HPYs for Entire 308 Weeks	(A) HPYs for 154 weeks of Flatter Yield Slopes, 10/09/2006~9/18/2009	(B) HPYs for 154 weeks of Steeper Yield Slopes, 9/18/2009~8/31/2012	(B) - (A)
S&P 500 BIGCAP	5.3%	-23.5%	37.7%	61.2%
S&P 400 MIDCAP	28.0%	-13.6%	48.1%	61.7%
S&P 600 SMALLCAP	21.9%	-19.1%	50.6%	69.7%
12 Biggest Cap Stocks (BIGGEST), Average	119.4%	22.1%*	60.6%	38.5%
12 Middle Cap Stocks (MIDDLE), Average	36.5%	-13.4%	58.5%	71.9%
12 Smallest Cap Stocks (SMALLEST), Average	-11.5%	-24.5%	13.1%	37.6%

Note:
This Table examines stock performance during different stages of yield slope with 12-moth lagging effects.
*Included in the sample, AAPL (Apple, Inc.) performed extremely well even during the period of flatter yield slopes.

TABLE 1-B
AVERAGE YIELD SLOPES

	Entire 308 Weeks	(A) 154 weeks of Flatter Yield Slopes, 10/09/2006~9/18/2009	(B)154 weeks of Steeper Yield Slopes, 9/18/2009~8/31/2012	(B) - (A)
Average Yield Slopes for Matching Periods	70.6	44.7	96.7	52.0

Note:
Performance is based on closing prices adjusted for dividends and splits.
BIGGEST = Twelve stocks of middle market capitalization cluster between $188,933,939,179 and $637,848,538,640 among 6,500 stocks as of 9/8/2012.
MIDDLE = Twelve stocks of middle market capitalization cluster between $4,419,017,438 and $ 4,483,792,544 among 6,500 stocks as of 9/8/2012.
SMALLEST= Twelve stocks of smallest market capitalization cluster between $501,872,433 and $507,200,794 among 6,500 stocks as of 9/8/2012.
All thirty-six sample stocks were screened from the following Wall Street Journal website: http://online.wsj.com/public/quotes/stock_screener.html

The second half of Table 1-A describes the performance differences of three judgmental samples of three distinctive stock clusters. The biggest cap stock cluster performed better than both small and mid-cap stock clusters during the entire period examined (10/09/2006~8/31/2012), as shown in the second column. That is, the BIGGEST stock cluster (with +119.4%) outperformed other stock clusters by wide margins. The MIDDLE and the SMALLEST stock clusters fell during the first period (10/09/2006~9/18/2009), but the BIGGEST stock cluster had positive performance (+22.1%) during the same period. The performance of all three stock clusters sharply rose during the second period (9/18/2009~8/31/2012) with the BIGGEST having the best performance (+60.6%). However, in terms performance differences between two periods (shown in the last column), the MIDDLE cap stock cluster performed best (+71.9% improvement). Table 1-B shows the average yield slope for the entire 308 weeks was 70.6. The yield slope average for the first 154 week period was 44.7, but the second 154 week period had much steeper slope of 96.7.

TABLE 2
WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST COMPARING PERFORMANCE DURING DIFFERENT STAGES OF YIELD SLOPE WITH 12-MOTH LAGGING EFFECTS

STOCK INDEX SAMPLES	Z	2-tailed P
Biggest Cap Stock Cluster (BIGGGEST), N=12	-2.589	.010
Middle Cap Stock Cluster (MIDDLE) , N=12	-3.059	.002
Smallest Cap Stock Cluster (SMALLEST) , N=12	-2.432	.015
ALL Cap Stock Clusters, N=36	-4.556	.000

Note:
This is examination of judgmental samples for stocks of different sizes of market capitalization, 2006-2012.
Performance is based on closing prices adjusted for dividends and splits.

Table 2 shows the test results comparing holding period yields among three judgmental sample clusters, 1) the biggest cap stock cluster, 2) the middle cap stock cluster, and 3) the smallest cap stock cluster. The tests compare the performance during the first 154 week period and the performance during the second 154 week period. As indicated by the z values (-2.589, -3.059 and -2.432 respectively), the performance during the second period shows statistically significant improvement for all three stock clusters at a 2% significance level. When, the test is performed for all 36 sample stocks, the result shows even greater significance (Z = -4.556; 2-tailed P = 0.000).

CONCLUSION

This paper found a significant link between the effects of different degrees of yield slope and performance of stocks for the period, 2006-2012. The steeper yield slope had significantly positive effects on stocks regardless of market capitalization. Yield slope became sharply steeper since September 19, 2008. The steeper yield slope was a direct result of US Fed's accommodative monetary policy. On December 16, 2008, US Fed initiated zero interest rate policy (ZIRP), as reported in the New York Times by Andrews and Calmes (2008). This paper provided the evidence that strong stock market performance in the second half of the sample period (9/18/2009~8/31/2012) was impacted by a result of steeper yield slope. One can argue that this finding supports the notion, "Don't fight the Fed."

At the same time, it is important to note that steeper yield slope had not been linked to the labor market in a positive way, since the national unemployment rate hovered above 8% in the second half of the sample period. However, the issue related to the labor market is beyond the scope of this paper. Furthermore, the sustainability of the stock market momentum affected by steeper yield slope could be challenged by a weak labor market, potential inflationary pressure, and other factors. These issues should be subjects of further study.

REFERENCES

Andrews, Edmund L., and Jackie Calmes. 2008. "Fed Cuts Key Rate to a Record Low." The New York Times,

December 16, 2008. http://www.nytimes.com/2008/12/17/business/economy/17fed.html?_r=1&hp (accessed on September 8, 2012).

Banz, R.W. 1981. "The Relationship between Return and Market Value of Common Stocks." Journal of Financial Economics 9: 3-18.

Estrella, Arturo, and Gikas A. Hardouvelis. 1991. "The Term Structure as a Predictor of Real Economic Activity." The Journal of Finance 46(2): 555-576.

Estrella, Arturo, and Mary R. Trubin. 2006. "The Yield Curve as a Leading Indicator: Some Practical issues." Current Issues in Economics and Finance. Federal Reserve Bank of New York. 12(5): 1-7.

H.15 Selected Interest Rates, US Federal Reserve. http://www.federalreserve.gov/default.htm (accessed on September 8, 2012).

Lowry, Richard. 2007. VassarStats, http://faculty.vassar.edu/lowry/wilcoxon.html.

S&P U.S. Indices. 2012. Index Methodology. http://www2.standardandpoors.com (accessed on September 8, 2012).

SPSS Statistical Algorithms. 1985. SPSS Inc.

Strong, Robert A. 2006. Portfolio Construction, Management, & Protection. 4th ed. Thomson South-Western.

Yu, Geungu. 2007. "The Cyclical Impact of Small and Big Cap Stocks on Optimal Portfolios for Period 2000-05." Journal of Social and Behavioral Sciences 40 (1): 25-37.

Yu, Geungu, Phillip Fuller and Dal Didia. 2008. "Inverted Yield Curve and Stock Performance: Recent Evidence" Southwestern Economic Review, Volume 35, Number 1, 131 – 138.