INVERTED YIELD CURVE AND STOCK PERFORMANCE: RECENT EVIDENCE

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ABSTRACT

This study investigated the linkage between the effects of an inverted yield curve and the performance of small, mid, and big cap stocks for the period 2005-2007. The comparative performance of small, mid and big cap stocks during the period was examined. In general, there seemed no significant link between the two variables, which would support the efficient market hypothesis. However, as an anomaly, the biggest cap stocks significantly outperformed the middle and the smallest cap stocks when the yield curve was inverted. This could reflect an economic environment in which the pendulum may have swung in favor of the big cap stocks.

INTRODUCTION

An axiom in finance is: "buy low, sell high." Most investors strive to capture the essence of the phrase. Given an opportunity to make a profitable investment, investors 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 there are changes in the economy. Correspondingly, it is not unusual for investors to prefer one asset class over another depending on the economic environment.

A yield curve shows the relationship between interest rates and maturities of the debt instruments issued by a same issuer. Long-term interest rates are normally higher than short-term rates, making the yield curve upward sloping. When long-term interest rates are lower than short-term rates, the curve is downward sloping, i.e., inverted.

Some investors may believe that big cap stocks are preferred over mid or small cap stocks when the yield curve is inverted. This belief could be based on the expectation that an inverted yield curve precedes an economic slow down, i.e., a recession (Estrella and Trubin, 2006). They may perceive that larger firms tend to 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) can reduce their costs more easily; and 3) are more diversified than smaller firms.

Does an inverted yield curve matter for the performance of stocks of different market capitalization? This is an issue that has not been examined in the literature. Even though there has been a great deal of discussion of the cyclical nature of the small firm effect, there has been no specific attention paid to the inverted yield curve as a possible causal factor of the cyclical nature, at least partially. The findings of this study not only could shed some light on a partial cause of the cyclical nature of the small firm effect, but also could help understand a possible big firm effect associated with the inverted yield curve phenomenon.

LITERATURE REVIEW

There has been conspicuous small firm anomaly, or the small firm effect, 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) and Reinganum (1981). Brown, Kledon, and Marsh (1983) rejected the hypothesis that the excess return attributable to size was stable throughout time. Reinganum (1984) claimed a serious misspecification in the capital asset pricing model: returns on smaller capitalized companies were much greater than those on larger companies, even after adjusting for difference in estimated beta risk. Perhaps most disturbing to theorists, market capitalization was a much better predictor of average return than beta. Reinganum (1992) also confirmed the cyclical nature of small cap anomaly, but he insisted that the small firm effect was still a long-term phenomenon. Elfakhani and Zaher (1998) examined small firm stocks' performance for the period 1986-1990 and also confirmed that the small firm size effect was neither consistent over all months, nor limited to small stock portfolios in January.

Examining historical price data of small cap proxies, such as the Russell 2000 Index, Yu (2007) 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.

Historically, the slope of the yield curve had demonstrated the power of predicting future changes in the real output of the economy. Using the quarterly sample from 1955 through 1988, Estrella and Harouvelis (1991) observed 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 an indicator of a pending economic recession. For example, 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 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.

Since an inverted yield curve can result from expected deflation, investors probably bid up the prices of large cap stocks during an inverted yield curve period because the large cap stocks would be perceived to outperform mid or small cap stocks in a deflationary environment. Therefore, this paper attempts to find the link

between the effects of an inverted yield curve and a possible superior performance of big cap stocks during the recent period.

RESEARCH AND INVESTIGATIVE QUESTIONS

The primary research question of this paper is: Do the effects of an inverted yield curve on performance differ among stock indices 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) Was the performance of small cap stocks during the period of inverted yield curve significantly different from the performance before the inverted period?
2) Was the performance of mid cap stocks during the period of inverted yield curve significantly different from the performance before the inverted period?
3) Was the performance of big cap stocks during the period of inverted yield curve significantly different from the performance before the inverted period?
4) Is there any particular stock group that performed significantly well during the period of inverted yield curve?

The degrees of significance levels found in response to these questions would validate the superior performance of particular group(s) of stocks compared to the performance of others during the inverted yield curve as shown in TABLE 1.

METHODOLOGY

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, firm size and overall market returns affect performance of stocks. This study uses the weekly data of three market indices --- S&P 600 Small Cap, S&P 400 MidCap, and S&P 500 as proxies of small cap, mid cap, and large cap stocks, respectively.

Figure 1

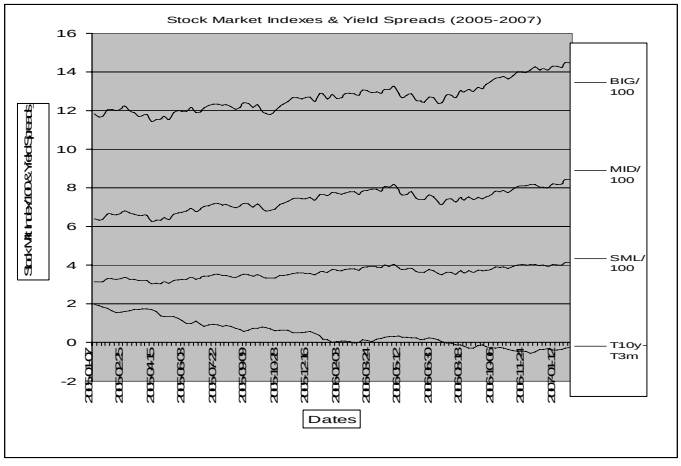

FIGURE 1 shows the inverted yield spread appeared on February 24, 2006 first for the sample period. Therefore, for investigative purposes, this study used February 24, 2006 as benchmark date to distinguish between the pre-inverted period (January 7, 2005 thru February 24, 2006) and the inverted period (February 24, 2006 thru February 2, 2007). FIGURE 1 provides a visual representation of the performance of three market indices before and during the period of the inverted yield curve. TABLE 1 compares the holding period yields for small, mid, and big cap stocks for the entire period and sub-periods. Small and mid cap stocks outperformed big cap stocks during the pre-inverted period. Interestingly, big cap stocks outperformed both small and mid cap stocks during the inverted period. The holding period yield at time t (HPY_t) in this 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

TABLE 1
COMPARATIVE HOLDING PERIOD YIELDS
FOR SMALL, MID, AND BIG CAP STOCKS, 2005-2007
(EXAMINATION OF INDEX PERFORMANCE)

STOCK INDEXES	Entire 98 Weeks	(A)49 Weeks before the Inverted	(B) 49 Weeks during the Inverted	(B) - (A)
S&P SMALLCAP 600	28.16%	18.35%	8.28%	-10.07%
S&P 400 MIDCAP	28.66%	19.02%	8.10%	-10.92%
S&P 500	23.52%	9.89%	12.41%	2.52%

TABLE 2
AVERAGE HOLDING PERIOD YIELDS FOR 49 WEEKS
BEFORE AND DURING THE PERIOD OF INVERTED YIELD CURVE, 2005-2007
(EXAMINATION OF JUDGMENTAL SAMPLES FROM INDEX COMPONENTS)

STOCK INDEX SAMPLES (N=12)	(A) 49 Weeks before the Inverted	(B) 49 Weeks during the Inverted	(B) - (A)
Smallest Cap Stocks (SML)	-3.42%	-2.79%	0.63%
Middle Cap Stocks (MID)	7.94%	10.95%	3.00%
Biggest Cap Stocks (BIG)	6.74%	15.40%	8.66%

Note: Performance is based on close prices adjusted for dividends and splits.
SML=S&P SMALLCAP 600 INDEX
MID = S&P 400 MIDCAP INDEX
BIG = S&P 500 INDEX

This study's null hypothesis is that there are no significant differences in the effects of inverted yield curves on performance differences among small, mid and big cap stocks during the sample period of 2005-2007. This would imply that the market perceives the effects of an inverted yield curve as neutral or market is efficient. The

alternative hypothesis is that there are significant differences in the effects of inverted yield curves on performance differences among small, mid and big cap stocks during the sample period. This would imply that the contributory roles of inverted yield curves would have caused cyclical behavior of stock groups of different market cap. Since the difference could be either positive or negative, two-tailed significance tests were conducted.

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

> 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. The S&P MidCap 400 represents the mid-cap range of companies, and the S&P SmallCap 600 represents small-cap companies.

Standard & Poor's uses the following:

> Unadjusted market capitalization of US$ 5 billion or more for the S&P 500, US$ 1.5 billion to US$ 5.5 billion for the S&P MidCap 400, and US$ 300 million to US$ 2 billion for the S&P SmallCap 600.

First, this study used a random sample of 32 stocks from S&P 600 SmallCap index components to represent small cap stocks, a random sample of 32 stocks from S&P400 MidCap index components to represent mid cap stocks, a random sample of 32 stocks from S&P500 index components to represent large cap stocks.

Second, in search for a more conspicuous impact of inverted yield curve on different sizes of capitalization, this study used judgmental samples of 12 smallest cap stocks of S&P 600 SmallCap index to represent the smallest cap stocks, 12 middle cap stocks of S&P 400 MidCap index to represent middle cap stocks, and 12 biggest cap stocks of S&P 500 index to represent the biggest cap stocks.

This study used Wilcoxon Matched-Pairs Signed-Ranks Test of SPSS© to handle the investigative questions. The Wilcoxon Test has excellent efficiency and can be more powerful than the t-test in part because the sample period of the inverted yield curve investigated in this study was relatively short. The Wilcoxon test is useful for a partial equilibrium analysis to examine the effects of inverted yield curve. Weekly stock index and individual stock data were collected from historical data provided by Commodity Systems, Inc. The weekly stock index and individual stock quotes were adjusted for stock splits and dividends for the sample periods. This study collected weekly data of rates of 10-year U.S. T-bonds and 3-month U.S. T-bill rates from the Federal Reserve Board Statistics Release and Historical Data. The sample period was from January 7, 2005 to February 2, 2007.

Wilcoxon Matched Pairs Signed Ranks Test Algorithm

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, 49 weeks before February 27, 2006,

X_b = Holding period yield, 49 weeks after February 27, 2006.

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 (Di) of holding period yields is calculated using the following formula:

$$D_i = X_{a,i} — X_{b,i} \quad (2)$$

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

$$Z = [\min (Sp, Sn) — (n(n+1)/4)]/[n(n+1)(2n+1)/24]^{1/2} \quad (3)$$

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

TABLE 2 described the performance differences of three judgmental samples of the smallest, mid, and the biggest cap stocks before and during the period of inverted yield curve. It compared the average holding period yields for two separate periods of 49 weeks before and during the inverted yield curve. The smallest cap stocks of S&P 600 Small Cap index and the middle cap stocks of S&P400 MidCap index performed slightly better during the period of inverted yield curve than for the pre-inverted yield curve period. However, the biggest cap stocks of S&P500 index demonstrated the most conspicuous performance improvement during the inverted yield curve. Its HPY of 15.40% during the period of inverted yield curve was more than doubled, compared to its HPY of 6.74% for the period before the inverted.

TEST RESULTS AND FINDINGS

TABLE 3 showed the test results comparing holding period yields among three random sample groups: 1) the small cap stocks representing S&P600 SmallCap index members, 2) the mid cap stocks representing S&P 400 MidCap index members, and 3) the big cap stocks representing S&P 500 index members. The tests compared their performance for 49 weeks before and during the period of 49 weeks of inverted yield curve. As indicated by its z values (-0.168, -1.011, and -0.580 respectively), the returns during the period of inverted yield curves were not statistically significant for all three groups of small, mid, and big cap stocks. Therefore, this finding is consistent with what one would expect from an efficient market.

TABLE 4 showed the test results comparing holding period yields among three judgmental sample groups: 1) the smallest cap stocks of 589th thru 600th ranks in size among S&P600 SmallCap index members, 2) the middle cap stocks of 195th thru 206th ranks in size among S&P 400 MidCap index members, and 3) the biggest cap stocks of 1st thru 12th ranks in size among S&P 500 index members. The tests compared their performance for 49 weeks before and during the period of 49 weeks of inverted yield curve. As indicated by its z values (-.157 and -0.549 respectively), the returns during the period of inverted yield curves were not statistically significant for the smallest and middle cap stocks. The biggest cap stocks showed significantly greater positive returns when the yield curve was inverted. This was evidenced by the fact that the biggest cap stocks of S&P500 performed significantly better during the inverted yield curve than before the period of inverted yield curve. That is, the biggest

cap stocks of S&P500 group showed that the positive impact of inverted yield curve was significant at 2.8% of the two-tailed test. Of course, the outstanding performance could be due to factors other than the inverted yield curve. However, it is a reasonable assessment that the inverted yield curve contributed to the positive performance of the biggest S&P 500 group in particular. This is probably because investors would have sought for a safe haven alternative during the period of inverted yield curve. They probably considered the biggest cap stocks as the best alternative during the inverted yield curve.

TABLE 3
WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST COMPARING PERFORMANCE BEFORE AND DURING THE PERIOD OF INVERTED YIELD CURVE (EXAMINATION OF RANDOM SAMPLES FROM INDEX COMPONENTS, 2005-2007)

STOCK INDEX SAMPLES (N=32)	Z	2-tailed P
Small Cap Stocks (SML)	-0.168	.866
Mid Cap Stocks (MID)	-1.011	.312
Big Cap Stocks (BIG)	-0.580	.562

Note: Performance is based on close prices adjusted for dividends and splits.
SML=S&P SMALLCAP 600 INDEX
MID = S&P 400 MIDCAP INDEX
BIG = S&P 500 INDEX

TABLE 4
WILCOXON MATCHED-PAIRS SIGNED-RANKS TEST COMPARING PERFORMANCE BEFORE AND DURING THE PERIOD OF INVERTED YIELD CURVE (EXAMINATION OF JUDGMENTAL SAMPLES FROM INDEX COMPONENTS, 2005-2007)

STOCK INDEX SAMPLES (N=12)	Z	2-tailed P
Smallest Cap Stocks (SML)	-0.157	.875
Middle Cap Stocks (MID)	-0.549	.583
Biggest Cap Stocks (BIG)	-2.197	.028

Note: Performance is based on close prices adjusted for dividends and splits.
SML=S&P SMALLCAP 600 INDEX
MID = S&P 400 MIDCAP INDEX
BIG = S&P 500 INDEX

SUMMARY AND CONCLUSIONS

In general, there seemed no significant link between the effects of inverted yield curve and performance of small, mid, and big cap stocks for the period 2005-2007. This general finding would support the notion of efficient market. However, it is interesting to know that, on average, small and mid cap stocks outperformed big cap stocks before the yield curve was inverted; big cap stocks outperformed both small and mid cap stocks during the period of inverted yield curve. In particular, the biggest cap stocks performed best with the only statistical significance when the yield curve was inverted.

This study's findings suggested that there were significant differences in the effects of inverted yield curves on performance of the biggest cap stocks during the sample period of 2005-2007. This would imply that the contributory roles of inverted yield curves could have partially caused cyclical nature of stock groups of different

sizes of market cap. That is, the market could have perceived the effects of inverted yield curve as positive signal for the biggest cap stocks during the period of recent inverted yield curve. Or, the superior performance of the biggest cap stocks could have resulted from the market tendency that caused capital flows to channel mostly toward the biggest cap stocks during the period of yield curve inversion. At the same time, it appeared that the small firm anomaly was losing its strength during the sample period of inverted yield curve.

An inverted yield curve is transitory. This study did not attempt to find how to predict the period of inverted yield curve. It found an empirical evidence of positive link between the inverted yield curve and superior performance of the biggest cap stocks. It suggests the following for portfolio rebalancing: when investors experience a period of inverted yield curve, they can better prepare themselves for the consequences of ending of the inverted yield curve by repositioning portfolios accordingly, in particular by reducing the allocation of big cap stocks. However, the timing of portfolio rebalancing upon ending of an inverted yield curve would require further research partly due to possible inertia of anticipatory investor behavior with respect to the inverted yield curve phenomenon.

REFERENCES

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

Brown, Philip, Allan W. Kleidon, and Terry A. Marsh. 1983. "New Evidence on the Nature of Size-related Anomalies in Stock Prices." *Journal of Financial Economics* 12: 33-59.

Elfakhani, Said, and Tarek Zaher. 1998. "Differential Information Hypothesis, Firm Neglect and the Small Firm Size Effect." *Journal of Financial and Strategic Decisions* 11(2): 29-40.

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.

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

Reinganum, Marc R. 1984. "Discussion: What the Anomalies Mean.**"** *The Journal of Finance*. Papers and Proceedings, Forty-Second Annual Meeting, American Finance Association, San Francisco, CA. 39(3): 837-840.

_____. 1987. "Abnormal Returns in Small Firm Portfolios." *Financial Analysts Journal* 37: 52-57.

_____. 1992. "A Revival of the Small-Firm Effect." *Journal of Portfolio Management* 9(2): 55–62.

S&P U.S. Indices. 2007. *Index Methodology*. http://www2.standardandpoors.com.

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.