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# An Examination of the Short Term Reversal Premium

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AN EXAMINATION OF THE SHORT TERM REVERSAL PREMIUM

by

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ABSTRACT

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Utah State University, 2017

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The intent of this study is to explore short-term reversal effects in public securities markets. The basis of this study is to take into consideration prior work done by economists, paying particularly attention to periods specifically before and after the decimalization of the stock market in 2001. This study finds that from years 1980-2000, there is a monthly return premium of -0.0552% or 5.5 basis points, which is quite significant with a t-statistic of 11.08. Following decimalization in 2001 through year 2012, this monthly return premium drops 44% to -0.031% or 3.1 basis points, again with a high t-statistic of 4.50. Despite these findings, the resulting return premium is still quite small in nature and would require large capital commitments to realize any type of meaningful return. Regardless, there inherently appears to be an arbitrage opportunity that would pique the curiosity of any rational investor and begs to be explored further.

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I would like to thank all the Economics and Finance faculty at Utah State University for inspiring me to study finance and helping me to excel in my studies throughout both my undergrad and graduate degrees. Special thanks to my incredible wife, Shelynn, for putting me through school and being a tremendous support. Lastly, I'd like to thank my fellow classmates for all the help on assignments; late nights studying and doing projects; and most importantly for the lasting friendships made during our time at Utah State University.

Tim

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## Introduction

The old adage of "what goes up must come down" is well founded on the principal of physics and perhaps originally attributable to Sir Isaac Newton and his discovery of the law of gravity. Today, the saying, albeit more colloquial than Newton's time, is well used and certainly has application in financial markets. The idea of something moving in one direction and then reversing back towards its origin has common application to finance in what is known as a reversion to the mean. Reversion to the mean is the theory that prices in financial markets will eventually return to an average price point that is readily observable from historical data. Prices will oscillate back and forth around this average and any deviation will eventually return to it. The time it takes to return is an important factor as deviations could last for a few seconds, a few days, or even years. In some cases, a reversion may never occur as a positive or negative shift may be attributable to fundamental changes in a business and therefore its price will change to accommodate the new norm. Nevertheless, basing one's trading strategy on mean-reversion principals is certainly something every investor should be aware of.

Employing a short-term month-over-month trading strategy of taking an opposite, or reverse, trading position based on the previous month's return is a well explored trading strategy. These short-term month-over-month trading strategy gains, particularly prior to 1987, have been well documented and shown to be statistically significant. Returns have been reported to be around 2% per month, or a staggering 24% per annum (Jegadeesh, 1990). If one believes as Fama (1970) that markets are efficient and as Hayek (1945) and

others that securities follow a Brownian, or martingale, motion, no such predictable and observable opportunity should exist, particularly in such a consistent month-over-month trading strategy.

There have been many attempts at explaining the reasoning behind these short-term stock reversals: DeBondt and Thaler (1985) argued that these reversals were due to over-reactions to information in the market. Given the widely emotional and behaviorally biased nature of investors, particularly the mass of common investors, overreactions are certainly bound to take place; more recently, Pastor and Stambaugh (2003) proposed a more technical explanation surrounding a liquidity effect in prices where those who provide liquidity to the market earn a premium for doing so; and much prior to them, Cox and Peterson (1994) argued that this reversal premium was due largely in part to what is known as the bid-ask bounce, which artificially inflates the calculation of variance.

Exploring further along the lines of Cox and Peterson (1994), this study seeks to identify if this short-term reversal premium is still relevant in today's market; particularly with the quick dissemination of news and instantaneous market quotes through electronic means and, most specifically, the decimalization of stock market price quotes mandated by the SEC in 2001. Especially interesting in most of these prior papers is that researchers end their data collection in 1987, where it has been documented and suggested that a large portion of the return reversal premium dissipates for the most part (Cox and Peterson, 1994).

In order to truly capture the full effect of a short term reversal premium, drastic swings in prices are ideally captured. The probability of the price reversing on a stock that has experienced a large gain of 10% in a short period is higher than a stock that only gains 1% given the larger short-term movement in the price. As stated previously, this price movement may be a fundamental change in price due to some event such as a surprise earnings announcement or acquisition bid. If, however, the movement is not attributable to a fundamental event, a reversal is more likely but whether the event is fundamental or not such events are still prone to price overreactions and bid-ask bounces as observed by previous studies.

The date of October 19, 1987 has come to be known as "Black Monday", when the stock market experienced a very drastic "flash crash". After Black Monday, regulators rebuilt trade-clearing protocols to bring uniformity to the market. These same regulators also put in place a new rule known as a trading "curb" which is informally known as a market circuit breaker. Much like an actual circuit breaker in an electrical current system, these curbs allow exchanges to immediately halt trading in instances of unusually large price increases or declines in majorly traded markets. Beginning at this time, large gains in short-term reversal strategy trading began to show evidence of dissipation, suggesting a correlation with this new regulation.

This study aims to explore the period particularly before and after the decimalization of the stock market. Prior to 2001, stocks on all major exchanges were quoted on a fractional basis. The smallest price movement that could be quoted was $1/16^{th}$,

or 6.25 pennies on the dollar. When the NYSE was started 200 years ago market quotes were based on the same Spanish trading convention with prices denominated on a 1/8$^{th}$ basis. Many financial practices were adopted from the Spanish, including the influence of the Spanish silver dollar coin, or reale de a ocho, on the American dollar. The Spanish silver dollar was worth eight reales and was literally divided into eight pieces when change for a transaction needed to be made. From this practice spawns the oft squawked, "pieces of eight!" saying mimicked by a pirate's loyal parrot. Many conventions in financial markets are routed in long-standing traditions as evidenced by US Treasury bonds still being quoted on a 1/32$^{nd}$ basis to this day. Because price movements happened in roughly 6 cent steps, order volumes in theory could push prices up and down at a faster pace than if price steps were smaller resulting in larger volatility in prices to be captured in a short-term reversal trading strategy.

Decimalization was the process of converting the quoting system of financial markets to a decimal basis with the smallest price tic being 1/100, or one cent. The U.S. Securities and Exchange Commission mandated that all stock markets in the U.S. convert to a decimal basis by April 9, 2001. Having prices in financial markets quoted on a one cent basis conformed the U.S. to international standards and made it easier for investors to read and interpret prices and movements. Furthermore, with a smaller price step than what was previously available in the market, order volumes in theory would have a less drastic effect on prices and liquidity would improve given the tighter bid-ask spreads.

## Data and Methodology

Daily stock return data from the universe of stocks available from the Center for Research in Security Prices (CRSP) during the period 1982-2012 was gathered for this study. Very small cap stocks, less than two dollars (penny stocks), were excluded from the data. Additionally, the book-value of equity was collected from Compustat for stocks that had this information available. This data was used to calculate the book-to-market and market capitalization ratios. The values of equity were controlled to be positive only so that the natural log of book-to-market ratios could be computed (variable *logBM).* In total, this represents a sample size of roughly 1.2 million observations.

The analysis of the data consisted of three sections: (1) Running Fama-Macbeth cross-sectional regressions across the entire time period (Figure 1) using the following model:

$$R_{t+1} = \beta_0 + \beta_1 beta + \beta_2 logCAP + \beta_3 logBM + \beta_4 momentum + \beta_5 illiq + \beta_6 idiovolt + \beta_7 return + \epsilon.$$

Where the dependent variable is stock returns in the next month, $R_{t+1}$; *beta* is the CAPM beta; *logCAP* and *logBM* are the natural logarithm values of market cap and book-to-market; *momentum* is the cumulative return from month t-12 to t-2, or momentum premium; *illiq* is the ratio of the absolute value of daily return scaled by volume and average to the monthly level, or Amihud illiquidity premium; *idiovolt* is the idiosyncratic volatility or standard deviation of daily residual returns, where residuals are obtained from a daily Fama and French 3-factor model (MKTRF, SMB and HML); and *return* is the current month's

return. (2) Breaking the data into two sections surrounding decimalization, 1982 to 2000 and from 2001 to 2012. (3) Examining an eight-year spectrum around the 2001 decimalization in years 1997-2000 and then from years 2001-2004. And (4), examining a little closer spectrum of six years around 2001 from 1998-2000 and then 2001-2003.

Decimalization was mandated by the SEC to be fully complete by April 9, 2001. As many firms had already begun to switch to decimalization prior to April 2001 beginning in September 2000, it will be stated that all of 2001 will be considered post-decimalization. All standard errors and t-statistics in the Fama-Macbeth regressions have been controlled for heteroskedasticity and autocorrelation by applying a Newey-West (1987) correction using 3 lags.

**Results**

Full Period: From the years 1980-2000, there is a monthly return premium of -0.0552% or 5.5 basis points, which is quite significant with a t-statistic of 11.08. Following decimalization in 2001 through year 2012, this monthly return premium drops 44% to -0.031% or 3.1 basis points, again with a high t-statistic of 4.50. All tables presented are comprised of Fama and MacBeth (1973) regression means with 3-lag Newey-West adjusted t-statistics (in parenthesis).

| | 1980-2012 | Pre-Decimalization (1980-2000) | Post-Decimalization (2001-2012) |
|---|---|---|---|
| Intercept | 0.0323<br>(5.97) | 0.0322<br>(4.73) | 0.0326<br>(3.64) |
| Beta | -0.0006<br>(-0.83) | -0.0005<br>(-0.61) | -0.0009<br>(-0.57) |
| LogCAP | -0.0005<br>(-1.26) | -0.0002<br>(-0.37) | -0.0010<br>(-2.04) |
| LogBM | 0.0060<br>(10.11) | 0.0071<br>(8.62) | 0.0041<br>(6.38) |
| Momentum | 0.0052<br>(3.47) | 0.0091<br>(6.58) | -0.0013<br>(-0.44) |
| Illiq | 0.0001<br>(3.20) | 0.0001<br>(3.65) | 0.0001<br>(1.71) |
| Idiovolt | 0.0146<br>(0.37) | 0.0468<br>(0.99) | -0.0397<br>(-0.56) |
| Return | -0.0462<br>(-11.01) | -0.0552<br>(-11.08) | -0.0310<br>(-4.50) |

The real return for the most part is small and would require a large amount of capital being traded to make any sort of meaningful return. For example a $10MM dollar investment would produce a $37M annualized return representing the need to commit large amounts of capital to this strategy, ignoring transaction costs. Nevertheless, there does exist a premium as evidenced by the variable, *return*, in the model and there is a

significant decrease in this variable of 44% from pre to post-decimalization. This 44% drop is significant based on the adjusted t-statistic of 2.84 which is computed from a z-score of 0.00852 from the standard errors.

Illiquidity is another important factor to note as represented by *illiq*. Prior to 2001, the coefficient on illiquidity is 0.0001 and significant and remains at 0.0001 after 2001 but is insignificant suggesting that decimalization did indeed play a role in increasing liquidity in the market.

Other factors in the model behave as expected such as a positive value associated with book-to-market, *logBM*, which is highly significant across the entire period and decreases slightly from pre to post-decimalization but remains significant. Although the *logCAP* variable has a negative value associated with market cap, it is insignificant in the data pre-2001 and is barely significant after 2001. This variable changes across time with periods of existence (high t-statistics) and periods of almost negligible existence which calls into question its reliability in financial modeling, particularly in portfolio creation.

Finally, the momentum premium, shown in the model as *momentum,* is positive and significant pre-decimalization but is negative and completely insignificant post decimalization. This suggests that momentum, or the observation that stocks with positive gains continue to increase and stocks with losses continue to decrease, disappears after decimalization.

Also interesting to note is the average slope on *beta,* which is the variable for the CAPM beta, is negative and statistically insignificant, which goes against the Capital Asset

Pricing Model (CAPM) theory. Contradictions to the CAPM model such as this have been shown in many studies previously.

Eight-year Period: Examining results in a smaller window shows that in the four years prior to decimalization, the coefficient on *return* is -0.0572% and significant. It is important to note here that this value is very close to the value over the entire pre-decimalization period of -0.0552%. Examining the result in a four-year window after decimalization shows a decrease in the coefficient down to -0.0436%, still significant, which again affirms the hypothesis that decimalization played a role in decreasing this result. This decrease represents a change of 23.8% between the four years pre and post-decimalization.

| | Four Years Pre-Decimalization (1997-2000) | Four Years Post-Decimalization (2001-2004) |
|---|---|---|
| Intercept | 0.0122 | 0.0581 |
| | (0.78) | (4.74) |
| Beta | 0.0000 | -0.0042 |
| | (0.02) | (-1.92) |
| LogCAP | 0.0008 | -0.0023 |
| | (0.49) | (-3.19) |
| LogBM | 0.0055 | 0.0052 |
| | (2.13) | (4.57) |
| Momentum | 0.0074 | 0.0003 |
| | (1.94) | (0.08) |
| Illiq | 0.0002 | 0.0002 |
| | (3.05) | (1.35) |
| Idiovolt | 0.1413 | 0.0894 |
| | (0.91) | (0.55) |
| Return | -0.0572 | -0.0436 |
| | (-3.38) | (-4.08) |

Illiquidity again goes from significant to insignificant between the before and after periods providing justification for the increase in liquidity in the market post-decimalization. The value of book-to-market is still positive but is close to being insignificant in the model in the four years prior to decimalization.

Momentum is once again positive and just barely insignificant pre-decimalization and is again quite statistically insignificant in the period four years post-decimalization. This is similar to the findings in the full period results suggesting that perhaps there was still some value attributable to momentum prior to decimalization but was decreasing leading up to it.

Six-year Period: Drilling down a little closer to a six-year window around decimalization continues to show the same results although the decline on *return* post-decimalization is reduced to 18%. The results are still significant with sufficient t-statistics.

| | Three Years Pre-Decimalization (1998-2000) | Three Years Post-Decimalization (2001-2003) |
|---|---|---|
| Intercept | 0.0059 | 0.0654 |
| | (0.33) | (4.58) |
| Beta | 0.0008 | -0.0048 |
| | (0.33) | (-1.75) |
| LogCAP | 0.0006 | -0.0028 |
| | (0.34) | (-3.76) |
| LogBM | 0.0042 | 0.0055 |
| | (1.34) | (3.64) |
| Momentum | 0.0071 | 0.0004 |
| | (1.42) | (0.08) |
| Illiq | 0.0002 | 0.0001 |
| | (2.91) | (1.66) |
| Idiovolt | 0.2069 | 0.1570 |
| | (1.04) | (0.79) |
| Return | -0.0604 | -0.0495 |
| | (-2.72) | (-3.75) |

Similarly to the results above during the eight-year window, illiquidity again goes from significant to insignificant between the before and after periods providing justification for the increase in liquidity in the market post-decimalization.

The value of book-to-market is still positive and is now insignificant in the model for the three years prior to decimalization but is still positive and statistically significant in the three years post-decimalization.

Momentum is once again positive and even more insignificant further suggesting that any value contributing to *return* pre-decimalization is decreasing leading up to it and is completely insignificant post-decimalization.

The averages of the time-series slope coefficients can be found in Figure 1 below. Figure 1 represents the full data-set, or 384 months. The coefficient on *return*, $\beta_7$, for the entire period is negative at -0.0462 with a very significant t-statistic of 11.01.

**Portfolio Creation Considerations**

Many prior papers examining this effect couple their Fama-Macbeth (1973) regressions with back-tested portfolio creation and analysis. For example, Cox and Peterson form an equally weighted portfolio of all stocks with at least a 10 percent drop in a single day. Others have formed portfolios based on industry weight or other factors. For the sake of exploring the overall effect of decimalization on this strategy and not on a particular concentration, I have not conducted a portfolio analysis segment to be included in this report and have thus deferred to essentially an equally weighted market portfolio consisting of the universe of stocks available in CRSP. Conducting such an analysis could help to further drill down into specific sectors, industries and asset-weighting in order to truly isolate the potential benefits of implementing an actual trading strategy.

Additionally, portfolio creation can be an important factor in presenting back-testing validity but is conditional on time. By focusing only on a six or eight-year window around the decimalization period there will only be 36 to 48 monthly observations in the data which is not nearly enough data to produce inference and run statistically sounds tests. This is evidenced by the low, adjusted t-statistics in these periods which are calculated from z-scores based on standard errors relying on a limited number of observations.

## Conclusion

The above results show that there still exists a reversal premium in the market but it has been drastically reduced since decimalization. It has been shown in this study that this premium did decrease by 44% after 2001 which suggests that decimalization, which was a major material event that changed the fundamental quotation reporting and operation of the stock market, is correlated with this decrease. This finding is demonstrated on a twenty four, eight and six-year window centered around decimalization in 2001 and the findings have held in all tested periods. Despite this decline, the data does not show a complete disappearance of the reversal premium and still suggests a monthly reversal premium of 3.1 basis points, or 0.37% per year, and requires additional study to further explain this market anomaly.

As in all economic studies, reliability of these results is based upon the reliability of the underlying model. Much of the explained results could be based on other non-included factors represented in the error term. However, the model used in this study is highly similar to that of previous studies, such as Bali, Cakici and Whitelaw (2010) and therefore considered to be a satisfactory model for testing this hypothesis.

APPENDICES

Figure 1. Summary statistics of the data from 1980-2012.

| | $\beta_i$ | Std Error | t-statistics | Probt | DF |
|---|---|---|---|---|---|
| Intercept | 0.0323 | 0.0054 | 5.97 | <0.0001 | 383.0 |
| Beta | -0.0006 | 0.0008 | -0.83 | 0.4060 | 383.0 |
| LogCAP | -0.0005 | 0.0004 | -1.26 | 0.2073 | 383.0 |
| LogBM | 0.0060 | 0.0006 | 10.11 | <0.0001 | 383.0 |
| Momentum | 0.0052 | 0.0015 | 3.47 | 0.0006 | 383.0 |
| Illiq | 0.0001 | 0.0001 | 3.20 | 0.0015 | 383.0 |
| Idiovolt | 0.0146 | 0.0395 | 0.37 | 0.7118 | 383.0 |
| Return | -0.0462 | 0.0042 | -11.01 | <0.0001 | 383.0 |

Figure 2. Full set of data pre and post-decimalization from 1980-2012. Here the data shows a 44% decrease in the return coefficient with an adjusted t-stat of 2.84 based on a z-score of 0.00852. This table comprised of Fama and MacBeth (1973) regression means with 3-lag Newey-West adjusted t-statistics (in parenthesis).

| | 1980-2012 | Pre-Decimalization (1980-2000) | Post-Decimalization (2001-2012) |
|---|---|---|---|
| Intercept | 0.0323<br>(5.97) | 0.0322<br>(4.73) | 0.0326<br>(3.64) |
| Beta | -0.0006<br>(-0.83) | -0.0005<br>(-0.61) | -0.0009<br>(-0.57) |
| LogCAP | -0.0005<br>(-1.26) | -0.0002<br>(-0.37) | -0.0010<br>(-2.04) |
| LogBM | 0.0060<br>(10.11) | 0.0071<br>(8.62) | 0.0041<br>(6.38) |
| Momentum | 0.0052<br>(3.47) | 0.0091<br>(6.58) | -0.0013<br>(-0.44) |
| Illiq | 0.0001<br>(3.20) | 0.0001<br>(3.65) | 0.0001<br>(1.71) |
| Idiovolt | 0.0146<br>(0.37) | 0.0468<br>(0.99) | -0.0397<br>(-0.56) |
| Return | -0.0462<br>(-11.01) | -0.0552<br>(-11.08) | -0.0310<br>(-4.50) |

Figure 3. Four years of data pre and post-decimalization. The concentration of this data is to more fully focus on the eight year period surrounding decimalization. Here the data shows a 24% decrease in the return coefficient. This table comprised of Fama and MacBeth (1973) regression means with 3-lag Newey-West adjusted t-statistics (in parenthesis).

| | Four Years Pre-Decimalization (1997-2000) | Four Years Post-Decimalization (2001-2004) |
|---|---|---|
| Intercept | 0.0122 | 0.0581 |
| | (0.78) | (4.74) |
| Beta | 0.0000 | -0.0042 |
| | (0.02) | (-1.92) |
| LogCAP | 0.0008 | -0.0023 |
| | (0.49) | (-3.19) |
| LogBM | 0.0055 | 0.0052 |
| | (2.13) | (4.57) |
| Momentum | 0.0074 | 0.0003 |
| | (1.94) | (0.08) |
| Illiq | 0.0002 | 0.0002 |
| | (3.05) | (1.35) |
| Idiovolt | 0.1413 | 0.0894 |
| | (0.91) | (0.55) |
| Return | -0.0572 | -0.0436 |
| | (-3.38) | (-4.08) |

Figure 4. Similar to the table above, this table shows three years of data pre and post-decimalization. Here the data shows an 18% decrease in the return coefficient. This table comprised of Fama and MacBeth (1973) regression means with 3-lag Newey-West adjusted t-statistics (in parenthesis).

| | Three Years Pre-Decimalization (1998-2000) | Three Years Post-Decimalization (2001-2003) |
|---|---|---|
| Intercept | 0.0059 | 0.0654 |
| | (0.33) | (4.58) |
| Beta | 0.0008 | -0.0048 |
| | (0.33) | (-1.75) |
| LogCAP | 0.0006 | -0.0028 |
| | (0.34) | (-3.76) |
| LogBM | 0.0042 | 0.0055 |
| | (1.34) | (3.64) |
| Momentum | 0.0071 | 0.0004 |
| | (1.42) | (0.08) |
| Illiq | 0.0002 | 0.0001 |
| | (2.91) | (1.66) |
| Idiovolt | 0.2069 | 0.1570 |
| | (1.04) | (0.79) |
| Return | -0.0604 | -0.0495 |
| | (-2.72) | (-3.75) |

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