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High Returns and Low Volatility: The Case for Mid-Cap Stocks

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High Returns and Low Volatility: The Case for Mid-Cap Stocks

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Abstract

This study examines excess risk-adjusted returns generated by mid-cap firms with an average market equity between $2.4 billion and $5.5 billion in 2017. Researchers have heavily studied the small-firm effect since its identification in the early 1980s, leading investors to overweight small-cap securities. Additional investments in the small-cap segment caused the small-cap anomaly to weaken. This study finds that excess returns of small-cap firms compared to mid-cap firms are not statistically significant in the periods 1946 – 2017 and 1982 -2017. However, mid-cap firms generate significantly higher 3-year average returns relative to small and large-cap firms after the initial identification of the small-cap anomaly (1982 – 2017). Further, mid-cap securities generate a higher risk-adjusted return after the small-cap anomaly was identified. This study hypothesizes the mid-cap anomaly results from greater growth potential for mid-caps relative to large-caps while still being large enough to weather economic storms. This study also hypothesizes that non-size related factors have the largest impact on the mid-cap segment. The results support the existence of a mid-cap anomaly; however, the results suggest the anomaly is not a result of the growth potential of firms within the segment. Additionally, the results suggest non-size related factors such as book-to-market and operating profitability have the smallest impact on mid-cap securities. Therefore, this study concludes excess returns generated by mid-cap securities represent a true anomaly that is not dependent upon non-size related factors.

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I. Introduction

Background of the Issue

Researchers frequently attempt to exploit market anomalies, and scholars critically analyze anomalies following their identification. The small-cap anomaly identified by Banz (1980) is one of the most heavily studied market anomalies. Banz's findings suggest a size-premium exists where smaller firms generate excess returns. Although the study identified the anomaly, it lacked an explanation of causation. Scholars attempted to identify likely causes of the anomaly in the decades following the publication. Many hypotheses and arguments were constructed as supporting contributions to the small-cap anomaly, and researchers attempted to identify causal relationships. Others argued the small-cap anomaly was identified on the basis of inherent miscalculations, and published articles contradicting the results of Banz's publication. Although various researchers disagreed with the anomaly, the identification of the small-cap anomaly led investors and equity fund managers to overweight small-cap securities in the following years, eventually leading to the weakening of the small-cap anomaly.

Research Objective

The extensive research of small-cap securities in the years following the identification of the small-cap anomaly resulted in neglect of mid-cap securities. The research objective of this study is to identify a mid-cap anomaly in the time period following the identification of the small-cap anomaly in 1980. The study will fulfill this objective if the results suggest mid-cap securities generate larger risk-adjusted returns and significantly larger average returns than small and large-cap securities. Another objective of this study is to identify factors that contribute to the mid-cap anomaly. This study hypothesizes that growing securities' growth potential outweighs the decline potential of declining firms within the mid-cap segment. The study also

hypothesizes that non-size related factors increase variability among mid-cap securities more than among small and large firms. Factors that influence the variability of returns include the Book-to-Market (B/M) ratio and Operating Profitability (OP) of a firm for the purposes of this study.

II. Literature Review

The Small-Firm Effect

Investors, analysts, and researchers often attempt to identify mispriced securities and market anomalies to generate excess returns. The "market efficiency hypothesis suggests that market… prices fully reflect all available information," and that investors are unable to outperform the market (Latif et al., 2011). However, history suggests markets fail to follow the market efficiency hypothesis, and "these deviations are called anomalies" (Latif et al., 2011).

Researchers have studied various market anomalies comprehensively in recent decades, and the small-cap anomaly is one of the most researched. Banz (1980) initially identified the small-cap anomaly by analyzing historical returns based on the market equity of firms. The study found "the common stock of small firms had, on average, higher risk-adjusted returns than the common stock of large firms." After the identification of the small-firm effect, numerous researchers supported the findings and attempted to identify causation of the anomaly. Fama and French (1992) found, "tests do not support the central prediction… that average stock returns are positively related to market beta," but market size is critical in determining security returns; specifically, "size and book-to-market equity seem to describe the cross-section of average stock returns." French also illustrates, "part of the size effect in the simple regressions is due to the fact that small… stocks are more likely to have high book-to-market ratios, and part of the simple

book-to-market effect is due to the fact that high [book-to-market] stocks tend to be small." The findings highlight an inherent correlation between market equity and the B/M ratio, making one incapable of isolating market equity or the B/M ratio for analysis.

Elfakhani and Zaher (1998) hypothesized the small size of firms serves as a proxy for differential information between small firms and large firms. Because there is less publicly available information regarding small firms, the study suggests researchers and investors should expect a larger risk premium for smaller firms. The scholars conclude, a "joint size-firm neglect effect" exists, from which "the size effect does not exist separately," but excess returns for small-cap securities are a direct result of firm neglect (Zaher, Elfakhani, 1998). Nathan (1996) also hypothesized the small-firm effect could be explained through the differential in market information for small and large firms, and found, "the small firm effect can be entirely explained by differential information availability among firms." On the other hand, Chan, Chen, and Hsieh (1983) argued that proper risk adjustment measures would explain the higher returns of small firms, and concluded that the small-firm anomaly can be captured using a multifactor pricing model.

Although many researchers reached conclusions in support of the small-firm effect, others have disagreed with its findings. Basu (1981) argued that small firms earn a "marginally higher risk-adjusted return than the common stock of large NYSE firms," but this "size effect virtually disappears when returns are controlled for differences in Earnings to Price ratios." Essentially, excess returns are not only a result of size, but are a result of the differences in Earnings to Price between securities. Roll (1981) also expressed his dissatisfaction with the small-firm effect, and found that investors trade small firms less frequently than they trade larger firms. Lower trading volume leads to "downward biased measures of portfolio risk and

overestimates of 'risk adjusted' average returns." In other words, an inaccurate calculation of risk is inherent within the findings that support the small-firm effect.

Berk (1995) agrees that small firms outperform large firms, but he finds the difference in performance can be explained by the difference in reaction to news amongst highly leveraged small and large firms. Following his first article, Berk (1997) argues, "Modern financial theory predicts that when there is no relation in the economy between firm size and return, the relation between firm market value and return will be negative." The conclusion suggests that market value is "not only a measure of a firm's size, but also a measure of a firm's discount rate." Therefore, scholars have associated market value with excess returns, when the firm's discount rate is likely the cause of excess returns.

The Neglect of Mid-Cap Securities

Many scholars agree the small-cap segment has not generated the impressive returns recently that it has historically. Increased awareness following the identification of the small-cap anomaly led investors to overweight small firms, causing the anomaly to weaken. Horowitz, Loughran, and Savin (2000) analyzed the periods 1963 – 1981 and 1982 – 1999, and observed an "annualized return difference between small and large firms over 13% [for the earlier period], compared to a negative 2% return differential from 1982 - 1999." The failure of small-cap firms to outperform large firms in the more recent period supports the claim that the small-firm effect disappeared following its identification. The authors hypothesized, "as investors became aware of the size effect, small firm prices increased (thus lowering subsequent returns)," and "the recent increase in passive indexation… has given more weight to the largest capitalization firms at the expense of smaller firms." The authors published an additional article in 2000, concluding the "results show that the widespread use of size in asset pricing is unwarranted."

T. Rowe Price (2007) also published an article that suggested there was "a significant downside to small-cap stocks at the current time, but… the best days of the small-cap cycle are probably behind [investors]." The company believes excess returns generated by small firms are largely historical. Schwert (2003) suggests anomalies commonly weaken following their identification, stating, "The size effect, the value effect, the weekend effect, and the dividend yield effect seem to have weakened or disappeared after the papers that highlighted them were published."

Although the small-cap anomaly has weakened since its identification, arguments concerning size as a critical factor continue. Some researchers argue that market equity remains an important factor if utilized in combination with non-size related factors. Asness, Cliff, Israel, Moskowitz, and Pedersen (2015) acknowledge the limitations of the small-cap anomaly, such as a "weak historical record, significant variation over time, in particular weakening after its discovery in the early 1980's, and [a concentration] among microcap stocks." However, the researchers conclude that size is a valuable factor given investors control for the quality of firms in which they invest.

Comprehensive analysis of the small-cap anomaly has left the mid-cap segment of the market ignored in recent years. Although many researchers have overlooked the mid-cap segment, some notable researchers have focused their work on the segment. For example, Schwartz (2014) suggests, "Mid-caps tend to be something of a forgotten size segment" (p. 1). Although the investment community tends to focus on small and large-cap firms, Schwartz believes mid-cap securities play a critical role within investment portfolios, and provide comparable returns and lower risk.

Farrell (2017) found "over the past 10 years, mid-caps have generated better returns (7.86%) than small caps (7.06%) and have taken on less risk." Not only can mid-cap firms generate higher returns, but they can also lower the risk of a portfolio. Further, Trainor (2017) argues, "the small size anomaly is simply not present over the last 30+ years," and concludes, "the most consistent fund class appears to be mid-cap stocks that do relatively well regardless of the time period." Trainor does not suggest mid-cap firms generate the largest returns often, but that the lower volatility of mid-cap securities causes them to perform well irrespective of the period analyzed.

There are various schools of thought regarding market equity as a screening tool. However, the literature suggests the anomaly has weakened over the past 30-years, and scholars have ignored mid-cap securities during the period. As presented by Trainor, an unidentified mid-cap anomaly has the potential to replace the small-firm effect. Because mid-cap stocks have exemplified excess returns and extremely limited volatility in recent periods, the segment's return/risk measures are even more impressive than those of small and large-cap firms.

III. Methodology

Data

This study examines the mid-cap anomaly using historical returns from Kenneth R. French's security data library. Monthly returns are available from July 1926 through July 2017. The study excludes returns prior to July 1946 due to missing data and the inherent volatility of securities during early years. The study also excludes any securities with unavailable historical returns or market equity information.

Initial monthly returns are organized using a univariate sort based on market equity. The data is sorted into 10 deciles based on market equity, and the 10 portfolios "are constructed…

using the June market equity and NYSE breakpoints" (French). Securities with a market equity in the lowest 10% have an average equity value of $118 million as of January 2017. Small-cap mutual funds traditionally invest in firms much larger than $118 million. For example, the Vanguard Small-Cap Index Fund Investor Shares (NAESX) fund has a median market capitalization of $4.2 billion. Because active mutual funds have difficulties trading such small securities, firms with a market capitalization in the lowest 10% are excluded from analysis. The remaining nine market equity deciles are distributed equivalently into small, mid, and large-cap segments. For comparative analysis purposes, the study also examines the period 1982 – 2017. The later period encompasses a time in which the small-cap anomaly had become common knowledge within the research and investment communities.

Additional return data is obtained from French's database, and is organized by two bivariate sorts based on market equity and another variable factor. One set is "100 Portfolios Formed on Size and Book-to-Market," and historical returns are arranged by the intersection of "10 portfolios formed on size (Market Equity) and 10 portfolios formed on the ratio of book equity to market equity (French)." The second set of data is "100 portfolios Formed on Size and Operating Profitability," and the portfolios comprise "the intersections of 10 portfolios formed on size and 10 portfolios formed on profitability (OP)." The study utilizes the B/M ratio as a factor because Fama and French suggest the ratio predicts expected returns. The study also analyzes operating profitability as a factor because firms with high profitability have historically generated excess returns. The study analyzes 1982 – 2017 for the B/M and OP data.

Results are evaluated using similar risk and return measures. Return measures include average return, minimum return, and maximum return, and risk measures include standard deviation and Value at Risk. The formula to calculate average returns is,

$$Annualized\ Average\ Return = \{1 + Cumulative\ Return\}^{\frac{1}{Years\ Held}} - 1$$

The minimum return is the lowest return during the period, and the maximum is the highest return. The standard deviation measures the dispersion of returns in various periods. The standard deviation is given as,

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

where N is the number of observations, x_i is the observed values, and μ is the mean value of the observations. This study utilizes the historical method for all Value-at-risk (VAR) calculations. Analyzing historical data increases the inherent risk of the calculation because historical returns cannot predict future returns. However, historical returns are easily accessible for analysis. All VAR calculations are performed at the 95% significance level, and the result is the amount that 5% of the total observations are below. The Sharpe Ratio is calculated to provide a risk-adjusted measure of return, and is given as,

$$Sharpe\ Ratio = \frac{r_p - r_f}{\sigma_p}$$

Where r_p is the average portfolio return, r_f is the risk-free rate, and σ_p is the portfolio standard deviation. The St. Louis Federal Reserve was accessed to calculate all risk free rates. The average 90-day Treasury-Bill rate from 1946 – 2017 is 4.05%, and the average 90-day rate from 1982 – 2017 is 3.89%.

The study also evaluates historical mutual fund returns to further analyze the volatility of mid-cap returns as they relate to mutual funds. Analysis of historical mutual fund returns within the study should support the results of historical mutual fund securities. Morningstar's mutual fund database was utilized to gather data (Fund Category Performance). Mutual funds are categorized by the intersection of size and investment type. To remove duplicate fund returns,

this study analyzes one mutual fund in each investment category from each mutual fund family. The sample periods for mutual fund returns are the most recent three and five-year periods, and all mutual fund returns are calculated as simple averages. The database provides individual fund returns and aggregate fund segment returns. The growth and value premium are calculated using aggregated fund segment returns.

Statistics

The study uses a two-sample t-test to determine if the difference between average returns is significant, and assumes all returns are normally distributed. The hypothesis test is H^0: the mean returns between analyzed segments are not significantly different. The alternative hypothesis is H^1: the mean returns of the two segments are significantly different. All statistical tests are performed at the 95% significance level, and the degrees of freedom (df) is calculated as the smaller of $n_1 - 1$ and $n_2 - 1$. The t-stat is given as,

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where $\overline{x_1}$ and $\overline{x_2}$ are the mean returns, s_1^2 and s_2^2 are the respective variances, and n_1 and n_2 represent the number of observations in each population. If the t-stat is greater than the critical t-value, the null hypothesis is rejected and the average returns are assumed to be significantly different.

The study uses regression analysis to determine the significance of B/M and Operating Profitability in relation to average returns. The calculation for the test statistic through regression analysis is given as,

$$\text{T-Stat} = \frac{b_1}{s_b}$$

where b_1 represents the slope of the regression and s_b represents the standard error of the slope coefficient. The analyzed factor (B/M and OP) is significant if the resulting p-value is below 0.05.

IV. Results

The Mid-Cap Anomaly

The suggested weakening of the small-cap anomaly led scholars to revisit market equity's impact on returns, and a handful of researchers suggest mid-cap securities generate excess returns following the small-cap anomaly's identification. Table 1 presents annualized returns and risk measures from 1946 – 2017. The results are organized into deciles based on market equity.

Table 1: Annualized performance and risk measures based on a univariate sort of size. Returns for each decile are analyzed for the period 1946 – 2017.

Decile Returns (1946 - 2017)									
Decile	2nd Decile	3rd Decile	4th Decile	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile
Average 12 Month Rolling Return	14.71%	15.09%	14.60%	14.61%	14.23%	14.32%	13.79%	13.16%	11.70%
Minimum 12 Month Rolling Return	-47.08%	-43.07%	-40.72%	-43.04%	-40.84%	-46.08%	-44.72%	-47.21%	-41.20%
Max. 12 Month Rolling Return	101.64%	95.47%	94.59%	93.03%	83.45%	81.03%	69.98%	64.25%	55.95%
Std. Deviation - 12 Month Rolling	24.86%	22.34%	21.85%	21.10%	19.86%	19.92%	18.46%	17.13%	16.33%
Average 36 Month Rolling Return	13.15%	13.80%	13.42%	13.44%	13.22%	13.29%	12.81%	12.34%	10.99%
Minimum 36 Month Rolling Return	-23.33%	-21.03%	-19.97%	-19.34%	-17.33%	-18.38%	-16.69%	-16.25%	-18.76%
Maximum 36 Month Rolling Return	69.11%	59.27%	55.47%	45.62%	45.43%	46.18%	37.00%	34.03%	35.23%
Std. Deviation - Annualized 36 Month	12.52%	11.01%	10.96%	10.36%	9.59%	9.47%	8.61%	8.66%	9.57%

Deciles 2 – 5 generate the highest average 1-year returns, illustrating the small-firm effect. From 1946 – 2017, firms with the lowest market equity generate the largest average 1-year returns, and returns decrease as market equity increases. For example, decile 8 generated an average 1-year return of 13.79%, compared with 14.61% by decile 5. Because minimum 1-year returns are mixed, no pattern is identified. However, deciles 2 - 4 generate the largest maximum 1-year returns, at 101.64%, 95.47%, and 94.59% respectively. The results suggest small-cap

firms generate larger average and maximum 1-year returns. This is also shown by the fact small-cap firms have the highest standard deviation.

The results shift slightly when observing 3-year periods. Small-cap and mid-cap firms generate mixed 3-year average returns. Because the average returns are mixed, the data suggests small-cap firms fail to generate noticeably larger 3-year returns than mid-cap firms do. The large-cap segment has the lowest average 1- and 3-year returns. More extreme minimum and maximum 3–year returns suggest small-cap firms experience higher volatility than mid-cap and large-cap firms do. Excluding decile 10, the 3-year standard deviation decreases inversely with market equity suggesting smaller securities pose higher risk.

The study organizes average returns into low, mid, and large-cap classifications as set forth in the methodology. Tables 2 and 3 summarize the results and provide risk and return measures.

Table 2: Annualized return and risk measures are calculated for small, mid, and large-cap securities. Returns are based on 1-year periods extending from 1946 – 2017.

Rolling 1-Year Annualized Returns (1946 - 2017)			
	Low 30%	Mid 30%	High 30%
Average Rolling 1-Year Returns	14.76%	14.35%	12.07%
Minimum 1-Year Return	-42.48%	-43.56%	-42.45%
Maximum 1-Year Return	96.15%	84.33%	58.51%
Standard Deviation	22.43%	19.96%	16.35%
Value at Risk (95%)	-20.78%	-18.24%	-15.61%
Sharpe Ratio	0.48	0.52	0.49

Small-cap securities generate the largest average 1-year return from 1946 - 2017. Table 2 suggests the average return decreases as market equity increases during the period. Mid-cap firms generate a slightly lower minimum 1-year return than small and large-cap firms. Small-cap securities generate the highest maximum return during the period, but also generate the highest standard deviation and worst Value at Risk. The Sharpe Ratio is used as a risk-adjusted measure of return, and mid-cap securities have the highest Sharpe Ratio. The resulting Sharpe Ratios

indicate mid-cap securities generate the highest 1-year risk-adjusted return between 1946 and 2017.

Table 3: Annualized return and risk measures are observed for small, mid, and large-cap securities from 1946 – 2017. All returns are based on 3-year periods.

Rolling 3-Year Annualized Returns (1946 - 2017)			
	Low 30%	Mid 30%	Top 30%
Average Annualized 3-Year Returns	13.49%	13.31%	11.34%
Minimum Annualized 3-Year Return	-21.00%	-18.18%	-17.02%
Maximum Annualized 3-Year Return	59.47%	45.82%	32.85%
Annualized Standard Deviation	11.18%	9.54%	9.13%
Value at Risk (95%)	-7.21%	-5.78%	-5.72%
Sharpe Ratio	0.84	0.97	0.80

The results are similar when analyzing 3-year rolling annualized returns, and Table 3 suggests average returns again function inversely with market equity. Small-cap firms generate the most extreme minimum and maximum returns. Small-cap securities also have the highest 3-year standard deviation and Value at Risk, suggesting higher returns of small firms come at the expense of higher risk measures. Again, mid-cap securities generate the highest Sharpe Ratio based on 3-year returns. Therefore, mid-cap securities generate a higher risk-adjusted return than small and large firms during the period.

The results in tables 2 and 3 suggest smaller firms do generate excess returns, and average 1- and 3-year returns function inversely with market equity. However, small-cap firms also generate higher risk measures, and small-cap firms do not generate the highest risk-adjusted return. The study utilizes a statistical t-test to determine if the difference in average returns of small, mid, and large firms is statistically significant. The difference in average 1-year returns of small firms and mid-cap firms produces a test statistic of 0.281, and the difference in average 3-year returns results in a test statistic of 0.25, both of which fail to exceed the critical value of 1.65. Therefore, although the average returns of small-cap firms are larger than mid-cap firms, the excess returns generated by small-cap firms are not significantly larger than the returns generated by mid-cap firms. However, the 1- and 3-year average returns of small-cap and mid-

cap firms are significantly larger than the average returns of large-cap firms. Therefore, small and mid-cap firms significantly outperform large-cap firms, but small-cap firms fail to significantly outperform mid-cap firms. Because small-cap firms fail to significantly outperform mid-cap firms, the results suggest there is a small and mid-cap premium in comparison to large firms, but there is no size premium between small and mid-cap firms.

Table 4: Annualized performance and risk measures are presented based on a univariate sort of size. 1-year and 3-year returns are analyzed from 1982 – 2017.

Decile Returns (1982 - 2017)									
Decile	2nd Decile	3rd Decile	4th Decile	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile
Average 1-Year Rolling Return	13.25%	14.15%	13.04%	14.12%	14.08%	14.45%	14.16%	13.86%	12.48%
Minimum 1-Year Rolling Return	-44.63%	-43.07%	-37.95%	-43.04%	-36.10%	-46.08%	-44.72%	-47.21%	-41.20%
Max. 1-Year Rolling Return	101.64%	95.47%	94.59%	93.03%	83.45%	81.03%	69.98%	64.25%	55.95%
Std. Deviation - 1-Year Rolling	23.65%	21.09%	20.19%	20.62%	19.08%	19.44%	18.61%	17.48%	17.26%
Average 3-Year Rolling Return	11.65%	12.87%	12.14%	12.98%	13.20%	13.50%	13.11%	13.01%	11.70%
Minimum 3-Year Rolling Return	-21.97%	-17.84%	-16.43%	-15.41%	-11.69%	-17.74%	-16.69%	-16.25%	-18.76%
Max. 3-Year Rolling Return	36.08%	35.05%	37.40%	35.30%	33.42%	31.56%	33.13%	33.49%	35.23%
Std. Deviation - Annualized 3-Year	9.78%	8.79%	8.95%	8.77%	8.40%	8.78%	8.29%	8.81%	11.01%

This study analyzes the period 1982 – 2017 for comparison purposes, and decile return and risk measures are presented in table 4. Excluding decile 3, mid-cap deciles generate higher 1-year average returns than small-cap deciles. For example, deciles 5, 6, and 7 have average 1-year returns of 14.12%, 14.08%, and 14.45%, compared with 13.25% and 13.04% for deciles 2 and 4. Deciles with larger market equity generate the lowest minimum 1-year returns, and small-cap securities generate the largest maximum 1-year returns. Small-cap deciles have the highest 1-year standard deviations, at 23.65%, 21.09%, and 20.19% respectively. Studying 3-year returns, deciles 5-7 generate the highest average returns. 3-year minimum returns yield mixed results, as the smallest minimum 3-year returns are scattered among market equity segments. The 3-year standard deviation of small-cap securities is again larger than the standard deviation of mid-cap firms and large-cap firms. Tables 5 and 6 display risk and return measures based on market equity segments.

Table 5: Annualized performance and risk measures are shown. Small, mid, and large-cap segments are analyzed based on 1-year periods from 1982 – 2017.

Rolling 1-Year Annualized Returns (1982 - 2017)			
	Low 30%	Mid 30%	Top 30%
Average Rolling 1-Year Returns	13.40%	14.27%	12.73%
Minimum 1-Year Return	-40.81%	-42.30%	-42.45%
Maximum 1-Year Return	96.15%	84.33%	58.51%
Standard Deviation	20.92%	19.36%	17.07%
Value at Risk (95%)	-18.62%	-15.94%	-18.91%
Sharpe Ratio	0.45	0.54	0.52

Table 6: Annualized performance and risk measures are shown. Small, mid, and large-cap segments are analyzed based on 3-year periods from 1982 – 2017.

Rolling 3-Year Annualized Returns (1982 - 2017)			
	Low 30%	Mid 30%	Top 30%
Average Rolling 3-Year Returns	12.27%	13.33%	11.95%
Minimum 3-Year Return	-17.87%	-15.29%	-17.02%
Maximum 3-Year Return	36.30%	32.31%	32.85%
Standard Deviation	8.88%	8.46%	10.24%
Value at Risk (95%)	6.40%	6.60%	9.00%
Sharpe Ratio	0.94	1.12	0.79

Based on table 5, small and mid-cap securities generate larger average 1-year returns than large-cap firms from 1982 - 2017. Small and mid-cap firms generate average 1-year returns of 13.4% and 14.27%, compared with 12.73% for large-cap firms. However, the average 1-year return of mid-cap firms is larger than the average return for small-cap firms during the period. Large-cap firms generate the lowest 1-year minimum return during the period, and small-cap firms generate the highest maximum return at 96.15%. The standard deviation decreases as market equity increases. For example, mid-cap firms had a standard deviation of 19.36%, and large-cap firms had a standard deviation of 17.07%. Further, mid-cap securities generate a higher Sharpe Ratio than small and large firms based on 1-year returns. Additionally, mid-cap firms have the best 1-year VAR and the highest 3-year average return during the period, at -15.94% and 13.33% respectively. Mid-cap securities have the lowest 3-year standard deviation and a slightly higher VAR than small-cap securities. Again, mid-cap firms have the highest Sharpe Ratio at 1.12.

The results suggest mid-cap securities outperform small and large-cap firms during the period 1982 – 2017. Mid-cap firms generate the highest average 1- and 3-year returns during the

period, and generate lower risk measures than small-cap firms. Further, the mid-cap segment has the highest Sharpe Ratio in both tables, suggesting mid-cap firms generated the highest risk-adjusted returns from 1982 – 2017. Statistical t-tests were performed on 1- and 3-year returns to determine statistical significance. The difference in 1- and 3-year average returns of small and large-cap securities is insignificant, and the difference in 1-year returns of mid-cap firms compared to small and large-cap firms is also insignificant. However, 3-year returns generated by mid-cap firms are significantly larger than the returns generated by small-cap firms and large-cap firms. Not only do mid-cap firms generate the highest risk-adjusted returns, but they also generate larger average 3-year returns that are significantly larger than the returns of small and large-cap securities.

Small firms generate higher average returns than mid-cap and large-cap firms from 1946 - 2017; however, the excess returns are not statistically significant. Therefore, the small-cap anomaly is not statistically significant from 1946 – 2017. In the period following the small-cap anomaly's identification (1982 – 2017), mid-cap firms generated significantly larger 3-year returns than small and large firms. Not only do small firms fail to significantly outperform from 1946 – 2017, but mid-cap firms generate significantly larger returns than small and large-cap firms from 1982 – 2017. The results suggest a mid-cap anomaly exists in the period following the identification of the small-cap anomaly (1982 – 2017).

The literature suggests that mid-cap firms may not outperform year-over-year, but they tend to outperform over longer periods. To assess this theory, the study calculates the percentage of periods each market equity segment generates the highest and lowest return in both periods. Arguments in favor of mid-cap securities often stem from lower volatility, suggesting the

likelihood of outperformance increases when securities are held for longer periods. The distribution of the highest and lowest returns in the period 1946 – 2017 are presented in table 7.

Table 7: Distribution of highest and lowest returns by market equity. 1-, 3-, and 5-year periods are presented for the period 1946 – 2017.

1-Year Rolling Returns (1946 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	40.63%	38.88%
Mid-Cap	19.44%	11.29%
Large-Cap	39.93%	49.83%

3-Year Rolling Returns (1946 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	41.09%	40.40%
Mid-Cap	17.23%	9.08%
Large-Cap	41.68%	50.52%

5-Year Rolling Returns (1946 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	42.03%	39.23%
Mid-Cap	21.77%	3.84%
Large-Cap	36.20%	56.93%

The results suggests mid-cap firms generate the highest or lowest 1-year return less often than small and large firms do. Small-cap firms generate the largest 1-year return most often, and large-cap firms generate the lowest 1-year return most frequently. Either small or large firms generate the largest 1-year return 80.56% of the time during the period, and generate the smallest return 88.71% of the time. When analyzing 5-year periods, mid-cap firms generate the largest return 21.77% of the time and the lowest return 3.84% of the time. These results suggest mid-cap securities outperform small-cap and large-cap securities more frequently when held for longer periods. In addition, the likelihood of mid-cap securities performing worse decreases over longer periods. The same calculations were performed for the period 1982 – 2017, and are presented in table 8.

Table 8: Illustrates the distribution of highest and lowest returns by market equity. 1-, 3-, and 5-year periods are presented for the period 1982 – 2017.

1-Year Rolling Returns (1982 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	31.61%	44.69%
Mid-Cap	28.07%	9.54%
Large-Cap	40.33%	45.78%

3-Year Rolling Returns (1982 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	21.53%	51.50%
Mid-Cap	35.42%	3.54%
Large-Cap	43.05%	44.96%

5-Year Rolling Returns (1982 - 2017)		
	Periods with Highest Return	Periods with Lowest Return
Small-Cap	17.17%	48.23%
Mid-Cap	44.69%	1.91%
Large-Cap	38.15%	49.86%

Following the identification of the small-cap anomaly, large firms generated the highest and lowest 1-year return most often. Mid-cap firms generated the largest 5-year return most often, and generated the lowest 5-year return only 1.91% of the time from 1982 – 2017.

The results provide strong evidence that small-firms underperform mid-cap firms from 1982 – 2017. Following the anomaly's identification, the small-cap segment generated the highest 3- and 5-year return less often than mid-cap and large-cap firms did, and small-cap firms generated the lowest return more often in the later period than the earlier period. The data supports the disappearance of the small-cap anomaly and illustrates the existence of the mid-cap anomaly from 1982 – 2017. During the entire period (1946 – 2017), mid-cap firms generated the highest 1-, 3-, and 5-year returns less often than small and large firms did. However, mid-cap firms generated the highest 5-year returns more frequently than any other segment since the identification of the small-cap anomaly. The percentage of 5-year periods mid-cap firms generate the lowest return also decreases from 3.84% during the entire period to 1.91% following the identification of the anomaly.

The data suggests mid-cap firms rarely outperform, but more rarely underperform, in any given year. Because of the lower volatility of mid-cap firms, their 3- and 5-year geometric returns are normally the best, and generate the highest average return. The results appear strongest over the past 35 years. Therefore, mid-cap stocks appear to be more attractive than small and large-cap stocks for the typical buy-and-hold investor. The results suggest a mid-cap anomaly exists, and it has generated its strongest results following the identification of the small cap anomaly.

Mid-Cap Security Growth Potential

This study hypothesizes that growing firms within the mid-cap segment lead to the generation of excess returns and the mid-cap anomaly. Mid-cap firms generally enter the segment after being classified as a small-cap or large-cap firm. Firms that are declining conventionally enter the mid-cap segment after being classified as a large-cap firm, and growing firms enter the mid-cap segment after being classified as a small-cap firm. The study hypothesizes that growing firms generate excess returns because the growth potential is unlimited, but the loss potential for declining firms is limited at 100%. Therefore, the upside potential of growing mid-cap firms outweighs the downside potential of declining firms.

Data was gathered from the Center for Research in Security Prices (CRSP) to test the hypothesis. Based on a univariate sort of size, small and large-cap firms are excluded from the results in order to focus on the mid-cap segment. Monthly returns from 1927 – 2016 are presented in table 9. A hypothetical mid-cap portfolio was created that excludes firms that were classified as large-cap firms the prior year. The CRSP database was utilized to create the hypothetical portfolio. To support the hypothesis, average returns of the hypothetical portfolio should generate significantly larger monthly returns than the historical portfolio.

Table 9: Historical average monthly returns for the period 1927 – 2017 are observed for mid-cap securities.

1927 - 2016 Returns			
	Decile 5	Decile 6	Decile 7
Average Monthly Return	1.18%	1.12%	1.09%

Table 10: Theoretical average monthly returns of mid-cap securities for the period 1927 – 2017 are observed, excluding firms that were classified as large-cap firms in the prior year.

1927 - 2016 Returns (Hypothetical Portfolio)			
	Decile 5	Decile 6	Decile 7
Average Monthly Return	1.20%	1.14%	1.10%

The hypothetical portfolio does yield higher monthly returns. Each decile under review generates a higher average monthly return in the hypothetical portfolio than in the historical portfolio. Statistical t-tests are performed to determine if the excess returns of the hypothetical portfolio are significant. T-tests were performed for deciles 5, 6, and 7, and resulted in respective test statistics of 0.06, 0.06, and 0.03. Because each test statistic is smaller than the critical t-value of 1.65, the excess returns generated by the hypothetical portfolio are not statistically significant. The results suggest the growth potential of firms in the mid-cap segment is not a significant cause of the mid-cap anomaly, and the results fail to support the hypothesis.

B/M and Operating Profitability as Critical Factors

Although the results suggest the growth potential of mid-cap firms is not a significant factor of the anomaly, this study also analyzes the effect of the B/M ratio and OP on average returns. This study hypothesizes non-size related factors cause greater variation of returns in the mid-cap segment, leading to excess returns. Essentially, non-size related factors have a greater impact on mid-cap firms than on small-cap and large-cap firms. To support this hypothesis, the significance of B/M and OP on average returns should be greater for mid-cap securities than small and large-cap securities. The study analyzes the period 1982 – 2017, and returns are sorted by B/M and OP. The B/M ratio is used because French identified a "simple book to market premium," and it has been suggested that firms with higher B/M ratios generate excess returns.

In addition, OP was selected because firms with high OP have traditionally outperformed firms with low OP.

The study analyzes portfolios formed on the bivariate sort of size and B/M first. The study excludes securities with market equity and B/M in the lowest 10% due to the small size of these firms that generally preclude them from being held by most ETFs or mutual funds. Table 11 presents annualized returns.

Table 11: Annualized average returns for the period 1982 - 2017 are presented based on 100 portfolios created through a bivariate sort on size and B/M. The smallest 10% of securities based on Market Equity and Book-to-Market are excluded.

Small-Cap		Mid-Cap		Large-Cap	
Low 30% B/M	11.73%	Low 30% B/M	13.40%	Low 30% B/M	12.91%
Mid 30% B/M	15.02%	Mid 30% B/M	13.93%	Mid 30% B/M	11.30%
High 30% B/M	13.74%	High 30% B/M	14.33%	High 30% B/M	11.61%

Table 11 suggests average returns are inversely related to the B/M ratio for large-cap firms. For example, average returns decrease from 12.91% for the low 30% B/M, to 11.61% for the high 30% B/M. These results suggest the B/M ratio is not a significant factor for large-cap securities. After further analysis, the large-cap segment consists of fragmented historical data. Therefore, the results for the large-cap segment are inconclusive. However, complete historical data for small and mid-cap firms is available.

Regression analysis is performed to determine the significance of the B/M ratio on the returns of small and mid-cap firms. The analysis resulted in a p-value of .36 for small-cap firms and .12 for mid-cap firms. Therefore, the B/M ratio is not a significant factor for small or mid-cap firms from 1982 - 2017. The results indicate that the B/M ratio does not generate greater variability among returns within the mid-cap segment.

Table 12 presents average annualized returns for the portfolios sorted by size and OP.

Table 12: Annualized average returns from 1982 – 2017 are presented for 100 portfolios created through a bivariate sort on size and OP, excluding the smallest 10% of securities based on Market Equity and Operating Profitability.

Small-Cap		Mid-Cap		Large-Cap	
Low 30% OP	12.17%	Low 30% OP	13.07%	Low 30% OP	9.30%
Mid 30% OP	14.07%	Mid 30% OP	14.31%	Mid 30% OP	11.27%
High 30% OP	15.47%	High 30% OP	14.73%	High 30% OP	13.56%

The initial results suggest OP has a more direct relationship with stock returns than the B/M ratio. Average returns increase as OP increases for each market equity segment. For example, large-cap firms with the lowest 30% OP generate an average return of 9.30%, and the firms with the largest 30% OP generate an average return of 13.56%. Regression analysis was performed on average returns with respect to OP, and resulted in a p-value of .00 for small firms, .049 for mid-cap firms, and .00 for large firms. The results suggest the relationship between OP and the average return is significant for small, mid, and large-cap securities. However, the p-value of .049 for mid-cap securities suggests OP is only slightly significant during the period. Additionally, the most recent 25-year period was analyzed to determine if the significance is a result of the period. The period 1992 – 2017 results in a p-value of .28 for mid-cap securities. Therefore, OP is only slightly significant from 1982 – 2017, and the results suggest the significance is only a result of the time period selected.

The results in tables 11 and 12 present convincing evidence that the mid-cap anomaly is not a direct result of non-size related factors having a greater impact on the mid-cap segment. The B/M ratio is not a statistically significant factor for mid-cap firms, and OP is less significant for mid-cap firms than small and large firms. Further, OP appears to be significant as a result of the period selected. Non-size related factors resulting in greater variation of mid-cap returns does not appear to be a direct cause of the excess returns generated by mid-cap firms over the past 35-years.

Mutual Fund Analysis

Although the results fail to support the growth potential and non-size factor hypotheses, they suggest mid-cap securities are somewhat immune to non-size related factors. Because mid-cap firms are less impacted by non-size related factors, it appears that the mid-cap anomaly is a true anomaly that is not dependent on other factors. To further analyze this position, the study questions if all mid-cap firms benefit from the mid-cap anomaly such that all mid-cap firms benefit from the anomaly similarly, and is there less variation between the returns of mid-cap firms than other market equity segments? In essence, attaining excess returns from buying midcaps is solely dependent on buying any mid cap firms and not any specific mid-cap firms related to other factors such as book-to-market or operating profits.

If all mid-cap firms perform similarly, one would expect the volatility among different mid-cap mutual funds to be lower than the volatility among small-cap or large-cap mutual funds. The results presented above suggest the mid-cap anomaly is not dependent on non-size related factors. However, these factors appear to be more significant for the returns of small and large firms. To test the theory, mutual fund returns from Morningstar's mutual fund database were analyzed. Table 13 illustrates average 5-year returns for each mutual fund category.

Table 13: Average 5-year returns of mutual fund categories are presented.

	Growth	Value	Blend
Small Cap	11.65%	9.16%	10.18%
Mid Cap	11.98%	10.56%	10.65%
Large Cap	13.80%	10.63%	12.04%

Average returns are organized by market equity and investment-type (blend, value, and growth). To evaluate the variation among the returns of small, mid, and large-cap mutual funds, the study calculates a growth premium and a value premium. The growth premium and value premium are calculated as follows,

$$Growth\ Premium = Average\ Growth\ Fund\ Return - Average\ Blend\ Fund\ Return;$$

$$Value\ Premium = Average\ Value\ Fund\ Return - Average\ Blend\ Fund\ Return$$

The growth and value premium illustrate the excess returns generated by growth and value funds in comparison to a blend of the market equity segment. The results are presented in table 14.

Table 14: The 5-year growth premium (Avg. growth return – Avg. blend return) and value premium (Avg. value return – Avg. blend return) are presented for small, mid, and large-cap mutual funds.

	Growth Premium	Value Premium
Small cap	1.47	-1.02
Mid Cap	1.34	-0.08
Large Cap	1.77	-1.40

The results support the theory that lower volatility exists between mutual fund returns in the mid-cap segment than in the small-cap and large-cap segments. The growth and value premium for mid-cap firms are closer to 0 than the premiums for small and large-cap firms. This suggests that all mid-cap mutual funds perform similarly in comparison to small and large funds. To further analyze the variation among mutual funds, 3- and 5-year standard deviations of mutual fund returns were calculated, and are presented in tables 15 and 16.

Table 15: The standard deviation of 3-year average returns for mutual funds are presented by segment.

	Growth	Value	Blend
Small Cap	3.00	2.98	2.79
Mid Cap	2.48	2.38	2.36
Large Cap	2.99	1.96	2.70

Table 16: The standard deviation of 5-year average returns for mutual funds are presented below by segment.

	Growth	Value	Blend
Small Cap	2.77	2.78	2.57
Mid Cap	2.32	2.11	2.03
Large Cap	2.60	2.22	2.18

The results suggest the 3- and 5-year standard deviation between mid-cap fund returns is lower than that for small-cap funds, excluding the blend segment. Because returns vary less among mid-cap funds, the requirement to screen mutual funds using non-size related factors is reduced. However, it is critical that investors rely on non-size related factors and additional screens when investing in small or large-cap mutual funds. Because there is greater dispersion between mutual fund returns in the small-cap segment, screening with non-size related factors is critical to ensure quality funds are selected. However, the screening requirement is lower when investing in mid-cap mutual funds, as the variation among fund returns is smaller.

Analysis of Results

The results support the existence of a mid-cap anomaly in the period 1982 – 2017. Further, the anomaly does not appear to be dependent upon non-size related factors. Mid-cap firms experience lower volatility, and the data suggests all firms within the segment benefit from the anomaly. Conversely, excess returns generated in the small and large-cap segments appear to be a result of non-size related anomalies, as these factors have a greater significance on the small and large-cap segments.

V. Conclusion & Recommendations

This study highlights the absence of the small-cap anomaly following its identification in 1980. Small-cap firms generate larger average returns than mid-cap firms from 1946 – 2017, but the excess returns are not statistically significant. Additionally, mid-cap firms generate larger average returns than small and large-cap firms from 1982 – 2017. The excess 3-year returns generated by mid-cap firms in this period are statistically significant. Additionally, the small-cap

anomaly is not statistically significant during either period analyzed, and is non-existent from 1982 – 2017.

The results suggest a mid-cap anomaly exists from 1982 – 2017. Not only do mid-cap firms generate the highest risk-adjusted returns, but they also generate larger 1- and 3-year average returns relative to small and large-cap firms. Statistical t-tests suggest the excess 3-year returns of mid-cap firms are statistically significant. This gives evidence a mid-cap anomaly exists and is statistically significant from 1982 – 2017.

This study hypothesized the mid-cap anomaly is a result of the excess growth potential of growing firms. A hypothetical portfolio that excluded declining firms failed to generate significantly larger average returns than the historical portfolio. Therefore, the growth potential of firms does not appear to be a significant factor of the mid-cap anomaly. The study rejects the hypothesis regarding growing firms.

The study also hypothesizes non-size related factors cause greater variation among returns for the mid-cap segment, leading to the mid-cap anomaly. Using the B/M ratio and OP, the study calculated the significance of the relationship between each factor and average returns to determine if B/M and OP are significant factors in predicting returns for small, mid, and large-cap firms. The results fail to support the hypothesis, and suggest B/M is not a significant factor for mid-cap firms and OP achieves minimal significance as a result of the period analyzed. Neither factor appears significant in comparison with the returns of mid-cap firms, suggesting mid-cap securities have an immunity to non-size related factors. Because the returns of mid-cap firms are less effected by the B/M ratio and OP, excess returns generated by mid-cap securities appear to represent a legitimate anomaly that is not dependent on non-size related factors.

Market value of equity appears to be the sole driver of the mid-cap anomaly. Although small and large firms have outperformed in various historical periods, the results suggest the outperformance is a result of non-size related factors. In other words, small-cap firms do not outperform because of their size, but because non-size related factors such as OP significantly influence their returns. This influence makes it necessary to sort with non-size related factors to identify quality firms when investing in small and large-cap securities or mutual funds. Because small and large firms generate more variable returns, there is a higher likelihood that individual firms will underperform in these segments. The mid-cap anomaly appears to be a valid size-based anomaly because size-related factors alone (market equity) generate excess returns. Additional screening is less necessary when investing in mid-cap firms because the majority of mid-cap firms benefit from simply being within this size range.

Mid-cap firms are more capable of adjusting to environmental and market changes than large-cap firms. The smaller size of mid-cap firms reduces administrative bloat and allows the firms to adapt more quickly. Faster adjustments result in a higher likelihood of success and higher security returns within a fluid environment. In addition, mid-cap firms are less often overwhelmed by interest costs and general economic contractions than small-cap firms because they have greater financial resources. The study's results suggest mid-cap firms are more capable of adapting to market changes relative to large firms and less likely to fail due to economic contractions relative to small-cap firms. This "happy" medium leads to higher risk-adjusted returns and significantly higher average returns than small and large-cap firms.

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