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# Structural and Return Characteristics Of Mid-Capitalization Firms: A Study Into The Myth Around The Superior Returns Of Mid-Size Stocks

Lane Steinberger

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# STRUCTURAL AND RETURN CHARACTERISTICS OF MID-CAPITALIZATION FIRMS: A STUDY INTO THE MYTH AROUND THE SUPERIOR RETURNS OF MID-SIZE STOCKS

By

Lane Alex Steinberger

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

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**ACCEPTANCE**

This dissertation was prepared under the direction of the Lane Steinberger's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Executive Doctorate in Business in the J. Mack Robinson College of Business of Georgia State University.

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**ABSTRACT**

Structural and Return Characteristics of Mid-Capitalization Firms: A Study Into the Myth Around the Superior Returns of Mid-Size Stocks

By

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Over the years there has been significant research around the misspecification of the Capital Asset Pricing Model (CAPM), which challenges the linear relationship between beta and market returns. One of the biggest challenges relates to the "small-firm effect," which states there are two classifications of stocks (large and small) and that the companies with small-market capitalizations have higher returns. However, the definition of a small-cap is vague and there has been little focus in academia on the stocks in the middle-market capitalization deciles. Despite this, institutional and retail investors created the "mid-cap" category in the early 1990s and, since then, the risk-adjusted returns have been exceptional, relative to small- and large-cap stocks. This study examined mid-cap stocks from an academic perspective and delves into the "mid-cap myth" by evaluating the category over the past 85 years to answer the question around whether mid-caps are superior to other asset class. The results revealed that the highly touted and advertised mid-cap stock performance premium during the 1980-2013 time period was statistically insignificant. Moreover, mid-caps did have superior

risk-adjusted returns over the extended time period studied (1928 to 2014); however, these superior returns relative to small-caps were not driven by the uniqueness of the mid-sized companies, but by the underperformance of small-cap stocks, specifically small-cap growth stocks. When studying the behavior or migration of mid-size companies, they do not appear to exhibit unusual behavior relative to companies with smaller market capitalizations, especially in the area of mergers and acquisitions. Thus, the question becomes why small-cap companies underperform relative to their risk level. The answer lies in the inclusion of the NASDAQ stocks to the CRSP database after 1972. This change not only doubled the number of stocks deemed small-caps, but also added a significant number of unprofitable fast-growing companies to the small-cap growth category, specifically in the technology and healthcare industries. The study benefits practitioners by providing insight into the omnipresent claim of mid-cap outperformance from 1980-2014, while also benefiting academia providing more insight into small-caps' underperformance during this period and how investigating small-cap growth companies further could add insight into the viability or magnitude of the size and value premium going forward.

# I INTRODUCTION

Stock investing has changed substantially over the past 100 years. Today, most asset allocators' stock portfolios are diversified among securities with large- and small-market capitalizations. This study investigates stocks residing in the middle-market capitalizations (otherwise known as mid-cap stocks). Currently, over 1,300 funds focus on these securities; almost as many small-capitalization funds. To understand how this asset class came to fruition, one needs to understand the history of finance and stock investing.

The foundation of academic research in finance began with Harry Markowitz (1952) in his groundbreaking paper Portfolio Selection; the basis for the now well-known theory among academics and practitioners called Modern Portfolio Theory (MPT). This theory revealed investors have different risk profiles. Some prefer less risk, some prefer more risk, and by choosing an optimum mix of risk assets and allocating between investment options, investors could maximize the return of a portfolio at their given level of risk. In other words, it showed, via diversification, how an investor's wealth could be optimally invested in financial assets to produce an optimal return while also eliminating some (not all) of the intrinsic or company-specific risk of a single asset.

From a practitioner standpoint, this placed rigor around the widely known assumption at the time that "all your eggs should not be placed in the same basket." Moreover, before Markowitz, investment courses taught in universities were mainly focused on single security analysis; which meant picking undervalued stocks. Benjamin

Graham and David Dodd advocated what is called value investing, which centered on purchasing a security or company stock of a profitable company with undervalued assets. A factor identified in the Basu (1977) paper which he called the value premium and was formalized later in Fama and French's three-factor model (Fama and French 1992).

The issue with Markowitz's model was it defined volatility and risk the same, which led to its offshoot; the asset pricing models developed by Sharpe (1964) and Litner (1965) in the 1960s, otherwise known as the Capital Asset Pricing Model (CAPM). The model was a significant advancement to Modern Portfolio Theory, evidenced by the fact both Markowitz and Sharpe shared the Nobel Prize in 1990. CAPM formally established the relationship between risk and reward and has formed the way researchers and practitioners think about returns and risk. It was premised on the fact investors would pressure on the price of a stock to the point where the expected return would compensate them for the risk. Thus, the riskier, more volatile stocks compared to the market would require lower prices to achieve a higher return. Moreover, the risk of the stock was measured relative to the market as opposed to its own price volatility. The stock price would be set by the market, and investors would achieve returns directly related to risk as measured by the market *beta*. The beta (or relative risk of a specific stock share) reflects its marginal contribution to the risk of the entire market portfolio of risky securities. In the end, CAPM provided a simple linear relationship between market risk and expected return and is widely considered the foundation of modern price theory for capital markets.

Despite all the accolades, the CAPM model did not adequately explain the observed returns of securities, especially the ones that were much more volatile than the market. The model came into question when Fama and MacBeth (1973) determined, as predicted by Sharpe's model, there is a positive relation between average stock returns and risk; however, the results were period-specific. In other words, prices and actual performance may not fall in line with what the CAPM model should have predicted during certain periods. Additionally, investment managers (the practitioners) with a focus on small or value companies were claiming they were skilled in outperforming the market – a claim that did not seem to coincide with what was being discovered in academia.

This spawned new challenges to the old model. Ross (1976) first challenges CAPM model with the Arbitrage Pricing Theory; a theory that espouses a multi-factor explanation, as opposed to a single factor in CAPM, whereby there are multiple risk premia to compensate investors for return. This led to notion that "beta is dead" and more follow-up research and theories in the 1970s and 1980s showing there may be additional risk premia that the CAPM model does not capture, according to Ball (1978), Basu (1977) and Reinganum (1981).

This research study zeros in on one of the most popular challenges to the CAPM theory; the idea of earning a premium by investing in smaller capitalization companies – a concept that has been around since the early 1980s and first was discussed in Rolf Banz's seminal paper in 1981. This was an earth-shattering proposition at the time,

since Banz found firms with the smaller market capitalization had higher returns, but not necessarily higher betas.

The size effect, as it was termed, became an important concern for retail and institutional money managers as well. In fact, it led to the development of an entirely new asset class for institutions and mutual funds, which changed stock investing as we know it. However, for the next 20 years after the Banz discovery, capturing the premium became the biggest challenge for academics as well as practitioners and it came under intense scrutiny. The small-cap stock asset class underperformed large- and mid-cap stocks from 1980 to 2000. The speculation was that once the secret was discovered by Banz , the small-cap premium disappeared. In addition to the long periods of poor performance, the small-cap effect weaknesses were revealed in follow-up studies that found the return was concentrated in less-liquid stocks or microcap stocks, with most of the premium occurring in the January.

The size effect is one of the most prominent academic anomalies. The history of research around small-capitalization securities and their role in discrediting CAPM is rich. This study reevaluates the small-firm effect in a different light. The question revolves around how stock market asset classes are defined which, in the academic context, classifies a stock in only two ways; large or small. The size of the equity value may be able explain returns of the stock, but the classification used in academia appears too broad and neglects to consider the companies in between large and small market capitalizations (i.e., mid-caps). Why do academics slavishly use this simple bifurcation method to easily divide the large and small company stocks and not disaggregate the

mid-size firms? Moreover, how do you define a small-cap? Academic studies have devised various definitions of small-caps, the bottom 10% of the NYSE, securities listed on the AMEX , or stocks listed on the NASDAQ. However, at least in academia, no one has analyzed the middle-market capitalization companies in any capacity. In fact, Fama/French's famous three-factor study, simply set the breaking point for the small-cap factor (SMB) at the median capitalization of the NYSE market.

Despite this, practitioners (i.e., money managers) have established and invested in mid-cap funds since the early 1990s when Russell released the first mid-cap index. Moreover, this is when the Morningstar, a highly respected source of independent investment analysis for beginners and sophisticated investors, created the now ubiquitous nine-square grid (style boxes) that capture size, security valuation, and security growth. One well-known mid-cap money manager I spoke with said, "*The institutional world didn't really recognize mid-caps as a class until after Russell launched their index…. Morningstar invented the style boxes, and that definitely gave impetus to the category. Morningstar was an early fan of … our Mid-Cap Growth Fund*" (Anonymous personal communication, May 22, 2015).

Currently, according to Morningstar, there are over 1,300 mutual funds classified as mid-cap funds as of 2014. What's more, the widely regarded Russell mid-cap index has outperformed the large (Russell 1000) and small-cap indices (Russell 2000) over the past 34 years with less risk than small-caps (s.d. = 16.8% versus 19.5%) and only slightly more than large-caps (s.d. = 15.3%).

This fact has been behind the marketing effort of most mid-cap mutual fund managers. One manager leads off a white paper with this comment, "*However, we believe mid-cap stocks are an anomaly. Over a reasonably long-period of time, mid-caps have outperformed both large-caps and small-caps, with less relative risk as measured by historical index volatility,*" (Lazorishak 2014). There are various arguments managers use as to why they invest in mid-caps. Another leading mid-cap asset manager claims mid-cap stocks are an "investment sweet spot" and states several reasons why: "better diversification of business operations, deeper manager resources, less volatility and more moderate downside risk, more operational experience, more apt to benefit from new product growth, more nimble, and better margin performance than small companies with faster earnings growth." (Arends 2014)

This study will probe into the "myth" around investing in mid-caps, called a myth since there is no academic research to support isolating this asset class to use in a diversified portfolio. The research aims to provide the practitioner with a study that delves deeper into this phenomenon, which I am calling the "mid-cap effect," by evaluating their role in the domestic stock markets over the past 85 years. At the same time, it will analyze the style characteristics (value and growth) while also studying: the behavior of mid-cap stocks by assessing migration, how and what type of small- and large-caps becomes mid-caps, how a mid-cap becomes a large-cap, and the effect on performance when mid-cap drops to a small-cap. Moreover, it will advance and fill the gap in academic research around small-caps by answering the research question centered on whether the mid-cap category is unique in having superior risk-return

tradeoff compared to large and small companies. Could there be something unique about this asset class that academia and practitioners are missing? Could the mid-cap asset class exhibit more merger and acquisition activity than small-caps? Could one industry be the reason for mid-caps outperformance? This study will provide a better sense of how and what type of mid-cap stocks merge, go bankrupt, or migrate to a large-cap stock.

The entire foundation of academic research in investing tends to be based on asset pricing models developed by Sharpe, Litner and Black in the 1960s (i.e., CAPM). This research study expects to contribute to the academic literature around the misspecification of the CAPM model by delving deeper into one of the most popular anomalies: the small-firm effect. The study will dissect the asset class by studying the mid-size companies using analyses on the mid-size firm effect and the style-return characteristics of the asset class. This will benefit the practitioner by establishing academic rigor around mid-cap investing and validating (or not validating) an allocation to this popular asset class.

# II LITERATURE REVIEW

## I.1 Small-Firm Effect

The research on the companies with smaller market capitalizations is vast. Rolf Banz and Marc Reinganum are the most common names associated with this important discovery. Rolf Banz's (1981) study 35 years ago made him the unofficial father of the small-firm effect. He led the way on studying these type of companies, firms with smaller market capitalizations, in his seminal paper called The Relationship between Return and Market Value of Common Stocks. He studies what he terms the "size effect" where he found firms with smaller market capitalizations have higher risk-adjusted returns than larger firms. The paper focused on firms on the New York Stock Exchange (NYSE) from 1936 to 1975 and formed five equally-weighted and value-weighted portfolios with a stipulation the firms had to be public for at least five years.

At the same time, Marc Reinganum also was studying performance of small firms. Reinganum (1980) uses Arbitrage Pricing Theory to measure risk and assessed small-capitalization stocks by researching all securities on the NYSE and the American Stock Exchange (AMEX) from 1963-1978. He found that grouping portfolios by firm size (small and large), the small-company portfolio earned, on average, 20% more than the large company portfolios. Moreover, Reinganum (1981) extended this study by using CAPM as his measure of risk to evaluate small-caps. He formed 10 equal-weighted portfolios, the first decile as the largest while the tenth decile contained stocks with the smallest market cap, based on market size, and analyzed their excess return relative to

the market. He found only positive anomalous return behavior in the bottom two deciles (or portfolios) with the smallest market capitalization.

As noted in the table below, in years following, others conducted research on the small-firm effect using various definitions with varying results. Brown et al (1983b) studied the entire NYSE from 1962-1978, Keim (1983) studied the NYSE and AMEX from 1963-1979, Lamoureux and Sanger (1989) looked at only NASDAQ stocks in addition to the NYSE and AMEX from 1973-1985, and Fama-French (1992) studied the entire CRSP database NYSE/AMEX/NASDAQ from 1962 to 1986, then extended the study with Jim Davis to 1929 to 1997. The results show the monthly size premium ranging from 0.2% (Fama, French and Davis) to 2.52% (Keim).

***Table 1 Results of Previous Studies on the Small-cap Effect***

| Paper | Size premium (% p.m.) | Test period | # Securities | # Portfolios | MV largest/ smallest |
|---|---|---|---|---|---|
| Banz (1981) | 0.40 | 1936–1975 | NYSE | 5 | NA |
| Reinganum (1981) | 1.77 | 1963–1977 | 566 NYSE- AMEX | 10 | 212 |
| Brown et al. (1983b) | 1.85 | 1962–1978 | 566 NYSE | 6 | NA |
| Keim (1983) | 2.52 | 1963–1979 | 1500–2400 NYSE - AMEX | 10 | 248 |
| Lamoureux and Sanger (1989) | 2.00 | 1973–1985 | 7659 Nasdaq | 20 | 449 |
| Lamoureux and Sanger (1989) | 1.70 | 1973–1985 | 4170 NYSE/Amex | 20 | 1519 |
| Fama and French (1992) | 0.63 | 1962–1989 | NYSE/Amex/Nasdaq | 10 (SMB = Median ) | 296 |
| Fama, French, Davis (2000) | 0.2 (t-stat 1.78) | 1929-1997 | NYSE/Amex/Nasdaq | 10 (SMB = Median) | 296 |

*Source: Van Dijk (2011)*

Fama-French (1992) was one of the most significant of these studies and is said to be the paper that awakened academics and practitioners to this asset classification. They find that beta in isolation does little to explain variation in returns. They suggest stock risks are multi-dimensional and postulate that the market, size, and book-to-

market equity (BE/ME) capture the cross-section of average returns during the period 1963 to 1990. They believe the differences in average return are due to differences in risk and these two factors are proxies for sensitivity to risk factors. However, when studying size alone during the various sub-periods the size premium did not appear persistent. Fama and French (1995) show that small stocks tend to be less profitable than big stocks. However, prior to 1980, this was not so. For some unexplained reason, the recession of 1981 and 1982 was a "prolonged-earnings depression" for small stocks and they do not participate in market boom in the middle and late 1990s.

### II.1.1 Persistence of the Small-Firm Effect

The small-firm effect has been inconsistent and there have been several papers showing where the small-firm effect disappeared during prolonged periods. Banz (1981) and Keim (1983) show the size effect is inconsistent over the 1926-1975 period. Some have even questioned the well-known Reinganum (1981) study by arguing there is a selection bias since it only focuses on the 14-year period 1963-1977. Marsh et al (1983) looked at quarterly stock market data from June 1967 to December 1979 to evaluate the size effect. He rejected the notion the small-cap premium is stable over time and found that different estimation measures could produce different conclusions about the size effect. Brown et al (1983) showed the magnitude of the size effect is sensitive to time periods. Chan, Karceski and Lakonishok (2000), Van Dijk (2011), Crain (2011), Eleswarapu and Reinganum (1993), Dichev (1998), showed the small-cap premium was negative during the 1980s and 1990s. Handa et al (1989) showed the small-firm effect

varied over different sub-periods between 1941 and 1982. Pettengil et al (2002) showed small-cap outperformance can vary over bull and bear markets.

Fama, French and Davis (2000) extended the Fama-French 1992 study to a 68-year period and found similar results to the earlier one; however, the size premium using their definition over the entire period (1929-1997) was shown to not be significant. Horowitz, Loughran, Savin (2000a & 2000b) warned money managers not to bet on the size effect because it changes over time. They delved into the size effect using the Fama and French (1992) method and found the small-firm premium to be statistically insignificant in explaining returns. As noted in the charts below (Figure 1), Crain (2011) used the Horowitz et al (2000) studies to show small-cap firms had more years of underperformance (17 years) than premium years (12).

Figure 1: Annual returns of smallest decile minus largest decile reported by CRSP, 1926-1981

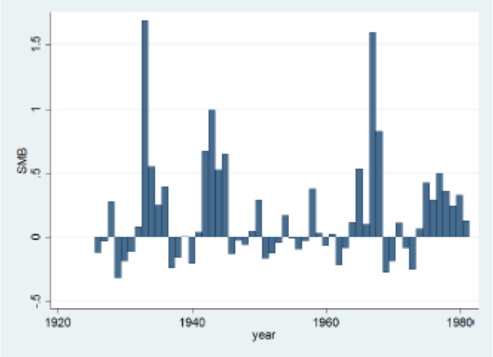


Figure 2: Annual returns of smallest decile minus largest decile reported by CRSP, 1982-2010

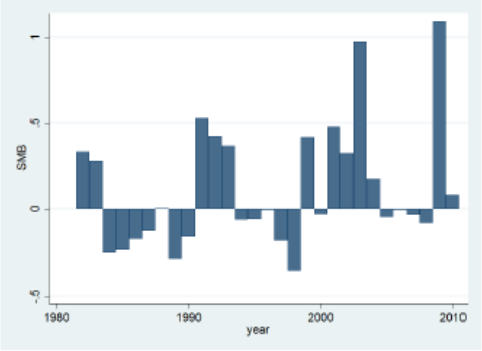


***Figure 1 Annual Returns of the Smallest Decile minus Largest Decile***

*Source: Crain (2011)*

Amihud (2002) shows the size effect is strong from 1964 to 1980, but from 1981-1997, it is statistically insignificant. Dimson (2011) shows the size premium does exist over long periods of time, but their behavior has changed and no longer outperforms.

Roll (1983) looked at mean returns of the American Stock Exchange stocks (basically a measure small-cap) and the NYSE (large-cap) stocks from 1963 -1981 using a buy-hold approach, arithmetic method, and daily rebalancing. He found a significance difference in the returns of small-cap stocks over large-cap stocks using all approaches;

however, the rebalanced and arithmetic methods proved superior to the buy-and-hold strategy.

### II.1.2 January or Seasonality Effect

The January effect is sometimes called the seasonality effect or Turn-of-the-Year effect. There has been considerable research around the puzzling January effect lead by the Rozeff and Kinney's (1976) seminal study, which showed stocks generally increase in the month of January (believed to be due to tax-loss harvesting in December), and these returns tend be higher than any other month. As noted in the graph below (Figure 2), this seasonality effect tends be more pronounced with small-caps (mainly in the first week of the month); when removing the month of January, it causes the small-cap premium to disappear (Reinganum (1981), Roll (1981) and Keim (1983). Keim (1982) looked at daily and monthly returns from 1963-1979 to investigate seasonality of the small-firm effect. He found that 50% of the small-firm effect occurred in January of every year with 26% attributable in the first week of trading. Horowitz et al (2000a), Easterday et al (2009), Lamoureux and Sanger (1989) observe that the smallest decile returns are much higher than the larger deciles during the month of January, while Brown et al (1983) show the January effect for small firms did exist between 1967 and 1979.

Gu (2003), Stephan (2009), Crain (2011) and Van Dijk (2011) show the January effect is still present, but has decreased over time, while Easterday et al (2009) and Moller and Zinca (2008) study just the sub-period 1980-2007 and found the January effect also existed during this time period and was more prevalent with small-caps.

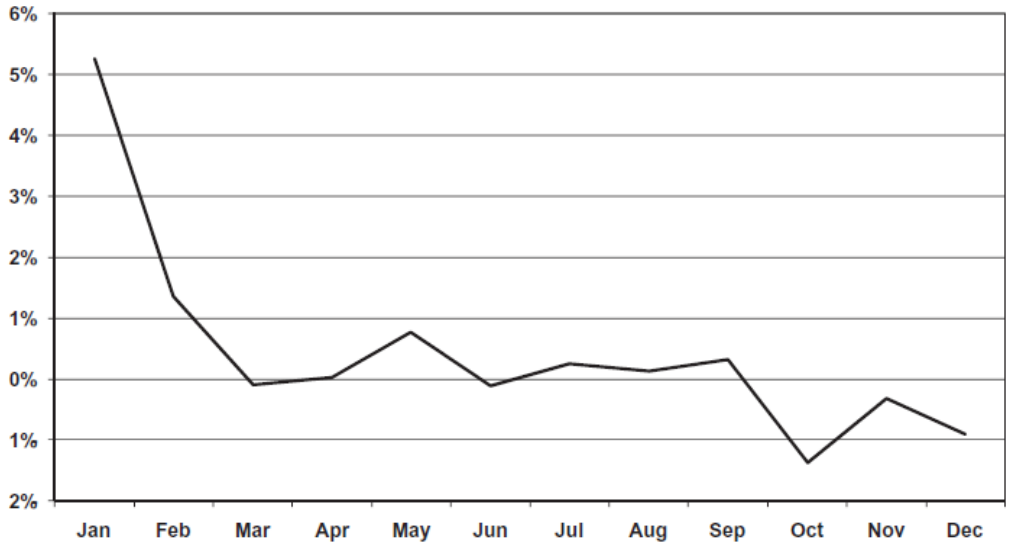


***Figure 2 The January Effect***

*Source: Van Dijk (2011); Seasonal patterns in the size effect in U.S. equity returns 1927–2010. This figure depicts the average market-weighted return differential between the smallest and largest size-quintiles of all NYSE, Amex, and Nasdaq stocks in each month over the period 1927–2010.*

However, there is not a clear explanation as to why the January effect exists. Constantinides (1984) shows that tax trading does not explain the small-firm anomaly, but may be a factor in the seasonal (January) effect. Sias and Starks (1997) studied securities held mostly by individuals as opposed to institutions and concluded these securities had a much stronger seasonality effect, while Poterba and Weisbenner (2001) found changes in the capital gains tax has an effect on the January anomaly. This implies the effect may be caused by tax-loss selling by individuals in December and buying back in January – a theory also supported by Keim (1983). Roll (1983) contested this reasoning that the investors could "bid up" the prices in December to take advantage of the January increase. His counter to this logic is the fact it becomes more challenging with small-caps because of the lack of liquidity and transaction costs. Moreover,

internationally, Dimson et al (2002) and Brown et al (1983) did not find any seasonality effect with U.K. stocks and Australia, respectively; while Japanese and Canadian (pre-cap gains tax) stock markets showed signs of the January effect even when there was no reason for tax-loss selling, per Berges et al (1984) and Kato and Schallheim (1985).

### II.1.3 Limited to the Smallest Firms in the Bottom Decile

Banz (1981) states the relationship between small-company stocks is not linear and only occurs with the very smallest firms; thus, the "larger" small-caps and mid-caps do not reveal a size premium. He says the smallest firms have very unexplained mean returns. However, in regards to mid-cap, he does show an equivalent metric using median-sized firms. It is important to note his analysis is very limited on median-sized firms, especially given he only uses the NYSE. Additionally, any analysis around the median market cap uses a small sample size and limited time frame. Moreover, Reinganum (1981) found the effect only occurred in the bottom two deciles (or portfolios) with the smallest market capitalization. Horowitz et al (2000a) show the size effect is driven by smaller listed firms with market capitalizations less than $5 million, while Fama-French (2008) says the size effect "owes much of its power to microcaps." Crain (2011) and Bryan (2014) show the small-cap premium is driven mainly by the smallest 5% of firms. However, none of these studies provide a strong explanation. Crain (2011) speculates the lower liquidity in these smaller stocks could provide a liquidity premium.

### II.1.4 Compensation for Risk

Since Banz's seminal research on size effect, there have been many research papers challenging its existence. The empirical research has mostly questioned whether there is a true risk-based story to explain the size effect (some sort of "extra" risk the borne by the investor); or could the explanation be centered on investment decisions by firms, stock-market liquidity, or investor behavior.

Stoll (1983) looks at transactions costs (bid-ask spread and broker commissions) and the contention the small-cap premium can achieved before transactions costs; thus, discrediting CAPM. He finds this is dependent on investment horizon. In situations where the horizon is under one year, the small-cap premium disappears when you consider transaction costs. He also showed the small-cap bias is not caused by infrequent trading when using monthly data. Several studies have expanded on this by investigating whether or not the small-cap premiums may be compensation for liquidity risk. Amihud and Mendelson (1986) show there is a relationship between return and stock illiquidity as measured by bid-ask spreads. Brennan and Subrahmanyan (1996), Amihud (2002), Hou and Moskowitz (2005), Sadka (2006), Liu (2006), and Ibbotson, Chen, Kim, and Hu (2013) continue on the Amihud et al (1986) study by showing the illiquidity effect measured in various ways (turnover, bid-ask spread, commissions) is much stronger in relation to small-caps, which helps explain why there are excess returns with smaller-sized companies. Thus, the smaller firms generate higher returns due to the liquidity risk. Zhang (2006) says "information uncertainty" is a risk factor and relates the size premium to the lack of information the investors have on the small firms. He also finds a higher return is achieved for illiquid stocks. Most recently, Kalesnik

and Beck (2015), as noted in Table 2, shows smaller stocks do indeed have wider bid-ask spreads, but this has decreased over the past 10 years.

***Table 2 Bid-Ask Spreads by Size Groups (U.S., 1988-2014)***

| Size Quintile | Bid–Ask Spread (Average over full period) | Bid–Ask Spread (Average last 10 years) |
|---|---|---|
| 1—Smallest 20% | 4.56% | 1.57% |
| 2 | 2.11% | 0.29% |
| 3 | 1.25% | 0.13% |
| 4 | 0.83% | 0.10% |
| 5— Largest 20% | 0.46% | 0.06% |

Note: Quintiles are defined by joint NYSE/NYSE MKT (formerly American Stock Exchange) breakpoints.
Source: Research Affiliates, LLC, using CRSP/Compustat Database.

Chen (1983) uses APT to show there is a relationship between the size-effect and risk, while Chan & Chen (1985) used a multi-factor pricing equation to show changing risk premiums (as measured by default spreads and other economic variables) due to economic contractions and expansions explained the additional return provided by small-cap stocks versus large-cap. This gives more weight to the efficient market story, which explains the size effect as an additional risk borne by the investor as opposed to some sort of behavioral story based on investor preferences.

Roll (1981) delves deeper into the risk story, whereby the small-cap investor is taking on more risk relative to a large-cap so therefore is paid a higher return. He finds, because they trade less frequently, the actual small-cap risk is downward-biased and

underestimated regardless of which model you use. This was substantiated by Dimson (1979) and Scholes and Williams (1977). However, Reinganum (1982) tests this hypothesis that small firms have higher average returns due to improper estimations of security betas. The results showed while the direction of the bias in security betas is apparent, the magnitude of the difference in returns is not explained by the slight difference in beta. Levy (1978) and Mayshar (1979) state transaction costs and other constraints limit the average investor's ability to diversify properly, which would negate any predictions by CAPM since it assumes all investors are diversified. In other words, the investor bears additional risk that requires additional compensation. Lakonishok and Shapiro (1984, 1985) study CRSP data from 1954-1981 and reject this implication, but also reject the notion CAPM can explain the small-firm effect. Berk (1995) challenges the assumption that the size anomaly implies that the CAPM is misspecified and says it is misleading to refer to the size effect as an anomaly. He states that market value may not be the proxy for the missing factor in CAPM. Berk (1996) and Berk (1997) show there is no relation between size and market value using other measures for firm size (like sales). When this occurs, firms with small market values will have higher expected returns because the size anomaly reflects the higher discount rates (due to the higher risk) associated with the these smaller companies. This was also reiterated in Kalesnik and Beck (2015), see Table 3, which showed the difference in credit ratings between the smallest and largest deciles.

***Table 3 Distressed and Volatility Characteristics of Stocks by Size Groups (U.S., 1988-2014)***

| Size Quintile | S&P Credit Rating (Average over full period) | % of Companies Delisted (Annual average) | Portfolio Volatility | 25th Percentile Stock Volatility | Median Stock Volatility | 75th Percentile Stock Volatility |
|---|---|---|---|---|---|---|
| 1—Smallest 20% | B | 2.38% | 20.6% | 32.1% | 50.5% | 76.0% |
| 2 | BB- | 0.37% | 20.6% | 26.8% | 37.6% | 51.7% |
| 3 | BB | 0.13% | 19.0% | 23.8% | 32.1% | 42.8% |
| 4 | BBB- | 0.03% | 17.0% | 21.1% | 28.2% | 37.0% |
| 5—Largest 20% | A+ | 0.01% | 14.3% | 19.8% | 25.5% | 33.2% |

Note: Quintiles are defined by joint NYSE/NYSE MKT (formerly American Stock Exchange) breakpoints.
Source: Research Affiliates, LLC, using CRSP/Compustat Database.

### II.1.5 International Markets

There have been several studies examining the size effect in other countries. Van Dijk ( 2013) lists research on 19 countries and found in 18 of the 19 emerging market and developed countries the small-firm effect existed with the premium ranging from 0.13% to 5.06%. However, he caveats this by saying some of the research may not be reliable; the time periods varied, some of the studies were not published in reputable journals, and there is no clear consensus on whether the size of the firm should be based on local stocks or a broader index like all of Europe or Asia. Various research studies, including Annaert et al (2002), Rouwenhorst (1999), and Barry et al (2001), delve into this and find dramatic differences when comparing an emerging market, for instance, to its own country or the broader emerging-market index. Dimson and Marsh (1999) and Michou et al (2010) find similar results to the U.S. studies. There was a size premium in the U.K. form 1955 to 1986, but from 1989 to 1997 large stocks outperformed by the same amount. The same is true for Australia where Brown,

Kleidon and Marsh (1983), Beedles, Dodd and Officer (1988), Anderson, Lynch and Mathiou (1990), and Gaunt, Gray and McIvor (2000) all document a size effect.

### II.1.6 Other Explanations of the Small-Firm Effect

There are several arguments to explain why the small-firm effect occurs; estimation errors, disinformation, existence of tax deferrals, growth potential.

Keown and Fields (1988) relate the small-firm effect to the merger effect, which provided further evidence that the anomaly presented in Wansley, Roenfeldt and Cooley (1983) was not due to likely acquisition targets, but based on the smaller market capitalization.

Cook and Rozeff (1984) studied Basu and Reinganum's contradictory convictions on the role of the value effect as measure by the earnings/price ration on the small-cap effect. Reinganum believed size subsumes the earnings/price ratio and Basu believed just the opposite. Cook et al (1984) found that neither are correct and that they are two separate effects.

Schwert ( 1983) states that, the statistical association between risk and average returns is only "marginally significant" and "firm size and average stock returns is about as strong as the association between risk and average returns."

Chan and Chen (1991) postulate that the small firms tend to be marginal firms that have lost value due to poor performance and are more likely to have high leverage. Thus, they are more sensitive to the economy and will have higher returns than the

large firms when the economic news is positive and the macroeconomic environment improves.

Investor behavior studies have shown that there may be some investor preference for small-cap stocks. Gompers and Metrick (2001) show that increased institutional demand for stocks drives a preference for large liquid stocks over smaller ones, while Lakonishok et al (1992) argues that smaller-company stocks are harder to justify to plan sponsors.

Although Israel and Moskowitz (2013) could not provide statistically significant evidence, they attribute the change in the small-cap premium over time to the increase in institutional and hedge-fund participation. Chordia, Subrahmanyam and Tong (2014) show increased liquidity and trading due to hedge-fund assets under management led to a decline in the premiums associated with several anomalies including the small-firm effect. Crain (2011) says the findings also may be linked to growth of small-cap mutual and investment funds in the 1980s.

It is also interesting to note the recent findings of Asness et al (2015). They find that stocks with very poor quality are typically small and distressed/illiquid with much lower returns, which drag down the over return of the small-cap asset class. Thus, they reexamine the small-cap premium after to controlling for quality by using what he calls a QMJ or Quality minus Junk factor (long the top 30% high-quality and short the bottom 30% junk stocks), which ranks stocks on profitability (profits per unit of book value), growth (five-year growth in profitability), safety (low-volatility and leverage), and

payout ratio. Once they control for "junk" stocks, the results "produce a robust size premium that is present in all time periods, with no reliably detectable differences across time from July 1957 to December 2012, in all months of the year, across all industries, across nearly two dozen international equity markets, and across five different measures of size not based on market prices." This is related to a similar study by Hou and Van Dijk (2014), which finds small firms' underperformance in the 1980s and 90s was due to "negative profitability shocks."

Barry and Brown (1984) look at NYSE returns from 1931-1980 to investigate the information hypothesis in relation to the small-firm effect; they state the " risk of low-information securities is higher than the perceived risk of high information securities." They also investigate the period-listing effect, which says returns for securities listed for a shorter time are higher than securities listed longer.

Finally, Mcquarrie (2009) argues the CRSP database, the most widely utilized stock database by academics and practitioners (via Morningstar/Ibbotson), has some key limitations. First, CRSP only goes back to 1926, so it excludes a large portion of history in the stock market going back to the 1790s. Second, and more importantly, the CRSP only uses the NYSE before 1962, which means all the stocks trading on the OTC on exchanges in Boston, Chicago, Philadelphia, etc., were excluded. These excluded stocks would most definitely be classified as the smaller enterprises in the bottom-capitalization deciles. Thus, it leads one to question whether the data on small-cap stocks is a good representation. This is especially true since the small-cap universe, as

defined by the NYSE in the 1930s, consisted mainly of large-cap stocks that became what Fama and French (2006) termed “fallen angels.”

## II.2 MIGRATION

Fama and French (2007) examine the behavior of small and large stocks and how they migrate across size and value portfolios to contribute to the size and value premium. As noted in their paper, they classify stock migration according to four cohorts: 1) ***Same***- stocks that do not change category from one period to the next; 2) ***dSize***- small stocks that transition to large stocks and large stocks that transition to small stocks; 3) ***Plus***- stocks that move to neutral or growth or are acquired; 4) ***Minus***- stocks that move toward value, delisted, or their book equity goes negative. In regards to the size premium, they find the majority of the size premium from 1927 to 2006 is linked to the high average excess returns (more than 50%) earned by the 8-12% of small-cap stocks that move from the small to large portfolio from year to year. Moreover, even though “Plus” migrations are more likely to occur with value stocks, small-cap growth stocks, which also tend to be more profitable and fast growing, have the biggest impact on the small-cap premium when they move to large-cap given the size of their market cap versus value stocks. On average, from 1926-2005, 8% of large-cap value stocks transitioned to small-caps, 6.3% of large neutral stocks, and 6.5% of large-growth stocks, while 6.3% of small-growth, 4.7% of small-neutral, and 2.8% of small value become large-caps on average every year. Thus, a large-cap is more likely to migrate across boundaries compared to a small-cap. Fama and French do admit this may have something to do with the using the NYSE median as the demarcation point, which

makes it more difficult for a very-small-cap company to transition up (due to its smaller capitalization) compared to a large-cap transitioning down.

Gharghori et al (2007) study migration in Australian Securities Exchange (ASX) from 1991-2006 and find contradicting results. They discover, in contrast to the Fama and French (2007) U.S. study, the size premium in the Aussie stock market is mainly due to the outsized return of small-cap value stocks that remain in the same group; thus, the small-cap stocks that change categories by growing to large-cap stock only make a minimal contribution to the size premium.

Finally, Chen et al (2010) look at style migration in the U.S. market from June 1975 to 2007 via five size quintiles (1 = smallest and 5 = largest) and show that, on average, over the time period the 84-88% of the stocks remain in the smallest and largest quintiles, while the middle quintiles tend to migrate the most with only approximately 65% of the stocks in the 2 and 3 quintiles staying in their same size category year to year.

### II.3 Value Premium

Value-oriented stock selection has been occurring since the great Benjamin Graham started investing in the 1920s. He and David Dodd espoused a philosophy of buying highly profitable, but undervalued securities. Their primary criteria was noted in the book, “The Intelligent Investor,” which, along with some profitability metrics, the price of the stock could be no more than 1.5 times net asset value or 15 times the average of the three years’ earnings Graham (1949).

This posed another challenge to the CAPM model and eventually led to academic research analyzing how a portfolio strategy of stocks with strong value characteristics (defined in various ways) has outperformed growth stocks and the market overall. Basu (1977) led the way with his seminal paper, "Investment Performance of Common Stocks in Relation to their Price-Earnings Ratios." In this paper, Basu defines a value stock as low P/E (price to earnings) and forms five equally weighted portfolios from low to high P/Es using a 14-year sample from 1957 to 1971. As noted in the table below, Table 4, he finds the low P/E portfolio outperformed the high P/E one by approximately six percent, 16.3% versus 9.34%. Rosenberg, Reid, and Lanstein (1985) study the performance of high and low B/M stocks from 1973 to 1984 by going long the high and short the low B/M stocks. They were one of the first to use B/M as the value metric and find the average monthly return of this portfolio was close to 0.36% per month during the time studied. Fama and French (1990) study value and size characteristics. They find that using a B/M metric, as B/M increases average returns increase and this effect is stronger with the smaller-market capitalization stocks. They study the entire CRSP and COMPUSTAT databases from 1963-1990 and determine the highest B/M deciles produced a 1% average-monthly-return premium over the lowest B/M decile. They also found a stronger effect in the smaller stocks, which were 1% higher than large stocks.

***Table 4 Basu (1977) Results***

*Source: Basu (1977)*

PERFORMANCE MEASURES & RELATED SUMMARY STATISTICS
(April 1957–March 1971)

| Performance Measure/ Summary Statistic | CAPM defined with | P/E Portfolios[1] | | | | | | Market Portfolios[1] | |
|---|---|---|---|---|---|---|---|---|---|
| | | *A* | *A** | *B* | *C* | *D* | *E* | *S* | *F* |
| Median P/E ratio and inter-quartile range[2] | — | 35.8 (41.8) | 30.5 (21.0) | 19.1 (6.7) | 15.0 (3.2) | 12.8 (2.6) | 9.8 (2.9) | 15.1 (9.6) | |
| Average annual rate of return ($\bar{r}_p$)[3] | — | 0.0934 | 0.0955 | 0.0928 | 0.1165 | 0.1355 | 0.1630 | 0.1211 | 0.1174 |

Jaffe, Jeffrey F., Donald B. Keim, and Randolph Westerfield (1989) study 30 NYSE and AMEX firm portfolios ranked first by E/P and then size from April 1951 to December 1986. They found positive and significant returns among the highest E/P portfolios regardless of size.

Basu (1993) uses earnings yield as a valuation metric (earnings to price or E/P). He creates five equally weighted portfolios from high to low and concludes the returns are highest for high-earnings-yielding stock and even higher in the small-cap asset class.

Lakonishok, Sleifer and Vishny (1994) research several value metrics: book-to-market (B/M), cash flow to price (C/P), earnings to price (E/P), growth of sales (GS), and multidimensional measures of value from 1963-1990 of stocks on the NYSE/AMEX. They found the high-low C/P portfolio produced the highest return (11% difference) for a single variable and a strategy of using C/P and GS together outperform all portfolios with a 22% per-year-return. They also suggest that cognitive behavioral biases were the driver of the rewards driven by the value premium.

Fama and French (1993) investigate all stocks excluding financials on the NYSE, AMEX, and NASDAQ exchanges from 1963 to 1990 using the earnings to price and dividend to price (D/P) rations in addition to book-to-market. They build six market-value-weighted portfolios based on size and value: small value, small neutral, small growth, big value, big neutral and big growth. The size break-point is at the median market value of the New York Stock Exchange and the B/M groups are ranked with the top 30% deemed "high" (or value), the next 40% "neutral," and the next 30% "low" (or growth). They develop a high-minus-low (HML) factor, which equates ½ (small value + big value) minus ½ (small growth + big growth). The small-minus-big factor measures the small-cap effect (SMB) and is noted as: SMB = 1/3 (small value + small neutral + small growth) – 1/3 (big value + big neutral + big growth). Again, they find higher returns on small and value stocks and the highest in the small-cap value portfolios. Moreover, they find the E/P and D/P high minus low portfolios produce a monthly return premium of 0.12 -0.14%. They continue on this in their Fama and French (1996) paper by combing two-value characterics using the B/M and GS (five-year growth in sales), E/P and GS, and CP and GS. They verify that there are high average returns on portfolios using all the different value measures.

Chan, Jegadeesh, Lakonishok, J. (1995) study the largest 20% CRSP NYSE-AMEX value and glamour (growth) stocks from 1968 to 1991 using high and low book-to-market ratios. They discover a 5% average five-year return (5 post-formation years) difference between high and low book-to-market portfolios. As noted in Table 5, Chan and Lakonishok (2004) look at various studies and determine value-investing produces

higher returns, but believe the behavioral argument (as opposed to higher risk) explains this difference.

Chan, Hamao and Lakonishok (1991) study the value premium in the Japanese stock market using several metrics: earnings yield, book-to-market and cash-flow yield from 1971 to 1988. They find a significant relationship between all of them; however, book-to-market and cash-flow-yield have the biggest impact on expected returns. Capaul, Rowley and Sharpe (1993) study the value premium across six countries (France, Germany, U.K., Switzerland and the U.S.) from January 1981 to January 1992 and found the value-growth spread to be significant and positive on a global basis (0.29%/month), but not significant at the country level. This implies a value strategy needs to be implemented globally.

Fama and French (1998) study value and growth stocks in 13 markets across the U.S., Europe, and Asia from 1975 to 1995 and found a value premium of 7.68% per year on a global basis and an individual country basis in 12 of the 13 markets.

Kothari, Shanken and Sloan (1995) challenge the Fama and French (1992) study that used Compustat data by conducting the same analysis with the Standard and Poor's industry-level data from 1947 to 1987. They found that, due to survivorship-bias issues, the true relationship between high and low B/M and average returns were very weak.

Similar to small-cap stocks, some believe the extra return earned by value stocks (i.e., the value premium) could potentially have a risk story and others believe it is more behavioral. Obviously, Fama and French (1992, 1993) believe it is the compensation for

higher risk, while Lakonishok, Sleifer and Vishny (1994) espouse a behavioral explanation related to judgmental biases and agency issues with institutional money managers.

***Table 5 Chan and Lakonishok (2004) Results***

*Source: Chan and Lakonishok (2004)*

| Study/Measure | 1A | 1B | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10A | 10B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. Fama and French (1992)** | | | | | | | | | | | | |
| *1. Sorted by book-to-market ratio* | | | | | | | | | | | | |
| Monthly return (%) | 0.30 | 0.67 | 0.87 | 0.97 | 1.04 | 1.17 | 1.30 | 1.44 | 1.50 | 1.59 | 1.92 | 1.83 |
| Beta | 1.36 | 1.34 | 1.32 | 1.30 | 1.28 | 1.27 | 1.27 | 1.27 | 1.27 | 1.29 | 1.33 | 1.35 |
| Log size | 4.53 | 4.67 | 4.69 | 4.56 | 4.47 | 4.38 | 4.23 | 4.06 | 3.85 | 3.51 | 3.06 | 2.65 |
| *2. Sorted by earnings-to-price ratio* | | | | | | | | | | | | |
| Monthly return (%) | 1.04 | 0.93 | 0.94 | 1.03 | 1.18 | 1.22 | 1.33 | 1.42 | 1.46 | 1.57 | 1.74 | 1.72 |
| Beta | 1.40 | 1.35 | 1.31 | 1.28 | 1.26 | 1.25 | 1.26 | 1.24 | 1.23 | 1.24 | 1.28 | 1.31 |
| Log size | 3.64 | 4.33 | 4.61 | 4.64 | 4.63 | 4.58 | 4.49 | 4.37 | 4.28 | 4.07 | 3.82 | 3.52 |

| **B. Lakonishok, Shleifer, and Vishny (1994)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1. Sorted by book-to-market ratio* | | | | | | | | | | |
| Annual return (%) | 11.0 | 11.7 | 13.5 | 12.3 | 13.1 | 15.4 | 15.4 | 17.0 | 18.3 | 17.3 |
| Average annual return over 5 years (%) | 9.3 | 12.5 | 14.6 | 15.4 | 15.8 | 16.6 | 18.4 | 18.9 | 19.6 | 19.8 |
| Size-adjusted average annual return (%) | –4.3 | –2.0 | –0.30 | 0.4 | 0.6 | 1.2 | 2.4 | 2.8 | 3.3 | 3.5 |
| *2. Sorted by earnings-to-price ratio* | | | | | | | | | | |
| Annual return (%) | 12.3 | 12.5 | 14.0 | 13.0 | 13.5 | 15.6 | 17.0 | 18.0 | 19.3 | 16.2 |
| Average annual return over 5 years (%) | 11.4 | 12.6 | 14.3 | 15.2 | 16.0 | 16.7 | 18.8 | 19.1 | 19.6 | 19.0 |
| Size-adjusted average annual return (%) | –3.5 | –2.4 | –0.9 | –0.1 | 0.5 | 1.3 | 2.6 | 2.6 | 2.9 | 1.9 |
| *3. Sorted by cash-flow-to-price ratio* | | | | | | | | | | |
| Annual return (%) | 8.4 | 12.4 | 14.0 | 14.0 | 15.3 | 14.8 | 15.7 | 17.8 | 18.3 | 18.3 |
| Average annual return over 5 years (%) | 9.1 | 12.2 | 14.5 | 15.7 | 16.6 | 17.1 | 18.0 | 19.2 | 19.9 | 20.1 |
| Size-adjusted average annual return (%) | –4.9 | –2.5 | –0.6 | 0.5 | 1.3 | 1.9 | 2.5 | 3.4 | 3.7 | 3.9 |

| **C. Chan, Hamao, and Lakonishok (1991)** | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| *1. Sorted by book-to-market ratio* | | | | |
| Monthly return (%) | 1.3 | 1.7 | 1.9 | 2.4 |
| Monthly standard deviation | 4.3 | 4.3 | 4.3 | 4.6 |
| *2. Sorted by earnings-to-price ratio* | | | | |
| Monthly return (%) | 1.5 | 1.7 | 1.8 | 1.9 |
| Monthly standard deviation | 4.3 | 4.1 | 4.1 | 4.3 |
| *3. Sorted by cash-flow-to-price ratio* | | | | |
| Monthly return (%) | 1.4 | 1.7 | 1.9 | 2.2 |
| Monthly standard deviation | 4.1 | 4.1 | 4.3 | 4.6 |

*Notes*: The sample for Panel A was all NYSE, Amex, and Nasdaq stocks with data on returns and accounting information. Monthly returns were measured for equally weighted portfolios. Results in Panel B came from all NYSE and Amex stocks with data on returns and accounting information. Buy-and-hold returns on equally weighted portfolios were measured annually from April each year for 1968–1989. Panel C results were based on all stocks in the first and second sections of the Tokyo Stock Exchange. Monthly equally weighted portfolio returns were measured from June 1971 to December 1988. In the sorts by earnings to price and cash flow to price, results were provided only for stocks with positive earnings or positive cash flow at the portfolio formation date.

## III THEORECTICAL BACKGROUND AND HYPOTHESIS

As noted in the literature review, in previous studies, the small-cap premium was described as not being persistent. In most of the studies, if the premium was statistically significant, the study utilized a narrow time period, which implies data snooping. The longest history provided, Fama, French and Davis (2000), revealed a small-cap premium of 0.2% per month over a 68-year period; however, the data was found to not be significantly different from zero. It is very possible the mid-cap premium is more stable through time and it is one of the goals of this study to develop the proper test to evaluate this premium. The objective is to create a mid-cap premium measurement that evaluates a premium over small-caps and a premium over large-caps, which effectively is long mid-cap stocks and short large-cap stocks, while also going long mid-caps and short small-caps. Most analyses specifically focused on mid-caps are limited to white papers or reports developed by practitioners; not academics. Mainly large money managers of mid-cap funds with the goal of selling their product. The most common index is maintained by Russell Investments, the Russell mid-cap index, so most of these white papers produced by practitioners utilize their comprehensive database, which provides the returns of this index going back to 1979. Fortunately, for the marketers of mid-cap funds, mid-caps outperformed the large and small indices over the 35-year period 1979-2014. My analysis will expand on this by creating an index using the same Russell mid-cap methodology; however, it will utilize data over an 85-year period via the CRSP database. The analysis also will provide a return for the large- and small-cap categories by determining the compound annual growth rate (CAGR) over the five, ten,

twenty, thirty, fifty and since-inception periods. At the same time, from a practitioner perspective, shorter time frames are more relevant. Thus, the analysis will evaluate each decade going back to the 1930s to not only provide a rolling 10-year and 5-year return, but also the percentage probability of achieving a premium in each of the size categories. From an academic perspective, the mid-cap premium will be evaluated in conjunction with a t-stat validity test. The ultimate goal is to prove or disprove whether the outperformance of mid-caps over the past 35 years was or was not an anomaly.

**Hypothesis 1: The mid-cap premium is more persistent through time.**

**Hypothesis 1a: The mid-cap premium is an anomaly of the 1980s and is statistically significant.**

**Hypothesis 1b: The mid-cap premium is more likely to occur versus the small-cap premium and large-company stocks.**

Since 1980, the Russell Mid-cap index has outperformed the Russell 2000 (Small-cap index) with less return and risk. This contradicts the research on small-caps by Banz and others. Although we do not expect this to persist through time, some would expect mid-caps to have returns closer to small-caps, but with much less risk. One practitioner mentioned, "Ah, there was the hook: in theory, mid-cap was a sweet spot in the marketplace, with returns closer to small-caps and risk right in between small and large," (Anonymous personal communication, May 22, 2015). Thus, this research tests risk-adjust returns.

**Hypothesis 2: Mid-cap companies have higher risk-adjusted returns over the past 85 years**

Fama and French examined how small-caps migrate to large-caps and how large-caps migrate to mid-caps. They find on average, 8% of large-cap value stocks transitioned to small-caps, 6.3% of large-neutral stocks, and 6.5% of large-growth

stocks, while 6.3% of small-growth, 4.7% of small-neutral, and 2.8% of small-value become large-caps on average every year. We examined this by studying how and what type of small stocks transition to mid-caps on their way to becoming large stocks. Do certain stocks from specific industries make this journey? Some practitioners believe the merger and acquisition activity occurs at higher rates in the mid-cap category relative to small-company stocks.

**Hypothesis 3: Mid-cap companies have different positive and negative migrations than small-caps.**

**Hypothesis 3a: Mid-caps are more likely to be involved in mergers and acquisitions than small-caps.**

## IV DATA COLLECTION METHOD AND MEASURES

The sample consists of all New York Stock Exchange (NYSE), the NYSE MKT (formerly known as the American Stock Exchange), NYSE ARCA (previously known as the Archipelago Exchange), the American Stock Exchange (AMEX), and NASDAQ ordinary common stocks that appear on the Center for Research in Securities Prices (CRSP) and on Compustat tapes with data available for certain income statement and balance sheet items. We exclude all CRSP share codes except 10 and 11; thus, there are no American depository receipts (ADRs), closed-end mutual funds, foreign stocks, unit investment trusts, and American trusts. We do include REITS (CRSP share code 18) since they are part of the indices used by practitioners.

The sample period is from January 1928 to December 2014. The time periods for each market in the CRSP database are as follows:

- New York Stock Exchange (NYSE) begins December 31, 1925
- American Stock Exchange (NYSE MKT) begins July 2, 1962
- NASDAQ Stock Market (NASDAQ) begins December 14, 1972
- ARCA Exchange (ARCA) begins March 8, 2006

There are various definitions of a large-caps, mid-caps, and small-caps. The popular style-boxes developed by Morningstar defines a large-cap as a stock in the top 70% of market capitalization, the next 20% are deemed mid-caps, and the bottom 10% are labeled small-caps. Their portfolios are rebalanced quarterly. While MSCI, takes the top 2,500 companies in the stock universe and calls the top 300 large-caps, the next 450 mid-caps, and the next 1,750 small-caps. The popular S&P indices are almost

impossible to replicate given they use a subjective committee approach to determine the constituents of their indices. In general, they take the top 1500 stocks and the first 500 (i.e., S&P 500) are considered large-caps, the next 400 (i.e., S&P 400) are mid-caps, and the next 600 are small-caps (i.e., S&P 600). They add financial viability screens, which require the sum of the most recent four consecutive quarters' as-reported earnings to be positive as should the most recent quarter, while firms' balance-sheet leverage should be operationally justifiable. This creates a quality tilt in all their indices.

As noted in Table 6 below, the returns for all the index providers tend to be close to the proxy portfolios created (Russel Mid-Cap Proxy, CRSP Mid-Cap Proxy) so this study will form three value-weighted portfolios (Russell Small-Cap Proxy, Russell Mid-Cap Proxy and Russell Large-Cap Proxy) using the Russell methodology. Russell is one of the most popular benchmark providers for practitioners while also being the easiest to replicate. We will use the Russell Mid-Cap Index (RMI) definition to evaluate mid-size stocks. The RMI is derived from the Russell 1000 (large-cap index), which is a sub-set of the Russell 3000 (total stock market index). The first 1000 stocks are considered large- and mid-cap stocks, and the next 2000 are considered small-caps (i.e., the Russell 2000).

***Table 6 Proxy Return Comparison***

| Performance | | | | | | |
|---|---|---|---|---|---|---|
| Monthly: 01/1979 - 12/2014 | | | | | | |
| | | | | | | |
| | **Annualized** | **Total** | **Growth of** | **Annualized** | **Average** | **Monthly** |
| **Data Series** | **Return (%)** | **Return (%)** | **Wealth** | **Std. Dev (%)** | **Return (%)** | **Std. Dev (%** |
| CRSP Mid-Cap Proxy | 13.10 | 8,320 | 84.20 | 17.32 | 1.16 | 5.00 |
| Russell Mid-Cap Proxy | 12.65 | 7,180 | 72.80 | 17.08 | 1.12 | 4.93 |
| Russell Midcap Index | 13.76 | 10,267 | 103.67 | 16.86 | 1.20 | 4.87 |
| | | | | | | |

As noted by Russell, to determine membership in Russell 3000 index, the following process occurs:

- On the last trading day in May each year, all eligible securities are ranked by their total market capitalization. The largest 4,000 are determined; then the top 3000 of the 4000 form the Russell 3000.
- Reconstitution occurs on the last Friday in June.
- All Russell indexes are completely rebuilt using annual reconstitution.
- Eligible initial public offerings (IPOs) are added to Russell indexes at the end of each calendar quarter.
- A stock must have a close price at or **above $1.00** (on its primary exchange) on the last trading day in May to be considered eligible for inclusion.
- Companies with a total market **capitalization less than $30 million** are not eligible for inclusion in Russell U.S. indexes.
- Companies with only a small portion (5% or less) of their shares available in the marketplace are not eligible for the Russell Indexes; otherwise known as float adjusted.
- The following share-types are not eligible for inclusion: preferred and convertible preferred stock, redeemable shares, participating preferred stock, warrants, rights, installment receipts and trust receipts.

The Russell Mid-Cap Index is derived by excluding the first 200 securities of the Russell 1000 and including only the next 800 stocks. However, in 1926, there were only about 700 companies in the entire market. Thus, a percentage of market cap is more appropriate for this analysis. According to Russell's methodology, the large-cap category consists of the first 200 stocks of the Russell 3000, which equates to approximately 65% of the total market capitalization of the Russell 3000. The Russell

Mid-Cap Index equates to the next 65% to 90%, and the residual, the small-cap index (Russell 2000), equates to the bottom 10%. For simplicity and ease of programming, the Russell rules were not followed to the letter. Thus, the proxy was reconstituted at the end of the year instead of June, and no restrictions on price and market cap were imposed in addition to ignoring the float adjustment. As noted in Table 6, the Russell and CRSP proxy were compared to the actual indices and were found to be very close. Moreover, the objective of this study is to compare the mid-cap indices to the large and small asset classes using the same criteria so, as long as this was followed, the results would not change.

A field was created to track cumulative market cap across the whole stock database and then value-weighted within the size the category.

A second, more academic measurement focused on the CRSP 3-5 deciles was developed, which is a sub-set of the CRSP 10 decile index data popular in the Fama/French and other academic studies. As with the Russell proxy, we used CRSP share codes 10, 11, and 18 (REITs). Using the NYSE breakpoints provided by Ken French (French 2016), we divided all stocks in the CRSP database into 10 deciles; the 1$^{st}$ decile contains the top 10% of stocks in terms of cumulative market capitalization and the tenth (or bottom) decile contains the smallest 10%. The CRSP 1$^{st}$ and 2$^{nd}$ deciles were grouped and deemed large-caps; the next 3$^{rd}$, 4$^{th}$ and 5$^{th}$ deciles were grouped and deemed mid-caps, and the 6$^{th}$ through 10$^{th}$ deciles made up the small-caps. From there, the stocks were ranked on market value and a value-weighted return was created for each asset class. Based on end-of-year market values on December 31, we categorized

every stock on January 1st of the following year as a large (CRSP 1-2), mid (CRSP 3-5), or small (CRSP 6-10). We then computed the yearly return for each security using the monthly return values provided by CRSP, and then weighted each security within its respective asset class, to compute a value-weighted return for each asset class each year. Thus, if a company delisted mid-year, the return would still be represented in all the months it existed, which prevents survivorship bias. The PERMNO was used as the unique identifier and market value was determined by multiplying the shares outstanding by the price.

Like Fama-French (1992), a mid-cap premium variable – versus small (MMS) and versus large (MML) – was created. Using the value (weighted portfolios for mid-caps and small-caps), the premium represents the difference in monthly returns between these two asset classes. This is slightly different from the Fama-French (1992) calculation in which they dissect two asset classes (small and large) by computing a value-weighted return for the value, growth, and neutral classifications. They then take an equal-weighted average of the returns on the three small portfolios and three big portfolios and compute the difference.

To measure risk-adjusted returns, the Sharpe Ratio was calculated on each asset class portfolio. The Sharpe Ratio is a measure of return obtained per unit of risk as measured by standard deviation. The return typically is measured using an average of excess return (return minus the risk-free rate); however this study uses a compound annual growth rate (CAGR) less the risk-free as measured by the 30-day Treasury bill.

This essentially is a measure of financial efficiency that measures how well the portfolio produces the return for every unit of risk taken.

Sharpe Ratio = Return (portfolio) – Return (risk-free) / Standard Deviation (portfolio)

The Sortino Ratio was developed by Dr. Frank Sortino of the Pension Research Institute and is a variation of the Sharpe Ratio except that it is only focused on downside volatility; not total volatility, which considers both the upside volatility (good) and the downside volatility (bad). It was developed to ensure a manager or fund is not penalized for the good risk. The statistic is determined, like the Sharpe, by adjusting the return using the risk-free 30-day Treasury bill. The downside risk, as opposed to standard deviation, is calculated using semi-deviation, which is a measure of dispersion of returns falling below zero.

Sortino Ratio = $\mathbf{r} - \mathbf{r}_{\text{isk free/ Semi-variance of downside}}$
r= monthly return
rf = risk free
Semi-Variance $= \left(\frac{1}{n} * \sum \quad (-r)\text{^}2\right)^{1/2}$
n= the total number of observations
r= the monthly return below zero

Next, using a method similar to the Fama-French (1992) methodology, the small-, mid- and large-asset classifications were disaggregated to form nine new portfolios: small value, small neutral, small growth, mid value, mid neutral, mid growth, large value, large neutral, and large growth. This was done by forming sorts of stocks on market value and book-to-market value. As noted above, in December of each year from 1951 to 2014, all stocks are ranked on size using the Russell methodology to break

the stocks into small, mid, and large. A shorter time period is used since the COMPUSTAT data only includes balance sheet data as of 1951. However, the database does not contain every company found in the CRSP database, especially with mid- and small-cap stocks. The database becomes more robust after 1970.

All the stocks are then divided into three different book-to-market categories based on the breakpoints for the bottom 30% (growth), middle 40% (neutral), and top 30% (value) of the ranked values of BE/ME for all stocks. Book value of common equity (BE) is defined similar to the Fama-French (1992) study, which uses the Compustat book value of stockholders equity plus balance-sheet deferred taxes minus book value of preferred stock. The BE/ME represents the book common equity for the fiscal year ending in the calendar year divided by the market equity at the same time.

Negative BE firms were not used when calculating the breakpoints for BE/ME or when forming the size-BE/ME portfolios. Only firms with ordinary common equity (as classified by CRSP) are included in the tests. The nine portfolios are constructed from the intersection of the three size and three BE/ME groups. For example, small value (SV) contains the stocks in the small market value group, but also in the highest BE group. Monthly value-weighted returns are then calculated for the nine portfolios at the end of every year. To be included, a company must have CRSP stock prices for December and Compustat book common equity for the same year. Thus, there are some firms missing balance sheet data in Compustat, so all the firms represented in the Russell proxy portfolios may not be represented in the nine new portfolios. Academics have termed this issue, and others related to matching CRSP and Compustat, a

"selection bias" and there have been some arguments this may distort the results in the value premium research, including Breen and Korajczyk (1994) and Kothari, Shanken and Sloan (1995). However, Davis (1994) used the Moody's manuals to estimate the B/M variables pre-Compustat and found the value premium still existed. While La Porta (1993) found similar results, and Chan, Jagadeesh, and Lakonishok (1995) state this issue is "greatly exaggerated."

The portfolios were value-weighted so we can mimic portfolios designed by other index providers like Russell and MSCI. The value and growth weights were assigned separately using the Fama/French measurement for value and growth, while Russell uses three variables in the determination of growth and value. They use the book-to-price (B/P) ratio with a ranking process, like FF, while their growth metric is determined using the Institutional Brokers' Estimate System forecast for medium-term earnings growth (2-year) and sales-per-share historical growth (5-year).

To complete the migration analysis, a database was developed by merging the CRSP stock-level data related to prices and market value with delisting codes and Compustat industry-level data; specifically SIC codes. The delisting codes were generally related to mergers and stock exchanges in addition to bankruptcies and firms going private. Mergers and stock exchanges were coded between 200-390, while everything else was considered "other delisting." As noted in Table 7, the high-level SIC codes (1-12) were used to segment each stock into the following industries: consumer non-durable, consumer durable, manufacturing, energy, chemical, business equipment, telecommunications, utilities, retail and wholesale shops, healthcare, finance and other.

***Table 7 SIC Code Descriptions***

| SIC Code Descriptions | |
|---|---|
| **Consumer Non-Durables** | Food, Tobacco, Textiles, Apparel, Leather, Toys |
| **Consumer Durables** | Cars, TVs, Furniture, Household Appliances |
| **Manufacturing** | Machinery, Trucks, Planes, Office Furniture, Paper, Com Printing |
| **Energy** | Oil, Gas, and Coal Extraction and Products |
| **Chemicals** | Chemicals and Allied Products |
| **Business Equipment** | Computers, Software, and Electronic Equipment |
| **Telecom** | Telephone and Television Transmission |
| **Utilities** | Regulated utilities |
| **Wholesale, Retail, and Some Services** | Laundries, Repair Shops |
| **Healthcare** | Medical Equipment, Drugs, And Health Services |
| **Finance** | Commercial Banks, Insurance, Real Estate, Security & Commodity Brokers |
| **Other** | Mines, Construction, Building Materials, Transportation, Hotels, Business Services, Entertainment |

Each stock in each size category is identified and marked when it migrates to another asset class. For example, a mid-cap becomes a large-cap or small-cap, from one year to the next, or it delists because of a merger or bankruptcy. Since Compustat data was used, the analysis was conducted on stocks after 1950. Since the Compustat data is limited up to 1970, the analysis zeroed in on all migrations after 1980, to focus on mid-caps' superior performance from 1980 to 2014. Additionally, once each migrated security was marked, and assigned a delisting and industry code, the portfolio style (value, neutral, growth) was linked with each stock in addition to market value and return, although the data is very limited for vanishes due to delistings.

# V RESULTS

Two proxies for mid-cap were created, one called the Russell proxy, based on the Russell methodology, and another called the CRSP proxy, which used the CRSP 3-5 deciles of CRSP 1-10 to estimate mid-cap returns. As noted in **Appendix A**, both proxies provide a similar risk-return profile.

The Russell proxy shows that since the inception date of 1928 to the end of 2014, mid-caps have outperformed large-cap stocks. What's interesting is although the small-company stocks had a slightly higher CAGR (Compound Average Growth Rate), 10.9% versus 10.3%, the mid-cap returns were very close, only a 0.6% difference. This was evident in the CRSP measurement as well, with a 0.7% difference. However, comparing the difference using a measurement similar to the Fama-French small-cap premium methodology (SMB), the difference in return between the mid- and small-cap monthly average returns is not significantly different from zero ( MMS=-0.11, t-stat <2), while the difference between large and mid is significant (MML=0.16, t-stat>2). This answers the issue around persistence of the mid-cap premium over small and large. The premium exists and persists through time relative to large-cap stocks *(Hypothesis 1*), but any notion that mid-caps outperform small-cap stocks, like what happened in the 1980s, is dispelled by this analysis, so proving *Hypothesis 1a* incorrect. What's more interesting is when you look at risk as measured by standard deviation, the standard deviation for mid-caps during this 86-year-period falls well below the small-cap standard deviation. Thus, using the risk-adjusted measure of return like the Sharpe ratio, we find mid-caps have better risk-adjusted returns relative to small and large, which proves *Hypothesis 2*

correct. Using the Russell proxies, since the inception, the mid-cap portfolio produced a Sharpe ratio of 0.32 versus 0.30 for the small and large portfolios. The results were even better over the 50-year-period, reflecting 0.33 for mid-cap versus 0.27 for large ad 0.29 for small.

This becomes more evident when you analyze the risk-adjusted return using the Sortino ratio, a measure that only focuses on downside risk and return. The risk-adjusted returns are even more attractive, 0.52 for mid-caps, 0.49 for small-caps, and 0.47 for large caps. Thus, the story is mid-caps have higher returns than large-cap stocks. We would expect this. However, the returns are very close to the small-cap return. We would not expect this. From an academic perspective, this contradicts the small-firm effect and should not be so. You would expect mid-cap returns to fall in the very middle of large- and small-cap returns. We are showing this is true with risk, but not return. Thus, an investor can achieve a return close to small-caps with much less volatility and downside risk -- an attractive proposition for any investor.

Moreover, practitioners like to look at rolling returns, since any client is only willing to give anyone 3-5 years to produce superior returns to the market. Thus, it appears mid-cap may fit that bill better than small-caps. As noted in **Appendix B**, the rolling 3-, 5- and 10-year probability of achieving a mid-cap return over large cap tells an interesting story. Over the rolling 3- and 5-year periods from 1928-2014, mid-caps were more likely to have higher returns over large than small-caps (i.e., 56% versus 54%, and 67% versus 59%). Even in the 10-year rolling return, mid-caps were just as likely to have higher returns as small-caps, so proving the *Hypothesis 1b* partially true. Again, when

analyzing the mid-cap premium using a rolling average the 3-, 5- and 10-year rolling returns, there is significance over all time periods (MML=1.65, 1.70, & 1.60 respectively, t>2). Thus, there may be some diversification benefits to adding mid-caps to a portfolio of stocks.

Regarding the claim that mid-cap stocks outperform both small- and large-cap stocks, this appears not to be true over long period of times. We do show over the 30-year period from 1985 to 2014, mid-caps did outperform small and large (11.52% versus 10.12%, and 10.7% respectively); however, the mid-cap premium over small and large (MMS/MML) did not reveal this difference was significant (MMS=0.07, MML =0.09, t<2), which proves that the outperformance over the 30- and 50-year period cannot be expected going forward.

Once the proxies were developed and analyzed, to help delve deeper in the superior risk-adjusted returns of mid-caps, we established nine different style categories using the Russell proxy: large-cap growth, large-cap neutral, large-cap value, mid-cap growth, mid-cap neutral, mid-cap value, small-cap growth, small-cap neutral, and small-cap value.

Additionally, as noted in the literature review, value stocks outperform growth stocks over time and small-cap-value stocks have outperformed all asset classes historically. This analysis wanted to confirm this effect existed for mid-caps.

For the past 50 years, mid-cap value stocks did outperform growth stocks (13.60% versus 7.61%), while small-cap value significantly beat small-cap growth by over 10% (17.13% vs. 6.52%). Large-cap value performed better than large-growth stocks,

but by a much smaller margin of 1.6%. When validating the value premium across all asset classes using a method similar to the Fama-French monthly return method, over the 50-year period, the mid- and small-cap value premiums ( 0.44 and 0.77, t>2) were significant, while large-cap was not. At the same time, the correlation shows there are diversification benefits to adding mid-cap value stocks to a portfolio. As noted in Appendix J, the mid-cap value premium reveals a correlation coefficient of 0.56 versus the large-cap premium and 0.79 versus small-caps.

What's interesting is the performance in the growth category across asset classes. While the small-cap value asset class bested mid- and large-value stocks (by 3.5% and 5.5% per year), compared to only a 0.21% difference when looking at small-cap and mid-caps in aggregate, small-cap growth stocks significantly underperformed mid- and large-growth stocks. This also occurs despite significantly greater volatility risk. Thus, the Sharpe Ratio for small-cap growth stocks over this time period equates to 0.06 versus 0.12 and 018 for mid- and large-growth. This is counterintuitive since, given the research on the small-firm effect, all small-cap categories should at least outperform large-caps over an extended amount of time. Even the small-cap neutral category achieved similar results beating the mid-cap and large-cap neutral portfolios by over 2.5% and 3.5%.

In other words, the dramatic underperformance in small-cap growth stocks appears to be dragging down the entire small-company category in aggregate. This is interesting since the key to mid-cap stocks' superior performance during the 1980 to 2014 period appears to lie in the small-cap growth category. Thus, this knowledge

changes the original question by not asking why mid-caps returns did so well during this time period, but instead asking why small-caps performed so poorly.

## V.1 Migration

There are some common beliefs espoused by many practitioners regarding mid-caps and how they may behave differently than small-caps. Thus, the movements (or migrations) among small-, mid- and large-cap stocks were analyzed. Moreover, the analysis allows us to provide more color around this issue related the unusual small-cap performance during the 1980-2014 time period, especially related to the small-cap growth category. Again, a movement or migration may be a merger, bankruptcy, or a change in size category. The movements were dissected by asset class and even by sector (SIC classification). On average, as noted in the below table, about 17% of mid-caps have some sort of movement every month, while only 10% of small-caps either merge, go bankrupt, or make the jump to mid-cap territory. This makes sense since mid-caps have more places to migrate compared to small-caps; they can either drop to small-cap or jump to large-cap. Chen et al (2010) also confirmed in his research that mid-caps tend to migrate more often. A small-cap almost never leaps to the large-cap classification before spending some period of time as a mid-cap. Of this 17% for mid-cap movements, the majority migrate down to small-caps (about 60%) on average in any given year, while about 27% migrate up to large-caps, and 17% vanish via merger or delisting. However, on average, over 95% of the time that a mid-cap vanishes, it's due to a merger. Thus, of the 17% of the mid-caps that move, on average, every year, over 40% of the time, it is a positive transition. Said another way, approximately 7% of mid-

caps either merge or migrate to large-caps every year. Since positive transitions, on average, have higher-market-caps, average $3.5B in market value versus $1.5B for negative transitions, this has an impact on returns, but not enough to definitively say it drives the mid-cap outperformance relative to small. What's more, according to Appendix L, the majority of positive transitions during the 1980-2013 time period came from the finance (23%) sector, which is significant since finance companies only represent 19% of the mid-cap category. Additionally, the business equipment sector represented 13% of the positive mid-cap transitions and 19% of negative transitions.

There have been arguments that mid-caps have a better ability to benefit from merger and acquisition activity, which they do, but how does this compare to small-caps? Only about 4% of small-caps vanish every year due to mergers, while mid-cap mergers average around 4.25% of the category. Thus, there is nothing unusual in the merger activity in mid-caps relative to small-caps, which proves *Hypothesis 3* incorrect. This is also true with migrations that move up to a new asset class (on average, 2% of small-caps jump to mid-cap every year) while close to 3.5% of mid-caps jump to large-caps. Like mid-caps, these small-cap jumps in category were also dominated by the finance and business equipment industry sectors during the 1980-2013 time period.

Furthermore, Fama and French (2007) state, "In the end, the size premium in average returns for 1927-2006 traces almost entirely to the high average excess returns (more than 50 percent) earned by the 8-12% of the market capitalization of small-cap stocks that moves to a big-cap portfolio from one year to the next." They go on to say the negative transitions in small-caps case bankruptcies and delistings had a large

negative returns, but a small-market-value impact (2% of the small-cap market cap). This syncs with our study that looks at the 1980-2013 timeframe in that small-cap positive transitions (including both small- to large-mergers) represents about 15% of the market capitalizations and an average 85% return. However, for mid-caps, the positive transitions represent about 11% of the market value with an average 65% return, while the negative transitions represent 6% of market value. Thus, there does not appear to be evidence the mid-cap positive transitions are superior to small-cap positive transitions. (As a side note, the return data on mergers is not completely accurate since it is difficult to calculate return of a delisting on a partial-year basis. Thus, the return on mergers is estimated using the previous year returns.)

Regarding "fallen angels" (stocks that fall from large to mid or mid to small), on average, only about 3% of new mid-caps consist of a new fallen angels (formerly large-caps) in any given year. While on average, about 8% of new mid-caps consist of a newly minted "rising star", small-caps that become mid-caps. Thus, this challenges the assumption that the majority of mid-cap returns are either driven by fallen angels or rising stars; the numbers do not appear significant enough to have a major impact.

The industry data on overall positive and negative movements in the small- and mid-stock categories seem to sync with the changes in industries overtime. For example, from 1928 to 2014, the percentage of public companies in finance moved from 5% to 22%, and business equipment goes from 2% of all stocks in 1928, to 20% in 2000, and down to 14% in 2014. Thus, the most movements in small-cap and mid-cap were in

these two industries. This did not change much from 1980 to 2014 except for the business equipment taking a much larger role during that time.

However, as noted above, the small-cap growth category returns were unusually low over the past 30-50 years. This also occurred, although to a lesser extent, in the mid-cap growth category. When dissecting the small-cap growth into industries, as expected, the business equipment sector plays an outsized role in positive and negative small-cap growth movements; however, the healthcare sector has a significant impact also within this category (16% of all small-cap growth movements versus a 7% representation in the overall small-cap category). The same observation was not found in the mid-cap growth category, so the answer to the small-cap growth underperformance could possibly be found in the business equipment and healthcare sectors.

***Table 8 Migrations***

| All Migrations | Total Small-Cap Movement | Total Mid-Cap Movement | Total Large-Cap Movement |
|---|---|---|---|
| 10-Year | 11% | 17% | 11% |
| 20-Year | 13% | 20% | 15% |
| 30-Year | 13% | 19% | 14% |
| 50-Year | 12% | 18% | 12% |
| 70-Year | 11% | 16% | 12% |
| **Since Incpt (1928)** | **10%** | **17%** | **12%** |

| Movements by Asset Class | Descriptions | Average Since Inception |
|---|---|---|
| Small Vanish | Delisting or Merger | 80% |
| Small to Mid | Small-cap to Mid-Cap | 20% |
| Small to Large | Small-Cap to Lg Cap | 0% |
| Mid Vanish | Delisting or Merger | 22% |
| Mid to Small | Mid-cap to Sm-Cap | 58% |
| Mid to Large | Mid-Cap to Lg Cap | 21% |
| Large Vanish | Delisting or Merger | 15% |
| Large to Mid | Lg-Cap to Mid Cap | 85% |

# VI DISCUSSION

The analysis revealed middle-capitalization stocks have had higher returns than small-cap and large-cap stocks over the past 50 years. At the same time, going back to 1928, mid-cap stocks outperformed large caps and have had returns very close to small-cap returns with much less risk; thus, much higher risk-adjusted returns. At the surface, mid-cap stocks look very attractive and, based on these achievements, any investment company would seriously consider a mid-cap allocation in a diversified portfolio. Given these attractive statistics, one could even question why the mid-cap should not replace the small-cap allocation entirely. These facts have been touted by almost every mid-cap portfolio manager in business today. However, this analysis places some academic rigor around the asset class and brings to light several very important facts about the superior performance of mid-caps.

First, when segmenting each asset class into different styles (growth, neutral value), the mid-cap neutral and value categories underperformed small-caps. Second, the mid-cap premium over small-caps is not statistically significant or persistent over the time period studied. Third, when studying migration, mid-caps do not appear to exhibit unusually high merger activity or jumps up to the large category relative to small-caps. In fact, they tend to migrate downward, which can be a drag on performance. Fourth, small-cap growth stocks appear to be dragging down the entire small-cap category, creating the unusually small return difference between mid-caps and small-caps over the extended time period going back to 1928.

Thus, demystifying the mid-cap myth involves investigating not why mid-caps have done so well, but why small-caps have done so poorly. Mid-caps have outperformed large caps. This is in line with what we have learned from the research around the small-cap effect, so you would expect this given the higher-volatility risk and smaller market capitalization. However, you would not expect mid-caps to have higher returns than small-caps over the 50-year-period and since inception, you would not expect them to have returns close to small stocks. You would expect the risk and return to be equally spaced between small and large. So, why have small-caps done so poorly relative to mid-caps? The answer appears to lie in the CRSP database. As stated in the literature review, Mcquarrie (2009) notes the CRSP database has several limitations. The most glaring is that before 1962, all the stocks trading on the OTC on exchanges in Boston, Chicago, Philadelphia, etc., were excluded. If these stocks were included, they would most likely be deemed small-caps.

After 1962, the American Stock Exchange is added to the CRSP dataset and, most importantly, the NASDAQ stocks were included after 1973. Table 9 notes the number of stocks deemed small-caps double in 1963 and again in 1974.

***Table 9 Change In Number Of Stocks In CRSP***

| | | | | | | | Total | | Mid-Cap ($M) | Small-cap ($M) |
|---|---|---|---|---|---|---|---|---|---|---|
| Year t | Large-cap | *g* | Mid-Cap | *g* | Small-Cap | *g* | # of Stocks | *g* | Avg Mkt Cap | Avg Mkt Cap |
| 1962 | 104 | | 284 | | 720 | | 1,108 | | 285 | 44 |
| 1963 | 116 | *12%* | 350 | *23%* | 1,468 | *104%* | 1,934 | *75%* | 292 | 28 |
| | | | | | | | | | | |
| 1973 | 160 | | 468 | | 1,849 | | 2,477 | | 338 | 31 |
| 1974 | 179 | *12%* | 661 | *41%* | 3,918 | ***112%*** | 4,758 | *92%* | 203 | 15 |

The inclusion of these new exchanges to the CRSP database changes the characteristics of the small-cap asset class dramatically. This is noted in Fama and French (2004) in their study of new lists on NYSE-AMEX-NASDAQ from 1973-2001. They state NASDAQ absorbs most of the OTC stocks noted above and for the post-1972 period. As noted in Table 9, the majority of these listings go to the small-cap category, while bringing down the average market capitalization of small-caps to 15MM, from 31MM. This is mainly driven by NASDAQ's less stringent listing requirements during this period. NASDAQ did not even impose a minimum net income requirement ($750,000) until 1997. Fama and French (2004) state that the profitability of new lists from NASDAQ and AMEX during the 1980-2001 period drifts significantly downward, even several years after listing. And, especially as the new list becomes more Internet-related in the 1990s, the firms tend to be low-profitable, but high-growth companies. This drives the probability of survival for new lists down from 67% to 37%.

Moreover, confirming the results in the migration study, the FF study states healthcare and high-tech firms become a bigger portion of the new lists, moving from about 20% in the 1970s, to around 40% in the 1990s, to close to 55% in 2001. This is interesting given that we know from this analysis small-cap growth firms drive down the performance of the entire small-cap category and, as stated in the results section, healthcare and business equipment play an outsized role in the small-cap growth negative migration movements. What's more, the Fama/French study shows that the business equipment (called HiTec in their paper) and healthcare profitability drops more than the other industries from 1972-2001. The percentage of seasoned firms in these

industries with negative earnings, rises from 9% and 5% in the 1970s to 58% and 50% in 2001. So, it looks as if these two sectors are the fast-growing, unprofitable, small-cap growth firms that had a significant impact on the category and worthy of future study. As a side note, the FF study did not consider finance companies, which we know play a big role in all the stock categories (small, mid and large) during this time.

This brings up the issue of profitability and how it relates to mid-caps. We know the low-profit, fast-growing firms are an impediment to small-cap returns. This is noted in Asness (2015) when he states the size premium research is weak; however, when you screen out the low-quality (or low-profit) "junk" firms, the size premium becomes very robust and persistent in the U.S. and international markets. In other words, weeding out the least profitable firms changes the relationship between size and the cross-section of expected returns. This means the mid-cap premium during the 50-year-period noted above goes away when considering profitability. This is evident when replacing the Russell small-cap proxy data with a small index that excludes the least-profitable stocks and comparing to mid- and large-caps.

As noted in the below table, the Dimensional U.S. Small Index, which contains this profitability exclusion, outperforms over the time periods studied with a statistically significant monthly premium versus mid- and large-sized stocks (0.21 and 0.36, t>2). Finally, the four-factor model in Appendix L, regresses the returns of the various asset classes against a market, value (HML), size (SMB) and profitability (Profit) factor. It validates the small-cap-growth category relative to the small-cap-neutral and value

category has a negative relationship with the profitability factor and contains the smallest (SMB=0.88, t>0), least profitable (profit=-0.08, t>0) companies in the category.

***Table 10 Dimensional Small-Cap Indices (Profitability Exclusion)***

*Source: Dimensional Fund Advisors*

| Performance<br>**01/1928 - 12/2014** | | |
|---|---|---|
| Data Series | CAGR | Std. Dev. |
| Russell Large | 8.87 | 17.77 |
| Russell Mid | 10.27 | 21.04 |
| Dimensional US Small Cap Index | 12.22 | 24.35 |
| Performance<br>**01/1980 - 12/2014** | | |
| | CAGR | Std. Dev. |
| Russell Large | 11.11 | 15.12 |
| Russell Mid | 12.15 | 17.08 |
| Dimensional US Small Cap Index | 14.11 | 18.68 |

Thus, one can conclude the mid-cap category acts as a de facto profitability screen serving a Darwin-like natural selection function in the evolution of small-cap stocks – meaning the least fit, unprofitable small-caps eventually die off and never get the chance to become larger and stronger.

## VI.1 Contributions to Practice

This research challenges the notion that mid-caps are superior to small-cap stocks and evaluates the mid-cap anomaly over the past 30-50 years. As stated above, the issue is not that mid-caps are superior; it is why small-caps are inferior. A practitioner can now view the claims of mid-cap fund managers with a skeptical eye.

The 30-year outperformance of mid-caps touted in most white papers has been shown to be insignificant. Yes, mid-caps do reveal superior risk-adjusted returns over the time period studied; however, it is not the "Goldilocks" scenario espoused in most research papers by the top mid-cap mutual fund managers. This is a special asset class, but not for the reasons most analyst state. Despite the claims made by managers, like mid-caps benefit more from merger and acquisition activity or have deeper management resources than their small-cap counterparts, the mid-cap category outperforms because small-cap growth stocks have underperformed.

With that said, mid-caps did show superior risk-adjusted returns over the time periods studied, by offering returns close to mid-caps with much less risk. Thus, an asset allocator could approach this in various ways. To the passive portfolio manager, one could say that if you passively allocate to small-cap stocks using an index like the Russell 2000, you should seriously consider changing or weighting heavily to mid-caps for this portion of the portfolio. Or, simply bifurcate the small-cap asset class into growth/value and significantly overweight the value portion since most of the unprofitable small-caps are typical found in the growth category. Moreover, the analysis showed value outperformed growth, so value-tilting a passive portfolio can increase returns, while at the same time there are some diversification benefits to adding mid-value to complement a small-cap value tilt.

To the active asset allocator, you should have an allocation to mid-caps in your portfolio; however, the small-cap portfolio (and, to some extent, mid-caps) should have some sort of screen for profitability. Whether you sort and weight the portfolio to the

most profitable stocks, screen out the least profitable small-caps, like Fama/French, or the bottom 30%, like Cliff Asness, profitability should be considered in any small-cap portfolio. Mid-caps are still good investments. Allocations should be made to the category since mid-caps offer a good compromise for someone not comfortable with the risk inherent in small-sized companies, but has the risk tolerance of something more than what large-cap stocks offer.

## VI.2 Contributions to Theory

Academic research has centered on small- and large-capitalization companies and has neglected to consider the middle-market stocks, despite their popularity with practitioners. The mid-cap asset class can be researched much further so, to the academic, we can say mid-caps fall in line with the research around the small-firm effect and CAPM misspecification, whereby the smaller the firm in market capitalization, the higher the return. Having said this, mid-caps are unusual in that they have provided superior risk-adjusted returns versus large- and small-company stocks over the time period studied. This occurs because of issues inherent in the small-cap asset class, specifically small-cap growth. According to Fama-French (2004), the inclusion of NASDAQ stocks in the CRSP database drove an onslaught of small unprofitable companies to the small-cap stock category after 1972. Thus, one could delve into this issue further by investigating the NASDAQ exchange change in standards increased even more since the Fama/French study ended in 2001. As it stands now, we know the exchange listing requirements have become more rigid over the years and have even added a minimum amount of net income to the list of prerequisites. Have the standards

changed since 2001? We know from Gao, Ritter, & Zhu, (2013) that less companies are going public, so is the profile of a typical small-cap, new-list changing? We know most of the unprofitable companies came from the technology and healthcare sectors. Is this changing? For example, are the new-lists stronger and more profitable today? If so, mid-caps may not reflect superior returns relative to small-company stocks in the future. More interesting is the impact on the small-cap value premium. If the profile of a small-cap growth stocks changes, can we challenge the magnitude of the small-cap value premium espoused by Fama-French? If so, the small-cap value premium may drop significantly (or even disappear) after transaction costs.

In conclusion, this research demystifies the mid-cap myth, by dissecting the asset class and identifying the true drivers of the mid-cap stocks relative and absolute returns over the highly advertised 30-year period, in addition to the time period beginning in 1928. Mid-caps have a role in investors' portfolios and academic research. The practitioner just needs to understand how mid-caps relate to small-caps and develop a strategy and allocation to optimize their role in any portfolio. Academics can delve deeper, not only into small-caps growth stocks and their role in the small-stock category, but also into their effect on the value premium going forward.

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# APPENDICES

## Appendix A: Russell Proxy Results

The sample consists of all New York Stock Exchange (NYSE), the NYSE MKT (formerly known as the American Stock Exchange), NYSE ARCA (previously known as the Archipelago Exchange), the American Stock Exchange (AMEX), and NASDAQ ordinary common stocks that appear on the Center for Research in Securities Prices (CRSP) and on COMPUSTAT tapes with data available for certain income statement and balance sheet items. We exclude all CRSP share codes except 10 and 11; thus there are no American Depository Receipts (ADRs), closed-end mutual funds, foreign stocks, unit investment trusts, and American trusts. We do include REITS (CRSP share code 18) since they are part of the indices used by practitioners.

The large cap category consists of the first 200 stocks of the Russell 3000, which equates to approximately 65% of the total market capitalization of the Russell 3000. The Russell Mid-Cap Index equates to the next 65% to 90%, and the residual, the small cap index (Russell 2000), equates to the bottom 10%.

## Russell Proxy

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 1928 -2014 | 1928 -1970 |
|---|---|---|---|---|---|---|---|
| Russell Large | 7.04 | 9.04 | 10.70 | 9.01 | 10.36 | 8.87 | 7.76 |
| Russell Mid-Cap | 9.56 | 10.44 | 11.52 | 10.77 | 11.82 | 10.27 | 9.25 |
| Russell Small | 8.01 | 10.35 | 10.12 | 10.98 | 11.85 | 10.88 | 11.14 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 28'-'14 | 28'-'70 |
|---|---|---|---|---|---|---|---|
| Russell Large | 14.35 | 15.43 | 15.18 | 14.97 | 14.25 | 17.77 | 20.10 |
| Russell Mid-Cap | 17.42 | 17.44 | 17.08 | 17.46 | 16.37 | 21.04 | 24.09 |
| Russell Small | 20.67 | 20.35 | 19.41 | 20.21 | 18.80 | 24.58 | 28.47 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 28-'14 | 28'-'70 |
|---|---|---|---|---|---|---|---|
| Russell Large | 0.39 | 0.41 | 0.46 | 0.27 | 0.44 | 0.30 | 0.30 |
| Russell Mid-Cap | 0.47 | 0.45 | 0.46 | 0.33 | 0.47 | 0.32 | 0.31 |
| Russell Small | 0.32 | 0.38 | 0.33 | 0.29 | 0.41 | 0.30 | 0.33 |
| *Risk Free ( 30 day T-Bill)* | *1.42* | *2.66* | *3.68* | *5.04* | *4.10* | *3.46* | *1.8* |

| **Sortino Ratio** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 28-'14 |
|---|---|---|---|---|---|---|
| Russell Large | 0.56 | 0.61 | 0.70 | 0.41 | 0.70 | 0.47 |
| Russell Mid-Cap | 0.68 | 0.66 | 0.68 | 0.51 | 0.74 | 0.52 |
| Russell Small | 0.47 | 0.57 | 0.49 | 0.45 | 0.64 | 0.49 |
| Risk Free ( 30 day T-Bill) | 1.42 | 2.66 | 3.68 | 5.04 | 4.10 | 3.46 |

## Appendix B: Crsp Proxy Results

A second more academic measurement focused on the CRSP 3-5 deciles was developed, which is a sub-set of the CRSP 10 decile index data popular in the Fama/French and other academic studies. As with the Russell proxy, we used CRSP share codes 10, 11, and 18 ( REITs). Using the NYSE breakpoints provided by Ken French (French 2016) we divided all stocks in the CRSP database into 10 deciles, the 1st decile contains the top 10% of stocks in terms of cumulative market capitalization and the tenth or bottom decile contains the smallest 10%. The CRSP 1st and 2nd deciles were grouped and deemed large caps, the next 3rd, , 4th , and 5th, deciles were grouped and deemed mid-caps, and the 6th through 10th deciles made up the small caps. From there, the stocks were ranked on market value and a value-weighted return was created for each asset class. Based on end-of-year market values on December 31, we categorized every stock on Jan 1st of the following year as a large (CRSP 1-2), mid (CRSP 3-5), or small (CRSP 6-10).

### CRSP Proxy

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 1928-2014 |
|---|---|---|---|---|---|---|
| CRSP Large ( Decile 1-2) | 7.21 | 9.34 | 10.93 | 9.18 | 10.52 | 9.09 |
| CRSP Mid-Cap ( Decile 3-5) | 9.84 | 11.05 | 12.14 | 11.18 | 12.12 | 10.68 |
| CRSP Small (Decile 6-10) | 8.25 | 10.41 | 10.65 | 11.19 | 11.96 | 11.38 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 1928 |
|---|---|---|---|---|---|---|
| CRSP Large | 14.40 | 15.37 | 15.11 | 14.93 | 14.21 | 18.05 |
| CRSP Mid-Cap | 17.94 | 18.01 | 17.43 | 17.71 | 16.63 | 21.90 |
| CRSP Small | 20.24 | 20.31 | 19.38 | 19.98 | 18.66 | 25.94 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 1928 |
|---|---|---|---|---|---|---|
| CRSP Large | 0.40 | 0.44 | 0.48 | 0.28 | 0.45 | 0.31 |
| CRSP Mid-Cap | 0.47 | 0.47 | 0.49 | 0.35 | 0.48 | 0.33 |
| CRSP Small | 0.34 | 0.38 | 0.36 | 0.31 | 0.42 | 0.31 |
| Risk Free ( 30 day T-Bill) | 1.42 | 2.66 | 3.68 | 5.04 | 4.10 | 3.46 |

| **SORTINO Ratio** | 10-yr | 20-yr | 30-yr | 50-yr | 70-yr | 1928 |
|---|---|---|---|---|---|---|
| CRSP Large | 0.58 | 0.64 | 0.73 | 0.43 | 0.72 | 0.49 |
| CRSP Mid-Cap | 0.69 | 0.70 | 0.73 | 0.54 | 0.77 | 0.53 |
| CRSP Small | 0.50 | 0.58 | 0.54 | 0.48 | 0.66 | 0.52 |
| Risk Free ( 30 day T-Bill) | 1.42 | 2.66 | 3.68 | 5.04 | 4.10 | 3.46 |

## RLAppendix C: Russell Proxy By Asset Class And Year

| Year t | Large | Mid-Cap | Small-Cap | Total # of Stocks | Mid-Cap ($M) Avg mkt cap | Small-cap ($M) Avg Mkt Cap |
|---|---|---|---|---|---|---|
| 1928 | 64 | 141 | 353 | 558 | 104 | 18 |
| 1929 | 68 | 152 | 369 | 589 | 87 | 11 |
| 1930 | 65 | 142 | 469 | 676 | 66 | 7 |
| 1931 | 53 | 132 | 503 | 688 | 37 | 4 |
| 1932 | 44 | 123 | 514 | 681 | 39 | 4 |
| 1933 | 44 | 113 | 507 | 664 | 65 | 8 |
| 1934 | 54 | 133 | 481 | 668 | 52 | 7 |
| 1935 | 58 | 143 | 470 | 671 | 71 | 9 |
| 1936 | 60 | 150 | 473 | 683 | 82 | 13 |
| 1937 | 66 | 175 | 469 | 710 | 43 | 5 |
| 1938 | 58 | 156 | 535 | 749 | 65 | 8 |
| 1939 | 63 | 164 | 521 | 748 | 55 | 7 |
| 1940 | 57 | 166 | 530 | 753 | 50 | 7 |
| 1941 | 57 | 175 | 533 | 765 | 42 | 5 |
| 1942 | 58 | 174 | 542 | 774 | 46 | 6 |
| 1943 | 60 | 178 | 532 | 770 | 56 | 9 |
| 1944 | 69 | 201 | 506 | 776 | 58 | 11 |
| 1945 | 79 | 231 | 486 | 796 | 75 | 16 |
| 1946 | 98 | 257 | 468 | 823 | 56 | 12 |
| 1947 | 102 | 264 | 507 | 873 | 53 | 11 |
| 1948 | 99 | 269 | 541 | 909 | 51 | 10 |
| 1949 | 93 | 267 | 576 | 936 | 63 | 11 |
| 1950 | 100 | 268 | 596 | 964 | 76 | 15 |
| 1951 | 102 | 283 | 599 | 984 | 86 | 15 |
| 1952 | 102 | 275 | 627 | 1,004 | 98 | 17 |
| 1953 | 98 | 273 | 646 | 1,017 | 98 | 16 |
| 1954 | 98 | 262 | 656 | 1,016 | 149 | 25 |
| 1955 | 99 | 267 | 655 | 1,021 | 172 | 29 |
| 1956 | 90 | 267 | 662 | 1,019 | 194 | 31 |
| 1957 | 89 | 261 | 672 | 1,022 | 177 | 26 |
| 1958 | 87 | 250 | 707 | 1,044 | 273 | 42 |
| 1959 | 94 | 260 | 681 | 1,035 | 281 | 46 |
| 1960 | 95 | 273 | 687 | 1,055 | 284 | 42 |
| 1961 | 99 | 271 | 707 | 1,077 | 345 | 54 |
| 1962 | 104 | 284 | 720 | 1,108 | 285 | 44 |
| 1963 | 116 | 350 | 1,468 | 1,934 | 292 | 28 |
| 1964 | 112 | 342 | 1,487 | 1,941 | 343 | 32 |
| 1965 | 116 | 355 | 1,549 | 2,020 | 401 | 42 |
| 1966 | 135 | 395 | 1,504 | 2,034 | 319 | 33 |
| 1967 | 142 | 399 | 1,541 | 2,082 | 402 | 54 |
| 1968 | 167 | 477 | 1,422 | 2,066 | 387 | 61 |
| 1969 | 197 | 535 | 1,345 | 2,077 | 275 | 39 |
| 1970 | 178 | 491 | 1,526 | 2,195 | 309 | 36 |

| Year | Large | Mid-Cap | Small-Cap | Total # of Stocks | Mid-Cap ($M) Avg mkt cap | Small-cap ($M) Avg Mkt Cap |
|---|---|---|---|---|---|---|
| 1971 | 167 | 451 | 1,656 | 2,274 | 410 | 47 |
| 1972 | 179 | 475 | 1,716 | 2,370 | 420 | 46 |
| 1973 | 160 | 468 | 1,849 | 2,477 | 338 | 31 |
| 1974 | 179 | 661 | 3,918 | 4,758 | 203 | 15 |
| 1975 | 168 | 612 | 3,659 | 4,439 | 321 | 22 |
| 1976 | 191 | 628 | 3,676 | 4,495 | 382 | 29 |
| 1977 | 217 | 680 | 3,699 | 4,596 | 329 | 29 |
| 1978 | 247 | 753 | 3,523 | 4,523 | 296 | 29 |
| 1979 | 257 | 774 | 3,409 | 4,440 | 361 | 36 |
| 1980 | 279 | 777 | 3,348 | 4,404 | 428 | 42 |
| 1981 | 267 | 791 | 3,524 | 4,582 | 421 | 39 |
| 1982 | 291 | 817 | 3,847 | 4,955 | 448 | 42 |
| 1983 | 285 | 811 | 3,815 | 4,911 | 548 | 53 |
| 1984 | 323 | 961 | 4,176 | 5,460 | 434 | 40 |
| 1985 | 295 | 879 | 4,446 | 5,620 | 621 | 53 |
| 1986 | 293 | 878 | 4,447 | 5,618 | 677 | 55 |
| 1987 | 280 | 855 | 4,711 | 5,846 | 681 | 47 |
| 1988 | 256 | 774 | 5,182 | 6,212 | 862 | 55 |
| 1989 | 257 | 759 | 4,966 | 5,982 | 991 | 61 |
| 1990 | 226 | 670 | 4,886 | 5,782 | 987 | 53 |
| 1991 | 192 | 593 | 4,892 | 5,677 | 1,629 | 95 |
| 1992 | 219 | 691 | 4,827 | 5,737 | 1,564 | 103 |
| 1993 | 257 | 797 | 4,790 | 5,844 | 1,516 | 112 |
| 1994 | 300 | 961 | 5,106 | 6,367 | 1,204 | 94 |
| 1995 | 299 | 1,010 | 5,447 | 6,756 | 1,523 | 123 |
| 1996 | 289 | 1,031 | 5,607 | 6,927 | 1,860 | 147 |
| 1997 | 287 | 1,120 | 6,023 | 7,430 | 2,254 | 173 |
| 1998 | 254 | 1,064 | 6,127 | 7,445 | 2,687 | 178 |
| 1999 | 165 | 792 | 6,059 | 7,016 | 4,619 | 295 |
| 2000 | 154 | 768 | 5,762 | 6,684 | 5,313 | 292 |
| 2001 | 150 | 661 | 5,569 | 6,380 | 5,231 | 308 |
| 2002 | 155 | 708 | 4,848 | 5,711 | 3,701 | 239 |
| 2003 | 159 | 685 | 4,444 | 5,288 | 5,091 | 386 |
| 2004 | 187 | 775 | 3,991 | 4,953 | 5,041 | 418 |
| 2005 | 210 | 817 | 3,878 | 4,905 | 4,896 | 418 |
| 2006 | 217 | 798 | 3,834 | 4,849 | 5,345 | 476 |
| 2007 | 215 | 805 | 3,760 | 4,780 | 5,416 | 433 |
| 2008 | 191 | 700 | 3,794 | 4,685 | 3,452 | 278 |
| 2009 | 156 | 625 | 3,645 | 4,426 | 5,549 | 446 |
| 2010 | 179 | 655 | 3,327 | 4,161 | 6,183 | 523 |
| 2011 | 203 | 686 | 3,145 | 4,034 | 5,320 | 462 |
| 2012 | 191 | 631 | 3,065 | 3,887 | 6,555 | 579 |
| 2013 | 190 | 627 | 2,967 | 3,784 | 8,597 | 821 |

Appendix D: Migration By Industry

| **Since Inception** | **TOTAL Movement** | **Small Vanish** | **Small to Mid** | **Mid-Vanish** | **Mid to Small** | **Mid to Large** | **Large Vanish** | **Large to Mid** |
|---|---|---|---|---|---|---|---|---|
| Consumer NonDur | 7% | 8% | **7%** | 8% | 7% | **7%** | 7% | 8% |
| Consumer Durables | 3% | 3% | **3%** | 3% | 4% | **3%** | 3% | 4% |
| Manufacturing | 14% | 13% | **15%** | 11% | 15% | **14%** | 14% | 15% |
| Energy | 6% | 5% | **5%** | 9% | 5% | **7%** | 7% | 6% |
| Chemicals | 3% | 2% | **3%** | 1% | 4% | **5%** | 5% | 5% |
| Bus Equipment | 13% | 15% | **13%** | 9% | 15% | **11%** | 11% | 10% |
| Telecom | 3% | 2% | **3%** | 4% | 3% | **3%** | 3% | 2% |
| Utilities | 5% | 1% | **4%** | 6% | 4% | **10%** | 10% | 11% |
| Retail & Whol Shops | 10% | 12% | **10%** | 7% | 10% | **8%** | 8% | 9% |
| Healthcare | 6% | 7% | **6%** | 7% | 5% | **6%** | 6% | 4% |
| Finance | 16% | 19% | **16%** | 21% | 14% | **16%** | 16% | 15% |
| Other | 13% | 14% | **13%** | 14% | 14% | **10%** | 10% | 11% |
| TOTAL | 100% | 100% | **100%** | 100% | 100% | **100%** | 100% | 100% |

| **1980 to 2013** | **TOTAL Movement** | **Small Vanish** | **Small to Mid** | **Mid-Vanish** | **Mid to Small** | **Mid to Large** | **Large Vanish** | **Large to Mid** |
|---|---|---|---|---|---|---|---|---|
| Consumer NonDur | 5% | 5% | 5% | 8% | 5% | 5% | 7% | 6% |
| Consumer Durables | 3% | 2% | 3% | 3% | 3% | 3% | 2% | 4% |
| Manufacturing | 10% | 10% | 10% | 7% | 11% | 9% | 7% | 10% |
| Energy | 5% | 5% | 4% | 7% | 5% | 5% | 11% | 5% |
| Chemicals | 3% | 2% | 2% | 2% | 3% | 4% | 4% | 4% |
| Bus Equipment | 17% | 18% | 17% | 11% | 19% | 15% | 4% | 15% |
| Telecom | 3% | 3% | 3% | 5% | 3% | 4% | 13% | 3% |
| Utilities | 3% | 1% | 3% | 5% | 4% | 8% | 2% | 11% |
| Retail & Whol Shops | 11% | 11% | 11% | 7% | 11% | 10% | 2% | 10% |
| Healthcare | 8% | 9% | 8% | 7% | 6% | 6% | 0% | 4% |
| Finance | 20% | 21% | 20% | 24% | 16% | 21% | 36% | 18% |
| Other | 13% | 13% | 12% | 14% | 13% | 10% | 11% | 10% |
| TOTAL | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Appendix E: Stock Market Industry Breakout

| | Consumer NonDur | Consumer Durables | Manufacturing | Energy | Chemicals | Bus Equipment | Telecom | Utilities | Retail & Whol Shops | Healthcare | Finance | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1928 | 17% | 6% | 22% | 10% | 3% | 2% | 1% | 4% | 8% | 2% | 5% | 20% |
| 1929 | 18% | 6% | 23% | 9% | 3% | 2% | 1% | 3% | 10% | 1% | 3% | 20% |
| 1930 | 18% | 6% | 24% | 8% | 4% | 3% | 1% | 3% | 9% | 1% | 4% | 19% |
| 1935 | 16% | 5% | 26% | 7% | 5% | 3% | 1% | 3% | 10% | 2% | 5% | 18% |
| 1940 | 16% | 6% | 27% | 7% | 5% | 3% | 1% | 3% | 10% | 2% | 5% | 15% |
| 1945 | 15% | 6% | 29% | 6% | 5% | 4% | 1% | 4% | 10% | 2% | 4% | 14% |
| 1950 | 15% | 5% | 28% | 6% | 5% | 4% | 1% | 6% | 9% | 2% | 5% | 14% |
| 1955 | 14% | 5% | 28% | 5% | 6% | 3% | 1% | 9% | 9% | 2% | 5% | 13% |
| 1960 | 12% | 5% | 29% | 5% | 6% | 4% | 1% | 9% | 9% | 3% | 5% | 11% |
| 1965 | 13% | 5% | 25% | 5% | 5% | 7% | 1% | 6% | 11% | 2% | 7% | 12% |
| 1970 | 13% | 5% | 23% | 5% | 5% | 8% | 2% | 6% | 11% | 3% | 7% | 12% |
| 1975 | 11% | 4% | 19% | 5% | 3% | 8% | 1% | 4% | 12% | 3% | 18% | 12% |
| 1980 | 9% | 3% | 18% | 6% | 3% | 10% | 1% | 5% | 12% | 4% | 18% | 11% |
| 1985 | 6% | 3% | 14% | 7% | 2% | 16% | 2% | 4% | 11% | 6% | 18% | 12% |
| 1990 | 6% | 3% | 11% | 4% | 2% | 15% | 2% | 4% | 10% | 8% | 23% | 12% |
| 1995 | 6% | 3% | 11% | 4% | 2% | 15% | 2% | 3% | 12% | 9% | 21% | 12% |
| 2000 | 5% | 2% | 9% | 3% | 2% | 20% | 3% | 2% | 11% | 9% | 21% | 13% |
| 2005 | 5% | 2% | 9% | 3% | 2% | 18% | 3% | 3% | 10% | 11% | 22% | 12% |
| 2010 | 5% | 2% | 9% | 4% | 2% | 16% | 3% | 3% | 9% | 11% | 23% | 14% |
| 2013 | 5% | 2% | 9% | 4% | 2% | 14% | 3% | 3% | 8% | 10% | 22% | 19% |

# Appendix F: Stock Market Style Classification By Year

| Style Category | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Large Growth | 22 | 29 | **39** | 46 | 56 | 50 | 48 | 51 | 47 | **52** | 49 | 55 | 64 | 73 | 76 | 81 | 76 | 83 | 84 | 94 | 85 | 88 | 83 | 75 | 72 |
| Large Neutral | 31 | 38 | **52** | 63 | 74 | 68 | 64 | 70 | 63 | **71** | 67 | 76 | 85 | 98 | 102 | 106 | 104 | 112 | 112 | 128 | 111 | 112 | 106 | 98 | 101 |
| Large Value | 22 | 29 | **38** | 46 | 56 | 50 | 47 | 51 | 47 | **52** | 49 | 55 | 64 | 73 | 76 | 78 | 79 | 84 | 83 | 93 | 86 | 84 | 83 | 76 | 76 |
| Mid Growth | 57 | 66 | **89** | 114 | 135 | 132 | 124 | 132 | 132 | **187** | 176 | 181 | 193 | 209 | 210 | 215 | 218 | 227 | 233 | 271 | 242 | 238 | 228 | 207 | 206 |
| Mid Neutral | 75 | 89 | **118** | 155 | 178 | 176 | 169 | 179 | 179 | **247** | 237 | 243 | 262 | 282 | 284 | 288 | 285 | 303 | 304 | 353 | 316 | 312 | 312 | 284 | 279 |
| Mid Value | 56 | 66 | **88** | 114 | 134 | 132 | 125 | 134 | 134 | **187** | 176 | 183 | 196 | 213 | 213 | 213 | 225 | 233 | 224 | 261 | 242 | 232 | 223 | 209 | 211 |
| Small Growth | 89 | 116 | **228** | 257 | 274 | 342 | 410 | 430 | 460 | **771** | 848 | 836 | 825 | 766 | 766 | 770 | 813 | 854 | 898 | 899 | 954 | 934 | 1012 | 1058 | 1045 |
| Small Neutral | 121 | 155 | **307** | 343 | 365 | 459 | 550 | 577 | 624 | **1018** | 1139 | 1130 | 1101 | 1055 | 1025 | 1046 | 1074 | 1171 | 1200 | 1220 | 1335 | 1282 | 1370 | 1446 | 1460 |
| Small Value | 91 | 115 | **229** | 257 | 273 | 342 | 408 | 429 | 463 | **756** | 851 | 840 | 819 | 788 | 766 | 768 | 811 | 863 | 895 | 881 | 981 | 965 | 1020 | 1106 | 1094 |
| **TOTAL** | **564** | **703** | **1188** | 1395 | 1545 | 1751 | 1945 | 2053 | 2149 | **3341** | 3592 | 3599 | 3609 | 3557 | 3518 | 3565 | 3685 | 3930 | 4033 | 4200 | 4352 | 4247 | 4437 | 4559 | 4544 |
| **Growth Rates** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Large Growth | | 32% | **34%** | 18% | 22% | -11% | -4% | 6% | -8% | **11%** | -6% | 12% | 16% | 14% | 4% | 7% | -6% | 9% | 1% | 12% | -10% | 4% | -6% | -10% | -4% |
| Large Neutral | | 23% | **37%** | 21% | 17% | -8% | -6% | 9% | -10% | **13%** | -6% | 13% | 12% | 15% | 4% | 4% | -2% | 8% | 0% | 14% | -13% | 1% | -5% | -8% | 3% |
| Large Value | | 32% | **31%** | 21% | 22% | -11% | -6% | 9% | -8% | **11%** | -6% | 12% | 16% | 14% | 4% | 3% | 1% | 6% | -1% | 12% | -8% | -2% | -1% | -8% | 0% |
| Mid Growth | | 16% | **35%** | 28% | 18% | -2% | -6% | 6% | 0% | **42%** | -6% | 3% | 7% | 8% | 0% | 2% | 1% | 4% | 3% | 16% | -11% | -2% | -4% | -9% | 0% |
| Mid Neutral | | 19% | **33%** | 31% | 15% | -1% | -4% | 6% | 0% | **38%** | -4% | 3% | 8% | 8% | 1% | 1% | -1% | 6% | 0% | 16% | -10% | -1% | 0% | -9% | -2% |
| Mid Value | | 18% | **33%** | 30% | 18% | -1% | -5% | 7% | 0% | **40%** | -6% | 4% | 7% | 9% | 0% | 0% | 6% | 4% | -4% | 17% | -7% | -4% | -4% | -6% | 1% |
| Small Growth | | 30% | **97%** | 13% | 7% | 25% | 20% | 5% | 7% | **68%** | 10% | -1% | -1% | -7% | 0% | 1% | 6% | 5% | 5% | 0% | 6% | -2% | 8% | 5% | -1% |
| Small Neutral | | 28% | **98%** | 12% | 6% | 26% | 20% | 5% | 8% | **63%** | 12% | -1% | -3% | -4% | -3% | 2% | 3% | 9% | 2% | 2% | 9% | -4% | 7% | 6% | 1% |
| Small Value | | 26% | **99%** | 12% | 6% | 25% | 19% | 5% | 8% | **63%** | 13% | -1% | -3% | -4% | -3% | 0% | 6% | 6% | 4% | -2% | 11% | -2% | 6% | 8% | -1% |
| **TOTAL** | | 25% | **69%** | 17% | 11% | 13% | 11% | 6% | 5% | **55%** | 8% | 0% | 0% | -1% | -1% | 1% | 3% | 7% | 3% | 4% | 4% | -2% | 4% | 3% | 0% |

| Style Category | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Large Growth | 67 | 56 | 65 | 75 | 88 | 87 | 83 | 81 | 73 | 48 | 43 | 45 | 45 | 46 | 55 | 60 | 63 | 62 | 56 | 44 | 53 | 60 | 54 | 55 | 60 |
| Large Neutral | 90 | 76 | 88 | 103 | 115 | 113 | 110 | 108 | 98 | 62 | 60 | 60 | 62 | 63 | 72 | 82 | 85 | 83 | 77 | 61 | 71 | 80 | 74 | 74 | 80 |
| Large Value | 67 | 57 | 64 | 76 | 87 | 88 | 86 | 84 | 69 | 48 | 40 | 40 | 42 | 46 | 53 | 60 | 64 | 61 | 56 | 46 | 52 | 60 | 55 | 56 | 59 |
| Mid Growth | 190 | 170 | 197 | 228 | 267 | 284 | 278 | 311 | 288 | 215 | 199 | 181 | 203 | 189 | 221 | 231 | 222 | 223 | 196 | 178 | 181 | 193 | 178 | 176 | 191 |
| Mid Neutral | 248 | 227 | 266 | 298 | 359 | 369 | 383 | 413 | 377 | 284 | 273 | 242 | 267 | 258 | 294 | 306 | 291 | 287 | 263 | 241 | 246 | 252 | 236 | 240 | 257 |
| Mid Value | 191 | 173 | 199 | 227 | 271 | 280 | 287 | 299 | 283 | 220 | 197 | 179 | 198 | 194 | 219 | 230 | 219 | 222 | 195 | 176 | 187 | 190 | 178 | 176 | 195 |
| Small Growth | 1054 | 1099 | 1060 | 1117 | 1339 | 1403 | 1474 | 1507 | 1477 | 1444 | 1446 | 1399 | 1220 | 1135 | 1062 | 1042 | 1022 | 981 | 995 | 958 | 868 | 840 | 824 | 796 | 785 |
| Small Neutral | 1466 | 1508 | 1465 | 1514 | 1773 | 1897 | 1941 | 2040 | 2031 | 1975 | 1919 | 1877 | 1668 | 1523 | 1401 | 1379 | 1358 | 1292 | 1318 | 1269 | 1169 | 1096 | 1106 | 1063 | 1056 |
| Small Value | 1081 | 1113 | 1060 | 1126 | 1320 | 1420 | 1432 | 1515 | 1458 | 1462 | 1415 | 1322 | 1181 | 1070 | 1028 | 1001 | 1001 | 961 | 966 | 907 | 860 | 821 | 791 | 774 | 782 |
| **TOTAL** | 4454 | 4479 | 4464 | 4764 | 5619 | 5941 | 6074 | 6358 | 6154 | 5758 | 5592 | 5345 | 4886 | 4524 | 4405 | 4391 | 4325 | 4172 | 4122 | 3880 | 3687 | 3592 | 3496 | 3410 | 3465 |
| **Growth Rates** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Large Growth | -7% | -16% | 16% | 15% | 17% | -1% | -5% | -2% | -10% | -34% | -10% | 5% | 0% | 2% | 20% | 9% | 5% | -2% | -10% | -21% | 20% | 13% | -10% | 2% | 9% |
| Large Neutral | -11% | -16% | 16% | 17% | 12% | -2% | -3% | -2% | -9% | -37% | -3% | 0% | 3% | 2% | 14% | 14% | 4% | -2% | -7% | -21% | 16% | 13% | -8% | 0% | 8% |
| Large Value | -12% | -15% | 12% | 19% | 14% | 1% | -2% | -2% | -18% | -30% | -17% | 0% | 5% | 10% | 15% | 13% | 7% | -5% | -8% | -18% | 13% | 15% | -8% | 2% | 5% |
| Mid Growth | -8% | -11% | 16% | 16% | 17% | 6% | -2% | 12% | -7% | -25% | -7% | -9% | 12% | -7% | 17% | 5% | -4% | 0% | -12% | -9% | 2% | 7% | -8% | -1% | 9% |
| Mid Neutral | -11% | -8% | 17% | 12% | 20% | 3% | 4% | 8% | -9% | -25% | -4% | -11% | 10% | -3% | 14% | 4% | -5% | -1% | -8% | -8% | 2% | 2% | -6% | 2% | 7% |
| Mid Value | -9% | -9% | 15% | 14% | 19% | 3% | 2% | 4% | -5% | -22% | -10% | -9% | 11% | -2% | 13% | 5% | -5% | 1% | -12% | -10% | 6% | 2% | -6% | -1% | 11% |
| Small Growth | 1% | 4% | -4% | 5% | 20% | 5% | 5% | 2% | -2% | -2% | 0% | -3% | -13% | -7% | -6% | -2% | -2% | -4% | 1% | -4% | -9% | -3% | -2% | -3% | -1% |
| Small Neutral | 0% | 3% | -3% | 3% | 17% | 7% | 2% | 5% | 0% | -3% | -3% | -2% | -11% | -9% | -8% | -2% | -2% | -5% | 2% | -4% | -8% | -6% | 1% | -4% | -1% |
| Small Value | -1% | 3% | -5% | 6% | 17% | 8% | 1% | 6% | -4% | 0% | -3% | -7% | -11% | -9% | -4% | -3% | 0% | -4% | 1% | -6% | -5% | -5% | -4% | -2% | 1% |
| **TOTAL** | -2% | 1% | 0% | 7% | 18% | 6% | 2% | 5% | -3% | -6% | -3% | -4% | -9% | -7% | -3% | 0% | -2% | -4% | -1% | -6% | -5% | -3% | -3% | -2% | 2% |

## Appendix G: Russell Style Results

The small, mid, and large asset classifications were disaggregated to form nine new portfolios: small value, small neutral, small growth, mid value, mid neutral, mid growth, large value, large neutral, and large growth. This was done by forming sorts of stocks on market value and book-to-market value. In December of each year from 1951 to 2014, all stocks are ranked on size using the Russell methodology to break the stocks into small, mid, and large.

All the stocks are then divided into three different book to market categories based on the breakpoints for the bottom 30% ( growth), middle 40% ( Neutral), and top 30% ( Value) of the ranked values of BE/ME for all stocks. Book value of common equity (BE) is defined similar to the Fama-French (1992) study, which uses the COMPUSTAT book value of stockholders equity plus balance-sheet deferred taxes minus book value of preferred stock. The BE/ME represents the book common equity for the fiscal year ending in the calendar year divided by the market equity at the same time.

## Small-Cap Style Proxy

| CAGR | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Small-Cap Growth | 7.16 | 7.17 | 6.28 | 6.52 |
| Small-Cap Neutral | 8.83 | 12.51 | 12.42 | 12.89 |
| Small-Cap Value | 8.82 | 14.69 | 14.76 | 17.13 |

| Std Dev | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Small-Cap Growth | 20.77 | 23.63 | 22.75 | 23.71 |
| Small-Cap Neutral | 19.66 | 18.09 | 17.63 | 18.72 |
| Small-Cap Value | 25.96 | 22.98 | 21.31 | 21.43 |

| Sharpe Ratio | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Small-Cap Growth | 0.28 | 0.19 | 0.11 | 0.06 |
| Small-Cap Neutral | 0.38 | 0.54 | 0.50 | 0.42 |
| Small-Cap Value | 0.29 | 0.52 | 0.52 | 0.56 |

## Mid-Cap Style Proxy

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Mid-Cap Growth | 8.49 | 7.41 | 9.17 | 7.61 |
| Mid-Cap Neutral | 10.33 | 10.90 | 11.74 | 10.88 |
| Mid-Cap Value | 9.12 | 12.49 | 13.33 | 13.60 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Mid-Cap Growth | 17.39 | 22.11 | 20.94 | 21.04 |
| Mid-Cap Neutral | 17.35 | 16.75 | 16.39 | 16.01 |
| Mid-Cap Value | 18.60 | 17.50 | 17.18 | 17.44 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Mid-Cap Growth | 0.41 | 0.21 | 0.26 | 0.12 |
| Mid-Cap Neutral | 0.51 | 0.49 | 0.49 | 0.36 |
| Mid-Cap Value | 0.41 | 0.56 | 0.56 | 0.49 |
| *Risk Free ( 30 day T-Bill)* | *1.42* | *2.66* | *3.68* | *5.04* |

## Large-Cap Style Proxy

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 7.67 | 7.93 | 10.06 | 8.04 |
| Large-Cap Neutral | 8.41 | 10.90 | 12.15 | 9.30 |
| Large-Cap Value | 4.70 | 7.85 | 9.49 | 9.64 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 13.88 | 16.59 | 16.80 | 16.93 |
| Large-Cap Neutral | 13.94 | 15.06 | 14.80 | 15.18 |
| Large-Cap Value | 18.38 | 18.01 | 16.94 | 15.85 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 0.45 | 0.32 | 0.38 | 0.18 |
| Large-Cap Neutral | 0.50 | 0.55 | 0.57 | 0.28 |
| Large-Cap Value | 0.18 | 0.29 | 0.34 | 0.29 |

Appendix H: Size Premium Results

(i) MML = the average monthly returns of the Russell mid-cap proxy less the average monthly returns of the Russell large-cap proxy
(ii) SML = the average monthly returns of the Russell small-cap proxy less the average monthly returns of the Russell large-cap proxy
(iii) MMS = the average monthly returns of the Russell mid-cap proxy less the average monthly returns of the Russell small-cap proxy

| Premium | | 1928 to 2014 | 10-yr | 20-yr | 30-yr | 50-yr | Rolling 3-year | Rolling 5-year | Rolling 10-year | Corr MML | Corr SML | Corr of Neg. Prem MML vs SML | Corr of Pos. Prem MML vs SML |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MMS** | ***Mid-Small*** | **-0.11** | **-0.07** | **0.04** | **0.07** | **0.06** | **-1.15** | **-1.02** | **-0.80** | | | | |
| *t-stat* | | *1.68* | *-0.45* | *0.31* | *0.72* | *0.73* | *1.75* | *2.02* | *-2.59* | | | | |
| **MML** | ***Mid-Large*** | **0.16** | **0.24** | **0.14** | **0.09** | **0.17** | **1.65** | **1.69** | **1.60** | 1 | 0.86 | 0.73 | 0.75 |
| *t-stat* | | *2.49* | *1.46* | *0.95* | *0.84* | *1.98* | *2.47* | *3.35* | *5.57* | | | | |
| **SML** | ***Small -Large*** | **0.27** | **0.17** | **0.17** | **0.02** | **0.23** | **2.79** | **2.71** | **2.30** | 0.86 | 1 | 0.73 | 0.75 |
| *t-stat* | | *2.42* | *0.63* | *0.79* | *0.11* | *1.60* | *2.24* | *2.83* | *4.30* | | | | |

| Probability Of Premium | Rolling 3-yr | Rolling 5-yr | Rolling 10-yr |
|---|---|---|---|
| MMS | 55% | 51% | 37% |
| MML | 56% | 67% | 69% |
| Both at same t | 18% | 23% | 17% |
| SML | 54% | 59% | 69% |

## Appendix I: Value And Size Premium Results

All CRSP stocks are divided into three different book to market categories based on the breakpoints for the bottom 30% ( Growth), middle 40% ( Neutral), and top 30% ( Value) of the ranked values of BE/ME for all stocks. Book value of common equity (BE) is defined similar to the Fama-French (1992) study, which uses the COMPUSTAT book value of stockholders equity plus balance-sheet deferred taxes minus book value of preferred stock. The BE/ME represents the book common equity for the fiscal year ending in the calendar year divided by the market equity at the same time.

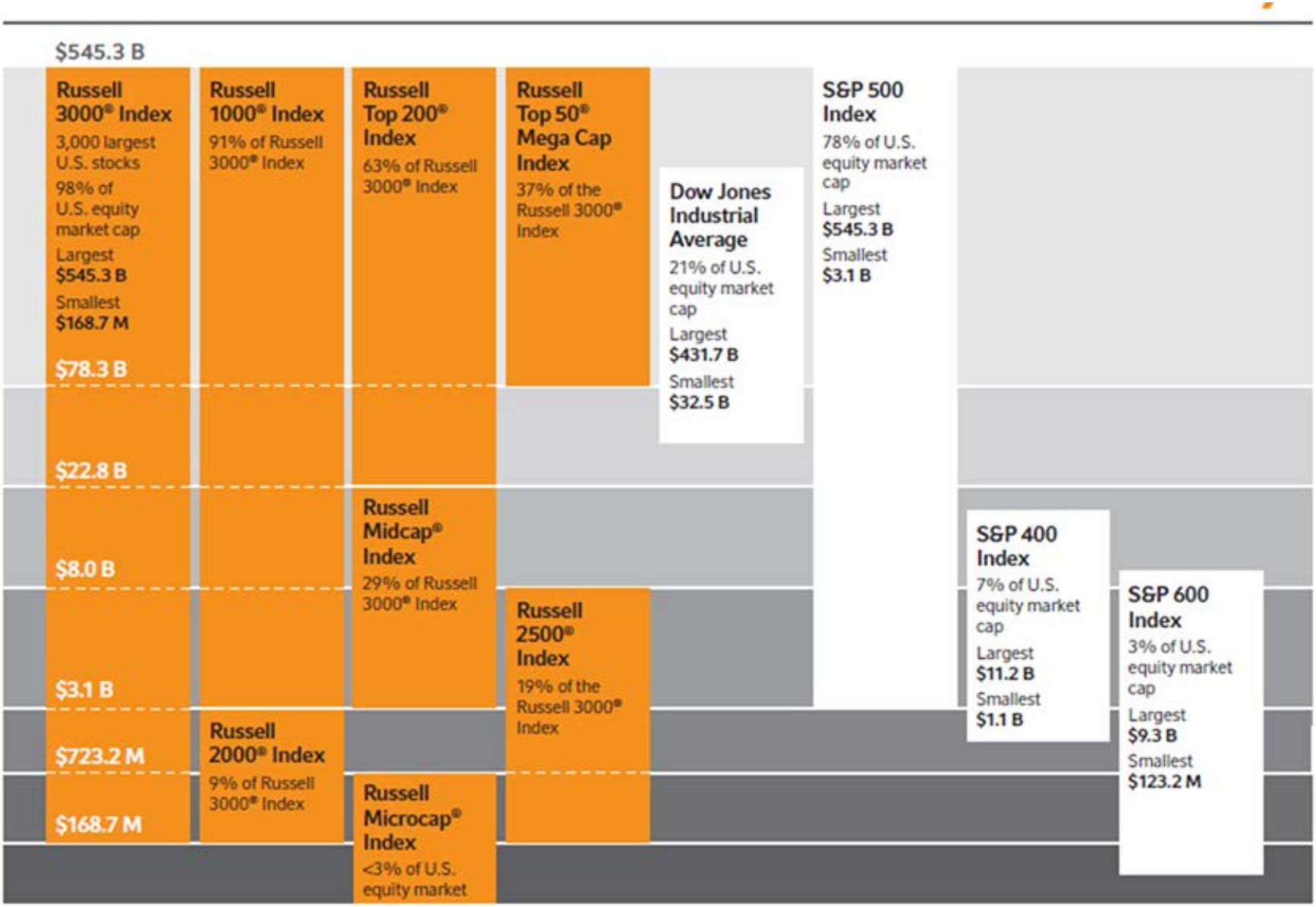
We do not use negative BE firms when calculating the breakpoints for BE/ME or when forming the size-BE/ME portfolios. Only firms with ordinary common equity (as classified by CRSP) are included in the tests. The nine portfolios are constructed from the intersection of the three size and three BE/ME groups. For example, small value (SV) contains the stocks in the small market value group but also in the highest BE group. Monthly value weighted returns are then calculated for the nine portfolios at the end of every year. (i) The large value premium is the average monthly return of large-cap value stocks less large-cap growth stocks. (ii) The mid-cap value premium is the average monthly return of mid-cap value stocks less mid-cap growth stocks (iii) The small-cap value premium is the average monthly return of small-cap value stocks less small-cap growth stocks

| | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| **Large-Cap Value Premium** | **0.17** | **-0.01** | **0.04** | **0.11** |
| *t-stat* | *0.61* | *-0.06* | *0.23* | *-0.80* |
| **Mid-Cap Value Premium** | **0.07** | **0.31** | **0.25** | **0.40** |
| *t-stat* | *0.34* | *0.98* | *1.13* | *2.45* |
| **Small-Cap Value Premium** | **0.22** | **0.55** | **0.61** | **0.77** |
| *t-stat* | *0.66* | *1.98* | *3.04* | *5.11* |

| **Correlations** | | LgValPrem | MidValPrem | SmallValPrem |
|---|---|---|---|---|
| Large Value Premium | Pearson Correlation | 1.00 | .562** | .523** |
| | Sig. (2-tailed) | | 0.00 | 0.00 |
| Mid-Cap Value Premium | Pearson Correlation | .562** | 1.00 | .791** |
| | Sig. (2-tailed) | 0.00 | | 0.00 |
| Small-Cap Value Premium | Pearson Correlation | .523** | .791** | 1.00 |
| | Sig. (2-tailed) | 0.00 | 0.00 | |

** Correlation is significant at the 0.01 level (2-tailed).

Appendix J: Russell And S&P Index Descriptions




Data as of May 31, 2014.

## Appendix K: Russell Style Results

The small, mid, and large asset classifications were disaggregated to form nine new portfolios: small value, small neutral, small growth, mid value, mid neutral, mid growth, large value, large neutral, and large growth. This was done by forming sorts of stocks on market value and book-to-market value. In December of each year from 1951 to 2014, all stocks are ranked on size using the Russell methodology to break the stocks into small, mid, and large.

All the stocks are then divided into three different book to market categories based on the breakpoints for the bottom 30% ( growth), middle 40% ( Neutral), and top 30% ( Value) of the ranked values of BE/ME for all stocks. Book value of common equity (BE) is defined similar to the Fama-French (1992) study, which uses the COMPUSTAT book value of stockholders equity plus balance-sheet deferred taxes minus book value of preferred stock. The BE/ME represents the book common equity for the fiscal year ending in the calendar year divided by the market equity at the same time.

**Value**

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Value | 4.70 | 7.85 | 9.49 | 9.64 |
| Mid-Cap Value | 9.12 | 12.49 | 13.33 | 13.60 |
| Small-Cap Value | 8.82 | 14.69 | 14.76 | 17.13 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Value | 18.38 | 18.01 | 16.94 | 15.85 |
| Mid-Cap Value | 18.60 | 17.50 | 17.18 | 17.44 |
| Small-Cap Value | 25.96 | 22.98 | 21.31 | 21.43 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Value | 0.18 | 0.29 | 0.34 | 0.29 |
| Mid-Cap Value | 0.41 | 0.56 | 0.56 | 0.49 |
| Small-Cap Value | 0.29 | 0.52 | 0.52 | 0.56 |
| *Risk Free ( 30 day T-Bill)* | *1.42* | *2.66* | *3.68* | *5.04* |

**GROWTH**

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 7.67 | 7.93 | 10.06 | 8.04 |
| Mid-Cap Growth | 8.49 | 7.41 | 9.17 | 7.61 |
| Small-Cap Growth | 7.16 | 7.17 | 6.28 | 6.52 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 13.88 | 16.59 | 16.80 | 16.93 |
| Mid-Cap Growth | 17.39 | 22.11 | 20.94 | 21.04 |
| Small-Cap Growth | 20.77 | 23.63 | 22.75 | 23.71 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Growth | 0.45 | 0.32 | 0.38 | 0.18 |
| Mid-Cap Growth | 0.41 | 0.21 | 0.26 | 0.12 |
| Small-Cap Growth | 0.28 | 0.19 | 0.11 | 0.06 |
| *Risk Free* | *1.42* | *2.66* | *3.68* | *5.04* |

**NEUTRAL**

| **CAGR** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Neutral | 8.41 | 10.90 | 12.15 | 9.30 |
| Mid-Cap Neutral | 10.33 | 10.90 | 11.74 | 10.88 |
| Small-Cap Neutral | 8.83 | 12.51 | 12.42 | 12.89 |

| **Std Dev** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Neutral | 13.94 | 15.06 | 14.80 | 15.18 |
| Mid-Cap Neutral | 17.35 | 16.75 | 16.39 | 16.01 |
| Small-Cap Neutral | 19.66 | 18.09 | 17.63 | 18.72 |

| **Sharpe Ratio** | 10-yr | 20-yr | 30-yr | 50-yr |
|---|---|---|---|---|
| Large-Cap Neutral | 0.50 | 0.55 | 0.57 | 0.28 |
| Mid-Cap Neutral | 0.51 | 0.49 | 0.49 | 0.36 |
| Small-Cap Neutral | 0.38 | 0.54 | 0.50 | 0.42 |
| *Risk Free ( 30 day T-Bill* | *1.42* | *2.66* | *3.68* | *5.04* |

Appendix L: Migration By Style And Industry

**Small-Cap Stock Industry Movement (1980-2013)**

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | Avg Mkt Val | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Small -Caps | 8% | 3% | 15% | 4% | 2% | 14% | 2% | 2% | 11% | 7% | 18% | 13% | 202 | 116,354 |
| Total Vanishes | 5% | 3% | 10% | 5% | 2% | 19% | 2% | 1% | 12% | 9% | 17% | 15% | 150 | 12,435 |
| Total Mergers | 5% | 2% | 10% | 4% | 1% | 19% | 2% | 1% | 11% | 10% | 22% | 13% | 213 | 6,447 |
| Total Delist | 6% | 3% | 10% | 6% | 2% | 19% | 3% | 1% | 13% | 9% | 12% | 17% | 84 | 5,988 |
| Total Small to Medium | 5% | 3% | 10% | 4% | 2% | 17% | 3% | 3% | 11% | 9% | 20% | 12% | 748 | 2,804 |
| | | | | | | | | | | | | | | 15,239 |

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | Wgt Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Postive Movement | 5% | 2% | 11% | 4% | 2% | 18% | 2% | 2% | 11% | 9% | 21% | 13% | 375 | 9,251 |
| Negative Movement | 6% | 3% | 10% | 6% | 2% | 19% | 3% | 1% | 13% | 9% | 12% | 17% | 84 | 5,988 |

| Positve Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S/G | 4% | 2% | 8% | 3% | 2% | 27% | 4% | 1% | 10% | 16% | 9% | 14% | 320 | 2,311 |
| S/N | 5% | 3% | 11% | 4% | 2% | 16% | 2% | 3% | 10% | 7% | 24% | 12% | 233 | 3,863 |
| S/V | 6% | 3% | 12% | 3% | 1% | 13% | 1% | 2% | 13% | 5% | 29% | 12% | 137 | 2,290 |

| Negative Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol | Healthcare | Finance | Other | Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S/G | 5% | 3% | 9% | 5% | 2% | 25% | 3% | 0% | 11% | 16% | 5% | 17% | 178 | 1,531 |
| S/N | 6% | 3% | 10% | 7% | 1% | 18% | 2% | 1% | 14% | 8% | 13% | 18% | 183 | 1,174 |
| S/V | 7% | 3% | 11% | 5% | 2% | 13% | 1% | 1% | 17% | 5% | 17% | 17% | 114 | 1,905 |

**Mid-Cap Stock Industry Movement (1980-2013)**

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret& Whol Shops | Healthcare | Finance | Other | Avg. Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Mid-Caps | 6% | 3% | 12% | 4% | 4% | 13% | 3% | 9% | 10% | 6% | 19% | 11% | 2,561 | 24,768 |
| Total Vanishes | 6% | 2% | 10% | 6% | 3% | 12% | 6% | 6% | 8% | 7% | 24% | 11% | 2,115 | 1,207 |
| Total Mergers | 6% | 1% | 11% | 5% | 3% | 12% | 5% | 6% | 8% | 7% | 24% | 11% | 2,024 | 1,156 |
| Total Delistings | 0% | 2% | 2% | 20% | 0% | 17% | 10% | 5% | 10% | 10% | 17% | 7% | 4,171 | 51 |
| Total Mid to Large | 5% | 3% | 9% | 5% | 4% | 15% | 4% | 9% | 10% | 6% | 21% | 9% | 5,569 | 823 |
| Total Mid to Small | 5% | 3% | 11% | 5% | 3% | 20% | 2% | 4% | 11% | 6% | 16% | 13% | 1,396 | 2,641 |

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret& Whol Shops | Healthcare | Finance | Other | Wgt Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Postive Movement | 6% | 2% | 10% | 5% | 3% | 13% | 4% | 7% | 9% | 7% | 23% | 10% | 3,498 | 1,979 |
| Negative Movement | 5% | 3% | 11% | 5% | 3% | 19% | 3% | 4% | 11% | 6% | 16% | 13% | 1,449 | 2,692 |

| Positve Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret& Whol Shops | Healthcare | Finance | Other | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M/G | 7% | 2% | 7% | 5% | 4% | 22% | 9% | 1% | 12% | 12% | 9% | 12% | 1,128 |
| M/N | 6% | 2% | 13% | 6% | 3% | 12% | 3% | 6% | 9% | 6% | 22% | 11% | 1,490 |
| M/V | 5% | 2% | 9% | 4% | 2% | 6% | 2% | 16% | 6% | 2% | 38% | 8% | 1,098 |

| Negative Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M/G | 5% | 2% | 9% | 5% | 2% | 29% | 3% | 0% | 12% | 10% | 7% | 16% | 1,071 |
| M/N | 6% | 4% | 12% | 6% | 4% | 17% | 2% | 4% | 12% | 6% | 16% | 11% | 1,113 |
| M/V | 4% | 3% | 11% | 4% | 3% | 10% | 3% | 9% | 9% | 2% | 30% | 13% | 762 |

## Large-Cap Stock Industry Movement (1980-2013)

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | Avg. Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Large-Caps | 5% | 3% | 13% | 9% | 6% | 12% | 7% | 11% | 5% | 9% | 14% | 6% | 22,798 | 7,677 |
| **Total Vanishes** | 6% | 2% | 7% | 11% | 2% | 8% | 13% | 5% | 3% | 12% | 23% | 8% | 13,254 | 209 |
| Total Mergers | **6%** | **2%** | **7%** | **11%** | **2%** | **8%** | **15%** | **5%** | **3%** | **13%** | **21%** | **7%** | 13,093 | 203 |
| Total Delistings | 0% | 0% | 17% | 17% | 0% | 0% | 0% | 0% | 0% | 50% | 17% | 0% | 18,707 | 6 |
| Total Large to Mid | 6% | 3% | 10% | 6% | 4% | 14% | 3% | 11% | 9% | 4% | 18% | 10% | 9,179 | 806 |

| | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Whol Shops | Healthcare | Finance | Other | Wgt Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Postive Movement | 6% | 2% | 7% | 11% | 2% | 8% | 15% | 5% | 3% | 13% | 21% | 7% | 13,093 | 203 |
| Negative Movement | 6% | 3% | 10% | 6% | 4% | 14% | 3% | 11% | 9% | 4% | 19% | 10% | 9,249 | 812 |

| Positve Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol Shops | Healthcare | Finance | Other | Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L/G | 12% | 2% | 6% | 6% | 2% | 14% | 8% | 6% | 2% | 29% | 2% | 10% | 14,632 | 49 |
| L/N | 6% | 2% | 9% | 12% | 3% | 6% | 9% | 3% | 6% | 10% | 22% | 10% | 10,288 | 86 |
| L/V | 2% | 2% | 4% | 13% | 0% | 6% | 26% | 7% | 0% | 0% | 41% | 0% | 18,330 | 54 |

| Negative Movement | Cons NonDur | Cons Durab | Manuf | Energy | Chemical | Bus Equip | Telecom | Utilities | Ret & Whol | Healthcare | Finance | Other | Avg Mkt Cap | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L/G | 11% | 4% | 6% | 8% | 5% | 25% | 3% | 2% | 9% | 7% | 6% | 13% | 6,456 | 232 |
| L/N | 6% | 3% | 16% | 4% | 5% | 13% | 3% | 8% | 12% | 4% | 18% | 8% | 7,831 | 321 |
| L/V | 2% | 3% | 8% | 5% | 3% | 7% | 2% | 23% | 7% | 2% | 30% | 9% | 9,163 | 259 |

## Appendix M: Four-Factor Model

The following model was created based on four of the five research factors from the Ken French data library (French 2015) : (i) Mkt-RF is the excess return on the market, which is the value weighted returns of all firms in the CRSP less the one-month T-bill rate (ii) HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios (iii) SMB (Small minus Big) is the average return on small-cap stock minus the average return on large-cap stocks (iiii) Profit or as French calls it RMW ( Robust Minus Weak) is the average return of the small and large stocks with the highest operating profitability per unit of book equity minus the average return of the small and large stocks with the lowest operating profitability per unit of book value. Operating profitability is revenue less cost of goods sold, selling, general and administrative expenses or interest expense.

| **1980-2013** | Constant | Mkt-RF | HML | SMB | Profit |
|---|---|---|---|---|---|
| Large Growth | 0.45 | 0.96 | -0.40 | -0.28 | 0.11 |
| Large Neutral | 0.43 | 0.98 | 0.07 | -0.23 | 0.07 |
| Large Value | 0.32 | 1.05 | 0.49 | -0.27 | -0.28 |
| Mid Growth | 0.45 | 1.05 | -0.43 | 0.38 | -0.22 |
| Mid Neutral | 0.29 | 1.04 | 0.24 | 0.24 | 0.15 |
| Mid Value | 0.31 | 1.07 | 0.61 | 0.20 | 0.10 |
| Small Growth | -0.04 | 1.11 | -0.27 | 0.88 | -0.08 |
| Small Neutral | 0.24 | 1.02 | 0.33 | 0.72 | 0.26 |
| Small Value | 0.45 | 1.10 | 0.70 | 0.84 | 0.04 |
| Large- Cap | 0.42 | 0.98 | -0.01 | -0.26 | -0.02 |
| Mid-Cap | 0.36 | 1.04 | 0.13 | 0.27 | -0.01 |
| Small-Cap | 0.21 | 1.04 | 0.16 | 0.78 | -0.01 |

| **1980-2013 (t-stat)** | Constant | Mkt-RF | HML | SMB | Profit |
|---|---|---|---|---|---|
| Large Growth | 5.9 | 54.7 | -15.5 | -10.0 | 3.2 |
| Large Neutral | 7.0 | 70.4 | 3.6 | -10.7 | 2.4 |
| Large Value | 4.0 | 58.8 | 18.6 | -9.5 | -7.8 |
| Mid Growth | 5.1 | 52.5 | -14.5 | 12.0 | -5.4 |
| Mid Neutral | 4.0 | 63.8 | 10.0 | 9.2 | 4.6 |
| Mid Value | 3.6 | 53.5 | 20.7 | 6.2 | 2.5 |
| Small Growth | -0.5 | 67.3 | -11.3 | 33.6 | -2.4 |
| Small Neutral | 3.6 | 67.4 | 15.0 | 30.3 | 8.4 |
| Small Value | 3.8 | 40.5 | 17.4 | 19.6 | 0.8 |
| Large- Cap | 11.7 | 120.4 | -0.9 | -20.4 | -1.3 |
| Mid-Cap | 6.1 | 77.6 | 6.4 | 12.7 | -0.5 |
| Small-Cap | 3.8 | 82.3 | 8.5 | 39.1 | -0.4 |

## VITA

Lane Steinberger was born in North Carolina and lives in Georgia. He serves as Chief Investment Officer of Redwood Wealth Management and holds both the Chartered Financial Analyst® and CERTIFIED FINANCIAL PLANNER™ designations. Prior to Redwood, he started his career with Bank of America's Global Corporate Investment Bank in Charlotte, N.C., advising clients on the foreign currency markets and derivative strategies. He later joined BellSouth in 2000, where he managed a $5 billion fixed income portfolio for the company's pension fund while also working as the fund's asset allocation strategist, managing the asset allocation of the entire pension portfolio.

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