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Competition in the U.S. Mutual Fund Industry

A performance evaluation of actively managed domestic equity mutual funds

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Abstract

I evaluate a total of 204 U.S. equity mutual funds split into one *major* group and one *additional* group for the time period 2002-2016. The major group consists of the ten largest U.S. mutual fund families based on AUM while the additional group consists of a sample of the remaining operative U.S. mutual fund families. The major group manages 58% of U.S. mutual fund supply, thus indicating a non-competitive market structure. By comparing the performances of these two particular groups, I investigate whether the current market structure within the U.S. mutual fund industry is beneficial from the point of view of U.S. investors. That is, is their aggregated private wealth efficiently invested considering that as few as ten U.S. mutual fund families are managing the majority of it? Or would they experience an increased yield if they rather reallocated it into the additional fund families? Moreover, I benchmark the performance of each group to adequate market indices in order to investigate whether the active management pays off. I find that out of my 28 regressions, eight yield alphas statistically significantly different from zero at the 1% level. Additionally, when comparing each group´s mean alpha to each other, I find a statistically significant difference for large value stocks net of fees to a significance of 99%. These findings combined suggest that the major group perform superior to the additional group and which accordingly justifies the fact that the major group manage the majority of U.S. mutual fund supply. My findings further support the fact, although with varying levels of statistical significance, that the active management by the two groups is generally not worth paying for since the fees exceed the beta-adjusted excess returns, interpreted as the actively managed mutual funds outperform the market on a gross level but once the fees are paid the net alphas inversely underperform the market. This tendency within the performance of mutual funds is in line with previous research.

Keywords: Performance evaluation, equity mutual fund, CAPM, Jensen´s alpha, OLS regression

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1. Introduction

Over the past several decades, the mutual fund industry has been associated with the so-called "active-versus-passive debate". The fundamental of this debate concerns the disagreement on the true interpretation of active management. Some mutual fund managers have been proved to very closely track certain benchmark indices in terms of stock-picking replication while still marketing the fund as being actively managed (Cremers & Petajisto, 2009). By doing so, the manager almost completely eliminates the probability of outperforming the market while still obtaining investor fees for "active" management. The manager therefore basically gets paid for passive management, i.e. a profitable strategy for the fund family but at the expense of the investors´ private wealth. This is in clear contrast to how the U.S. Securities and Exchange Commission (SEC) (2017) expresses it when advising investors: "Don´t let someone else live the life you´ve been saving for". Such a strategy explained above has become increasingly implemented by mutual fund managers and also has it been given the name "closet indexing". Consequently, attempts to identify closet indexers have been made through different measurements such as tracking error[1] and active share[2] (Cremers & Petajisto, 2009). The fact that investors pay for a service they may not receive, and more importantly often do so without being aware of it, is indeed serious.

This study will touch upon the active-versus-passive debate by evaluating the performance of U.S. mutual funds. Unlike previous studies though, I will focus on the performance of *major* U.S. mutual fund families. More precisely, *I will compare the historical performance of major U.S. mutual fund families to their additional peers during a time period of 15 consecutive years, starting from 2002 until 2016*. The definition of "major" is based on each family´s assets under management (AUM).[3] According to data retrieved from the Investment Company Institute (ICI) (2017) as of year-end 2016, the top ten[4] major U.S. mutual fund families are together managing 58% of total assets invested in U.S. mutual funds (Waggoner, 2016). These ten families will represent my *major* fund group while the *additional* fund group consists of a sample of the remaining U.S. mutual fund families. I have not been able to identify the total number of operative fund families in the U.S.[5], but according to Judy Steenstra at the ICI there are at least 200. The reason why I consider this comparison of groups to be of interest is due to the potential oligopolistic market structure which they

[1] Measures how closely the fund tracks its benchmark index by computing the standard deviation of the difference between fund returns and index returns. The higher the value, the more actively managed is the fund.
[2] Measures how much of the stock holdings as well as their allocation within the fund that deviate from its benchmark index. A high percentage corresponds to a high deviation and thus an indication of high active management.
[3] Total market value of all assets managed by the fund, i.e. a measure of fund size.
[4] See Appendix A.
[5] Which supply those particular mutual funds as I will investigate in this study.

represent. If the major group turns out to underperform the additional group, this would demonstrate an inefficient allocation of U.S. wealth since these ten families together manage the majority of U.S. fund supply but yet perform inferior to the additional market participants. Therefore, my initial objective is to investigate whether the major fund families really deserve such a dominant market position within the U.S. mutual fund industry by comparing both groups´ past performances. To my knowledge, such a comparison has not been conducted before. I will evaluate solely actively managed U.S. domestic equity mutual funds[6] of which all are open-ended.[7] My study is primarily addressed to U.S. *retail* investors[8] rather than to U.S. *institutional* investors[9] since the former most likely represent those that are being exploited due to ignorance regarding mutual funds. From an U.S. retail investor point of view, AMUSDEMFs are indeed an appropriate type of mutual fund to evaluate because as of mid-2016, 43.6% of U.S. households owned them. Additionally, 89% of total U.S. mutual fund assets as of year-end 2016 were held by U.S. *households* and 52% of these assets represented U.S. *equity* funds, where *domestic* holdings dominated (Investment Company Institute, 2017). This overrepresentation by households may partly be explained by the fact that U.S. citizens tend to save for education (college) as well as for retirement primarily through mutual funds. Furthermore, *I will benchmark each of the two groups to adequate market indices in order to confirm whether the active management really pays off*. That is, do my AMUSDEMFs outperform the market during the studied time period or do they in fact perform in line with passively managed funds (i.e. index funds), or perhaps worse? In accordance with the efficient market hypothesis (EMH)[10], actively managed funds do not yield superior returns to the index regardless of whether technical[11], fundamental[12], or any other analysis is applied. Thus, if the market is strongly efficient, neither of my two fund groups would be able to beat the market over time.

Based on data provided by Morningstar, I will evaluate a total of 204 AMUSDEMFs. Alphas[13] will be computed and interpreted as the performance measurement of the fund managers´ stock-

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[6] Henceforth, these particular funds will be given the abbreviation AMUSDEMFs.
[7] The most common kinds of mutual funds and which give the investor the possibility to easily purchase and sell *unlimited* shares to a low cost (Bodie, Kane & Marcus, 2014).
[8] i.e. individual investors/households.
[9] i.e. professional investors such as investment firms or similar.
[10] Financial theory assuming the existence of market efficiency, interpreted as the stock price reflecting and incorporating all available information. Stocks therefore never trade when being over or undervalued since they have already regressed to their fair value at the time of the purchase. There are three degrees of efficiency: weak, semi-strong, and strong (Fama, 1970). The theory is controversial where on the one hand academics tend to embrace it while on the other hand practitioners generally oppose it.
[11] Forecasts of stock prices are based on historical patterns in data (Bodie, Kane & Marcus, 2014).
[12] Forecasts of stock prices are based on the firm´s financial statements (e.g. assets and liabilities) as well as on market factors (e.g. interest rates and gross domestic product (GDP)) (Bodie, Kane & Marcus, 2014).
[13] Also known as Jensen´s alpha (α). This corresponds to the risk-adjusted excess return (or abnormal return) on the market return (Jensen, 1968).

picking ability.[14] My fund samples are additionally split into subsamples in order to correspond to each combination of investment style (value, blend, growth) as well as market capitalization (small, medium, large).[15] I will run 28 ordinary least squares (OLS) regressions using the regression equation applied to the capital asset pricing model (CAPM). The results are subsequently tested for statistical significance. Lastly, robustness checks concerning the reliability of my data are conducted and include tests for heteroscedasticity, autocorrelation, stationarity, normally distributed data, as well as for regression specification error.

I find that out of my 28 regressions, 20 yield alphas statistically insignificantly different from zero at the 1% significance level, thus indicating a performance by the two fund groups equalling that to the market. Eight regressions do however yield non-zero alphas to a significance of 99% where three of these correspond to the major fund group yielding positive gross alphas for small value, small blend, as well as large growth stocks. The remaining five regressions correspond to the additional fund group yielding positive gross alphas for small blend as well as large growth stocks whilst yielding negative net alphas for small growth, large value, as well as large blend stocks. Neither fund group yields positive net alphas of statistical significance. When comparing each group´s mean alpha to each other, I do find only a statistically significant difference at the 1% level for large value stocks net of fees, and where the major group performed the superior mean alpha. These performances combined suggest that the major group outperforms the additional group and which accordingly justifies the fact that the major group manages the majority of U.S. mutual fund supply. Concerning the active management, my findings do support the fact, although with varying levels of statistical significance, that it is generally not worth paying for the 204 AMUSDEMFs since the fees exceed the beta-adjusted excess returns. That is, the fund managers yield positive gross alphas which turn into negative net alphas once the fees are paid. Lastly, my time series data are stationary and have been adjusted for heteroscedasticity as well as autocorrelation. However, eight of my regressions have been tested positive for specification error at the 1% significance level.

My study is organised as follows. In the upcoming chapter I will begin with a review of what have previously been studied within my chosen topic. Next, my data samples (mutual funds, stock market indices, risk-free interest rate) are presented alongside the hypothesis. In Chapter 4, methodology and theory (including CAPM, Jensen´s alpha, and econometric approach) are highlighted, followed by results and analysis as well as a subsequent conclusion and discussion in

[14] Also known as (security) selection ability.

[15] I will discuss this procedure further in Chapter 3.

Chapter 5 and 6, respectively. Lastly, Chapter 7 will contain a discussion regarding recognised limitations affecting my study as well as suggestions for future research.

2. Literature Review

Studies of performance evaluation of mutual funds, and in particular *U.S.* mutual funds, are by no means unique to the field of finance. Plenty of literatures have been published over the years and I will therefore review solely a range of those that may be considered to be as closely related to my particular study within performance evaluation as possible.

Starting with a review of the active-versus-passive debate, empirical evidence points at a divergence between performances of active management. On the one hand, (Gruber, 1996; Jensen, 1967; Malkiel, 1995; Sharpe, 1966) find that actively managed funds do in fact underperform the market. On the other hand, (Grinblatt & Titman, 1993; Wermers, 2000) are able to prove the opposite. However, taking this divergence into consideration, there may be more evidence inclining that active management does *not* yield superior returns to a passively managed portfolio, at least not *net* of fees. Those studies presented above differ from each other in terms of approach, performance measurement, sample size, time span etc. but their resemblance is however to evaluate the performance of actively managed U.S. equity funds. Gruber (1996) asks himself why investors keep pouring money into funds which over time constantly underperform. He concludes that future performance can in fact be predicted by past performance and this is exactly what investors are pursuing when identifying previously outperforming funds. In contrast to many other studies, both Gruber (1996) and Malkiel (1995) are accounting for survivorship bias[16] and they are thereby avoiding a misinterpreted persistence of performance with the consequence of overestimating the fund manager´s stock-picking ability. Yet, Grinblatt and Titman (1993) does not find any evidence of passive management outperforming active management *whilst* accounting for survivorship bias. Despite those significantly positive risk-adjusted returns obtained in the study, it should however be mentioned that the authors do not rule out the possibility of underperforming the market *net* of fees. Moreover, Wermers (2000) emphasises the negative impact of fees on performance where he finds that those equity holdings included in his fund sample did outperform the market by an average of 1.3% per annum when being *gross* of fees. On a *net* return basis however, the funds were unable to beat the market when underperforming with a 1% per annum. Consequently, the fees exceeded the additional returns generated by the active management and thus made the investors to pay for a service they did not receive. Sharpe (1966) draws similar conclusions regarding the relationship between fee and fund performance where he summarises it as "good performance is associated with low expense ratios" (Sharpe, 1966, p. 132). Both Jensen (1967)

[16] Unsuccessful funds may be closed down by managers in order to not negatively affect the overall performance by a particular fund family. By not including such funds will lead to skewed results.

and Malkiel (1995) were unable to obtain returns which outperformed the market, regardless of whether returns gross or net of fees were computed.

In a quite recent study composed by Flam and Vestman (2014), similar conclusions as to those regarding the mutual fund performance in the U.S. can be drawn in the *Swedish* mutual fund industry. Flam and Vestman (2014) evaluates 115 actively managed equity funds as well as 15 equity index funds during the time period from 1999 to 2009. The average net excess return among the equity funds has been negative and the variation between them was quite substantial where the top fund yielded a net excess return of 13.6% per annum and the bottom fund -15.3% per annum. The average gross excess return was however positive, equalling 0.9% annually. Although more than half of the actively managed equity funds yielded positive gross excess returns, Flam and Vestman (2014) concludes that any evidence of true stock-picking skills among the Swedish fund managers could not be confirmed due to the lack of persistence of returns. Consequently, their performance may as well have been the result of pure luck. Regardless of stock-picking skills or not, the *investors* did not benefit from the active management since the *net* excess return was on average negative.

As far as I am aware, the only comparable approach to the one taken in my study regarding performance evaluation of *groups* of mutual fund families, and with the intention to investigate for an inefficient industry concentration, has been conducted by Dahlberg (2015). He depicts the mutual fund industry in *Sweden* as being dominated by the four largest banks[17] based on AUM, thus indicating an oligopolistic market structure similar to that in the U.S.[18] It turns out that almost each and one of those funds managed by the four banks has underperformed both its benchmark index as well as many of those funds managed by their additional peers.[19] Additionally, evidence point at the fact that some of these funds are suspiciously close to certain indices in terms of stock-picking replication that one may question whether closet indexing have been practiced. As a journalist, Dahlberg (2015) conducts interviews with a number of distinguished characters within the financial sector (e.g. William F. Sharpe) in order to obtain different perspectives. Based on these interviews, it appears as if the four banks have misled investors in order to benefit from those funds then chosen by the investors. The banks have subsequently escaped from giving proper advice about these particular funds´ past performances as well as appropriateness to actually invest in. Dahlberg (2015) aims to make investors react

[17] Nordea, Skandinaviska Enskilda Banken (SEB), Svenska Handelsbanken (SHB), Swedbank.
[18] A concentration within the *banking* industry is to be found in the U.S. too, consisting of J.P. Morgan Chase & Co, Wells Fargo & Co, Bank of America, and Citigroup (Federal Reserve, 2016). However, among these banks only J.P. Morgan Chase & Co is *also* qualified to represent the top ten U.S. mutual fund families.
[19] i.e. additional Swedish banks and mutual fund families.

against the four banks´ inability to perform superior to the market as well as to many of their competitors while *still* managing to maintain such a dominant market position. He calls on the investors to reallocate their wealth into those fund families which *do* perform and accordingly cease the contribution of benefitting the poorly performing banks.

My study is based on the CAPM framework. Complements to this single-factor model (with market risk[20] as the one factor) are multi-factor models such as Fama-French (1993) three-factor[21] as well as Carhart (1997) four-factor[22] models. Arguments claiming that more factors included in the model increase the explanatory power of the computed returns may be justified. However, Flam and Vestman (2014) apply all these factor models in their study and they find no evidence of any significant differences in returns. Additionally, as mentioned in the previous chapter, I will split my mutual fund data into subsamples in order to account for differences in stocks similarly to the multi-factor models.

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[20] Also known as beta (β). This risk arises from macroeconomic conditions such as repo rates, state of the economy etc. Through economic policy, market risk can be reduced but not entirely eliminated (Bodie, Kane & Marcus, 2014).

[21] This model adds another two factors to the initial market risk-factor. These are firm size (SMB) and the firm´s price-to-book (P/B) ratio (HML). SMB stands for "Small Minus Big" and is interpreted as the difference in returns between small- and large-sized firms (i.e. market capitalization). HML stands for "High Minus Low" and is interpreted as the difference in returns between value and growth stocks (i.e. investment style) where a high value corresponds to value stocks (high P/B ratio) and a low value corresponds to growth stocks (low P/B ratio). Small value stocks have tended to outperform the market over time and those two factors added here are able to distinguish between stocks in such a way that it will benefit the entire model used for performance evaluation.

[22] This is an extension of the three-factor model containing the additional factor "monthly momentum" (MOM). MOM captures the tendency of the stock price to keep increasing after its initial increase or vice versa, i.e. a momentum effect.

3. Data[23] and Hypothesis Development

The time series data in this chapter are separated into three sections. Morningstar provides the mutual fund data. Bloomberg (via LINC Lund) provides the Russell index series. The U.S. Treasury bill rates can be obtained on the official website of the Federal Reserve Bank of St. Louis (2017). The mutual funds as well as the index series consist of cumulative returns on a monthly basis ranging from 01/01/2002 to 12/30/2016. The Treasury bills share the equivalent time span. A motivation to the choice of this particular time period follows by the fact that it is long enough to enable the evaluation of *persistence* of performance achieved by the fund managers. Additionally, it does include the financial crisis of 2007-2008 which will highlight how well the managers were able to stock-pick during those turmoil markets which occurred at that particular time. My studied time period is further split into three sub periods[24] in order to more accurately investigate the managers´ persistence over time as well as to identify potential impact of market disturbances on performance throughout these 15 years, including the latest financial crisis mentioned above.

3.1 Mutual Funds

My selected AMUSDEMFs are listed in Appendix B and C, respectively. According to Table 9.1, there are 70 major as well as 134 additional funds in my study, together consisting of a total of 32,056 observations.

[Table 9.1]

Now, the selection process of these funds is rather comprehensive. I will go through it thoroughly using a step-by-step approach. First of all, in line with what was stated in the introduction, this study will entirely focus on those funds that share the characteristics of being open-ended, actively managed, dominated by U.S. domestic holdings, as well as possess a minimum equity exposure of at least 70%. The reason why to evaluate the performance of domestic equities is because investors tend to suffer from home-country bias.[25] Also, the higher the equity exposure in each fund, the more reliable will the beta-adjusted excess returns become as they measure the managers´ stock-picking abilities. Furthermore, in order to avoid an apples-to-oranges comparison, I will split my AMUSDEMFs into subsamples in accordance with the so-

[23] Those data of which this study is based on can be obtained upon request to the author.
[24] For the years 2002-06, 2007-11, 2012-16.
[25] This concept refers to the tendency of investing a large amount in domestic equities and thus not taking the benefits of international diversification into account. Explanations to this bias might be due to lack of knowledge in foreign securities including legal restrictions associated with it (Bodie, Kane & Marcus, 2014).

called "equity style box" created by Morningstar.[26] It enables nine different combinations of investment categories. The horizontal axis represents investment style (value, blend[27], growth) and the vertical axis represents market capitalization (small, medium, large). Large value stocks are considered to carry minimum risk while small growth stocks represent the most volatile of categories. According to Morningstar (2016), the definition of value stocks are based on low valuation (low price ratios and high dividend yields) and slow growth (low growth rates for earnings, sales, book value, as well as for cash flow). Conversely, the definitions of growth stocks are based on high valuations and fast growth. I will evaluate seven out of these nine possible categories. The medium capitalization segments for value and blend stocks have been excluded due to the lack of data. Moreover, alphas net and gross of fees are computed in order to distinguish the impact of fees on performance. That is, possible stock-picking skills among the fund managers will be identified by gross alphas although they might have been "eaten up" due to charged fees before investors have taken part of them.

As far as the data availability is concerned, the major fund group is represented by one fund per fund family and for each category. When lacking data on a major fund family for a particular category, I move downward in the list in Appendix A to the subsequent fund family. If lacking data again, I choose the subsequent fund family from the last one chosen when data were missing. This procedure is applied consistently throughout the selection process in order to maintain an even representation of each major fund family. I selected my additional fund group in a similar process. Since the additional fund families obviously consist of more than ten different families per style box category, I have added a higher amount of them into the subsamples but still one fund per fund family and for each category. The total number of additional families for each category varies due to data availability but it ranges from 17 to 22 families (see Table 9.1). One may argue that a potential bias arises in my study when I am not adding more funds into each category as well as that not all additional fund families are represented. To my defence though, I will emphasise the fact that the essential objective of my study is to compare the difference of performance between *groups* of families and not between *individual* families or funds.

Regarding boundaries for market capitalization segments, the U.S. medium capitalization segment typically ranges from $1 billion to $8 billion. Accordingly, the small capitalization segment falls below these values and the large segment above. Worth mentioning though is the fact that these

[26] This box has been attached to Appendix D.
[27] A mixture of value and growth. Also known as core stocks.

boundaries are approximations and may vary as well as overlap each other since there does not exist an official standard.

In order to satisfy a retail investor perspective, neither of my AMUSDEMFs requires a minimum investment exceeding $10,000. AMUSDEMFs with less than 36 months of observations have been excluded in order to give the managers enough time to prove their skills and persistence, as well as to avoid random factors affecting the performance. However, I have deliberately chosen to include funds which have closed down[28] during the studied time period in order to avoid survivorship bias (as long as they have been active for at least 36 months that is). All cumulative returns have been adjusted for reinvested dividends.[29] In addition to monthly returns, each fund also contains data on AUM, share class[30], and net expense ratio.[31] Tables 9.2.1-2 clearly confirm the difference in the size of AUM between my major and additional fund group. The former manages an average asset value of $9,587.03 million where the large market capitalization segments dominate the allocation. The additional fund group manages an average of $1,658.92 million where these assets are more spread between the different segments. As illustrated in Tables 9.3.1-2, the average annual net expense ratios are higher for the additional AMUSDEMFs in all seven style box categories. The small market capitalization segments tend to experience the highest expense ratios. A reason to that are likely to be the fact that small stocks are less predictable as well as less exposed to the market and therefore require more analysis by the fund managers, which consequently must be compensated by a higher expense ratio. The expense ratio is computed as annual fund costs over AUM (see Footnote 30). In comparison to the additional fund families, one can picture how the major fund families manage to keep their ratios lower due to their higher AUM. However, the major families may as well incur extra annual costs compared to their additional peers which mean that it is not possible to confirm that the major families´ lower expense ratios are due *solely* to their higher AUM. Table 9.4 summarises the fund families´ revenues from investors pouring money into their funds. Two things can be noted here: it is indeed a lot of money and the majority of these are collected by the major fund group. In the

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[28] Due to bankruptcy, mergers etc.

[29] My Morningstar data provide the options "Acc" (accumulation) or "Inc" (income) for each fund and where the former reinvests the dividends into the fund with no charge. This option is obviously more appropriate for long-term investment horizons.

[30] Funds with either share class A, B, C, advisor, investor, no-load, or retirement has been included in this study. The institutional share class has understandably been excluded.

[31] This is equivalent to the gross expense ratio minus potential fee waivers and reimbursements. Ultimately, this is the fund fee paid by the investor. The expense ratio is computed as the accumulated annual costs for running a particular fund (including fees for management, administration, and advertisement ("12b-1")) divided by its AUM. These costs are usually referred to as *on-going expenses*. Additionally, the investor may as well be charged to pay for *sales loads* which include costs for purchasing the fund (front-end load), redeeming the fund (back-end load), as well as for keeping the fund over time (level load). Sales loads are not included in the expense ratio (Investment Company Institute, 2017).

medium growth category alone, investors prefer the additional fund group before the major fund group.

[Table 9.2.1] [Table 9.2.2] [Table 9.3.1] [Table 9.3.2] [Table 9.4]

Unfortunately, I have not been able to obtain historical expense ratios since neither Morningstar nor any other terminal (as far as I know) keeps records of those. Therefore, 2016 year´s net expense ratios alone have been applied. This is clearly a bias since it may distort my computations. According to Flam and Vestman (2014) though, expense ratios have been highly persistent over time (at least in Sweden). Additionally, this bias will apply to *all* my AMUSDEMFs and thus implying that potential changes in expense ratios between my two fund groups might to some extent cancel each other out over time. Lastly, exchange traded funds (ETFs)[32] and charity funds are not treated in this study.

3.2 Stock Market Indices

I have studied all applicable U.S. market indices established by a range of different index families.[33] In order to achieve the most accurate results in my study, it is worthwhile investigating for potential differences between them. In accordance with the Morningstar style box of equity mutual funds described in the previous section, the majority of the equity indices do as well follow this categorisation. Although two indices appear to share the same category, e.g. Wilshire US Large-Cap Growth Index (Wilshire Associates, 2017) and MSCI USA Large Cap Growth Index (Morgan Stanley Capital International, 2017), their respective definition of market capitalization may differ. When studying these two particular indices´ fact sheets, there is indeed a difference. Consequently, the two indices share different standards for each market capitalization and this in turn will affect the performance evaluation when using the indices as benchmarks. Furthermore, some index families lack historical observations and as a substitute they back-test[34] the data which accordingly may provide bias results. Regarding investment style, there are no major differences in the methodology of separating growth from value stocks between the index families. Frequently used factors for this separation are price-to-sales (P/S) ratio, price-to-book (P/B) ratio, sales growth, as well as dividend yield (Morningstar, 2005).

Taken differences as those described above into consideration, I have chosen to apply the Russell stock indices as benchmarks in my study (listed in Appendix E). These are all fully float-

[32] These are more similar to a common stock than to a mutual fund since they can be bought and sold throughout the day (Bodie, Kane & Marcus, 2014).
[33] Morgan Stanley Capital International (MSCI), Russell Investments, S&P Global, Wilshire Associates.
[34] Procedure where the returns of the indices are estimated based on historical data. These estimations are obviously not as accurate as true observations.

adjusted[35] and market capitalization-weighted with annual reconstitution.[36] Initial public offerings (IPOs) are added quarterly. Also, adjustments have been made in order to include for reinvested dividends (FTSE Russell, 2017a). By choosing index series from the same family, Russell Investments that is, I will eliminate potential overlapping between different market capitalization segments. Unfortunately, this bias may however appear within my *AMUSDEMFs* since the fund managers themselves may stock-pick from e.g. the small capitalization segment and put into a medium capitalization fund or vice versa. This fact is hard to overcome and is simply something one has to accept. A clear-cut boundary between each of the market capitalization segments does not exist, regardless of those boundaries described in the previous section.

I have compiled the monthly returns of the Russell index series in Tables 9.5.1-4. When analysing the results of the returns in this chapter as well as in Chapter 5, I will focus on both the median and the mean. They measure the centre of the distribution but the median is less sensitive to outliers in the data. The average monthly market return in the U.S. stock market for the time period between 2002 and 2017 was 0.75% (see Table 9.5.1), making it 9% annually. Splitting the sample into three sub periods (see Tables 9.5.2-4) partly reveals the impact of the financial crisis of 2007-2008. The annual average market return from 2007 until 2011 was 2.88% (0.24% monthly) according to Table 9.5.3. This may not give the impression of a collapse but the sub period does include some recovery time, i.e. the actual decline was in fact much larger. The same table further indicates the high volatility of which the U.S. stock market experienced during this particular time, confirmed by an average monthly standard deviation of 6.35% as well as a significant difference between the mean return (0.24% monthly) and the median return (1.15% monthly). Moreover, a mutual pattern in Tables 9.5.2-4 is the fact that the small market capitalization segments did overall yield the highest returns. The risk factor is however not incorporated in these tables and the small market capitalization segment does tend to represent the most volatile of segments as stated earlier. In Chapter 5 I will further analyse these four tables in comparison to the returns of my two fund groups.

[Table 9.5.1] [Table 9.5.2] [Table 9.5.3] [Table 9.5.4]

3.3 Risk-free Interest Rate

The risk-free interest rate is one of the variables within the CAPM equation. Since my results will be derived from this model, it is important to use a proxy variable as close to the risk-free interest rate as possible. I consider the U.S. Treasury bill (T-bill) to be the most appropriate choice. A T-

[35] Available stocks and market movements are frequently updated.
[36] Each index is completely rebuilt in order to accurately represent its particular market segment.

bill is simply a debt obligation financed by the U.S. government with maturities up to one year. The structure is that of a zero-coupon bond, meaning no interest payments before maturity but instead sold at a discount of its par value[37] and thereby generating a positive interest rate to the investor (Bodie, Kane & Marcus, 2014). The risk exposure of purchasing a T-bill is correlated with the creditworthiness of the U.S. government, in other words a solid investment with a more or less guaranteed return. Table 9.6 illustrates the T-bill rate over time. Its trend is quite expected where it follows a similar pattern as the global interest rate trend. From 2007 and onward the T-bill rate has declined quite dramatically.

[Table 9.6]

3.4 Hypothesis

As stated before, this study will evaluate whether differences of performance exist between major U.S. mutual fund families and their additional peers. Additionally, whether these two fund groups have managed to outperform the market will also be tested. The performance is measured by computing alphas derived from CAPM.[38] I formulate hypotheses for each chosen category within the Morningstar equity style box as well as for each fund group alone. The alphas are further computed both net and gross of fees. Thus, in total there are 28 hypotheses. My null hypothesis

$$\mathbf{H_0}: \text{AMUSDEMFs yield alphas} = 0$$

is interpreted as if not being rejected, there are statistically insignificant differences of performance between the two groups of fund families and they have correspondingly performed in agreement with the CAPM prediction of alphas equalling zero, that is, they have performed identically to the market portfolio. If rejected though, the alphas are in fact statistically significantly different from zero and which subsequently indicates possible statistically significant differences of performance *between* the two fund groups. If rejecting the null hypothesis, the groups have either outperformed (positive alpha) or underperformed (negative alpha) the market portfolio. The alternative hypotheses

$$\mathbf{H_{1:1}}: \text{AMUSDEMFs yield alphas} \neq 0$$

$$\mathbf{H_{1:2}}: \text{Alphas by } major \text{ AMUSDEMFs} \neq \text{alphas by } additional \text{ AMUSDEMFs}$$

will answer whether this is true or not.

[37] The value at which the bond will be redeemed at maturity.
[38] I will explain this computation further in the upcoming chapter.

4. Methodology and Theory

My data samples have been presented in the previous chapter. Here I will describe how to apply these data on my chosen theories in order to obtain convincing results. These theories will first be explained and thereafter I will go through the econometric approach.

4.1 Oligopoly

My study is primarily focusing on a performance evaluation of AMUSDEMFs. However, since the selection of those funds included in my sample has been conducted with the intention to investigate whether the U.S. mutual fund industry shows any sign of imperfect competition (oligopoly), I feel the need to present a brief discussion on this rather comprehensive concept as well. I will not apply any microeconomic theories such as the models of Bertrand or Cournot since those are simply beyond the scope of my study.[39] More importantly, such models are unnecessary to apply in order to still understand the concept´s relation to this study.

If ten mutual fund families out of more than 200[40] are managing 58% of total assets invested in U.S. mutual funds, then the market obviously appears to be non-competitive. Of course, the development of this industry concentration may be due to motives based on perfect competition such as the fact that these ten families perform superior to their smaller peers, also may they charge lower fees (which they do according to Tables 9.3.1-2 presented earlier), or in any other way are they able to distinguish themselves enough to persuade investors to pour money into *their* particular funds rather than into the funds of their competitors. Another explanation to this industry concentration could be similar to that of the Swedish mutual fund industry. Those four major banks in Sweden, which all have been scrutinised by Dahlberg (2015) (see Chapter 2), have been around for a long period of time and accordingly contributed to industrialisation, survived modern financial crises etc. From the public in general and from investors in particular, such experiences combined have generated trust in the banks´ operations which consequently have appeared to have made investors unconcerned to actually investigate the banks´ fund performances *in relation* to their competitors. This lack of awareness among the investors has subsequently been a costly mistake given the poor fund returns yielded by the major Swedish banks. Furthermore, a trivial reason such as that of the *convenience* of not reallocate private wealth into another fund family may as well explain the current market structure within the U.S. mutual fund industry. As long as the fund family has not committed a notable mistake, e.g. flagrantly

[39] For this, see e.g. Varian (2014).

[40] As mentioned in Chapter 1, I have not been able to confirm the total number.

underperformed the market unlike their competitors, the investors hold on to their original fund family without even investigating for more profitable alternatives.

4.2 Capital Asset Pricing Model (CAPM)

The CAPM framework forms a cornerstone of modern portfolio theory. It has been immensely discussed and analysed in most academic journals worldwide. My intentions here are not in any way to attempt to outdo previous literature but rather outline the model´s main features in order to clarify how it will be applied to my study.[41] CAPM is used for investment application purposes such as asset pricing as well as equilibrium modelling. Concerning the latter, CAPM computes the expected return of a particular risky asset in relation to its market risk. A beta of 1 implies identical movements between the risky asset and the market while a $\beta > 1$ implies a higher volatility of the risky asset than that of the market. I will compute my betas by using the following equation

$$\beta_{\text{risky asset}} = \frac{\sigma_{\text{risky asset,market index}}}{\sigma^2_{\text{market index}}} \tag{4.1}$$

where my AMUSDEMFs denote the risky asset. The nominator denotes the covariance of the returns on the risky asset and the market index, i.e. a measure of to what degree these two move in tandem. The denominator denotes the variance of the market index, i.e. a measure of market volatility. Total risk carried by the risky asset further includes an additional risk known as firm-specific. However, the firm-specific risk has already been, in accordance with CAPM assumptions, eliminated through diversification strategies conducted by the rational investor. By investing in a particular risky asset, the investor claims compensation for the time value of money[42] (the risk-free interest rate, r_f) as well as for the market risk (β). The market risk is subsequently multiplied by the market risk premium and the product of these two equals the risk carried by the risky asset (Bodie, Kane & Marcus, 2014). Together, all these variables represent the right-hand side of Equation 4.2 below. The risk compensation claimed by the investor is equivalent to the expected return and which accordingly represents the left-hand side of the same equation. Consequently, these variables form the CAPM equation below.

$$E(r_{\text{risky asset}}) = r_f + \beta_{\text{risky asset}}(E(r_{\text{market index}}) - r_f) \tag{4.2}$$

The fact that CAPM is referred to as an equilibrium model can further be explained in a graphical context. Equation 4.2 is simply a straight line in an x-y-graph where the x-axis represents beta and

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[41] For a more exhaustive review of CAPM, I suggest its inventors (Lintner, 1965; Markowitz, 1952; Mossin, 1966; Sharpe, 1964).

[42] Holding an amount of money today is more beneficial than holding the same amount in the future since the amount today can be invested in exchange of an interest with maturity in the future.

where the y-axis represents the expected return of the risky asset. Additionally, the risk-free interest rate denotes the intercept while the market risk premium denotes the slope of a straight line. Ultimately, this expected return-beta relationship is more known as the security market line (SML). In equilibrium, the risky asset is plotted *on* SML and interpreted as being properly assessed in accordance with the CAPM equation. However, if the risky asset is plotted above SML (undervalued), this is interpreted as the risky asset yielding a superior return to its risk exposure. The opposite is true when the risky asset is plotted below SML (overvalued) (Bodie, Kane & Marcus, 2014). Now, my study is about evaluating the two mutual fund groups´ ability to pick those undervalued stocks in comparison to each other. If a particular stock is undervalued it will yield a positive alpha and if it is overvalued it will yield a negative alpha. In other words, my study will not entirely focus on absolute returns yielded by the two fund groups but also on those particular returns´ relations to risk exposure, i.e. risk-adjusted returns. Investors might have the tendency to evaluate the fund manager´s performance solely based on absolute returns and thus ignore the impact of the risk associated with it.

Lastly, there are a number of assumptions made upon CAPM and its underlying applications. Clearly, one questionable assumption concerns the measurability of the market returns. The market portfolio cannot possibly be observed and thereby estimated since it represents every asset in every market. By using a market index as a proxy, CAPM enables these returns to be measured anyhow but the model consequently omits to include potential firm-specific risk from those assets that were excluded from the index. According to Roll (1977), empirical tests based on CAPM are thus ambiguous.[43] This conclusion is in agreement with other studies such as that composed by Fama and French (2004). Another assumption which has been empirically questioned is that of the relationship between risk and return. Black, Jensen, and Scholes (1972) shows that CAPM does not always predict the stock´s return in relation to its beta since stocks with a low beta have been proved to yield superior returns to what was predicted by the model and vice versa. Moreover, CAPM assumes that investors have access to all available information at the same time in accordance with EMH. Yet, this hypothesis has been proved to be inconsistent due to market anomalies such as the January effect[44] or the neglected-firm effect[45] (Bodie, Kane & Marcus, 2014). Regardless of these assumptions and their subsequent limitations,

[43] Combined with additional criticism regarding CAPM, these are together known as Roll´s Critique.

[44] Stock prices tend to increase more in January than in other months. Tax reasons might explain this anomaly where investors sell off their stocks before year-end to obtain capital gains and then reinvest in the same stocks again in January.

[45] Less known stocks (smaller firms) tend to yield excess returns to a greater extent than more known stocks. This might be due to the higher risk as well as the lower liquidity associated with smaller firms. Additionally, the smaller stocks may not have been as analysed as their larger peers which make them more unpredictable.

I defend my decision of applying CAPM by referring to the discussion at the end of Chapter 2 regarding alternative models and their similarities to my approach to CAPM in this study.

4.3 Performance Measurement – Jensen´s Alpha

I briefly discussed Jensen´s alpha in the previous section as well as before that but here I will give it the whole picture. Alphas are measured as a *distance* within the expected return-beta graph. A positive alpha is interpreted as the risky asset´s beta-adjusted excess return on the market return and accordingly a measure of the stock-picking ability of the fund manager. The higher positive alpha, the higher *above* SML is the risky asset plotted on the expected return-beta graph and correspondingly the superior performance achieved by the manager. The alpha measure is based on that assumption made by CAPM about the relationship between risk and return, that is, when investors are more exposed to risk, they expect a higher return. Now, alphas correspond to the excess return on the market return at given levels of risk where a positive alpha is desirable since it yields a return in excess of what was expected given the particular risk level taken (Bodie, Kane & Marcus, 2014). In contrast to other performance measures such as the Sharpe ratio[46], Jensen´s alpha does not only compute the risk-adjusted return of a particular risky asset but also does it apply this return *in relation* to the market return. Additionally, when considering a portfolio of risky assets, Jensen´s alpha assumes that the portfolio carries only market risk since it has already been sufficiently diversified. Jensen´s alpha is therefore more appropriately applied to *mutual funds* since those are corresponding to well-diversified portfolios. The equation of Jensen´s alpha

$$\alpha_{\text{risky asset}} = r_{\text{risky asset}} - (r_f + \beta_{\text{risky asset}}(r_{\text{market index}} - r_f)) \qquad (4.3)$$

is derived from the CAPM equation from the previous section. This will be further adjusted to fit the regression analysis applied to CAPM in the upcoming section.

4.4 Econometric Approach

4.4.1 Regression Model Specification

My alphas will be computed both by running ordinary least squares (OLS) regressions with the market excess return[47] as the one independent variable, and by Jensen´s alpha in accordance with Equation 4.3. The OLS principle squares the alphas which mean that positive and negative alphas do not cancel each other out when adding them together. The reason why I also choose to run regressions and simply not entirely focus on alpha computations through Equation 4.3 is because the alphas will be tested for statistical significance by the use of my regressions. The regressions will thereby provide statistically significant answers to my hypothesis. This further includes those

[46] See Sharpe (1966).
[47] The difference between the market return and the risk-free interest rate.

hypotheses related to my five chosen robustness checks of the data which are all presented starting from Section 4.4.2.

$$\mathrm{r}_{\text{risky asset}} - \mathrm{r}_{\mathrm{f}} = \alpha_{\text{risky asset}} + \beta_{\text{risky asset}}(\mathrm{r}_{\text{market index}} - \mathrm{r}_{\mathrm{f}}) + \varepsilon \tag{4.4}$$

Equation 4.4 is the simple linear model used in my study. It is similar to Equations 4.2-3 from previous sections but has been modified in order to correspond to the regression analysis. My time series data consist of *historical* returns of the AMUSDEMFs and therefore the ex-ante expected return variable from Equation 4.2 is replaced by the excess return of the risky asset.[48] Again, the risky asset denotes my AMUSDEMFs. Additionally, a disturbance term (ε) has been added to Equation 4.4 in order to capture potential deviations in my regression. The model is supposed to measure how well variability in market returns explains variability in mutual fund returns. If the coefficient of determination (R-squared) equals one, the alphas will equal zero and the particular fund will accordingly yield identical returns as the market. With this outcome, all observations (returns) are plotted *on* the regression line.[49] If the regression does not manage to fit the data well, the factors that ought to be included in the model end up in the disturbance term, which will then increase. Possible firm-specific risk that has not been eliminated through diversification will represent one of those factors included in the disturbance term. A high value of the disturbance term consequently implies that the independent variable does not explain the dependent variable (the excess return of the risky asset) well. If so, considering adding more independent variables to the regression equation might improve the model (a multiple regression). However, since I have decided to derive my regressions from CAPM, I will hold on to the simple linear model. In addition, my apples-to-apples comparison of stocks in accordance with the Morningstar equity style box will make my single-factor model more similar to those multi-factor models (see Chapter 2) in terms of explanatory power.

The OLS principle is based on five general assumptions known as the Gauss-Markov theorem.[50] If these five assumptions apply, the OLS estimators (estimating the parameters α and β in the model) are proved to be the *best linear unbiased estimators (BLUE)*. In other words, the OLS estimators are then confirmed to be unbiased[51], efficient[52], as well as consistent[53] (Westerlund,

[48] The difference between the risky asset´s return and the risk-free interest rate.

[49] Also known as the security characteristic line (SCL). The relationship between the CAPM equation (Equation 4.2) and SML (Section 4.2) corresponds to the relationship between my regression equation (Equation 4.4) and SCL in terms of alpha interpretation.

[50] See Appendix F. The sixth assumption presented in the appendix does not apply to OLS linear regression models if the sample size is large enough. This will be explained further in Section 5.4.

[51] The estimator´s expected value equals the parameter being estimated, i.e. the estimated coefficient is on average true.

[52] The estimator´s variance is the lowest among all unbiased estimators.

2005). Next I will give a more thoroughly interpretation of these assumptions while at the end of Chapter 5 I will conduct tests in order to confirm whether my data comply with these properties or not.

4.4.2 Heteroscedasticity

When assumption four in the Gauss-Markov theorem is violated, the data are said to be heteroscedastic. The fact that the variance of the disturbance term is not constant in every observation but instead dependent on unobserved effects is problematic because it will affect the OLS estimators negatively. The estimators will no longer be efficient and this in turn implies that my regression model might be defect. Also, the regressions´ estimators of the standard errors will become biased and as a consequence my test statistic will be misinterpreted (Dougherty, 2011). In order to avoid this, I will begin by testing whether my data in fact are heteroscedastic by conducting White´s tests for each regression. I do not include cross-products in the tests since I am investigating solely for heteroscedasticity and not specification errors. The risk that my data suffer from heteroscedasticity is according to Kaufman (2013) quite substantial due to my *aggregated* dependent variable (i.e. each regression consists of data from *various* AMUSDEMFs as my study compare fund groups and not individual funds). I formulate the following hypothesis

$$\mathbf{H_0}\text{: Data are homoscedastic}$$

$$\mathbf{H_1}\text{: Data are heteroscedastic}$$

which will be tested in Chapter 5 and depending on the outcome subsequently adjusted.

4.4.3 Autocorrelation

The data are autocorrelated if the observations of the disturbance term are correlated (assumption five in the Gauss-Markov theorem). Autocorrelation is particularly common when applying time series data. The consequence on the OLS estimators is similar to that of heteroscedasticity, that is, they will become inefficient. When positive autocorrelation occurs, the variance of the parameters in the regression model (α and β) are underestimated and as a consequence my test statistic is overestimated (Dougherty, 2011). I will test for autocorrelation by conducting Breusch-Godfrey LM tests for each regression in Chapter 5 and then answer the hypothesis

$$\mathbf{H_0}\text{: Data are not autocorrelated}$$

$$\mathbf{H_1}\text{: Data are autocorrelated}$$

[53] The probability of the estimator´s value converging towards the true value of the parameter increases when the number of observations in the sample increases.

As with the test for heteroscedasticity above, I will adjust the data for autocorrelation if the null hypothesis is rejected. Assuming though that markets are strongly efficient, my data will not suffer from autocorrelation. Additionally, twelve lags have been included in the tests with the motivation that my data consist of monthly observations and autocorrelation may consequently appear within each year.

4.4.4 Stationarity

Stationary data are reliable while non-stationary data are not. Applying the latter will provide a misleading regression model. Non-stationarity may indicate a strong linear relationship between variables in the data which does not in fact exist and the regression will consequently produce results which are so-called "spurious". A random variable (y_i) is considered stationary if its mean and variance do not change over time (i.e. $E(y_i)=\mu$ and $Var(y_i)=\sigma^2$). A third condition for stationarity follows by the fact that the covariance of two values within the time series data depends solely on the distance between them and not on the time factor (i.e. $Cov(y_t,y_{t-c})$ depends on c but not on t). My data are likely to be non-stationary if assuming the existence of an efficient market where the stock prices follow a random walk (Dougherty, 2011; Westerlund, 2005). Whether my data are stationary or not will be confirmed in Chapter 5 by conducting Augmented Dickey-Fuller (ADF) unit root tests for each regression and where both the independent variable as well as the dependent variable is tested.

$$\mathbf{H_0}\text{: The variable has a unit root}$$

$$\mathbf{H_1}\text{: The variable does not have a unit root}$$

The hypothesis is interpreted as if the variables *do have* a unit root, they are non-stationary. Rejecting the null hypothesis is in other words desirable. I use as many lags as when testing for autocorrelation above (twelve) and for the same reason as explained in that particular section. In addition, I include both a trend and an intercept in the tests since I consider my variables to be growing over time, that is, in the long run the returns of the funds as well as of the market will increase more than the T-bill rate (Westerlund, 2005).

4.4.5 Normally Distributed Data

Assumption six in the Gauss-Markov theorem states that the disturbance term follows a normal distribution. When this is not the case and when the sample is not large enough, my hypothesis testing will provide unreliable answers (Westerlund, 2005). In Chapter 5 I will conduct Jarque-Bera tests for each regression in order to answer the hypothesis

$$\mathbf{H_0}\text{: The disturbance term is normally distributed}$$

$$\mathbf{H_1}\text{: The disturbance term is not normally distributed}$$

When the disturbance term is normally distributed, so are the regression coefficients (Dougherty, 2011). This corresponds to the CAPM assumption of stock returns having a normal distribution (Bodie, Kane & Marcus, 2014). A skewness of zero and a kurtosis of three indicate a normal distribution. Financial data tend however to have a kurtosis exceeding three due to the higher probability of experiencing extreme events (i.e. high fluctuations) compared to the normal distribution. This is accordingly known as a *leptokurtic* distribution (Brooks, 2014) and I expect my data to follow such a distribution.

4.4.6 Regression Specification Error

The potential risk of my linear regression model being misspecified due to omitted variables or incorrect functional form will be tested in Chapter 5 by Ramsey´s RESET test. This test will confirm whether assumption one in the Gauss-Markov theorem is satisfied or not. I formulate the hypothesis by adding the fitted value of the dependent variable ($\hat{y}^2$)[54] to the right-hand side of the regression equation and then I simply test whether it is statistically significant or not. The fitted value of the dependent variable captures potential properties of model misspecification.

$$\mathbf{H_0}: \gamma = 0$$

$$\mathbf{H_1}: \gamma \neq 0$$

γ denotes the parameter of $\hat{y}^2$. If I fail to reject the null hypothesis, no misspecification occurs since the parameter is zero and accordingly indicating neither omitted variables nor non-linearity in my regression equation. The consequence of rejecting the null hypothesis confirms that the OLS estimators are no longer unbiased (Dougherty, 2011; Westerlund, 2005).

[54] I specify *one* fitted term and thereof the square.

5. Empirical Results and Analysis

I have decided to split most of my computed data into quartiles[55] with the motivation that each sample consists of such a large number of observations which are accordingly more easily interpreted when divided into groups of four.

5.1 Net and Gross Excess Returns

Before evaluating the beta-adjusted excess returns (alphas) for each mutual fund group, I find it important to compile each group´s *absolute* returns. Indeed, this measure (not risk-adjusted) is what many investors rely on when determining which mutual funds to invest in. Even though it may not be the most adequate performance measure, the absolute net return is nevertheless the actual return earned by the investor and therefore a straightforward approach to confirm whether a particular fund in fact has outperformed another fund or the market and by how much, i.e. whether the fund has yielded an excess return on another fund or on the market.

Tables 9.7.1-4 present monthly *gross* returns for *major* AMUSDEMFs for the period 2002-16. According to Table 9.7.1, the mean return for the entire time period has been 0.87% and the median return for the same period was 1.34%. The fact that the median was superior to the mean indicates more negative outliers in the data compared to positive outliers. As expected, the small market capitalization segment did perform superior returns to the other segments but also to a higher volatility. Investigating for persistence of returns by splitting the studied time period into three sub periods reveal that the major fund group did achieve the best performance during 2012-16 with a mean return of 1.24% (see Table 9.7.4). Table 9.7.3 presents the most volatile period with an average monthly standard deviation of 6.38%. This sub period includes both the minimum and the maximum observation for each and one of the seven categories throughout the entire time period 2002-16. Although this was at the time of the financial crisis, the major fund families did manage to yield positive returns (mean of 0.39%) in all categories.

[Table 9.7.1] [Table 9.7.2] [Table 9.7.3] [Table 9.7.4]

When evaluating monthly *gross* returns for *additional* AMUSDEMFs for the period 2002-16 presented in Tables 9.7.5-8 it becomes clear that this group were unable to outperform the major group. However, the difference between the two groups´ performances is minor where the additional group yielded a monthly mean return of 0.85% (see Table 9.7.5) in comparison to the

[55] Those three points in the data which sort the observations into four groups of equal size. The first quartile corresponds to the observation between the minimum observation and the median, the second quartile corresponds to the median, and the third quartile corresponds to the observation between the median and the maximum observation.

major group´s 0.87%. The median return for the additional group (1.29%) was as well inferior to the major group´s median return (1.34%). Again, the small market capitalization segment did yield the highest returns. In line with the major group´s performance, the additional group did as well perform the best in the 2012-16 sub period (see Table 9.7.8) and the worst in the 2007-11 sub period (see Table 9.7.7). Notable though is the fact that the additional group did outperform their major peers at the time of the financial crisis (with an excess return of 0.02%[56]) whilst they took on a lower risk.[57] The opposite was however true for the other two sub periods, i.e. the major group yielded superior mean returns to less risk in comparison to the additional group (see Table 9.7.6 and Table 9.7.8).

[Table 9.7.5] [Table 9.7.6] [Table 9.7.7] [Table 9.7.8]

Comparing the monthly gross returns yielded by the major and the additional fund families presented above to the monthly *U.S. stock market index* returns for the same time period (see Tables 9.5.1-4) confirms that both fund groups did beat the market in terms of mean returns. The market yielded a monthly mean return of 0.75% (see Table 9.5.1) during 2002-16 compared to the major group´s 0.87% and the additional group´s 0.85%. However, in terms of median returns only the major group were able to yield superior returns to the market. Moreover, the market index experienced more volatility than the two fund groups with an average monthly standard deviation of 4.92% (see Table 9.5.1) compared to the major group´s 4.88% and the additional group´s 4.84%. Evaluating the market performance in each of the seven categories confirm that the two fund groups did perform superior to the market in all of them. By splitting the data into my three sub periods, one can identify similar patterns of performance as with the two fund groups explained above. The U.S. stock market did perform the best during the 2012-16 sub period and it performed the worst for the years 2007-11. In comparison to the major fund group, the market underperformed in all sub periods, both in terms of mean returns as well as median returns. The additional fund group yielded inferior mean returns to the market for the 2012-16 sub period but not for the other two sub periods.

The performance evaluation of AMUSDEMFs *net* of fees will not change considerably to those gross of fees AMUSDEMFs evaluated so far in terms of the *relation* between the two fund groups. Removing the fees added to the gross returns will obviously reduce the net returns for both groups but one can however expect a more significant decline for the additional group since

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[56] 0.41% minus 0.39%.

[57] With an average monthly standard deviation of 6.27% compared to the major group´s 6.38%.

these funds on average were proved to charge higher expense ratios in all style box categories (see Tables 9.3.1-2).

Tables 9.8.1-4 show monthly *net* returns for *major* AMUSDEMFs for the period 2002-16. Table 9.8.1 confirms that the major fund group yielded a monthly mean return of 0.78% which corresponds to 9.36% on an annual basis. The major fund families did thereby beat the market by an annual mean excess return of 0.36%.[58] The median return (1.24%) was however inferior to the market´s median return (1.33%). Additionally, the major fund group were on average unable to outperform the market in the medium growth as well as in the large value categories. The sub periods confirm that the major funds on average did underperform their benchmark indices in the 2012-16 sub period with a monthly spread of 0.05%.[59] The opposite was however true for the other two sub periods. The major funds yielded their one negative monthly mean return (-0.01%) in the large value category between 2007 and 2012 but this was yet higher than the market´s -0.05%.

[Table 9.8.1] [Table 9.8.2] [Table 9.8.3] [Table 9.8.4]

Moving on to the *net* performance of the *additional* fund families compiled in Tables 9.8.5-8. Investing in these funds for the period 2002-16 has given an annual mean return net of fees of 8.64% (see Table 9.8.5). In comparison to the equivalent return of their major peers (9.36%), the additional fund group has underperformed by an annual mean of 0.72%. This spread may seem as miniscule but when considering an investor employing a buy-and-hold strategy for these 15 years combined with the effect of compounding, the spread is in fact more significant. Furthermore, the additional funds performed inferior net returns to the major funds in each and one of the seven categories. Evaluating the sub periods show that the major funds were still superior in terms of mean returns in all categories (see Tables 9.8.6-8). Contrary to the major fund group, the additional fund families did not outperform the market throughout these years. Instead, they were beaten by an annual mean return of 0.36%.[60] In the small blend as well as in large growth categories, the additional funds did however yield superior net returns to their respective benchmark index. Focusing on the sub periods reveal that the additional funds did in fact outperform the market from 2002 until 2011 in terms of mean returns but due to their poor performance in the last sub period, they were unable to outperform the market for the entire time period (i.e. lack of persistence).

[Table 9.8.5] [Table 9.8.6] [Table 9.8.7] [Table 9.8.8]

[58] 9.36% minus 9%.
[59] 1.19% minus 1.14%.
[60] 9% minus 8.64%.

To sum up from an investor´s perspective, the major funds are preferably to the additional funds regardless of style box category. The active management is worth the fee paid to the major fund families except for those funds investing in medium growth as well as large value stocks. Passively managed index funds (i.e. the market) performed superior returns to the additional funds net of fees with the exception for the two categories small blend and large growth.

5.2 Beta-adjusted Net and Gross Excess Returns

In this section I present my *alpha* computations. As with the absolute returns, I find it necessary to evaluate the alphas both net and gross of fees. Gross alphas confirm whether the fund managers did in fact show any stock-picking abilities while the net alphas correspond to a measure of the risk-adjusted return obtained by the investor.

Tables 9.9.1-4 present monthly *gross* alphas for *major* AMUSDEMFs for the period 2002-16. The mean alpha (0.07%) as well as the median alpha (0.08%) was positive for the entire time period (see Table 9.9.1). This was also true for all seven style box categories except for the median in the medium growth category (-0.02%). The major funds did thereby outperform the market on a gross level and accordingly confirmed the managers' stock-picking skills (particularly for small value stocks). All four tables indicate a higher alpha in the small market capitalization segment with the exception for the years 2002-06. This particular sub period represented the worst performing sub period of all with a monthly mean alpha of zero (i.e. the major funds performed equivalent to the market) including the highest fluctuations with a monthly average standard deviation of 1.49% (see Table 9.9.2). Somewhat unexpected was the fact that the best performance by the major fund families was achieved at the time of the financial crisis, indicating stock-picking skills during turmoil markets (see Table 9.9.3).

[Table 9.9.1] [Table 9.9.2] [Table 9.9.3] [Table 9.9.4]

Monthly *gross* alphas for *additional* AMUSDEMFs for the period 2002-16 presented in Tables 9.9.5-8 confirm that this fund group (like the major fund group) were able to beat the market by yielding a positive monthly mean alpha of 0.06% (see Table 9.9.5). The additional funds underperformed the market only in the large value category by yielding a negative monthly mean alpha of -0.04%. The median alphas show similar performances. However, the additional group stock-picked inferior to the major group with an average monthly alpha spread of 0.01%[61] whilst they experienced higher fluctuations in their alphas with an average monthly standard deviation of 1.57% (compared to their major peers´ 1.33%). In fact, by splitting the time period into my

[61] 0.07% minus 0.06%.

three sub periods reveal that this lower persistence of yielding alphas remains for all sub periods. As with the major funds´ alphas, the alphas yielded by the additional group were generally higher in the small market capitalization segment and the best performance in terms of monthly mean alphas was also achieved in the 2007-11 sub period. The major fund group outperformed their additional peers in all sub periods except for that from 2002 until 2006.

[Table 9.9.5] [Table 9.9.6] [Table 9.9.7] [Table 9.9.8]

On a *net* of fees level, those alphas yielded by the *major* fund families during 2002-16 did underperform the market with a negative monthly mean alpha of -0.02% (see Table 9.10.1). The small value as well as the small blend categories did however manage to yield beta-adjusted excess returns on their benchmark indices in terms monthly mean alphas. Negative mean alphas were however the outcome too in each of the three sub periods (with the exception for the years 2007-11 illustrated in Table 9.10.3).

[Table 9.10.1] [Table 9.10.2] [Table 9.10.3] [Table 9.10.4]

In the previous section I mentioned that the difference between net and gross returns for the additional funds were to be greater than that of the major funds due to the higher expense ratios charged by the additional funds. This fact will obviously apply to the alphas as well and one can consequently expect higher negative net alphas yielded by the additional funds since this group has already been confirmed to yield inferior gross alphas to their major peers.

This argumentation turns out to be true when evaluating monthly *net* alphas for *additional* AMUSDEMFs for the period 2002-16 presented in Tables 9.10.5-8. The additional funds did underperform both the major funds (with an average monthly alpha spread of -0.06%[62]) as well as the market since they yielded both a negative monthly mean alpha of -0.08% and a negative monthly median alpha of -0.07% (see Table 9.10.5). In neither style box category were the additional fund group able to yield excess returns on either the major fund group or on the market. Similar conclusions can be drawn for the three sub periods.

[Table 9.10.5] [Table 9.10.6] [Table 9.10.7] [Table 9.10.8]

Based on the results in this section, I conclude that both fund groups managed to yield positive alphas on a gross level. However, when removing the fees paid by investors the alphas turned negative and this consequently confirms that neither fund group were able to outperform the market net of fees. Accordingly, the fees charged by the two fund groups were clearly not worth

[62] -0.08% minus -0.02%.

to pay in exchange for the benefits of active management. Lastly, the major funds did on average yield superior alphas to the additional funds. Whether the performance of the additional funds is in fact statistically significantly inferior to the major funds as well as to the market will be tested in the upcoming section.

5.3 Regressions

In Section 5.4 I present evidence for heteroscedasticity as well as autocorrelation in my data. All 28 regressions in this section are therefore estimated by using heteroscedasticity and autocorrelation-consistent (HAC) standard errors in order to adjust for these biases. Limitations regarding this particular estimation procedure are discussed in Chapter 7.

I have compiled my regression outputs in Table 9.11.1. The alpha coefficients imply a similar pattern as to those computed in the previous section. On a gross level, all alphas are positive except for the additional funds in the large value category. On a net level, all alphas are negative except for the major funds in the small market capitalization segment. In other words, the majority of my net alphas deviate negatively from the CAPM prediction of alphas equalling zero, thus indicating the two fund groups´ underperformance to the market during the time period 2002-16. The intention of running my regressions is however to obtain *statistically significant* answers. In Section 3.4 I did ask myself whether my AMUSDEMFs yield alphas equal to zero (null hypothesis). By studying Table 9.11.1, I can reject the null hypothesis at a significance level of 1% for eight out of these 28 regressions. For the remaining 20 regressions, the alphas are statistically insignificantly different from zero at the 1% level and consequently interpreted as neither have outperformed nor underperformed the market.[63] The evaluation of the eight regressions confirms (to a significance of 99%) that the major fund group managed to yield positive gross alphas in three categories[64] while in the categories of the additional funds only two[65] were able to yield positive gross alphas at the same significance level. Additionally, the additional funds were the only group yielding negative net alphas at the 1% significance level and this they did in three categories.[66] Neither fund group was able to yield positive net alphas to a significance as low as of 90%.

Leaving the alpha coefficients and now shifting the focus towards the beta coefficients. It is indeed quite surprising how low the values of the beta coefficients in Table 9.11.1 in fact are. With the market beta equal to one, only in the large growth category did the two fund groups

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[63] If rejecting the null hypothesis at the *10%* significance level rather than at the 1%, *15* regressions derived alphas statistically significantly different from zero.
[64] Small value (0.1543%), small blend (0.1320%), and large growth (0.0775%).
[65] Small blend (0.1246%) and large growth (0.1035%).
[66] Small growth (-0.0938%), large value (-0.1461%), and large blend (-0.0920%).

carry betas exceeding this value, albeit narrowly.[67] The remaining style box categories for both groups carried a beta lower than the market risk and this consequently support the fact that the majority of those funds applied to my study have been less volatile than the market portfolio, i.e. the risk aversion among the fund managers appears to have been higher than that by the market. Additionally, the major fund group carried higher betas in comparison to the additional fund group in all categories except for large growth stocks. Those standard errors corresponding to the beta coefficients in Table 9.11.1 denote the firm-specific risk which has not been diversified away. Ideally, these values would equal zero since they contribute to reducing the explanatory power of my regression equation. However, a firm-specific risk not even exceeding 2.5% among the beta coefficients may not be considered as a major bias. On the contrary, this confirms a well-diversified portfolio achieved by the fund managers.

Last of all, studying the R-squared of each regression in Table 9.11.1 indicates values close to one. The majority of the R-squared values exceed 90%[68] and thus implying the quite unfeasible task for the fund managers *not* to yield alphas equalling zero since the composition of their stock portfolios are very much alike that of the market (see the discussion in Section 4.4.1). To put it differently, on the one hand, the fund managers do not engage enough in stock-picking in order to enable themselves to actually outperform the market by far. On the other hand, this inactiveness by the managers minimises the risk of underperforming the market and which accordingly corresponds to those low values of the beta coefficients discussed above. In terms of risk management, one can express it as if the two fund groups reduce the downside risk *and* the upside potential. Now, investors pay fees in order to benefit from the upside potential but they are supposedly unaware of its restraint. Consequently, and as stated earlier in this study, the investors pay for a service they will most likely not receive, i.e. a net excess return on the market. Moreover, the major fund group has generated higher R-squared values to their additional peers in each category. This fact suggests that the additional fund families did engage in more active stock-picking compared to the major fund families. The superior engagement to active management conducted by the additional group did however end up with an inferior performance to the major group.

[Table 9.11.1]

[67] The major funds with a beta of 1.0127 and the additional funds with a beta of 1.0178.

[68] The highest value corresponding to as much as 95.18% and represented by the major fund group in the small growth category. As have been mentioned, the small market capitalization segment tends to represent the most volatile of segments. Therefore, in order to avoid an underperformance to the market, the major fund group simply tracks the index even closer. At the same time, the major group charges higher expense ratios in the small market capitalization segment than in the other two segments, with the exception for large blend stocks (see Table 9.3.1).

Table 9.11.2 answers my second alternative hypothesis formulated in Section 3.4. In contrast to an ordinary t-test (i.e. a Student´s t-test), the Satterthwaite-Welch t-test accounts for unequal variances as well as unequal sample sizes (i.e. an unpaired t-test). Accordingly, this will make the comparison of those alphas yielded by my two fund groups more reliable. If rejecting the null hypothesis in this test, there are statistically significant differences of mean alphas between the two groups. Although the major funds yielded superior mean alphas to the additional funds in most style box categories both net and gross of fees, the confirmation of these differences of performance shows rather low statistical significance (see Table 9.11.2). At a significance level of 1%, there was a statistically significant difference of performance between major and additional funds *solely* in the large value category for net alphas. At the 10% significance level there were additionally statistically significant differences in three categories.[69] The remaining categories showed no performance difference of statistical significance neither on a gross nor a net level.

[Table 9.11.2]

5.4 Robustness Testing

Tables 9.12.1-2 clearly show that each and one of my 28 regressions is *heteroscedastic* as well as *autocorrelated*. The null hypothesis is rejected at a significance level of 1% in both tests and for all regressions. Consequently, my estimators are neither unbiased nor efficient. In order to adjust for the biasedness I ran my regressions using HAC standard errors. However, this estimation procedure does not adjust for inefficiency among the two estimators. Alternatives to HAC standard errors are discussed in Chapter 7.

[Table 9.12.1] [Table 9.12.2]

Moving on to those tests for *stationarity* compiled in Table 9.12.3. Neither my independent variable nor my dependent variable does have a unit root since the null hypothesis is rejected for both of them. My regressions are therefore stationary. The t-Statistic is further supposed to be negative as the alternative hypothesis is in fact left tailed and this is also the case according to Table 9.12.3. The fact that my data are stationary as well as autocorrelated does indicate an inefficient U.S. stock market.

[Table 9.12.3]

Table 9.12.4 illustrates a typical pattern for financial data. It is obvious that all my regressions do follow a leptokurtic distribution rather than being *normally distributed* since the kurtosis for each

[69] Large value (gross), small value (net), and small growth (net). The major funds performed superior to the additional funds in all these categories.

and one of the regressions is in fact exceeding three. I therefore reject the null hypothesis claiming that the disturbance term is normally distributed. However, since I consider my regressions to contain a large enough number of observations (see Table 9.11.1), I find it unnecessary to transform my regression models in order to make them normally distributed. Instead I refer to the central limit theorem (CLT) stating that if a particular sample is large enough, its mean will approximate the mean of the population and thereby follow a normal distribution, regardless of the distribution of the population (Westerlund, 2005).

[Table 9.12.4]

The majority of my 28 regressions are correctly specified in accordance with the test results in Table 9.12.5. Yet, for eight regressions the null hypothesis is rejected at a significance level of 1%, thus indicating a *regression specification error* for each and one of them. Consequently, the OLS estimators of these particular regressions are biased. Still, I did include those eight regressions in the performance evaluation in Section 5.3. I will comment upon possible solutions to this lack of robustness in Chapter 7.

[Table 9.12.5]

6. Conclusion and Discussion

This study has evaluated the performance of 204 actively managed U.S. domestic equity mutual funds from 2002-2016. The funds were split into one major group (represented by the ten largest U.S. mutual fund families) and one additional group (represented by a sample of the remaining U.S. mutual fund families) in order to enable a comparison between each other as well as to the market. As described in the introduction, the underlying objectives of these comparisons have been to investigate for potential imperfect competition in the U.S. mutual fund industry on the one hand, and to confirm whether the active management has outperformed a passively managed portfolio on the other. I could reject my null hypothesis at the 1% level for eight regressions as these did yield alphas statistically significantly different from zero while the remaining 20 regressions accordingly yielded alphas corresponding to the performance by the market. Out of these eight regressions, three corresponded to positive gross alphas yielded by the major fund group in categories small value, small blend, and large growth while two corresponded to positive gross alphas yielded by the additional fund group in categories small blend and large growth. The last three regressions corresponded to negative net alphas yielded by the additional fund group in categories small growth, large value, and large blend. When I compared each group´s mean alpha to each other, I did find only a statistically significant difference at the 1% level in the large value category for net alphas. It was the major fund group that performed the superior mean alpha in this particular category.

By returning to my initial investigation objective in the introduction of this study, formulated as "*I will compare the historical performance of major U.S. mutual fund families to their additional peers during a time period of 15 consecutive years, starting from 2002 until 2016*", I can conclude that both groups of fund families yielded alphas statistically insignificantly different from zero at the 1% level in the majority of style box categories. However, in those categories of which they yielded statistically significant non-zero alphas to a significance of 99%, the major fund families did overall yield superior positive gross alphas to the additional fund families (and in more categories too) whilst the additional families were the only group yielding negative net alphas. These performances point toward the fact that the major group outperformed the additional group. In addition to my initial objective, I also formulated the subsequent "*I will benchmark each of the two groups to adequate market indices in order to confirm whether the active management really pays off*". My findings support the fact that the active management by the two fund families did pay off on a *gross* level since both groups overall yielded positive gross alphas, although with varying levels of statistical significance in most categories. However, once the fees had been paid and the investors were to collect their capital gains, the net alphas had turned negative. As a result, the active management outperformed the market but the investors did not benefit from it due to that the fees exceeded the beta-adjusted excess returns. This outcome is very much in line with previous studies such as that composed by Wermers (2000).

Based on my findings, what conclusions can be drawn upon the fact that as few as ten U.S. mutual fund families manage 58% of U.S. mutual fund supply? I present evidence suggesting that these ten fund families together perform superior to the others. However, the *difference*s of performance between the two groups of families are overall statistically insignificant and consequently there are most likely other reasons behind the development of this market structure. The intention of this study has however not been to actually *determine* these reasons[70] but rather investigate whether the current market structure within the U.S. mutual fund industry is beneficial from the point of view of *U.S. investors*. That is, is the aggregated private wealth of the U.S. investors efficiently allocated considering that the majority of this wealth is invested in the ten largest U.S. fund families? According to my results, the answer is yes. That being said, considering the overall underperformance by the active management, there are likely to be other *types* of mutual funds which are *more efficient* to invest in in terms of maximising the risk-adjusted return than AMUSDEMFs evaluated in this study.

[70] There may be plenty of reasons. I proposed a few of those in Section 4.1.

7. Limitations and Future Research

Those *drawbacks* associated with this study, and of which have not been discussed so far, will be emphasised here.

Of course, my results are only as good as the data and as far as I am concerned, the most obvious drawback in my study is the limited numbers of mutual funds corresponding to the additional fund group included. I apply a total of 134 additional funds in the study and consequently far from all of the additional U.S. fund *families* are represented. However, considering the scope of this study, including all of those fund families would have been too overwhelmingly. Additionally, the total number of operating U.S. fund families has neither been fully confirmed in this study. I must as well mention the fact that no mutual funds managed by the tenth largest U.S. fund family[71] have been included due to the lack of data.

Furthermore, as explained in Section 5.4, my regressions are adjusted for heteroscedasticity as well as autocorrelation by using HAC standard errors. Unfortunately, this procedure does not make the estimators efficient which accordingly obviously affects my results negatively. Alternative estimation procedures to HAC standard errors which *do* adjust for inefficiency are weighted least squares (WLS) regressions (adjusting for heteroscedasticity) and feasible generalised least squares (FGLS) regressions (adjusting for autocorrelation). However, these two procedures are neither impeccable. In order to apply the WLS regression properly, it requires knowing the weight of each observation in the sample, i.e. the standard deviation of the disturbance term in each observation, which I do not know (Dougherty, 2011). The disadvantage of applying the FGLS regression is that the inefficiency of the estimators is not adjusted if the sample is not large enough. In this case neither of the properties of the FGLS estimators is known and therefore the estimators may as well be even more inefficient than if running with OLS (Westerlund, 2005; Chung-Ming, 2014). My regression samples may however be considered large enough to run with FGLS.

Another shortcoming concerning my data is the fact that eight of my regressions suffer from specification error (see Section 5.4). As I mentioned in that particular section, these regressions have still been applied to my study although with the consequence of causing biased OLS estimators. Now, an alternative approach would have been to transform the variables within the regression model into logarithms and then test again for regression specification error. Yet, the transformation does not for sure make the specification error to go away. If the regressions were

[71] Dimensional Funds (DFA).

still to be misspecified after the transformation, the regression equation itself is incorrect due to a non-linear relationship between the independent variable and the dependent variable.

Future research could involve an identical study to the one conducted here but adjusted for those limitations discussed above. Particularly, by including more additional fund families as well as by expanding the studied time period will provide more reliable results. Additionally, replacing my one-factor model with those multi-factor models explained in Chapter 2 may as well provide more accurate results since those limitations corresponding to CAPM will then not become a bias. Moreover, as discussed in the previous chapter regarding non-competitive market structures such as that perceived in the U.S. mutual fund industry, it is of importance to scrutinise each and one of the market participants in order to confirm whether their performance actually are satisfying enough, and simply not legitimise their (potentially poor) performance due to their dominant market positions. Investigating for similar market structures in mutual fund industries such as to those in the U.S. or in Sweden are therefore of interest to conduct in other markets worldwide. Last but not least, the main focus of this study has not been on closet indexing although I have touched upon it. An investigation of whether my AMUSDEMFs do in fact replicate certain benchmark indices is highly appropriate to conduct since I did find indications of this in my study. Those measurements mentioned in Chapter 1 (i.e. tracking error and active share) are then relevant to apply in order to test for this.

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9. Tables[72]

Table 9.1 *Mutual fund sample*

Equity style box category	N major AMUSDEMFs	N additional AMUSDEMFs	N observations
Small Value	10	17	3,751
Small Blend	10	17	3,959
Small Growth	10	19	4,852
Medium Growth	10	18	4,843
Large Value	10	20	4,609
Large Blend	10	22	5,431
Large Growth	10	21	4,611
Total	**70**	**134**	**32,056**

Table 9.2.1 *AUM as of year-end 2016 (USD in millions), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	77.36	2,058.05	2,445.45	2,832.85	3,424.21	2,167.59	1,151.52
Small Blend	601.57	755.89	1,331.87	4,838.48	9,790.48	2,966.87	2,976.32
Small Growth	157.99	2,696.45	3,053.07	8,003.22	18,086.91	5,558.74	5,416.32
Medium Growth	405.06	1,266.03	2,050.33	3,332.49	4,036.38	2,171.68	1,223.36
Large Value	202.04	720.59	8,282.07	21,259.10	88,059.12	17,428.26	25,329.93
Large Blend	373.65	1,470.19	2,744.40	12,009.81	82,848.33	13,062.79	23,928.48
Large Growth	332.60	3,040.38	4,382.17	20,476.08	153,736.96	23,753.28	44,692.32
Average	**307.18**	**1,715.37**	**3,469.91**	**10,393.15**	**51,426.06**	**9,587.03**	**14,959.75**

Table 9.2.2 *AUM as of year-end 2016 (USD in millions), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	7.90	95.78	406.39	2,407.40	3,732.40	1,058.22	1,308.53
Small Blend	6.29	333.42	176.58	919.42	3,277.10	675.33	928.35
Small Growth	35.71	377.41	495.39	1,007.49	7,679.01	1,015.87	1,642.32
Medium Growth	10.10	272.96	1,098.86	3,402.10	7,946.71	2,206.04	2,615.15
Large Value	2.23	310.46	810.98	1,901.59	13,989.00	2,307.41	3,750.12
Large Blend	17.45	422.99	577.68	2,866.56	23,099.14	2,708.38	5,114.20
Large Growth	3.37	46.95	318.83	2,125.28	9,318.57	1,641.21	2,587.33
Average	**11.86**	**265.71**	**554.96**	**2,089.98**	**9,863.13**	**1,658.92**	**2,563.71**

Table 9.3.1 *Annual net expense ratios as of year-end 2016 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	1.11	1.23	1.49	1.84	2.22	1.55	0.36
Small Blend	0.29	0.80	1.16	1.34	1.55	1.07	0.38
Small Growth	0.46	0.75	1.02	1.38	1.81	1.09	0.47
Medium Growth	0.36	0.79	0.88	1.23	1.71	0.99	0.36
Large Value	0.26	0.68	0.92	1.35	1.94	1.01	0.54
Large Blend	0.34	0.90	1.21	1.69	2.06	1.22	0.56
Large Growth	0.46	0.67	0.98	1.17	2.16	1.04	0.49
Average	**0.47**	**0.83**	**1.09**	**1.43**	**1.92**	**1.14**	**0.45**

Table 9.3.2 *Annual net expense ratios as of year-end 2016 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	1.05	1.30	1.50	2.10	2.40	1.67	0.43
Small Blend	0.91	1.30	1.40	2.00	2.20	1.56	0.39
Small Growth	1.15	1.38	1.82	2.14	2.55	1.75	0.40
Medium Growth	0.77	1.23	1.45	2.01	2.40	1.58	0.46
Large Value	0.86	1.03	1.43	1.80	2.71	1.43	0.46
Large Blend	0.56	1.06	1.29	1.91	2.59	1.44	0.52
Large Growth	0.82	1.09	1.43	1.95	2.22	1.48	0.44
Average	**0.87**	**1.20**	**1.47**	**1.99**	**2.44**	**1.56**	**0.44**

[72] All tables in this chapter are based on the author´s computations in Microsoft Excel and EViews software and can be obtained upon request to the author.

Table 9.4 *Net expenses paid by investors as of year-end 2016 (USD in millions)*

Equity style box category	Major and Additional AMUSDEMFs	Major AMUSDEMFs	Additional AMUSDEMFs	Major AMUSDEMFs in %	Additional AMUSDEMFs in %
Small Value	637.35	338.37	298.98	0.53	0.47
Small Blend	505.02	352.65	152.37	0.70	0.30
Small Growth	808.77	454.50	354.27	0.56	0.44
Medium Growth	828.70	222.25	606.45	0.27	0.73
Large Value	2,462.89	1,744.79	718.10	0.71	0.29
Large Blend	2,204.99	1,659.22	545.77	0.75	0.25
Large Growth	2,236.40	1,729.96	506.44	0.77	0.23
Total	**9,684.12**	**6,501.74**	**3,182.38**	**0.67**	**0.33**

Table 9.5.1 *Monthly index returns for the time period 2002-16 (%)*

Equity style box category	Stock market index	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	Russell 2000® Value	-19.98	-2.31	1.39	4.25	15.87	0.89	5.43
Small Blend	Russell 2000®	-20.80	-2.75	1.58	4.38	15.46	0.84	5.51
Small Growth	Russell 2000® Growth	-21.70	-2.68	1.35	4.91	15.86	0.77	5.79
Medium Growth	Russell Midcap® Growth	-21.95	-1.86	1.36	3.92	14.21	0.77	5.00
Large Value	Russell 1000® Value	-17.31	-1.45	1.36	3.04	11.45	0.69	4.30
Large Blend	Russell 1000®	-17.46	-1.70	1.20	3.42	11.21	0.65	4.18
Large Growth	Russell 1000® Growth	-17.60	-1.53	1.07	3.39	10.97	0.61	4.25
Average		**-19.54**	**-2.04**	**1.33**	**3.90**	**13.58**	**0.75**	**4.92**

Table 9.5.2 *Monthly index returns for the time period 2002-06 (%)*

Equity style box category	Stock market index	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	Russell 2000® Value	-14.86	-1.56	1.36	3.99	10.21	1.30	4.50
Small Blend	Russell 2000®	-15.10	-2.75	0.92	4.40	10.73	1.02	4.91
Small Growth	Russell 2000® Growth	-15.37	-2.93	0.58	5.11	11.27	0.71	5.54
Medium Growth	Russell Midcap® Growth	-11.04	-2.13	1.36	3.76	9.62	0.76	4.51
Large Value	Russell 1000® Value	-11.12	-0.91	1.38	2.46	8.80	0.93	3.52
Large Blend	Russell 1000®	-10.74	-1.41	1.20	2.38	8.31	0.61	3.53
Large Growth	Russell 1000® Growth	-10.37	-1.78	0.55	2.56	9.17	0.29	3.77
Average		**-12.66**	**-1.92**	**1.05**	**3.52**	**9.73**	**0.80**	**4.33**

Table 9.5.3 *Monthly index returns for the time period 2007-11 (%)*

Equity style box category	Stock market index	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	Russell 2000® Value	-19.98	-4.00	1.30	4.74	15.87	0.10	7.12
Small Blend	Russell 2000®	-20.80	-4.48	1.70	4.27	15.46	0.26	7.00
Small Growth	Russell 2000® Growth	-21.70	-4.65	2.10	4.51	15.86	0.43	7.05
Medium Growth	Russell Midcap® Growth	-21.95	-3.85	0.73	4.46	14.21	0.42	6.54
Large Value	Russell 1000® Value	-17.31	-3.49	0.21	3.63	11.45	-0.05	5.75
Large Blend	Russell 1000®	-17.46	-3.07	0.94	3.68	11.21	0.15	5.52
Large Growth	Russell 1000® Growth	-17.60	-1.92	1.10	3.80	10.97	0.36	5.46
Average		**-19.54**	**-3.64**	**1.15**	**4.16**	**13.58**	**0.24**	**6.35**

Table 9.5.4 *Monthly index returns for the time period 2012-16 (%)*

Equity style box category	Stock market index	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	Russell 2000® Value	-6.75	-1.30	1.59	4.17	13.27	1.26	4.07
Small Blend	Russell 2000®	-8.79	-1.42	1.76	4.16	11.15	1.22	4.18
Small Growth	Russell 2000® Growth	-10.83	-1.73	1.40	4.89	8.95	1.18	4.45
Medium Growth	Russell Midcap® Growth	-7.57	-1.28	1.52	3.22	7.25	1.12	3.41
Large Value	Russell 1000® Value	-5.96	-0.59	1.49	2.92	7.55	1.20	3.04
Large Blend	Russell 1000®	-6.15	-0.75	1.33	3.22	8.09	1.19	3.00
Large Growth	Russell 1000® Growth	-6.41	-1.07	1.38	3.20	8.61	1.18	3.12
Average		**-7.49**	**-1.16**	**1.50**	**3.68**	**9.27**	**1.19**	**3.61**

Table 9.6 *Monthly Treasury bill rates for different time periods (%)*

Time period	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
2002-16	0.00	0.05	0.22	1.69	5.13	1.18	1.56
2002-06	0.83	1.15	1.69	3.32	5.13	2.29	1.40
2007-11	0.00	0.06	0.14	1.70	5.11	1.16	1.71
2012-16	0.00	0.02	0.05	0.11	0.41	0.09	0.09

Table 9.7.1 *Monthly returns gross of fees for the time period 2002-16 (%), major AMUSDEMFs*

Equity style box category	**Min.**	**Quartile 1**	**Median**	**Quartile 3**	**Max.**	**Mean**	**STD**
Small Value	-23.27	-1.82	1.36	4.44	20.79	1.07	5.37
Small Blend	-25.36	-1.96	1.57	4.12	21.53	0.97	5.29
Small Growth	-23.49	-2.27	1.52	4.61	18.14	0.95	5.43
Medium Growth	-22.06	-1.94	1.40	4.07	21.66	0.84	5.10
Large Value	-19.65	-1.41	1.25	3.15	15.58	0.74	4.26
Large Blend	-21.91	-1.51	1.16	3.34	14.97	0.76	4.26
Large Growth	-20.93	-1.46	1.09	3.65	13.20	0.77	4.43
Average	**-22.38**	**-1.77**	**1.34**	**3.91**	**17.98**	**0.87**	**4.88**

Table 9.7.2 *Monthly returns gross of fees for the time period 2002-06 (%), major AMUSDEMFs*

Equity style box category	**Min.**	**Quartile 1**	**Median**	**Quartile 3**	**Max.**	**Mean**	**STD**
Small Value	-13.89	-1.62	0.87	4.58	9.11	1.29	4.28
Small Blend	-13.75	-1.70	1.11	3.79	10.51	1.01	4.21
Small Growth	-15.72	-2.08	1.22	4.50	11.91	1.10	4.66
Medium Growth	-15.77	-1.64	1.48	4.03	15.28	0.93	4.59
Large Value	-12.83	-0.97	1.24	2.84	10.33	0.97	3.40
Large Blend	-13.06	-1.18	1.13	2.82	11.42	0.79	3.53
Large Growth	-10.95	-1.41	1.14	2.91	9.92	0.69	3.76
Average	**-13.71**	**-1.51**	**1.17**	**3.64**	**11.21**	**0.97**	**4.06**

Table 9.7.3 *Monthly returns gross of fees for the time period 2007-11 (%), major AMUSDEMFs*

Equity style box category	**Min.**	**Quartile 1**	**Median**	**Quartile 3**	**Max.**	**Mean**	**STD**
Small Value	-23.27	-3.30	1.22	4.58	20.79	0.51	7.24
Small Blend	-25.36	-3.69	1.75	4.65	21.53	0.57	6.90
Small Growth	-23.49	-4.40	1.60	4.94	18.14	0.50	6.89
Medium Growth	-22.06	-3.78	1.28	4.82	21.66	0.46	6.59
Large Value	-19.65	-3.45	0.76	3.64	15.58	0.07	5.72
Large Blend	-21.91	-2.97	1.04	4.03	14.97	0.28	5.65
Large Growth	-20.93	-2.46	0.70	4.25	13.20	0.35	5.67
Average	**-22.38**	**-3.44**	**1.19**	**4.42**	**17.98**	**0.39**	**6.38**

Table 9.7.4 *Monthly returns gross of fees for the time period 2012-16 (%), major AMUSDEMFs*

Equity style box category	**Min.**	**Quartile 1**	**Median**	**Quartile 3**	**Max.**	**Mean**	**STD**
Small Value	-8.15	-1.13	1.68	4.25	13.88	1.38	4.06
Small Blend	-10.01	-1.15	1.65	3.97	12.94	1.32	4.01
Small Growth	-14.06	-1.29	1.67	4.25	11.89	1.26	4.22
Medium Growth	-9.36	-1.17	1.41	3.65	10.71	1.14	3.62
Large Value	-8.09	-0.66	1.49	2.98	8.52	1.18	3.07
Large Blend	-7.89	-0.99	1.32	3.33	9.22	1.18	3.12
Large Growth	-10.36	-1.09	1.43	3.61	10.85	1.21	3.44
Average	**-9.70**	**-1.07**	**1.52**	**3.72**	**11.14**	**1.24**	**3.65**

Table 9.7.5 *Monthly returns gross of fees for the time period 2002-16 (%), additional AMUSDEMFs*

Equity style box category	**Min.**	**Quartile 1**	**Median**	**Quartile 3**	**Max.**	**Mean**	**STD**
Small Value	-26.12	-1.85	1.41	4.23	30.34	0.98	5.17
Small Blend	-27.29	-2.12	1.52	4.25	30.30	0.99	5.35
Small Growth	-25.28	-2.36	1.47	4.67	19.76	0.89	5.45
Medium Growth	-23.17	-2.00	1.25	4.07	22.43	0.85	4.99
Large Value	-19.84	-1.31	1.23	3.09	15.31	0.75	4.02
Large Blend	-24.80	-1.61	1.13	3.31	18.40	0.70	4.32
Large Growth	-21.48	-1.63	1.04	3.67	23.07	0.79	4.57
Average	**-24.00**	**-1.84**	**1.29**	**3.90**	**22.80**	**0.85**	**4.84**

Table 9.7.6 *Monthly returns gross of fees for the time period 2002-06 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-17.42	-1.54	1.45	4.30	16.08	1.35	4.39
Small Blend	-15.96	-1.62	1.51	4.03	12.17	1.24	4.19
Small Growth	-18.09	-2.49	1.31	4.66	19.46	0.95	5.09
Medium Growth	-13.59	-2.04	1.25	3.78	17.82	0.82	4.49
Large Value	-14.54	-0.97	1.35	2.78	12.29	0.94	3.45
Large Blend	-20.64	-1.31	1.10	2.87	18.40	0.76	3.89
Large Growth	-14.10	-1.60	0.92	3.07	12.41	0.63	3.97
Average	**-16.33**	**-1.65**	**1.27**	**3.64**	**15.52**	**0.96**	**4.21**

Table 9.7.7 *Monthly returns gross of fees for the time period 2007-11 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-26.12	-3.44	1.12	4.66	30.34	0.44	6.92
Small Blend	-27.29	-4.04	1.44	4.93	30.30	0.46	7.20
Small Growth	-25.28	-3.94	1.48	4.94	19.76	0.56	6.70
Medium Growth	-23.17	-3.36	1.55	4.76	22.43	0.65	6.34
Large Value	-19.84	-3.03	0.71	3.52	15.31	0.17	5.27
Large Blend	-24.80	-2.98	0.82	3.81	15.74	0.19	5.51
Large Growth	-21.48	-2.86	0.70	4.10	23.07	0.40	5.93
Average	**-24.00**	**-3.38**	**1.12**	**4.39**	**22.42**	**0.41**	**6.27**

Table 9.7.8 *Monthly returns gross of fees for the time period 2012-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-11.50	-1.43	1.47	3.93	15.11	1.16	3.96
Small Blend	-9.27	-1.42	1.54	3.91	13.05	1.27	3.98
Small Growth	-15.33	-1.33	1.61	4.30	11.32	1.15	4.26
Medium Growth	-12.39	-1.18	1.16	3.51	10.67	1.08	3.74
Large Value	-7.88	-0.71	1.41	3.04	9.09	1.09	3.05
Large Blend	-8.34	-0.87	1.41	3.23	8.87	1.15	3.14
Large Growth	-9.55	-1.18	1.27	3.65	11.37	1.21	3.49
Average	**-10.61**	**-1.16**	**1.41**	**3.65**	**11.35**	**1.16**	**3.66**

Table 9.8.1 *Monthly returns net of fees for the time period 2002-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-23.40	-1.96	1.24	4.32	20.68	0.94	5.37
Small Blend	-25.48	-2.05	1.48	4.02	21.44	0.88	5.29
Small Growth	-23.58	-2.33	1.42	4.50	17.99	0.86	5.43
Medium Growth	-22.12	-2.00	1.32	3.99	21.59	0.76	5.10
Large Value	-19.79	-1.50	1.19	3.06	15.44	0.67	4.26
Large Blend	-22.08	-1.61	1.06	3.23	14.80	0.65	4.26
Large Growth	-21.02	-1.55	1.00	3.57	13.11	0.69	4.43
Average	**-22.50**	**-1.86**	**1.24**	**3.81**	**17.86**	**0.78**	**4.88**

Table 9.8.2 *Monthly returns net of fees for the time period 2002-06 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-14.04	-1.73	0.75	4.44	9.01	1.16	4.28
Small Blend	-13.86	-1.80	1.02	3.67	10.44	0.91	4.21
Small Growth	-15.83	-2.16	1.14	4.40	11,80	1,01	4,66
Medium Growth	-15.87	-1.72	1.43	3.95	15.21	0.85	4.59
Large Value	-12.85	-1.02	1.18	2.78	10.30	0.90	3.40
Large Blend	-13.24	-1.30	1.04	2.72	11.25	0.69	3.53
Large Growth	-10.99	-1.50	1.04	2.85	9.83	0.60	3.76
Average	**-13.81**	**-1.60**	**1.09**	**3.54**	**11.12**	**0.87**	**4.06**

Table 9.8.3 *Monthly returns net of fees for the time period 2007-11 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-23.40	-3.41	1.09	4.46	20.68	0.38	7.24
Small Blend	-25.48	-3.72	1.64	4.57	21.44	0.48	6.90
Small Growth	-23.58	-4.50	1.53	4.81	17.99	0.41	6.89
Medium Growth	-22.12	-3.88	1.19	4.75	21.59	0.37	6.59
Large Value	-19.79	-3.50	0.69	3.55	15.44	-0.01	5.72
Large Blend	-22.08	-3.10	0.91	3.95	14.80	0.17	5.65
Large Growth	-21.02	-2.64	0.61	4.16	13.11	0.27	5.67
Average	**-22.50**	**-3.54**	**1.09**	**4.32**	**17.86**	**0.30**	**6.38**

Table 9.8.4 *Monthly returns net of fees for the time period 2012-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-8.29	-1.25	1.56	4.14	13.77	1.25	4.06
Small Blend	-10.12	-1.20	1.54	3.92	12.88	1.23	4.01
Small Growth	-14.21	-1.36	1.58	4.17	11.85	1.17	4.22
Medium Growth	-9.42	-1.24	1.33	3.55	10.65	1.06	3.62
Large Value	-8,19	-0.77	1.41	2.92	8.40	1.10	3.07
Large Blend	-8.04	-1.08	1.21	3.20	9.07	1.08	3.12
Large Growth	-10.45	-1.17	1.34	3.49	10.76	1.12	3.44
Average	**-9.82**	**-1.15**	**1.42**	**3.63**	**11.05**	**1.14**	**3.65**

Table 9.8.5 *Monthly returns net of fees for the time period 2002-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-26.22	-2.01	1.28	4.10	30.16	0.85	5.17
Small Blend	-27.40	-2.24	1.36	4.08	30.19	0.85	5.35
Small Growth	-25.39	-2.52	1.31	4.52	19.58	0.74	5.45
Medium Growth	-23.23	-2.13	1.15	3.95	22.33	0.72	4.99
Large Value	-20.00	-1.42	1.10	2.96	15.15	0.63	4.02
Large Blend	-24.98	-1.71	1.01	3.20	18.29	0.58	4.32
Large Growth	-21.64	-1.76	0.90	3.56	22.95	0.67	4.57
Average	**-24.12**	**-1.97**	**1.16**	**3.77**	**22.66**	**0.72**	**4.84**

Table 9.8.6 *Monthly returns net of fees for the time period 2002-06 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-17.59	-1.68	1.33	4.17	15.99	1.22	4.39
Small Blend	-16.13	-1.75	1.36	3.88	12.00	1.11	4.19
Small Growth	-18.25	-2.63	1.15	4.49	19.29	0.80	5.09
Medium Growth	-13.79	-2.17	1.15	3.67	17.76	0.69	4.49
Large Value	-14.69	-1.10	1.20	2.67	12.06	0.81	3.45
Large Blend	-20.75	-1.42	1.00	2.76	18.29	0.65	3.89
Large Growth	-14.22	-1.70	0.80	2.95	12.33	0.51	3.98
Average	**-16.49**	**-1.78**	**1.14**	**3.51**	**15.39**	**0.83**	**4.21**

Table 9.8.7 *Monthly returns net of fees for the time period 2007-11 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-26.22	-3.54	0.97	4.51	30.16	0.31	6.92
Small Blend	-27.40	-4.15	1.29	4.82	30.19	0.32	7.20
Small Growth	-25.39	-4.10	1.30	4.80	19.58	0.41	6.70
Medium Growth	-23.23	-3.51	1.39	4.62	22.33	0.52	6.34
Large Value	-20.00	-3.14	0.58	3.44	15.15	0.05	5.29
Large Blend	-24.98	-3.10	0.71	3.67	15.60	0.07	5.51
Large Growth	-20.25	-3.01	0.60	3.98	22.95	0.29	5.94
Average	**-23.92**	**-3.51**	**0.98**	**4.26**	**22.28**	**0.28**	**6.27**

Table 9.8.8 *Monthly returns net of fees for the time period 2012-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-11.70	-1.53	1.29	3.77	14.91	1.02	3.96
Small Blend	-9.39	-1.58	1.43	3.77	12.94	1.13	3.98
Small Growth	-15.49	-1.51	1.45	4.16	11.16	1.00	4.26
Medium Growth	-12.58	-1.33	1.04	3.39	10.57	0.95	3.74
Large Value	-8.01	-0.81	1.27	2.91	8.91	0.98	3.05
Large Blend	-8.42	-1.01	1.31	3.13	8.78	1.03	3.14
Large Growth	-9.66	-1.30	1.13	3.53	11.21	1.08	3.49
Average	**-10.75**	**-1.30**	**1.27**	**3.52**	**11.21**	**1.03**	**3.66**

Table 9.9.1 *Monthly alphas gross of fees for the time period 2002-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-5.13	-0.49	0.15	0.83	5.30	0.14	1.27
Small Blend	-5.97	-0.64	0.16	0.85	7.41	0.13	1.26
Small Growth	-27.30	-0.66	0.11	0.93	15.87	0.04	2.03
Medium Growth	-10.06	-0.64	-0.02	0.66	13.02	0.01	1.58
Large Value	-5.05	-0.51	0.00	0.52	5.15	0.03	0.96
Large Blend	-7.03	-0.48	0.07	0.57	5.67	0.06	1.11
Large Growth	-4.23	-0.58	0.10	0.74	4.64	0.08	1.08
Average	**-9.25**	**-0.57**	**0.08**	**0.73**	**8.15**	**0.07**	**1.33**

Table 9.9.2 *Monthly alphas gross of fees for the time period 2002-06 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-4.09	-0.81	-0.06	0.65	3.69	-0.04	1.37
Small Blend	-5.97	-1.00	0.03	0.85	4.03	-0.10	1.41
Small Growth	-27.30	-0.67	-0.01	0.80	10.47	-0.14	2.48
Medium Growth	-7.94	-0.70	-0.07	0.60	11.43	-0.03	1.75
Large Value	-5.05	-0.60	-0.08	0.48	4.31	-0.06	1.01
Large Blend	-7.03	-0.48	0.08	0.68	5.67	0.12	1.27
Large Growth	-3.47	-0.40	0.26	1.02	4.64	0.27	1.17
Average	**-8.69**	**-0.67**	**0.02**	**0.73**	**6.32**	**0.00**	**1.49**

Table 9.9.3 *Monthly alphas gross of fees for the time period 2007-11 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-5.13	-0.32	0.28	1.08	5.30	0.30	1.40
Small Blend	-4.55	-0.52	0.16	0.91	7.41	0.23	1.40
Small Growth	-11.89	-0.78	0.11	1.02	15.87	0.05	2.08
Medium Growth	-10.06	-0.74	0.00	0.74	13.02	0.02	1.86
Large Value	-3.86	-0.55	0.04	0.66	5.15	0.09	1.09
Large Blend	-4.93	-0.55	0.05	0.64	5.02	0.05	1.22
Large Growth	-3.01	-0.68	-0.01	0.63	3.32	0.01	1.02
Average	**-6.20**	**-0.59**	**0.09**	**0.81**	**7.87**	**0.11**	**1.44**

Table 9.9.4 *Monthly alphas gross of fees for the time period 2012-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-3.75	-0.45	0.14	0.76	3.18	0.14	1.06
Small Blend	-4.76	-0.51	0.20	0.77	3.85	0.18	0.99
Small Growth	-9.60	-0.54	0.24	0.97	7.23	0.20	1.39
Medium Growth	-4.69	-0.49	0.00	0.62	4.93	0.04	1.03
Large Value	-3.22	-0.40	0.03	0.45	3.93	0.04	0.77
Large Blend	-3.30	-0.40	0.06	0.45	2.53	0.01	0.82
Large Growth	-4.23	-0.58	0.08	0.67	3.28	0.01	1.06
Average	**-4.79**	**-0.48**	**0.11**	**0.67**	**4.13**	**0.09**	**1.02**

Table 9.9.5 *Monthly alphas gross of fees for the time period 2002-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-10.02	-0.78	0.08	0.95	12.85	0.06	1.62
Small Blend	-10.02	-0.78	0.11	1.00	12.73	0.13	1.65
Small Growth	-7.71	-0.90	0.09	1.09	9.93	0.05	1.65
Medium Growth	-6.54	-0.84	0.08	0.96	9.23	0.06	1.61
Large Value	-21.49	-0.71	-0.01	0.64	11.26	-0.04	1.59
Large Blend	-11.34	-0.62	0.01	0.64	11.58	0.03	1.35
Large Growth	-7.34	-0.75	0.07	0.92	12.70	0.10	1.53
Average	**-10.64**	**-0.77**	**0.06**	**0.89**	**11.47**	**0.06**	**1.57**

Table 9.9.6 *Monthly alphas gross of fees for the time period 2002-06 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-8.21	-0.93	-0.13	0.83	9.45	-0.05	1.54
Small Blend	-6.79	-0.86	0.11	0.97	6.04	0.08	1.70
Small Growth	-7.52	-1.05	0.02	1.12	9.93	-0.01	1.79
Medium Growth	-6.27	-1.04	-0.04	0.91	6.69	-0.04	1.67
Large Value	-13.82	-0.98	-0.19	0.49	9.78	-0.25	1.62
Large Blend	-11.34	-0.66	0.08	0.85	11.58	0.11	1.67
Large Growth	-6.08	-0.69	0.31	1.35	8.97	0.34	1.74
Average	**-8.58**	**-0.89**	**0.02**	**0.93**	**8.92**	**0.03**	**1.68**

Table 9.9.7 *Monthly alphas gross of fees for the time period 2007-11 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-10.02	-0.67	0.29	1.24	12.85	0.23	1.96
Small Blend	-10.02	-0.91	0.10	1.04	12.73	0.12	1.90
Small Growth	-6.83	-0.96	0.10	1.14	6.69	0.06	1.74
Medium Growth	-6.54	-0.78	0.16	1.17	9.23	0.18	1.72
Large Value	-21.49	-0.68	0.09	0.80	11.26	0.01	1.96
Large Blend	-10.89	-0.68	0.00	0.66	7.76	0.00	1.37
Large Growth	-7.34	-0.91	-0.01	1.02	12.70	0.06	1.64
Average	**-10.45**	**-0.80**	**0.10**	**1.01**	**10.46**	**0.09**	**1.76**

Table 9.9.8 *Monthly alphas gross of fees for the time period 2012-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-6.97	-0.75	0.05	0.84	4.76	0.01	1.37
Small Blend	-5.86	-0.66	0.12	1.00	5.93	0.16	1.38
Small Growth	-7.71	-0.76	0.11	1.00	4.74	0.09	1.41
Medium Growth	-6.19	-0.70	0.10	0.82	5.48	0.02	1.41
Large Value	-6.68	-0.57	0.03	0.61	6.83	0.06	1.17
Large Blend	-3.74	-0.51	-0.02	0.46	6.01	-0.02	0.91
Large Growth	-5.35	-0.70	0.05	0.67	5.54	-0.01	1.24
Average	**-6.07**	**-0.66**	**0.06**	**0.77**	**5.61**	**0.04**	**1.27**

Table 9.10.1 *Monthly alphas net of fees for the time period 2002-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-5.26	-0.62	0.03	0.71	5.18	0.01	1.27
Small Blend	-6.05	-0.74	0.07	0.76	7.33	0.04	1.26
Small Growth	-7.64	-0.70	0.02	0.79	4.94	0.00	1.24
Medium Growth	-10.12	-0.72	-0.10	0.57	12.95	-0.07	1.58
Large Value	-5.15	-0.58	-0.07	0.45	5.01	-0.05	0.96
Large Blend	-7.20	-0.56	-0.03	0.48	5.58	-0.05	1.11
Large Growth	-4.32	-0.65	0.02	0.65	4.57	0.00	1.08
Average	**-6.53**	**-0.65**	**-0.01**	**0.63**	**6.51**	**-0.02**	**1.21**

Table 9.10.2 *Monthly alphas net of fees for the time period 2002-06 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-4.24	-0.94	-0.19	0.55	3.58	-0.17	1.37
Small Blend	-6.05	-1.12	-0.05	0.75	3.94	-0.20	1.41
Small Growth	-5.91	-0.63	-0.06	0.65	4.94	-0.02	1.26
Medium Growth	-8.00	-0.79	-0.15	0.52	11.37	-0.11	1.75
Large Value	-5.15	-0.68	-0.14	0.40	4.21	-0.13	1.01
Large Blend	-7.20	-0.55	-0.01	0.58	5.58	0.02	1.26
Large Growth	-3.55	-0.51	0.17	0.94	4.57	0.19	1.17
Average	**-5.73**	**-0.75**	**-0.06**	**0.63**	**5.46**	**-0.06**	**1.32**

Table 9.10.3 *Monthly alphas net of fees for the time period 2007-11 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-5.26	-0.44	0.15	0.94	5.18	0.17	1.40
Small Blend	-4.67	-0.60	0.09	0.83	7.33	0.14	1.40
Small Growth	-7.64	-0.85	-0.01	0.81	3.68	-0.08	1.33
Medium Growth	-10.12	-0.81	-0.07	0.64	12.95	-0.06	1.86
Large Value	-3.97	-0.61	-0.03	0.60	5.01	0.01	1.09
Large Blend	-5.08	-0.67	-0.03	0.55	4.87	-0.05	1.22
Large Growth	-3.11	-0.76	-0.09	0.54	3.23	-0.07	1.02
Average	**-5.69**	**-0.68**	**0.00**	**0.70**	**6.04**	**0.01**	**1.33**

Table 9.10.4 *Monthly alphas net of fees for the time period 2012-16 (%), major AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-3.90	-0.58	0.02	0.63	3.08	0.01	1.06
Small Blend	-4.87	-0.59	0.12	0.67	3.77	0.09	0.99
Small Growth	-4.05	-0.60	0.16	0.84	3.93	0.08	1.11
Medium Growth	-4.75	-0.56	-0.07	0.54	4.86	-0.04	1.03
Large Value	-3.38	-0.49	-0.05	0.39	3.77	-0.04	0.77
Large Blend	-3.48	-0.49	-0.04	0.34	2.46	-0.10	0.82
Large Growth	-4.32	-0.65	0.00	0.59	3.19	-0.07	1.06
Average	**-4.11**	**-0.57**	**0.02**	**0.57**	**3.58**	**-0.01**	**0.98**

Table 9.10.5 *Monthly alphas net of fees for the time period 2002-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-10.12	-0.91	-0.06	0.80	12.67	-0.07	1.62
Small Blend	-10.19	-0.92	-0.01	0.87	12.62	-0.01	1.65
Small Growth	-7.83	-1.05	-0.07	0.94	9.75	-0.10	1.65
Medium Growth	-6.72	-0.97	-0.06	0.82	9.04	-0.07	1.61
Large Value	-21.65	-0.83	-0.13	0.51	11.10	-0.17	1.59
Large Blend	-11.44	-0.73	-0.11	0.52	11.48	-0.09	1.35
Large Growth	-7.53	-0.87	-0.05	0.79	12.58	-0.02	1.53
Average	**-10.78**	**-0.90**	**-0.07**	**0.75**	**11.32**	**-0.08**	**1.57**

Table 9.10.6 *Monthly alphas net of fees for the time period 2002-06 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-8.32	-1.04	-0.24	0.69	9.34	-0.17	1.52
Small Blend	-6.96	-0.97	-0.02	0.83	5.92	-0.05	1.70
Small Growth	-7.68	-1.20	-0.12	0.98	9.75	-0.16	1.79
Medium Growth	-6.45	-1.16	-0.16	0.79	6.62	-0.17	1.67
Large Value	-13.97	-1.10	-0.32	0.37	9.62	-0.38	1.62
Large Blend	-11.44	-0.77	-0.03	0.74	11.48	0.00	1.67
Large Growth	-6.24	-0.81	0.16	1.22	8.85	0.22	1.75
Average	**-8.72**	**-1.01**	**-0.10**	**0.80**	**8.80**	**-0.10**	**1.67**

Table 9.10.7 *Monthly alphas net of fees for the time period 2007-12 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-10.12	-0.79	0.17	1.11	12.67	0.10	1.96
Small Blend	-10.19	-1.03	-0.03	0.91	12.62	-0.01	1.90
Small Growth	-6.94	-1.10	-0.05	1.00	6.51	-0.09	1.74
Medium Growth	-6.72	-0.90	0.04	1.05	9.04	0.05	1.72
Large Value	-21.65	-0.81	-0.05	0.70	11.10	-0.11	1.96
Large Blend	-11.11	-0.80	-0.14	0.54	7.55	-0.12	1.38
Large Growth	-7.53	-1.01	-0.12	0.88	12.58	-0.06	1.64
Average	**-10.61**	**-0.92**	**-0.03**	**0.88**	**10.30**	**-0.03**	**1.76**

Table 9.10.8 *Monthly alphas net of fees for the time period 2012-16 (%), additional AMUSDEMFs*

Equity style box category	Min.	Quartile 1	Median	Quartile 3	Max.	Mean	STD
Small Value	-7.17	-0.88	-0.09	0.70	4.58	-0.13	1.37
Small Blend	-6.03	-0.79	0.00	0.87	5.76	0.03	1.38
Small Growth	-7.83	-0.92	-0.03	0.84	4.56	-0.06	1.41
Medium Growth	-6.28	-0.83	-0.03	0.69	5.29	-0.11	1.41
Large Value	-6.84	-0.69	-0.08	0.49	6.67	-0.06	1.17
Large Blend	-3.85	-0.64	-0.14	0.33	5.90	-0.14	0.91
Large Growth	-5.43	-0.81	-0.09	0.54	5.46	-0.14	1.24
Average	**-6.20**	**-0.79**	**-0.07**	**0.64**	**5.46**	**-0.09**	**1.27**

Table 9.11.1 *Regression outputs for the time period 2002-16*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	α	Std. Error (α)	t-Statistic (α)	Prob. (α)	β	Std. Error (β)	t-Statistic (β)	Prob. (β)	R-squared	N observations
Regr. 1	Small Value	Major	Gross	0.1543	0.0345	4.4746	0.0000	0.9754	0.0069	141.4071	0.0000	0.9484	1,496
Regr. 2	Small Blend	Major	Gross	0.1320	0.0401	3.2936	0.0010	0.9332	0.0137	68.0855	0.0000	0.9397	1,547
Regr. 3	Small Growth	Major	Gross	0.0608	0.0691	0.8803	0.3788	0.8502	0.0242	35.0918	0.0000	0.8052	1,710
Regr. 4	Mid Growth	Major	Gross	0.0152	0.0364	0.4170	0.6767	0.9796	0.0129	75.8718	0.0000	0.9114	1,756
Regr. 5	Large Value	Major	Gross	0.0254	0.0258	0.9862	0.3242	0.9732	0.0093	104.1809	0.0000	0.9516	1,608
Regr. 6	Large Blend	Major	Gross	0.0556	0.0306	1.8173	0.0693	0.9853	0.0113	87.5769	0.0000	0.9362	1,704
Regr. 7	Large Growth	Major	Gross	0.0775	0.0286	2.7119	0.0068	1.0127	0.0086	118.4083	0.0000	0.9451	1,520
Regr. 8	Small Value	Additional	Gross	0.0662	0.0385	1.7195	0.0857	0.9269	0.0119	78.0976	0.0000	0.9009	2,255
Regr. 9	Small Blend	Additional	Gross	0.1246	0.0402	3.0992	0.0020	0.9290	0.0112	82.7653	0.0000	0.9072	2,412
Regr. 10	Small Growth	Additional	Gross	0.0548	0.0348	1.5750	0.1154	0.9083	0.0081	111.6738	0.0000	0.9140	3,142
Regr. 11	Mid Growth	Additional	Gross	0.0567	0.0313	1.8138	0.0698	0.9422	0.0101	93.2285	0.0000	0.9008	3,087
Regr. 12	Large Value	Additional	Gross	-0.0237	0.0280	-0.8475	0.3968	0.8596	0.0203	42.3928	0.0000	0.8130	3,001
Regr. 13	Large Blend	Additional	Gross	0.0272	0.0237	1.1460	0.2519	0.9731	0.0111	87.5145	0.0000	0.9070	3,727
Regr. 14	Large Growth	Additional	Gross	0.1035	0.0293	3.5307	0.0004	1.0178	0.0099	102.4175	0.0000	0.8986	3,091
Regr. 15	Small Value	Major	Net	0.0256	0.0345	0.7420	0.4582	0.9754	0.0069	141.3766	0.0000	0.9484	1,496
Regr. 16	Small Blend	Major	Net	0.0395	0.0400	0.9874	0.3236	0.9333	0.0137	68.1620	0.0000	0.9398	1,547
Regr. 17	Small Growth	Major	Net	0.0001	0.0344	0.0037	0.9971	0.9286	0.0075	123.8446	0.0000	0.9518	1,710
Regr. 18	Mid Growth	Major	Net	-0.0677	0.0365	-1.8573	0.0634	0.9796	0.0129	75.8761	0.0000	0.9113	1,756
Regr. 19	Large Value	Major	Net	-0.0503	0.0257	-1.9602	0.0501	0.9731	0.0093	104.0838	0.0000	0.9517	1,608
Regr. 20	Large Blend	Major	Net	-0.0475	0.0304	-1.5609	0.1187	0.9853	0.0113	87.5652	0.0000	0.9364	1,704
Regr. 21	Large Growth	Major	Net	-0.0062	0.0287	-0.2159	0.8291	1.0126	0.0085	118.6585	0.0000	0.9450	1,520
Regr. 22	Small Value	Additional	Net	-0.0684	0.0385	-1.7790	0.0754	0.9268	0.0119	78.0165	0.0000	0.9009	2,255
Regr. 23	Small Blend	Additional	Net	-0.0078	0.0403	-0.1938	0.8463	0.9291	0.0112	82.7531	0.0000	0.9071	2,412
Regr. 24	Small Growth	Additional	Net	-0.0938	0.0348	-2.6957	0.0071	0.9083	0.0081	111.8357	0.0000	0.9140	3,142
Regr. 25	Mid Growth	Additional	Net	-0.0745	0.0314	-2.3720	0.0178	0.9422	0.0101	93.4880	0.0000	0.9008	3,087
Regr. 26	Large Value	Additional	Net	-0.1461	0.0282	-5.1869	0.0000	0.8598	0.0203	42.4116	0.0000	0.8130	3,001
Regr. 27	Large Blend	Additional	Net	-0.0920	0.0238	-3.8667	0.0001	0.9731	0.0111	87.5585	0.0000	0.9070	3,727
Regr. 28	Large Growth	Additional	Net	-0.0197	0.0294	-0.6722	0.5015	1.0177	0.0099	102.3694	0.0000	0.8986	3,091

Note: Contrary to all other values in Table 9.11.1, the alphas are *not* expressed as decimal numbers but as a percentage.

Table 9.11.2 *Satterthwaite-Welch t-test for equality of mean alphas between major and additional AMUSDEMFs*

Equity style box category	Gross or net of fees	Mean alpha (major AMUSDEMFs)	Std. Error of mean alpha (major AMUSDEMFs)	Mean alpha (additional AMUSDEMFs)	Std. Error of mean alpha (additional AMUSDEMFs)	Value	Prob.	N observations
Small Value	Gross	0.1416	0.0329	0.0639	0.0341	1.6384	0.1014	3,751
Small Blend	Gross	0.1282	0.0322	0.1267	0.0336	0.0310	0.9753	3,959
Small Growth	Gross	0.0364	0.0492	0.0504	0.0294	-0.2443	0.8070	4,852
Medium Growth	Gross	0.0130	0.0378	0.0563	0.0289	-0.9101	0.3628	4,843
Large value	Gross	0.0251	0.0240	-0.0431	0.0291	1.8071	0.0708	4,609
Large Blend	Gross	0.0573	0.0270	0.0276	0.0221	0.8498	0.3955	5,431
Large Growth	Gross	0.0804	0.0278	0.1022	0.0275	-0.5586	0.5765	4,611
Small Value	Net	0.0129	0.0329	-0.0707	0.0341	1.7625	0.0781	3,751
Small Blend	Net	0.0357	0.0322	-0.0057	0.0336	0.8886	0.3743	3,959
Small Growth	Net	-0.0032	0.0300	-0.0983	0.0294	2.2634	0.0237	4,852
Medium Growth	Net	-0.0699	0.0378	-0.0748	0.0289	0.1025	0.9183	4,843
Large value	Net	-0.0505	0.0240	-0.1655	0.0291	3.0480	0.0023	4,609
Large Blend	Net	-0.0459	0.0270	-0.0900	0.0221	1.2653	0.2058	5,431
Large Growth	Net	-0.0033	0.0278	-0.0210	0.0275	0.4522	0.6511	4,611

Table 9.12.1 *White´s test for heteroscedasticity excluding cross-products*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	F-statistic	Prob.
Regr. 1	Small Value	Major	Gross	79.2637	0.0000
Regr. 2	Small Blend	Major	Gross	136.8147	0.0000
Regr. 3	Small Growth	Major	Gross	31.1938	0.0000
Regr. 4	Medium Growth	Major	Gross	31.8564	0.0000
Regr. 5	Large Value	Major	Gross	44.7675	0.0000
Regr. 6	Large Blend	Major	Gross	69.7358	0.0000
Regr. 7	Large Growth	Major	Gross	19.4108	0.0000
Regr. 8	Small Value	Additional	Gross	112.8723	0.0000
Regr. 9	Small Blend	Additional	Gross	94.5678	0.0000
Regr. 10	Small Growth	Additional	Gross	58.7220	0.0000
Regr. 11	Medium Growth	Additional	Gross	139.2306	0.0000
Regr. 12	Large Value	Additional	Gross	91.2337	0.0000
Regr. 13	Large Blend	Additional	Gross	93.9198	0.0000
Regr. 14	Large Growth	Additional	Gross	97.3030	0.0000
Regr. 15	Small Value	Major	Net	79.4729	0.0000
Regr. 16	Small Blend	Major	Net	136.4030	0.0000
Regr. 17	Small Growth	Major	Net	22.8912	0.0000
Regr. 18	Medium Growth	Major	Net	31.7016	0.0000
Regr. 19	Large Value	Major	Net	46.0438	0.0000
Regr. 20	Large Blend	Major	Net	70.0648	0.0000
Regr. 21	Large Growth	Major	Net	19.2394	0.0000
Regr. 22	Small Value	Additional	Net	113.6562	0.0000
Regr. 23	Small Blend	Additional	Net	94.4194	0.0000
Regr. 24	Small Growth	Additional	Net	58.1881	0.0000
Regr. 25	Medium Growth	Additional	Net	137.6335	0.0000
Regr. 26	Large Value	Additional	Net	91.0052	0.0000
Regr. 27	Large Blend	Additional	Net	94.1023	0.0000
Regr. 28	Large Growth	Additional	Net	97.7161	0.0000

Table 9.12.2 *Breusch-Godfrey LM test for autocorrelation including twelve lags*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	F-statistic	Prob.
Regr. 1	Small Value	Major	Gross	5.7253	0.0000
Regr. 2	Small Blend	Major	Gross	4.9749	0.0000
Regr. 3	Small Growth	Major	Gross	8.3594	0.0000
Regr. 4	Medium Growth	Major	Gross	3.8945	0.0000
Regr. 5	Large Value	Major	Gross	3.5805	0.0000
Regr. 6	Large Blend	Major	Gross	3.8907	0.0000
Regr. 7	Large Growth	Major	Gross	2.4233	0.0041
Regr. 8	Small Value	Additional	Gross	3.9512	0.0000
Regr. 9	Small Blend	Additional	Gross	3.7924	0.0000
Regr. 10	Small Growth	Additional	Gross	4.8659	0.0000
Regr. 11	Medium Growth	Additional	Gross	2.9386	0.0004
Regr. 12	Large Value	Additional	Gross	45.0135	0.0000
Regr. 13	Large Blend	Additional	Gross	2.8489	0.0007
Regr. 14	Large Growth	Additional	Gross	2.2753	0.0072
Regr. 15	Small Value	Major	Net	5.7485	0.0000
Regr. 16	Small Blend	Major	Net	4.9271	0.0000
Regr. 17	Small Growth	Major	Net	3.5542	0.0000
Regr. 18	Medium Growth	Major	Net	3.8960	0.0000
Regr. 19	Large Value	Major	Net	3.5930	0.0000
Regr. 20	Large Blend	Major	Net	3.9093	0.0000
Regr. 21	Large Growth	Major	Net	2.4705	0.0034
Regr. 22	Small Value	Additional	Net	3.9390	0.0000
Regr. 23	Small Blend	Additional	Net	3.8579	0.0000
Regr. 24	Small Growth	Additional	Net	4.8309	0.0000
Regr. 25	Medium Growth	Additional	Net	2.9595	0.0004
Regr. 26	Large Value	Additional	Net	44.8538	0.0000
Regr. 27	Large Blend	Additional	Net	2.8513	0.0006
Regr. 28	Large Growth	Additional	Net	2.3014	0.0065

Table 9.12.3 *ADF unit root test for stationarity including a maximum of twelve lags*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	t-Statistic ($r_{market\ index}$-r_f)	Prob. ($r_{market\ index}$-r_f)	t-Statistic ($r_{risky\ asset}$-r_f)	Prob. ($r_{risky\ asset}$-r_f)
Regr. 1	Small Value	Major	Gross	-9.8783	0.0000	-10.1491	0.0000
Regr. 2	Small Blend	Major	Gross	-10.6208	0.0000	-10.5162	0.0000
Regr. 3	Small Growth	Major	Gross	-11.1430	0.0000	-10.7724	0.0000
Regr. 4	Medium Growth	Major	Gross	-10.9326	0.0000	-10.8595	0.0000
Regr. 5	Large Value	Major	Gross	-7.5708	0.0000	-7.6630	0.0000
Regr. 6	Large Blend	Major	Gross	-7.9917	0.0000	-10.3340	0.0000
Regr. 7	Large Growth	Major	Gross	-9.3750	0.0000	-9.8548	0.0000
Regr. 8	Small Value	Additional	Gross	-9.8044	0.0000	-12.6055	0.0000
Regr. 9	Small Blend	Additional	Gross	-10.9143	0.0000	-13.3743	0.0000
Regr. 10	Small Growth	Additional	Gross	-11.8559	0.0000	-12.7372	0.0000
Regr. 11	Medium Growth	Additional	Gross	-14.6890	0.0000	-14.7248	0.0000
Regr. 12	Large Value	Additional	Gross	-10.5209	0.0000	-10.9310	0.0000
Regr. 13	Large Blend	Additional	Gross	-12.0506	0.0000	-12.4581	0.0000
Regr. 14	Large Growth	Additional	Gross	-13.2289	0.0000	-14.2777	0.0000
Regr. 15	Small Value	Major	Net	-9.8783	0.0000	-10.1458	0.0000
Regr. 16	Small Blend	Major	Net	-10.6208	0.0000	-10.5136	0.0000
Regr. 17	Small Growth	Major	Net	-11.1814	0.0000	-10.7326	0.0000
Regr. 18	Medium Growth	Major	Net	-10.9326	0.0000	-10.8577	0.0000
Regr. 19	Large Value	Major	Net	-7.5708	0.0000	-7.6637	0.0000
Regr. 20	Large Blend	Major	Net	-7.9917	0.0000	-10.3272	0.0000
Regr. 21	Large Growth	Major	Net	-9.3750	0.0000	-9.8525	0.0000
Regr. 22	Small Value	Additional	Net	-9.8044	0.0000	-12.6129	0.0000
Regr. 23	Small Blend	Additional	Net	-10.9143	0.0000	-13.3697	0.0000
Regr. 24	Small Growth	Additional	Net	-11.8559	0.0000	-12.7375	0.0000
Regr. 25	Medium Growth	Additional	Net	-14.6890	0.0000	-14.7268	0.0000
Regr. 26	Large Value	Additional	Net	-10.5209	0.0000	-10.9215	0.0000
Regr. 27	Large Blend	Additional	Net	-12.0506	0.0000	-12.4511	0.0000
Regr. 28	Large Growth	Additional	Net	-13.2289	0.0000	-14.2739	0.0000

Table 9.12.4 *Jarque-Bera test for normally distributed data*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	Skewness	Kurtosis	Jarque-Bera	Prob.
Regr. 1	Small Value	Major	Gross	-0.1964	4.8193	215.9338	0.0000
Regr. 2	Small Blend	Major	Gross	0.0747	5.8384	520.7414	0.0000
Regr. 3	Small Growth	Major	Gross	0.0940	31.3974	57,459.3600	0.0000
Regr. 4	Medium Growth	Major	Gross	0.5233	13.1782	7,659.9580	0.0000
Regr. 5	Large Value	Major	Gross	0.1518	6.1576	674.1913	0.0000
Regr. 6	Large Blend	Major	Gross	0.0233	7.4341	1,396.1060	0.0000
Regr. 7	Large Growth	Major	Gross	-0.1524	4.1305	86.8184	0.0000
Regr. 8	Small Value	Additional	Gross	0.1649	9.4960	3,975.0410	0.0000
Regr. 9	Small Blend	Additional	Gross	0.2689	8.3584	2,914.6220	0.0000
Regr. 10	Small Growth	Additional	Gross	-0.0752	5.0735	565.8338	0.0000
Regr. 11	Medium Growth	Additional	Gross	0.0464	5.4485	772.2212	0.0000
Regr. 12	Large Value	Additional	Gross	1.0996	35.2921	130,995.6000	0.0000
Regr. 13	Large Blend	Additional	Gross	-0.1576	15.2413	23,285.6700	0.0000
Regr. 14	Large Growth	Additional	Gross	0.3165	6.6823	1,797.9230	0.0000
Regr. 15	Small Value	Major	Net	-0.1944	4.8176	215.3434	0.0000
Regr. 16	Small Blend	Major	Net	0.0662	5.8347	519.0883	0.0000
Regr. 17	Small Growth	Major	Net	-0.4339	5.6986	572.5491	0.0000
Regr. 18	Medium Growth	Major	Net	0.5358	13.1922	7,684.6360	0.0000
Regr. 19	Large Value	Major	Net	0.1241	6.1443	666.5417	0.0000
Regr. 20	Large Blend	Major	Net	-0.0423	7.4945	1,434.7740	0.0000
Regr. 21	Large Growth	Major	Net	-0.1624	4.1391	88.8488	0.0000
Regr. 22	Small Value	Additional	Net	0.1727	9.4725	3,947.3830	0.0000
Regr. 23	Small Blend	Additional	Net	0.2617	8.3607	2,915.5850	0.0000
Regr. 24	Small Growth	Additional	Net	-0.0765	5.0591	558.1200	0.0000
Regr. 25	Medium Growth	Additional	Net	0.0510	5.4445	769.9285	0.0000
Regr. 26	Large Value	Additional	Net	1.0602	35.1622	129,906.2000	0.0000
Regr. 27	Large Blend	Additional	Net	-0.1835	15.2784	23,432.7000	0.0000
Regr. 28	Large Growth	Additional	Net	0.3177	6.6911	1,806.6770	0.0000

Table 9.12.5 *Ramsey´s RESET test for regression specification error with one fitted term*

Regression	Equity style box category	AMUSDEMFs	Gross or net of fees	t-statistic	Prob.
Regr. 1	Small Value	Major	Gross	3.6309	0.0003
Regr. 2	Small Blend	Major	Gross	0.1699	0.8651
Regr. 3	Small Growth	Major	Gross	0.3978	0.6908
Regr. 4	Medium Growth	Major	Gross	3.6285	0.0003
Regr. 5	Large Value	Major	Gross	0.6804	0.4963
Regr. 6	Large Blend	Major	Gross	0.4320	0.6658
Regr. 7	Large Growth	Major	Gross	0.3202	0.7489
Regr. 8	Small Value	Additional	Gross	0.6639	0.5068
Regr. 9	Small Blend	Additional	Gross	0.2918	0.7705
Regr. 10	Small Growth	Additional	Gross	2.0569	0.0398
Regr. 11	Medium Growth	Additional	Gross	4.1364	0.0000
Regr. 12	Large Value	Additional	Gross	3.0770	0.0021
Regr. 13	Large Blend	Additional	Gross	0.5815	0.5609
Regr. 14	Large Growth	Additional	Gross	2.3233	0.0202
Regr. 15	Small Value	Major	Net	3.6301	0.0003
Regr. 16	Small Blend	Major	Net	0.1711	0.8642
Regr. 17	Small Growth	Major	Net	1.7937	0.0730
Regr. 18	Medium Growth	Major	Net	3.6247	0.0003
Regr. 19	Large Value	Major	Net	0.6926	0.4887
Regr. 20	Large Blend	Major	Net	0.4300	0.6672
Regr. 21	Large Growth	Major	Net	0.3030	0.7619
Regr. 22	Small Value	Additional	Net	0.6781	0.4978
Regr. 23	Small Blend	Additional	Net	0.2818	0.7781
Regr. 24	Small Growth	Additional	Net	2.0599	0.0395
Regr. 25	Medium Growth	Additional	Net	4.1280	0.0000
Regr. 26	Large Value	Additional	Net	3.0724	0.0021
Regr. 27	Large Blend	Additional	Net	0.6102	0.5418
Regr. 28	Large Growth	Additional	Net	2.3334	0.0197

10. Appendices

Appendix A – Major U.S. Mutual Fund Families[73]

The Vanguard Group
Fidelity Investments
Capital Research & Management (American Funds)
J.P. Morgan Chase & Co.
T. Rowe Price
BlackRock
Franklin Templeton Investments
Teachers Insurance and Annuity Association-College Retirement Equities Fund (TIAA)
Pacific Investment Management Company (PIMCO)
Dimensional Funds (DFA)

Appendix B – Major AMUSDEMF Sample

American Funds Growth Fund of Amer A
American Funds Growth Portfolio C
American Funds Invmt Co of Amer C
American Funds Washington Mutual R1
BlackRock Capital Appreciation Inv B
BlackRock Flexible Equity Investor B
BlackRock Large Cap Core Inv B
BlackRock Large Cap Value Inv A
BlackRock US Opportunities Inv A
BlackRock Value Opportunities Inv A
BlackRock Value Opportunities Inv C
Fidelity Advisor® Capital Development A
Fidelity Advisor® New Insights A
Fidelity Advisor® Small Cap A
Fidelity Advisor® Small Cap Growth A
Fidelity Advisor® Small Cap Value C
Fidelity Advisor® Stk Selec Lg Cp Val A
Fidelity® Growth Strategies
Fidelity® Select Construction & Hsg Port
Fidelity® Small Cap Discovery
Fidelity® Small Cap Growth
Fidelity® Small Cap Value
Fidelity® Stk Selec Lg Cp Val
Franklin Rising Dividends R
Franklin Small Cap Growth R
Franklin Small Cap Value A
Franklin Small Cap Value C
Franklin Small Cap Value R
Franklin Small-Mid Cap Growth C
Franklin Small-Mid Cap Growth R
JPMorgan Dynamic Growth A
JPMorgan Dynamic Small Cap Growth C
JPMorgan Intrepid Growth R2
JPMorgan Mid Cap Growth A
JPMorgan Small Cap Equity R2
JPMorgan Small Cap Growth C
JPMorgan Small Cap Value A
JPMorgan Small Cap Value C
JPMorgan Small Cap Value R2
JPMorgan US Equity R2
JPMorgan Value Advantage C

[73] From largest to smallest based on AUM.

PIMCO RAE Fundamental PLUS Small A *(Continued)*
PIMCO RAE Fundamental PLUS Small C
PIMCO RAE Low Volatility PLUS C
PIMCO StocksPLUS® Absolute Return C
PIMCO StocksPLUS® Small A
PIMCO StocksPLUS® Small R
T. Rowe Price Blue Chip Growth
T. Rowe Price Diversified Mid Cap Growth
T. Rowe Price Equity Income
T. Rowe Price New America Growth Advisor
T. Rowe Price New Horizons
T. Rowe Price Small-Cap Stock
T. Rowe Price Small-Cap Value Adv
T. Rowe Price US Large-Cap Core
TIAA-CREF Large-Cap Growth Advisor
TIAA-CREF Large-Cap Value Retail
TIAA-CREF Mid-Cap Growth Retail
TIAA-CREF Mid-Cap Growth Retire
TIAA-CREF Small-Cap Equity Advisor
TIAA-CREF Small-Cap Equity Retail
TIAA-CREF Social Choice Eq Retail
Vanguard Equity-Income Inv
Vanguard Explorer Inv
Vanguard Explorer Value Inv
Vanguard Growth & Income Inv
Vanguard Mid Cap Growth Inv
Vanguard Strategic Small-Cap Equity Inv
Vanguard US Growth Inv
Vanguard Windsor™ Inv

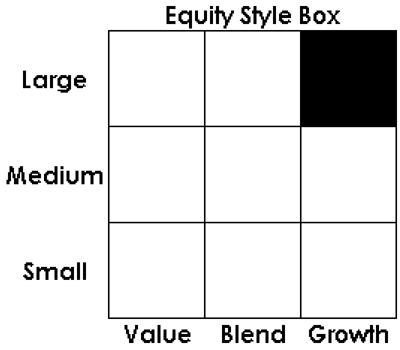
Appendix C – Additional AMUSDEMF Sample

AB Discovery Growth Advisor
Aberdeen US Multi-Cap Equity R
AC Alternatives® Discp Long Short Inv
Alger Capital Appreciation C
Alger Small Cap Growth B
AllianzGI NFJ Dividend Value C
AllianzGI NFJ Small-Cap Value R
AllianzGI Small-Cap Blend A
Amana Growth Investor
American Beacon Stephens Mid-Cap Gr Inv
American Beacon Zebra Small Cap Eq C
American Century Equity Growth A
American Century Equity Income R
Artisan Mid Cap Investor
Baird SmallCap Value Investor
Baron Discovery Retail
Baywood ValuePlus Investor
BBH Core Select Retail
BMO Mid-Cap Growth R3
Bridges Investment
Brown Advisory Small-Cap Growth Adv
Buffalo Growth
Calamos Opportunistic Value B
Calvert Small Cap C
Camelot Excalibur Small Cap Income A
Cavanal Hill Multi Cap Equity Inc C
ClearBridge All Cap Value B
ClearBridge Appreciation A
Columbia Acorn C

Columbia Small Cap Growth I A *(Continued)*
Cullen High Dividend Equity Retail
Davis NY Venture A
Davis Opportunity A
Delaware Small Cap Core R
Delaware Small Cap Value R
Deutsche CROCI® Equity Dividend C
Deutsche Small Cap Growth R
Diamond Hill Large Cap A
Domini Impact Equity R
Dreyfus Opportunistic US Stock C
Dunham Small Cap Growth A
Eagle Mid Cap Growth A
Eaton Vance Focused Value Opps A
Edgewood Growth Retail
Emerald Small Cap Value Investor
Eventide Gilead C
Federated Clover Value R
Federated Kaufmann Small Cap R
First Investors Equity Income Advisor
First Investors Growth & Income B
Gabelli Value 25 C
GAMCO Growth A
Glenmede Small Cap Equity Adv
Goldman Sachs Flexible Cap Growth R
Goldman Sachs Growth and Inc A
Goldman Sachs US Equity Insights R
Guggenheim Small Cap Value A
Hamlin High Dividend Equity Inv
Harbor Large Cap Value Inv
Hartford MidCap B
Hartford Small Company A
Heartland Value Investor
Optimum Large Cap Growth C
Highland Premier Growth Equity C
HSBC Opportunity C
Invesco American Franchise R
Invesco Select Companies B
Jackson Square Large-Cap Growth Inv
Jackson Square SMID-Cap Growth Inv
Janus Triton C
JHancock Disciplined Value C
Keeley Small Cap Value A
Legg Mason BW Divers Lg Cp Val R
Loomis Sayles Small Cap Value Retail
Lord Abbett Alpha Strategy R2
Lord Abbett Calibrated Dividend Gr B
Lord Abbett Growth Leaders B
Madison Mid Cap A
MainStay Common Stock C
MassMutual Select Mid Cap Growth A
MFS Equity Income A
MFS Equity Opportunities R1
MFS New Discovery B
Monetta
Morgan Stanley Inst Growth A
Morgan Stanley Inst Mid Cap Growth A
Morgan Stanley Inst Small Co Gr A
Nationwide Bailard Cogntv Val A
Nationwide Geneva Mid Cap Gr C
Nationwide HighMark Sm Cp Core C
Neuberger Berman Focus Adv

Oak Ridge Small Cap Growth C *(Continued)*
Olstein Strategic Opportunities Adviser
Oppenheimer Discovery R
Oppenheimer Rising Dividends A
Optimum Small-Mid Cap Value A
Pacific Financial Explorer Inv
Perkins Small Cap Value R
Perritt Low Priced Stock Investor
Pioneer Equity Income A
PNC Multi Factor Small Cap Core A
Principal SmallCap C
Principal Small-MidCap Dividend Inc C
Prudential Jennison Equity Opportunity B
Prudential Jennison Mid Cap Growth R
Putnam Small Cap Value B
RidgeWorth Ceredex Small Cap Value Eq A
RiverPark Large Growth Retail
Royce Small-Cap Value Investment
Salient Adaptive US Equity Investor
Saratoga Large Capitalization Growth C
Snow Capital Small Cap Value C
Sparrow Growth No-Load
SSgA Dynamic Small Cap A
State Farm Equity A
Sterling Capital Equity Income B
Strategic Advisers® Core
TETON Westwood Equity B
TETON Westwood SmallCap Equity C
Touchstone Small Cap Growth C
Transamerica Large Core R
Transamerica Small Cap Value Advisor
Waddell & Reed Core Investment C
Waddell & Reed Small Cap B
Wells Fargo C&B Large Cap Value C
Wells Fargo Small Cap Value A
Wells Fargo Small Company Value C
Westcore Small-Cap Value Dividend Retail
Victory Diversified Stock R
Victory Integrity Small-Cap Value R
Victory RS Mid Cap Growth R
Victory RS Select Growth R
Voya MidCap Opportunities C
Voya SmallCap Opportunities C

Appendix D – The Morningstar Equity Style Box



(Morningstar, 2005)

Appendix E – Stock Market Indices

Russell 1000® Index (tracks the performance of the 1000 *largest* firms in the U.S. stock market where all firms combined represent a benchmark for *blend* stocks)

Russell 1000® Value Index (represents those stocks within the Russell 1000® Index with investment style *value*)

Russell 1000® Growth Index (represents those stocks within the Russell 1000® Index with investment style *growth*)

Russell Midcap® Growth Index (tracks the performance of the 800 firms *in the bottom* of the Russell 1000 Index with investment style *growth*)

Russell 2000® Index (tracks the performance of the 2000 *smallest* firms in the U.S. stock market where all firms combined represent a benchmark for *blend* stocks)

Russell 2000® Value Index (represents those stocks within the Russell 2000® Index with investment style *value*)

Russell 2000® Growth Index (represents those stocks within the Russell 2000® Index with investment style *growth*)

(FTSE Russell, 2017b)

Appendix F – the Gauss-Markov Theorem

1. *The model is linear in parameters and correctly specified* (Ramsey´s RESET test)

2. *There is some variation in the independent variable in the sample* (this is true for the market excess return in Equation 4.4 since the market returns obviously fluctuate over time)

3. *The expected value of the disturbance term is zero for all observations, i.e.* $E(\varepsilon)=0$ (this is true as Equation 4.4 includes an intercept which works as a complement to the independent variable by including such factors not explained by the independent variable)

4. *The disturbance term is homoscedastic for all observations, i.e.* $Var(\varepsilon)=\sigma^2$ (White´s test)

5. *The values of the disturbance term have independent distributions, i.e.* $Cov(\varepsilon_a, \varepsilon_b)=0$ *if* $a \neq b$ (Breusch-Godfrey LM test)

6. *The disturbance term is normally distributed* (Jarque-Bera test)

(Dougherty, 2011)