NORTH-HOLLAND

Financial Services Review 10 (2001) 129–144

FINANCIAL SERVICES REVIEW

A stock selection model using Morningstar's style box

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Received 13 March 2001; received in revised form 20 September 2001; accepted 13 December 2001

Abstract

In this paper, we place firms in the Morningstar's style box cells and test whether selecting firms from these cells allows investors to compile a portfolio consistent with their risk tolerance. We confirm that the risk of those cells is consistent with the risk expectations published by Morningstar. Firms assigned to the upper left cells are lower risk than those assigned to the lower right cells. When we test for risk-adjusted returns we do not find that investing in high risk cells results in greater returns. Our results suggest higher returns are possible by investing in lower risk value cells.

JEL classification: G11

Keywords: Value; Morningstar; Portfolio; Stocks; Investment

1. Introduction

What's an investor to do? Retail brokers want individuals to let them handle their portfolios. After all, these professionals work full time in the field and should have top quality information and tools at their disposal. Discount and online brokers tell investors they can do the work themselves and save a great deal of money. After all, selecting good companies or mutual funds is not really that hard. Many "do it yourself" proponents advocate putting money into index funds and holding on.

In this paper, we investigate the viability of one approach to selecting individual securities. The major research question of this paper is whether individual investors can create an equity portfolio that carries with it the relative degree of risk that they prefer and that also earns them an acceptable risk-adjusted return. Our approach uses the readily available and easily accessible data provided by Morningstar.[2] Morningstar is well known

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[2] Morningstar stock selector at http://screen.morningstar.com/StockSelector.html?lnav=stocksSelect.

1057-0810/01/$ – see front matter
PII: S1057-0810(02)00091-4

and respected for their analysis and reporting of investment company information. To our knowledge, no one to date has studied the usefulness of Morningstar's individual company analysis and reporting.

Whether an investor is interested in purchasing individual stocks or selecting equity investment companies for their portfolio, they need to have a reasonable understanding of their investment objective. Of particular importance is that they must know their tolerance for risk. Recent markets movements have reminded many investors of their limitations on how much risk they can tolerate. Advocates of index investing proclaim that in the long-run the equity markets are a lot less risky than short-term volatility indicates. The problem with this philosophy is that many investors cannot ''stomach'' the short-run losses of wealth that will inevitably accompany investment in the equity markets. To ignore short-run volatility is tantamount to saying that individuals are more interested in saving than in short-run consumption. Savings and consumer debt statistics tell us that this mix is not the case.

We look at the ability to select individual common stocks that are consistent with the investor's risk tolerance. The selection process is mechanical and can be performed at a very low cost. With today's Internet technology and availability, transactions can be completed through an online brokerage service, thus reducing transactions costs to generally between $10 and $30 per trade. This small cost can probably be considered a negligible factor in the investment decision.

Section 2 discusses the relevance and importance to the investor of our research recommendations. Following Section 2, we provide a brief review of relevant literature on the topic of security selection. Section 4 presents, the methodology of the paper followed in Section 5 by the discussion of result. The conclusion is summarized in Section 6.

2. The need for standardization

Whether an investor is doing their own equity security selection or using the expertise of an advisor there is a need to be confident that the investor will own securities that are consistent with their risk tolerance. One of the first steps in the investment process is to measure the ability of an investor to handle the up and down movements in stock prices. This step is often handled through the administering of a risk questionnaire. Virtually all investment advisory firms have proprietary documents that accomplishment this risk assessment. If this assessment is done independent of an investment advisor there are web sites that offer questionnaires and evaluate the result. One example of a good online risk tolerance questionnaire can be found at the CNBC web site (http://www.moneycentral.msn.com/investor/calcs/n_riskq/main.asp).

Once risk has been determined the decision maker is then faced with picking securities that blend with the risk preferences of the investor. This selection process can be greatly simplified if a standard model could be used to identify equity securities that match the investor's risk preference. The paper examines one such standardized technique.

Many investing models that identify securities with specified characteristics, such as value or growth, have as part of the decision process a subjective element. By definition, subjective

factors are difficult, at best, to transfer to other individuals. Even if a screening model can be objectively applied, the criteria often consist of multiple variables that make application of the model difficult and often impractical. For example, Michaud (1998) provides a computerized screening model that offers the potential for abnormal returns, but to apply the model requires an understanding of multidimensional modeling.

Non-professional investors making independent decisions need to have an investment model that can be easily aligned with their personal investment preferences. Simplifying the investment process so that individual investors can make unemotional asset selections demands that the process be standardized and also easy to apply. Subjective selection would vary extensively among investors and in many cases result in less than optimal portfolios.

We examine in this paper whether the existing Morningstar style boxes, published by Morningstar Corporation, can be used to accomplish the selection objective. More details on the style boxes and their use are provided in Section 4.

3. Literature on security selection

Although our research is not tied to the claim for or against efficient markets, it is useful to look at some recent areas of research related to security selection and performance. One purpose of this brief review is to make it clear that in the academic arena there is still uncertainly about the benefits of any particular approach to selection of individual securities for an investor's portfolio. A second reason for reviewing some efficient-market literature is to note the absence of matching the risk of the portfolio with that of the investor.

Extant research on the selection of individual securities to be placed into an investor's portfolio is performed primarily in an attempt to test the efficient-market hypothesis. A recent example of this is by Olson, Nelson, Witt, and Mossman (1998). They use the EPS and relative strength ratings of *Investors Business Daily* as a means of identifying firms with above normal expected returns. They find some support for successful use of these measures. Their approach is acceptable to an investor willing to tolerate the risk of what are unquestionably momentum stocks. This segment is highly volatile and can cause many hours of lost sleep for an investor with a low degree of risk tolerance.

Value Line has been a frequent target for investment research. From the early research to the present there is support, though not unanimous, for the ability of Value Line to identify stocks that will perform better than other securities on a risk-adjusted basis over the subsequent 12 months. Much of the seminal research centered on the timeliness rankings provided by Value Line. Recently, investigators have reached into other areas of recommendation by Value Line.

Pawlukiewicz and Preece (1991) researched firms included in *The Value Line Special Situations Survey* (VLSSS). They find significant price responses to the inclusion of a firm in the VLSSS publication, but the response is transitory. Chandy, Peavy, and Reichenstein (1993) also look at a special sample of Value Line recommended firms. Each week Value Line profiles two firms from their list of firms ranked number 1 for timeliness. As with the VLSSS firms, the price response is in the hypothesized direction upon the publication of the report but reverses itself over the next several weeks. Peterson and Peterson (1995) look at

firms included in the "Stock Highlights" section of *The Value Line Investment Survey*. They find a significant and permanent price response to being included in this featured area.

Barber and Odean (2000) provide a unique insight into the performance of individual investors who primarily manage their own portfolios. Their conclusion about individual investor behavior is similar to that found by Carhart (1997) about professional portfolio managers. Both types of investors suffer from the incurrence of excessive costs. They found that the main detriment to the superior performance of individual investor portfolios was directly associated with the frequency and cost of trading.

One area of research that raises questions about the efficiency of equity markets is in the distinction between value versus growth firms. Fama and French (1992) and Lakonishok, Shleifer, and Vishny (1994) both provide support for the superior risk-adjusted performance of firms having characteristics identifying them as value firms. The value versus growth discussions have also become frequent topics for the popular press (Fisher, 1996; Scherreik, 1996; Clash & Grover, 1998).

Over the years there have been a variety of conclusions regarding the ability of fund managers to perform better than a buy-and-hold strategy. Dellva and Olson (1998) study the relationship between fund performance and fund fees. They find that the association is less than favorable for the investor. High turnover by active management of funds does not necessarily lead to improved risk-adjusted returns. This performance debate continues to this day (Walker & Hatfield, 1996; Porter & Trifts, 1998). However, the majority of the research concludes that very few investors will be able to do better than the market by investing through actively managed funds.

Morningstar has been recognized for many years for its analysis and descriptive data provided on investment companies. Although Morningstar does not claim that their fund data offers predictive information, there is evidence from research on mutual funds indicating that their information does add perceived value.

Khorana and Nelling (1998) find that the Morningstar 5-star rating system for mutual funds provides evidence that this system exhibits performance persistence over a 30-month period. Loviscek and Jordan (2000) conduct research more inline with the intent of our research. They use Morningstar's 5-star system to identify the better performing funds, then they select stocks from the portfolios of these funds for creation of a separate portfolio. They test whether individual investors can earn abnormal returns with a portfolio of the selected securities. Their results find marginal support for the rejection of their null hypothesis, but they conclude "that the evidence is not strong enough to recommend the stock selection strategy to the individual investor."

The most comprehensive study of investment models used by many Wall Street professionals was completed by O'Shaughnessy (1997, 1998). His most important contribution to academic research, and to applied investments, is that a disciplined long-term approach to investing using value and growth models leads investors to outperform the market by significant margins on a risk-adjusted basis. A recent popular press book by Dreman (1998) also addressed the issue of the value versus growth investing and the existence of efficient markets. His conclusions are similar to O'Shaughnessy (1997, 1998).

Both authors suggest that the major reason for the success of their portfolios is the lack of emotion in the use of passively managed single strategy models for forming investment

portfolios. From O'Shaugnessy's book, *What Works on Wall Street*, he states this condition as (p. 14.):

> Models never vary. They are always consistent. They are never moody, never fight with their spouse, are *never* hung over from a night on the town, and *never get bored*. They don't favor vivid, interesting stories over reams of statistical data. They never take anything personally. They don't have egos. They're not out to prove anything. If they were people, they'd be the death of any party.

This stability is offered as the reason index funds do so well. The portfolio managers follow an unemotional consistent model.

There is evidence that emotions play a major role in the decision making of individuals, principally in the area of being overconfident. This overconfidence was noted in the study by Barber and Odean (2000). People are more inclined to make choices based on their ''feelings'' about an alternative than about the hard evidence presented to them. For many examples of how personal intuition dominates the use of factual evidence in the decision process see the book *Emotional Intelligence* by Goleman (1995). Most of the time when emotion overrides the available facts the result is to the detriment of the decision-maker.

The evidence on mutual funds, individual security selection, and investor psychology has driven an increasing number of individual investors to put their money in index funds that are passively managed. Index funds have three advantages over managed funds. The first advantage is their ability to eliminate the emotional aspect of buy and sell decisions while still achieving the desired level of return for the risk undertaken. A second factor is the discipline to stick with a single strategy. After the initial portfolio is created for the fund subsequent asset selection decisions are primarily mechanical due to rebalancing and changes in the index components. The third advantage stems from the limited trading activity of the fund resulting in lower administration and transaction costs.

In contrast, there are three major problems with encouraging investors to place their money in index funds. First, they have a degree of risk associated with them. An investor must be careful in his selection of an index to be sure that the index has a level of risk that is consistent with their risk tolerance. An investor whose risk tolerance is consistent with the risk provided in the S&P 500 may prefer to index their money in such a tracking portfolio. If the investor's risk preference is not the same as the S&P 500 risk level then they need to identify an index that is consistent and place their funds there. A second difficulty arises from the fact that there may not be an easily identifiable index and an accompanying tracking portfolio that matches the risk desired. A final problem is that the risk of the tracking portfolio may change over time. This risk change results from the market weighting of securities. If a given sector increases in value relative to other sectors, the weight and importance of that sector in the index increases. This phenomenon occurred recently with the shift of the S&P 500 index to a heavy weighting on technology stocks. This index became much more like a technology fund than a diversified market index fund.

The model we present in the next section offers an alternative to index funds. This alternative overcomes the problems of shifting risk and psychological overconfidence, while also establishing a fixed portfolio rule with a single fixed strategy. The portfolio will

generate little trading leading to low transactions cost. The information gathering costs are also low and the identification of securities is mechanical and easy to follow.

4. Methodology

For years Morningstar has been placing mutual funds into one of nine cells in what they call their style box. Recently, Morningstar has begun to provide this same information for individual firms. Investors can first pick a market capitalization preference through the style box since firms are classified in the matrix rows as large, medium, or small-cap firms. Once divided by market capitalization the firms are placed in the appropriate column based on their characteristics as value, growth, or a blend of the value/growth characteristics. The format of the style box is shown in Fig. 1. Which cell a particular firm falls into can be obtained from Morningstar's web site (M) at zero cost.

Since the Morningstar publication of their style box for individual firms is a recent addition by the company, we could not go back in time and use old databases to identify the cell that a firm fit into. Fortunately, Morningstar publishes on their web site their technique for classifying firms into the cells of their style box. We use the Research Insight (1998) (R) database and apply the Morningstar methodology to classify firms over a sample period extending from 1982 to 1997. We are confined to these 16 years since they are the years available on the Research Insight (1998) database at the time of performing this research.

Morningstar does not classify every firm but limits the population to the largest 5,000 firms based on market capitalization. These firms account for the vast majority of the total equity market value of publicly traded firms. From those 5,000, the top 5% are classified as

1	2	3	
Value	Blend	Growth	
Cell 1-1 Low Risk	Cell 2-1 Low Risk	Cell 3-1	1 Large capitalization
Cell 1-2 Low Risk	Cell 2-2	Cell 3-2 High Risk	2 Mid capitalization
Cell 1-3	Cell 2-3 High Risk	Cell 3-3 High Risk	3 Small capitalization

Fig. 1. Layout of Morningstar's style box.

large-cap firms, the next 15% as mid-cap firms, and the remaining as small-cap firms. The makeup of the 5,000 firms and the resulting subgroups will vary each period as market capitalization varies. These size definitions make the process of filling the rows of the style box quite easy. The techniques for identifying firms as value, growth, or blend requires greater analysis. Although, Morningstar classifies as many as 5,000 firms, investors using the free screening function of their web site cannot obtain access to the full 5,000 firms. A recent review of the site found a total of approximately 1,500 firms available across all nine cells.

Using the same approach as Morningstar requires that two ratios be calculated for each firm, the price-to-earnings ratio (*P*/*E*) and the price-to-book (*P*/*B*) ratio. As does Morningstar, we start with the largest 5,000 firms based on total market capitalization. We obtain the market capitalization from the Research Insight (1998) database. We lose some of the firms due to a lack of data necessary for performing the ratio calculations. For example, firms with negative earnings result in an N/A for calculating these ratios and thus are eliminated from our final sample. Other firms drop out of our sample due to not having complete data for calculation of the necessary risk and return values required to test our hypothesis. As a result of these eliminations, the actual number of firms included each year varies and is significantly less than the full 5,000.

Elimination of firms with negative earnings and a negative book value carries with it a survivorship bias. As a result, we offer the caveat that the conclusions of our study apply only to firms that have a positive *P*/*E* and *P*/*B* ratio as of the calculation date of the ratios. This bias can easily be included in the screening process by any investor desiring to use this model. After elimination of the non-surviving firms we attempt to remain reasonably consistent with the Morningstar cell makeup as possible. We place 250 firms (5% of 5,000) in the large firm row and 500 firms (10% of the 5,000) in the mid-cap row. The remaining firms go into the small capitalization cells.

All of the ratios are calculated as of the year-end preceding the year the firms are placed into the style box. For example, for firms to be included in a style box for 1982 we used the price, earnings, and book value for year-end 1981.

Once these ratios are obtained for each firm they are divided by the average *P*/*E* and *P*/*B*, respectively, for all of the firms in their size category (the average of the matrix row). This calculation results in a relative *P*/*E* and *P*/*B*. These two relative values are added together for each firm. We use the same range of values that are used by Morningstar to place firms in the appropriate column. If the sum of the two relative ratios is greater than 2.25, the firm is considered to be a growth stock. Growth companies are defined as those having higher than average growth in sales and earnings. The prices of these stocks tend to trade at large price multiples due to the market's expectations that this growth rate will continue. Firms with *P*/*E* and *P*/*B* ratios that are high relative to firms of similar size leads to the growth classification. If the sum is less than 1.75, the firm falls into the value category since value style investing looks for firms with current market values substantially below their intrinsic value. Any value between 1.75 and 2.25 is placed in the blend column.

All firms can now been placed into one of the nine cell locations. The number of firms for each year in each cell is shown in Table 1.

The three value cells have the first, second, and fourth highest number of firms. Restricting the full sample to the highest capitalization firms insures that there will be more

Table 1
Number of firms in each Morningstar's style box using full sample

Year	Large value	Mid-cap value	Small value	Large blend	Mid-cap blend	Small blend	Large growth	Mid-cap growth	Small growth	Total of cells
1982	143	338	581	39	56	65	67	107	172	1568
1983	141	340	821	45	62	90	63	99	212	1873
1984	145	319	683	45	81	120	59	101	200	1753
1985	181	333	767	34	71	121	34	97	241	1879
1986	155	376	1003	37	53	93	57	72	166	2012
1987	185	304	893	28	85	139	36	112	242	2024
1988	144	303	1044	40	77	149	65	121	256	2199
1989	156	386	1230	35	51	130	58	64	249	2359
1990	198	315	946	19	70	139	32	116	302	2137
1991	166	283	1300	23	68	159	60	150	317	2526
1992	145	292	1551	39	93	167	65	116	313	2781
1993	165	324	1551	28	66	193	56	111	372	2866
1994	137	304	1646	48	74	301	64	123	506	3203
1995	162	353	1975	42	44	140	45	104	320	3185
1996	163	284	1955	40	80	151	46	137	318	3174
1997	184	353	2096	22	50	59	43	98	147	3052
Average	160	325	1253	35	68	139	53	108	271	2412

value firms selected than growth firm. Of the firms falling into the growth column, the cell with the smallest firms contains the largest number of observations. This outcome is consistent with the general observation that growth firms tend to be among the smaller firms.

The heart of our study and the first step in evaluating the use of Morningstar's style box approach is to test if their contention of a systematic pattern of risk from the classification into a particular cell holds true. Morningstar claims that the upper left cells (large value, large blend, and mid value) are the low risk cells, while the lower right cells (mid growth, small growth, and small blend) are the higher risk cells. The cells on the diagonal are expected to fall somewhere between these two groups. We use standard deviation of daily return as our measure of risk.

The reason we chose standard deviation over beta as the appropriate measure of portfolio risk is based on the findings of Fama and French (1992). They provide strong support for the inability of beta to adequately capture the risk associated with differences in cross-sectional stock returns. Drawing from extant research and their own results they offer that beta does not adequately account for leverage, size, and financial distress. Using beta would fail to capture the full range of risks associated with security returns.

The second step is to determine if the return earned is on average consistent with the risk undertaken within each cell. We calculate holding period returns (HPR) for each stock over the calendar year. The calculation of risk mentioned is done over the same time period as the calculated returns. For example, each security's HPR and standard deviation for the year 1982 is from the first trading day in 1982 through the last trading day of 1982. This whole process is repeated for each year through 1997.

To combine the impact of both risk and return we use two calculations. First, we divide the return for each cell by its respective standard deviation. This approach is similar to the Sharpe index except that we do not subtract the risk-free rate from the holding period return before dividing by the standard deviation. To subtract the risk-free rate would not change our outcome or conclusions. Recall that our objective is not to test for abnormal returns, but only to compare risk-adjusted return performance. Subtracting the risk-free rate for any particular year would result in only a scale change and would not alter relative rankings.

Beta could also have been used as the denominator in the risk/return calculation as is done with the Treynor index. We did look at 1 year of data using beta (1996) and found the results mostly consistent with the standard deviation results. The only difference observed was that beta appeared more random across the cells. This lack of pattern is not unexpected given the results already mentioned about the limit reliability of beta.

Because investors are more limited in the amount of money available for portfolio creation, the number of securities must be less than the number held by most mutual fund managers. To assist in selecting the "best" firms from each cell we rely upon the price-to-sales ratio (P/S). This single ratio has received wide attention as being a significant variable in identifying the future performance of a stock. Barbee, Mukherji, and Raines (1996) give three reasons why the price-to-sales ratio may provide a good indicator of future stock price performance. First, historical sales may be more reliable than profits due to a reduced ability to manipulate the sales variable. Second, earnings are more likely to be affected by short-term policy. Third, price-to-sales ratios cannot be a negative value. Of the four variables they tested, Barbee et al. (1996) find the P/S ratio (they actually used S/P) to have the only

statistically significant relationships with future stock returns. Gold and Lebowitz (1999) use the *P*/*S* ratio as one of their screens in testing computerized investing screening models, and O'Shaughnessy (1997, 1998) also finds this variable to be the most significant single indicator of future stock performance.

Of importance in the application of this model is the ease in which investors can acquire the value of the *P*/*S* ratio for each firm. For those with an interest in computer databases, there are a number of both expensive and inexpensive CD files available from which this ratio can be calculated. This information is also available at no cost on the Morningstar web site. If the investor is using the web site to identify firms they can use the Morningstar fund selector tool to list the firms in a particular cell. Then, by going to the "score these results" screen and customizing the criteria to show *P*/*S* ratios the investors can sort for the lowest *P*/*S* values. Select the desired number of firms with the lowest *P*/*S* ratio each cell to create the portfolio.

Due to the apparent success of the *P*/*S* ratio we use this variable to reduce the number of firms within each cell to a quantity that can reasonably be purchased by many investors. We create portfolios of both 10 and 20 firms by selecting the 10/20 firms with the lowest *P*/*S* ratio within each cell. While 10 and 20 are admittedly arbitrary, this quantity will provide adequate diversification to obtain the risk reduction benefits of diversification while not being too large to administer. Since online trading provides an inexpensive way to accomplish less than round lot transactions the resulting trading costs should not be detrimental to total returns.

5. Results

We start by looking at the full sample of firms in each cell. Table 2, part 1, shows the average standard deviation of returns for each of the nine cells, and the ranking of the cell risks based on the observed and expected pattern. Comparing the risk rankings we find only two minor ranking differences. The mid-growth cell and the small-value cells have their expected ranks of 3 and 4 to be reversed as 4 and 3, respectively, and the rankings of the large-blend and large-value cells are reversed.

The cells we are most concerned with are those in which Morningstar makes a direct claim of high or low risk. Shown in part 2 of Table 2 is that the three high expected risk cells are ranked 1, 2, and 3 and the 3 low expected risk cells are ranked 7, 8, and 9. These results confirm that our sample of firms and their classification appears to be consistent with Morningstar's risk ranking claim.

As stated earlier, in addition to the issue of risk, we are also interested in determining whether the portfolios selected by individual investors earns them an acceptable risk-adjusted return. Table 3 provides evidence on this return question. For all of our portfolios in calculating returns we rebalance the portfolios each year to stay totally within the same cell.

All three of the low-risk cells have higher returns than the three high-risk cells. This result appears to be the opposite of the standard risk/return trade-off that finance theory tells us we should expect. This high return is part of the risk/return equation, but we need to look a little deeper and investigate whether these returns compensate for the risk undertaken. We divide

Table 2
Average standard deviation of returns for Morningstar style boxes using full sample

Cell name	Average standard deviation	Risk rank, highest = 1, lowest = 9	Morningstar expected risk rank[a]
Part 1			
Small growth	0.5038	1	1
Small blend	0.4556	2	2
Mid growth	0.3813	4	3
Small value	0.3948	3	4
Mid blend	0.3308	5	5
Large growth	0.3069	6	6
Mid value	0.2812	7	7
Large blend	0.2467	9	8
Large value	0.2709	8	9
Part 2			
Low risk cells			
Large value	0.2709	8	9
Mid value	0.2812	7	7
Large blend	0.2467	9	8
High risk cells			
Mid growth	0.3813	3	3
Small blend	0.4556	2	2
Small growth	0.5038	1	1

[a] Morningstar does not make explicit claims about the risk order of the diagonal cells. The firm states that cells 1-1, 1-2, and 2-1 are of lowest risk, while cells 2-3, 3-3, and 3-2 are of highest risk. The diagonal cells fall somewhere between. The rankings of 4, 5, and 6 shown here are based on the literature that small firms are generally riskier than larger firms, and growth firms riskier than value firms.

Table 3
Average return and risk-adjusted index for Morningstar style boxes using full sample

	Average holding period return	Rank of holding period returns[a]	Risk-adjusted index[b]	Risk-adjusted index rank
Low risk cells				
Large value	13.41%	1	0.4949	1
Mid value	13.39%	2	0.4762	2
Large blend	9.71%	3	0.3935	3
High risk cells				
Mid growth	5.46%	5	0.1433	4
Small blend	5.88%	4	0.1291	5
Small growth	3.41%	6	0.0677	6

[a] The rankings for the column 3 rank of holding period return and for the column 5 risk-adjusted index ranking range from 1, the highest return or risk value, to 6, the lowest return or risk value.

[b] The risk-adjusted index is obtained by dividing the average holding period return by the standard deviation of returns for that cell.

Table 4
Average return and risk-adjusted index for Morningstar style boxes using 10 firms with lowest price-to-sales ratio annual rebalancing

	Average holding period return	Risk-adjusted index[a]	Risk-adjusted index rank[b]	10 Firm return less the full sample return[c]
Low risk cells				
Large value	14.99%	0.6151	1	1.58%
Mid value	21.11%	0.5220	2	7.72%
Large blend	11.43%	0.4798	3	1.72%
High risk cells				
Mid growth	11.03%	0.3230	4	5.57%
Small blend	14.64%	0.3227	5	8.76%
Small growth	8.62%	0.1884	6	5.21%

[a] The risk-adjusted index is obtained by dividing the average holding period return by the standard deviation of returns for that cell.

[b] The risk-adjusted index ranking ranges from 1, the highest risk-adjusted return, to 6, the lowest risk-adjusted return.

[c] The value in column 5 is obtained by subtracting the average holding period return for the full sample portfolio in Table 3 from the average holding period return in column 2.

the average return of each cell by the cell's average standard deviation. The high-risk cells have both the lowest returns and the lowest risk-adjusted returns. The low-risk cells have the three highest returns on both an absolute and risk-adjusted basis. Investors should expect average returns to compensate for higher risk. We do not find that firms in the high-risk cells offer higher returns. Instead, they offer substantially lower returns than those firms assigned to the low-risk cells.

Using the 10 firms with the lowest *P*/*S* ratio we obtain the results shown in Table 4. We report the same information in Table 4 that we do in Table 3. The low-risk cells have a higher risk-adjusted index value than do the high-risk cells. Column 5 shows the results of taking the column 2 returns and subtracting the same cell return for the full sample shown in column 2 of Table 3. For each cell the return is higher by selecting the 10 low *P*/*S* firms. The increase in return ranges from 8.76% for the small blend cell to 1.72% for the large value cell.

Looking at column 5 we find an interesting result. The advantage to using only 10 firms is generally higher for the high risk growth cells than for the low risk value cells. For the high risk cells the performance shows an increase of over 5% for all three cells, while for the low risk cells only one cell has a return increase greater than even 2% (7.72% for mid value cell). This observation is a surprise since low *P*/*S* ratios are usually more of a value indicator than a growth indicator, and two of the high-risk cells are growth cells. We suspect that our technique is selecting the more value-oriented firms among the population of firms.

We repeated the above procedures for the 10/20 firm portfolios and lagged the investment return by 1 year. In other words, we assumed that the investor did not invest in the firms in each cell until 1 year subsequent to the year-end for the firm's financial statements. The reason for testing using this lag in investment is that the data we use for classification of

Table 5
Accumulated wealth for Morningstar style boxes value of $10,000 after 16 years of compounded growth

	10 Lowest *P/S* ratios	Full sample
Low risk cells		
Large value	$75600	$67999
Mid value	$189283	$63344
Large blend	$49663	$38647
High risk cells		
Mid growth	$43827	$19163
Small blend	$46871	$20798
Small growth	$25553	$14002
S&P 500	$79217	$79217

All values assume that $10,000 was invested on 12/31/81. All dividends are reinvested. Returns are compounded from 1982 to 1997.

firms in the matrix would not be available immediately at year-end, which is what we assume with our classifications. By waiting until the end of the year, we are allowing the company information to be collected and made available to investors. Plus many investors prefer to do their portfolio rebalancing near the end or at the beginning of a year.

The ranking results using the delay were very similar to those just discussed. Although minor shifts in rankings were found, in all cases the low-risk portfolios ranked 1, 2, and 3 for risk-adjusted return and the high-risk portfolios contained the lower 3 return ranks.

Although risk-adjusted holding period returns are helpful for evaluating portfolio performance, the true ''name of the game'' for investing is the number of dollars that an investor can accumulate on their time horizon. We calculated the compounded value of an initial investment of $10,000 at the beginning of 1982 and held until the end of 1997. Using this geometric approach takes into consideration both the return and the variation of the returns during the sample period. The value of each cell's portfolio is shown in Table 5.

All three low-risk cells generated greater wealth accumulation than any of the three high-risk cells. This relative performance holds for all three portfolio sizes. To show that this result is not due to a couple of anomalous years, we graphed the performance of the six portfolios for the full sample and for the 10 and 20 security portfolios. Since all three graphs provide similar conclusions we present here only the graph for the full sample.

The performance of the low-risk portfolios is not due to just a few years but the high returns are consistent across time. The three low-risk cells start to exceed the value of the other three cells in the first few years of the sample period and continue to outperform the high-risk cells. All three low-risk cells combined experienced negative returns in only 10 of the 48 years of data. The high-risk cells had 19 cumulative years of negative returns. This approximately 2 to 1 ratio of negative returns also holds true for the 10 and 20 firm portfolios.

We did not compare the performance of any cells with a market index, such as the S&P 500, since our objective was not to look for abnormal performance but only average risk-adjusted performance. You may note that the cumulative value for the S&P 500 index is

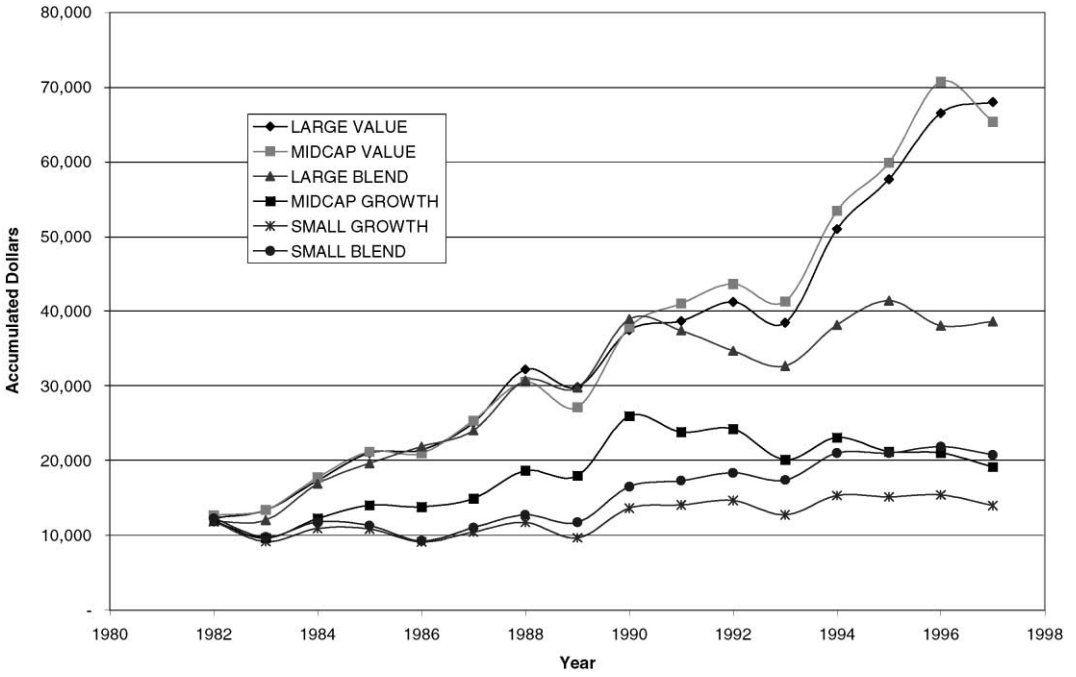

Fig. 2. Value of $10,000.

greater than all of the cumulative values except for the 10 firm portfolio in the mid value cell. Although the value is greater we can also note that the average standard deviation of the S&P 500 over the 17 years of our study is higher than any of the cell portfolios over this time horizon. The S&P 500 average standard deviation is 0.5925. The largest cell standard deviation as shown in Table 2 is 0.5038 for the small growth cell. For information and interest purposes only we have included the cumulative value of $10,000 for investing in the S&P 500 as a separate line item in Table 5 and Fig. 2.

6. Conclusion

The results indicate that the pattern of average risk for the portfolio of firms in the cells of the Morningstar's style box matrix is consistent with the claim of Morningstar. Using the Morningstar cell classifications allows the investor to insure that they are investing in a portfolio that is consistent with their relative risk tolerance. The procedure is simply to identify the cell with the risk level preferred by the investor from Morningstar.

Although the pattern of risk is consistent with expectations, the observed risk-adjusted return for the high-risk cells runs counter to the desired risk-return tradeoff. High-risk portfolio investors will not be adequately rewarded for the risk undertaken. The return from the low-risk cells exceeds that of the high-risk cells. The best risk/return combination comes from the use of the large-value and the mid-cap value cells, both of which fall into the

low-risk classification. Generally, the investor will obtain greater wealth in the long-run by selecting stocks from one of the low-risk categories.

Our results offer support for using the Morningstar's style box company-specific information as a selection tool for selecting low-risk value securities. While the securities assigned to the growth cells are found to be of higher risk than those in the value cells, they do not offer compensating returns to justify their inclusion in a portfolio. Investors seeking risk-adjusted high-performance securities cannot successfully use the stock selection strategy outlined in this paper.

Acknowledgments

The authors wish to thank the anonymous referees for their valuable contributions and a special thanks to editor Karen Eilers Lahey for her time and comments.

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