Equity Style Timing: A Multi-Style Rotation Model for the Russell Large-Cap and Small-Cap Growth and Value Style Indexes

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ABSTRACT

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In their search for "excess returns", investors have always considered timing strategies to be potential value-enhancement tools. While transaction costs in the past have often rendered such strategies unprofitable, we can expect the ongoing decline in these costs to be accompanied by a proliferation of timing strategies by investors. Therefore, being able to time the market accurately has significant implications for researchers and practitioners alike. In this paper, we develop a timing model based on macroeconomic and fundamental public information using Frank Russell large-cap and small-cap style indexes. Despite the fact that there exists an extensive literature on equity style timing, our study differs from other studies in that it attempts to time four different markets segments simultaneously and use a multinomial logit approach as opposed to the more common binary logit approach. The results show that the terminal wealth for the portfolio generated by our model is more than two times larger than the terminal wealth of the best performing buy-and-hold portfolio, suggesting that significant opportunities for "excess returns" can be exploited by implementing a multi-style rotation strategy that employs the investment recommendations of our model. Additional finding shows that the profitability of pursuing such strategy remains in the presence of reasonable levels of transaction costs.

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Finally, I would like to dedicate this work to the memory of my brother, Yasin, who left us unexpectedly this year. A special thanks to him for bearing the pressures of my studies, for always believing in me and for encouraging me to reach higher.

To the memory of my brother, Yasin.

« Tu resteras gravé dans nos coeurs à jamais ! »

« Reposes en Paix ! »

Table of Contents

List of Figures

List of Tables

List of Appendix

1. Introduction

Previous research (Ibbotson and Kaplan, 2000; Brinson, Randolph and Beebower, 1986; etc...) suggests that asset allocations decisions, across different asset classes and within a particular asset class such as equities, account for a large part of a portfolio's return. In fact, practitioners and researchers deem style allocation to be as important as asset allocation. According to Sharpe (1992), style exposure can determine up to 90 percent of a portfolio's return. Given this fact, Bauman and Miller (1997) argue that style-allocation decisions are now considered an essential step in the investment process. With this in mind, and given the fact that the technological advancements in the financial industry and the development and proliferation of index-related products in recent years have made trading in stock market indexes a popular way to gain exposure to the stock market, being able to predict the direction of style indexes has deep implications for researchers and practitioners.

Widespread evidence suggests that different equity styles have a tendency to perform differently at different point in times. Arshanapalli, Coggin and Doukas (1998), using international stock-market data, including data from the U.S., demonstrate that value-growth spread varies considerably from year-to-year with respect to both signs and magnitudes. Ahmed, Lockwood and Nanda (2002) find that performance rankings of stocks categorized by market capitalization and growth attributes significantly change overtime. Amenc, Malaise, Martellini and Sfeir (2003), using the S&P Barra Value and Growth indexes to reflect the value-growth phenomena and the S&P 500 and 600 indexes to reflect the market capitalization phenomena, also show a variation in style-indexes performance overtime. According to these researchers, the variation in style performance is due to the fact that the different style indexes are exposed to different economic and financial risk factors. Similarly, Oertmann (1999), exploring the dynamics of the value-growth spreads in 18 stock markets, shows that the value-growth spreads exhibit a time variation in a fashion similar to that of the global economic-risk premium. This suggests that the economic conditions and the market climate may play a role in this variation. Thus, as economic and market conditions change, shifting portfolio investments across the different styles will provide an opportunity to enhance returns. According to David Huntley, principal at HR Investment Consultants in Towson, Md., portfolios that adopt a style-consistent strategy tend to be more volatile than portfolios that diversify their assets. According to him, "if you are style-consistent you cannot deliver consistent results, because style goes in and out of favor" (Kahn, 1996). In fact, where investors have timing abilities, rotating the portfolio as style goes in and out of favor consistently adds value to the portfolio in both up and down markets.

In contrast to the current wisdom that investors are better off when they undertake a buy-and-hold strategy, that is, when they buy a diversified stock market index and hold it, Pu (2003) argues that adopting a buy-and-hold strategy and ignoring market timing is equivalent to saying that consumers should not maximize utility when they make consumption decisions.

Following this line of reasoning and with the widespread use of index-related products, the drop in transaction costs, the extensive body of literature illustrating the variation in style performance, the accumulation of empirical evidence that stock returns are in some sense predictable (Keim and Stambaugh, 1986; Campbell, 1987; Campbell and Shiller, 1988; Fama and French, 1989; and Ferson and Harvey,1991), we investigate whether investors can enhance the performance of their style portfolios by implementing a style-based timing strategy using fundamental and macroeconomic factors that have been widely cited in the literature as having an influence on stocks returns.

Providing additional evidence in favor of the market-timing advocates, this article documents the benefits of engaging in multi-style rotation strategies involving a large-cap value, a large-cap growth, a small-cap value and a small-cap growth equity indexes. Using a multinomial logit model to time the market, we first start the procedure by selecting a base index from which log-odds estimates for all other indexes are computed. We then estimate a set of models in an in-sample framework using publicly available macroeconomic and fundamental variables and generate out-of-sample monthly forecasts in a rolling-window framework for each potential model. When this is done, using the highest conditional probability estimate of the likelihood that one particular index will outperform the others as investment signals, we evaluate the out-of-sample performance of each model and select the model yielding the highest terminal wealth. Following this, we attempt to enhance the performance of the selected model by imposing probability thresholds (cutoffs). Finally, we verify whether our model possesses some real predictive ability using some market-timing tests and investigate whether our timing strategies are still profitable when transaction costs are taken into consideration.

We find that investors pursuing a style investing philosophy can dramatically enhance the performance of their portfolios by following the investment signals of our multinomial logit model. In fact, this study clearly shows that pursuing a strategy that shifts assets across the capitalization and the value/growth premium dimensions concurrently, provides not only the opportunity for significant added value, but, if investors possess some forecasting ability, also provides consistent added value in both bull and bear markets. Contrary to our expectations, the enhanced portfolios formed by a trading rule do not significantly outperform the "default" portfolio generated by the recommendations of our model. An additional and significant finding of the study is that investors can still rely on the investment recommendations of our model when transaction costs are considered. Despite the fact that the performance gap between the timing strategies and the buy-and-hold strategies are reduced, investors are strongly encouraged to pursue multi-style rotation strategies.

The remainder of the study is organized as follows. The next section undertakes a review of the market-timing literature. Section 3 presents a description of the data and the econometric approach used to predict the return spreads of the different Frank Russell indexes. Section 4 presents the buy-and-hold portfolios and an explanation of the different trading strategies used in the study. Section 5 analyzes the performance results of our market timing strategies. Section 6 applies a set of robustness checks to our results. Section 7 investigates the viability of our timing strategies in the presence of transaction costs. Section 8 proposes a set of implementation vehicles to carry out our strategies. The last section presents a conclusion.

2. Literature Review

In the pursuit of added value for their portfolios, investors have turned their attention in the last two decades to timing strategies. While many practitioners and market-timing advocates suggest that there are significant opportunities of value added to be exploited using this type of strategy, theoreticians usually remain sceptical about the real ability of investors to successfully invest in the right market at the right time.

2.1 Market Timing Literature

Pioneer work on market-timing dates back to 1975. Using U.S. data, Sharpe (1975) recognizes the potential rewards that market timing can have on the performance of a portfolio by rotating the funds between the stock market and the cash-equivalent market during the 1926 to 1972 sample period. However, Sharpe (1975) warns the investment community that a high prediction accuracy (at least 70%) is requisite for a market-timing strategy to be viable. As opposed to Sharpe (1975), Jeffrey (1984), also using annual rotations between the stock market and the cash market, and basing his work on a larger sample period that spanned from 1926 to 1982, tends to be more categorical on the feasibility of such a strategy. According to him, the incremental benefits of market timing are overwhelmed by the related incremental risks, suggesting that the potential rewards of market timing are "illusory". More recently, Bauer and Dahlquist (2001) provide additional evidence that market timing is indeed a difficult game. They note that the difficulties entailed in improving on a passive buy-and-hold strategy tend to be time-dependent. Using an approach they term the "roulette wheel", one new to the market-timing literature, evaluating all the possible paths that might have been taken as opposed to a buy-and-hold strategy, Bauer and Dahlquist (2001) tested several switching strategies between two asset-classes. These asset classes included large-cap stocks, small-cap stocks, long-term corporate bonds, long-term government bonds, intermediate government bonds and T-bills during the 1926 to 1999 period. For example, some of the authors' simulation results that clearly demonstrate that the timing difficulty significantly varies over time include the fact that 99.8% of the more than 1 million rotating paths between large-cap stock and t-bills during the 1995 to 1999 period would have underperformed a large-cap stocks buy-and-hold strategy. However, a similar switching strategy between large-cap stocks and t-bills in 1994 would have resulted in 59.1% of the switching paths outperforming the buy-and-hold large cap stocks strategy. Similarly, all the possible timing strategies, either bond-timing strategies or stock-timing strategies, would have been tough to exploit in some sub periods (for example, 1960-64) of the sample, while in another period (1930-34,) timing the stock market is deemed easier than timing the bond market or vice versa (1955-59).

Chua, Woodward and To (1987), using Canadian data spanning from 1950 to 1983, and using annual rotations between the stock market and the cash market as in Sharpe (1975) and Jeffrey (1984), find that a prediction accuracy ranging from 70% to 80% is needed in order for the market-timing strategy to outperform a buy-and-hold strategy. In addition to performing the same tests as their predecessors, Chua, Woodward and To (1987) also undertake a Monte Carlo simulation involving several mixtures of prediction accuracy in bull and bear markets. They find that even if an investor had correctly predicted all the bear markets during the period, the market-timing strategy's performance would still be lower than the buy-and-hold strategy's performance, suggesting that successfully predicting bull markets is deemed more important than bear markets.

Drom (1989) employs a similar switching strategy than in Chua, Woodward and To (1987)'s work, but his work differs from their work in the sense that it evaluates monthly, quarterly, and annual timing strategies. While Drom also finds that the rewards from market timing are considerable and that a high prediction accuracy is required to outperform a buy-and-hold strategy, he underlines the fact that a lower level of predicting accuracy is needed to beat the buy-and-hold strategy when the investor employs a frequent timing-strategy. However, the value added provided by a frequent-timing strategy comes at the expense of higher transaction costs. Kester (1990) also provides evidence that a lower level of forecasting accuracy is required when timing decisions are less spaced. Using three asset classes — large-cap stocks, small-cap stocks and cash, instead of a two asset classes as in the previous studies — Kester (1990) additionally finds that timing small-cap stocks is more likely to produce added value than timing large-cap stocks.

Lander, Orphanides and Douvogiannis (1997), for their part, investigate the timing ability of their forecasting model for the 1984-1996 period and note that a simple trading rule can be implemented to estimate the direction of the market. Using Graham and Dodd's (1951) observations that "common stock and bond valuations are linked by an equilibrium relationship between forecasted earnings yield and bond yield" as the motivation beyond their work, Lander, Orphanides and Douvogiannis's (1997) model attempts to predict the returns of the S&P 500 based on this equilibrium. Investing all the funds in the S&P 500 when the forecasted excess return of the S&P 500 is positive and all the funds in cash if it is negative, their results show that this trading rule yields a statistically superior performance with a lower volatility than an S&P 500 buy-and-hold strategy.

More recently, Pu (2003) provides additional supporting evidence of the viability of a simple market-timing strategy. Using U.S. data from 1970 to 2000, and without the use of a complex statistical model, Pu (2003) shows that it may be feasible to use a simple rule-of-thumb strategy to beat the buy-and-hold strategy. By using the spread between the earnings-to-price (E/P) ratio of the S&P 500 index and the diverse interest rates (three-month treasury bills and ten-year treasury notes) to evaluate the profitability of trading, Pu (2003) finds that extremely narrow spreads (compared to historical ranges) are useful predictors of market downturns. In fact, by adopting a switching strategy that invests in the stock market at all times, except when the spread is narrower than a specified threshold, investors may expect higher returns and a lower variance than they would using the buy-and-hold strategy.

Resnick and Shoesmith (2002), using a probit model to rotate assets between an S&P 500 mutual fund and t-bills over the January 1971 to December 1999 period, demonstrate that for each probability level, the probit model market-timing strategies outperformed the buy-and-hold S&P 500 strategy. In fact, a $1 investment in 1971 would have grown to a terminal value of $46.71 for the buy-and-hold strategy, compared to $71.19, $74.93 and $83.02 for the probit market-timing strategies, with probability screens of 30, 40 and 50 respectively. They note that the profitability of the timing strategies had a tendency to rise with an increase in the screen probability level. Using the Henriksson-Merton's (1981) statistical test to assess the market-timing ability of the probit model, the authors find that their model has significant timing abilities.

2.2 Style Timing Literature

Some recent market-timing literature focuses exclusively on exploiting the benefit of a style-timing strategy. From these set of studies, Levis and Liodakis (1999), with the use of a logit and an OLS model on U.K data from 1968 to 1997, evaluating strategies that fully rotate all their assets between value and growth style and between large-cap stocks and small-cap stocks, demonstrate that investors would have a better chance of beating a buy-and-hold strategy if they exploit a small cap/large cap spread than if they exploit a value/growth spread. In fact, the value/growth rotation strategy requires a 80% forecasting accuracy compared to a 65%-70% forecasting accuracy for a large cap/small cap rotation strategy. Additional study in the U.K, by Satchell and Yoon (1994), using this time a Markov switching model to rotate between styles, provides evidence on the capacity of the model to create excess return over the buy-hold strategy after taking into account the effects of transaction costs.

In an international setting, Oertmann (1999) tests whether the predictability of the value-growth spread noticed in his work can be exploited by an active style-rotation strategy using monthly data for 18 countries from January 1986 to March 1999. Comparing active style-rotation strategies with buy-and-hold strategies on a country-by-country basis, Oertmann (1999) shows that active style-rotation strategies between value stocks and growth stocks are superior to the respective passive strategies. In fact, in all countries except for Austria, the active style rotation strategies outperform the country's respective value and growth buy-and-hold strategies. Added values range from a minimum of 0.47% per year in Japan to a maximum of 7.21% per year in Singapore.

In the U.S, Gerber (1994), recognizing the variability in the performance of growth stocks and value stocks over the short term, exploits this opportunity using a logit-timing model based on quarterly data drawn from the Frank Russell 1000 index over the 1979 to 1993 period. In his study, Gerber allows an allocation-mapping scheme to be used, as opposed to be fully invested in one index after the timing signal. This allows the investor to adopt one of three possible asset mixes: a maximum-value asset mix (90% value/ 10% growth), a neutral-asset mix (50% value/ 50% growth) or a maximum - growth asset mix (10% value/ 90% growth). Applying the signals given by its model at the beginning of each quarter for three months during an out-of-sample period from 1987 to 1993, Gerber's logit market timing strategy outperforms his benchmark portfolio[1] net of transaction costs[2]. In fact, his style-timing model yields a compound annual return of

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[1] Invested 50% in the Value index and 50% in the Growth index.
[2] Round trip transactions costs of 1%.

17.56%[3] compared to 14.15% for his benchmark portfolio, 13.57% for the Frank Russell 1000 Value index and 14.53% for the Frank Russell 1000 Growth index. An added value of 3.41% per year over the benchmark could have been earned by following such a strategy.

Kao and Schumaker (2001), analyzing and comparing the performance of different monthly and annual timing strategies during the 1979 to 1997 period with perfect foresight[4] based on the market[5], style (Value/Growth) and size dimensions separately, show that market timing was the best return-enhancement tool. As a matter of fact, the perfect-foresight timing strategy based on the market dimension yields an annual return ranging from 43.23% to 48.24% when monthly decisions are made (12.59% to 15.41% when annual decisions are made), compared to a range of 24.58% to 34.52% (7.81% to 11.40%) for market capitalization timing strategies and 20.86% to 27.30% (7.02% to 10.37%) for style strategies. These results suggest that timing strategies in the U.S can be better exploited along the market and the size dimensions.

Copeland and Copeland (1999), using the daily changes in the implied volatility of options on stock index futures as the timing signal to rotate between value and growth stocks and to rotate between large-cap and small-cap stocks, show that a portfolio's performance can be enhanced if such rule is employed. By moving all their portfolio assets in value stocks or in large-cap stocks when the implied volatility has gone up, and

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[3] Net of transactions costs.
[4] Taking a long position in the higher returning asset or a short position in the lower returning asset.
[5] Stock versus cash strategy.

in growth stocks or small-cap stocks otherwise, Copeland and Copeland (1999)'s simulation results in an increase in value added for both dimensions.

Ahmed, Lockwood and Nanda (2002) using a rotation strategy that exploits the variability in market capitalization and value/growth spread simultaneously, show that there are substantial benefits of such multi-style rotation strategy in the U.S. According to their findings, the terminal wealth of a $10,000 initial investment in 1981 would have grown to $92,000 in 1997 if a single-style market capitalization would have been used, compared to a terminal wealth of $264,000 if a multi-style strategy was employed across the small value, small growth, large value and large growth dimensions.

Reinganum (1999), focusing only on exploiting the differential returns provided by stock market capitalization, finds that the benefits of managing the exposure between small cap stocks and large cap stocks can be considerable. Recognizing that accurately forecasting the performance of small-cap stocks and large-cap stocks can greatly enhance a portfolio's performance, Reinganum (1999) undertakes a simulation of two passive strategies and three active strategies involving NYSE stocks over the 1926 to 1999 period. Categorizing the large-cap portfolio as the top two market deciles of the NYSE stocks and the small-cap portfolio as the remaining eight deciles, Reinganum's passive strategies include the market portfolio and a fixed-weighted portfolio invested 65% in large-cap stocks and 35% in small-cap stocks. Regarding the three active strategies, those strategies are based on the premise that the allocation between large-cap stocks and small-cap stocks can be altered depending on which size deciles does better and are allowed to deviate in each direction from the 65%/35% fixed weighted strategy by 10%, 20% and 30% respectively. While the fixed weighted strategy resulted in a terminal weight of $2,291 from a $1 investment in 1926, the active strategy allowing a deviation of 30% resulted in a terminal wealth of $11,920, a terminal wealth nearly five times bigger, suggesting the importance of managing the market capitalization exposure in a portfolio.

More recently, Amenc, Malaise, Martellini and Sfeir (2003) provide additional evidence to support the viability of a style-timing strategy. Using a market-neutral strategy based on a dynamic multi-factor model that exploits the returns differentials between the S&P 500 Large Cap, the S&P 500 Large Cap Growth, the S&P 500 Large Cap Value and the S&P 600 Small Cap using data from 1997 to 2002 period and an out-of-sample period from June 2000 to December 2002, Amenc, Malaise, Martellini and Sfeir (2003) show that such strategy enhance the performance drastically. According to the authors, they use a market-neutral strategy that does not allow exposure to the S&P 500 because market-neutral funds are better able to isolate the rewards of a style-timing model. Rather than moving all their funds from one style to another, the authors execute their switching strategies with the use of complex weighting schemes that permit them to take long and short positions.

Amenc, El Bied, and Martellini (2003) complement the existing literature on style timing by extending the style-timing concept to alternative investments. In fact, while traditional style-timing frameworks dealt exclusively with traditional equity investment vehicles, Amenc, El Bied, and Martellini's (2003) framework utilizes a mix of traditional equity investments vehicles[6], alternative investment vehicles[7] and bond investment vehicles. By initially providing evidence of the superior performance of hedge-fund style timing[8] and by comparing the performance of a market timer with perfect foresight in the hedge-fund style universe, the equity-style universe and an equity/debt strategy during the 1995 to 2000 period, Amenc, El Bied, and Martellini mix traditional equity investments with alternative equity investments and traditional equity investments with both alternative investments and bond investments. Their strategies prove effective. In fact, both strategies result in rewards far higher than could have been obtained by following a "traditional" style-timing approach.

Additional evidence of the effectiveness of style-timing strategies can be seen in Cooper, Gulen and Vassalou (2001), Avramov (2002)[9] and Bauer and Molenaar (2002). Other studies, as mentioned in Amenc, Malaise, Martellini and Sfeir (2003), include Fan (1995), Sorensen and Lazzara (1995), Case and Cusimano (1995), Fisher, Toms and Blount (1995) and Mott and Condon (1995).

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[6] Style indexes.
[7] Hedge funds for example.
[8] 29.44% per year versus 27.10% for traditional equity universe and 20.88% for the equity/debt strategy.
[9] Using a Bayesian model

3. Data and Methodology

3.1 Data

3.1.1 Data Description

The data for this study consist of monthly data from January 1979[10] to December 2000 that has been obtained from four different sources: Datastream, Ibbotson Associates, Bloomberg and the Federal Reserve Board. The first sixty months of the sample, from January 1979 to December 1983, were used as the in-sample period to construct the econometric model aimed at predicting the best performing index, and the remaining 204 months of the study, from January 1984 to December 2000, serves as the out-of-sample forecast period from which the predictions of our model are evaluated.

3.1.2 Selection of Style Indexes

In order to implement our style-timing strategy, we have selected the Russell 1000 Value and Growth indexes and the Russell 2000 Value and Growth indexes. There are two reasons for the use of the Frank Russell Company style indexes throughout the study. First, these indexes tend to be widely followed by the investment community. In fact, according to Frank Russell Company's 2003 fact sheet, more than $250 billion are invested in investment products that have the Russell U.S. indexes as benchmarks.

[10] Inception date of the Frank Russell Company style indexes.

Secondly, the availability of exchange-traded funds[11] on the Russell indexes and the availability of futures contracts on the Russell iShares products, make practitioners' implementation of our style-timing model a more realizable and viable option.

3.1.3 Choices of Forecasting Variables

In addition to the four Frank Russell indexes, we obtained the study's potential predicting variables from the style-timing literature and the literature investigating the predictability of stocks returns. We selected these variables on the basis on the previous evidence of their ability to predict asset returns. Indeed, a number of studies have attempted to relate the performance of style stocks or stocks in general to technical, fundamental or macroeconomic variables.

Levis and Liodakis (1999), in their attempt to determine the value spread, use the lagged value spread, the inflation, the change in the three-month T-bill yield, the term structure, the pound/dollar exchange rate, the dividend yield and the equity-risk premium. Kao and Schumaker (1999), in addition to the inflation (CPI) and the yield curve spread factors, document the influence of the GDP Growth, the industrial production, the real bond yield, the earnings-yield gap [12] and the corporate credit spread on the value premium. Copeland and Copeland (1999) relate the implied volatility of the market, measured by the VIX indicator, to the performance of value and growth stocks and small-cap and large-cap stocks. Bauer and Molenaar (2002), attempt to time the S&P Barra

[11] ETFs provided by Barclay Global Fund Advisors: iShares Russell 1000 Value (IWD), iShares Russell 1000 Growth (IWF), iShares Russell 2000 Value (IWN), iShares 2000 Growth (IWO).
[12] Difference between the E/P ratio (S&P 500) and the long-term bond yield.

style indexes, using a synthesis of all the variables present in Levis and Liodakis (1999), Kao and Schumaker (1999) and Copeland and Copeland (1999)'s studies, in addition to using the composite leading-indicator factor. Cooper, Gulen and Vassalou (2001), show that the bond-default premium and the T-bill returns are the most important[13] variables among the set of variables used in their study investing the predictability of SMB and HML type of strategies. Oertmann (1999), analyzing the dynamics of the value-growth spread in an international setting, finds that the term premium, among other variables, has a significant influence on the value-growth spread in most regions of the world. The findings by Chan, Karceski and Lakonishok (1998) and Avramov (2002) were found to be consistent in the U.S in respect to the predictability of the term premium's effect on stock returns. Additional significant factor found by Avramov (2002) includes the equity premium. Jensen, Mercer and Johnson (1996) and Black (2002) provide evidence that the value premium in the U.S, is significantly larger[14] in an expansionary monetary-policy environment than in a restrictive environment. Sorensen and Lazzara (1995) note a positive relationship between the growth in industrial production and the value premium on the one hand and the interest rates and the value premium on the other, showing additional evidence of the economic significance of those two variables. Arnott, Dorian and Macedo (1991), provide further evidence of the ability of the equity risk premium, the changes in treasury-bills yield, the leading indicators and the inflation to predict style stocks returns. Black and Fraser (2004) demonstrate that the value premium in the U.S. is significantly negatively related to the past cumulative GDP growth rate. Estrella and Mishkin (1996,1998) and Resnick and Shoesmith (2002) document that the yield-curve

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[13] The R-square model selects T-Bills returns in 92% of the best models and the Default premium in 83% of the best models.

[14] In Black's study, the value premium is 2% higher.

spread is a good predictor of bear stock markets. Other evidence of the predictive ability of the earning yield, the dividend yield, and the interest rate is provided by Campbell and Shiller (1988) and Orphanides and Douvogiannis (1997), Lamont (1998) and Lee (1997), respectively.

We also consider other variables that are known to influence stock returns, such as consumer confidence and the unemployment rate as well as lagged variables of the return of other styles indexes (Wilshire indexes, S&P Barra indexes) and the S&P 500 return.

3.2 Methodology

3.2.1 Selection of Econometric Approach

While there exists an extensive body of literature dealing with the predictability of stock market returns that attempts to predict the price level or the return of stock market indexes, this approach, which tries to minimize the deviations of the forecasted value from the actual value[15], may not be the optimal procedure to follow depending on the trading strategies implemented by investors. In fact, a recent study by Leung, Daouk and Chen (2000) that compares the different types of econometric models used in the forecasting literature, have demonstrated that econometric models that attempt to predict the direction of stock market changes can result in a more significant out-of-sample performance than models predicting stock-indexes price levels. Evidence of the

[15] Called "forecasted error".

effectiveness of such an approach can be seen in Wu and Zhang's examination (1997) of the predictability of the future spot-exchange rate's movements, Maberly's investigation (1986) of the relationship between the interday and intraday price changes on the S&P 500 futures, and more recently Arshanapalli, Switzer and Hung's proposal (2004) of a dynamic asset-allocation strategy between the S&P 500 index and the EAFE index. In the style-timing literature, evidence of the profitability of this approach can be seen in Gerber (1994), Levis and Liodakis (1999), Amenc, Malaise, Martellini and Sfeir (2003) and Bauer and Molenaar (2002), among others.

Given the abundant evidence of the effectiveness of this approach and given the fact that the goal of our style-timing model is to select the best performing index among the four Frank Russell style indexes, a statistical technique able to generate a probabilistic forecast of a group membership is most appropriate. Econometric models suitable to predict the sign (direction) of index returns and so provide a recommendation for trading include: linear discriminant analysis, probit model, logit model and probabilistic neural networks. Among those econometric models, since the logistic approach has been widely used in the style-timing literature, and given the fact that each dependent variable is qualitative in nature, we opt for this methodology. However, our paper differs from the existing literature in that we use a multinomial logit model as opposed to a binary logit model. To the best of our knowledge this is the first paper that uses this methodology in the style-timing arena. The multinomial logit model is specified as:

$$\text{Prob }(y = j) = \frac{e^{\sum_{k=1}^{K} \beta_{jk} X_k}}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=1}^{K} \beta_{jk} X_k}}$$

The equation gives Prob (y=j) where j =1,2,….,J-1. One can note that parameters β have two subscripts, k for differentiating x variables, and j for differentiating responses categories. The subscript j indicates that there is J-1 sets of β estimates. In fact, this model is similar to the binary logistic regression model, except that the probability distribution of the response is multinomial instead of binomial and we have J-1 equations instead of one. Since we have to estimate only J-1 equations, the last response category is selected as the base category from which the other response categories are evaluated. One can derive the probability of this reference category by taking 1- [Prob (y=1) + …….+Prob (y=J-1)].

3.2.2 Model Building

Since we are dealing with a multinomial logit model, and the logistic regression approach uses an iterative (re-weighted least squares) procedure to obtain maximum-likelihood estimates of the probability that a particular style index will outperform another index, we require a base index from which log odds estimates for all other indexes are computed. In our study, we select the small-cap Russell 2000 Value index as the base index. Following this, we need to decide on the variables that will be included in our equations. In fact, the choice of appropriate predicting variables to determine the spread between each of the remaining three indexes and the base index is crucial. Using the variables that have been widely discussed in the literature as potential predictors of stock returns, we use the Granger causality test to determine whether potential variables affect the Russell 1000 Value/Russell 2000 Value total return spread, the Russell 1000 Growth/ Russell 2000 Value total return spread and the Russell 2000 Growth/Russell 2000 Value total return spread.

Evidence of the use of the Granger causality test to investigate a relationship between financial or macroeconomic variables and the stock market is present in many studies in the finance field. A study by Karamustafa and Kucukkale (2001) using the Granger causality methodology to explore whether economic activities in Turkey have explanatory power on stock returns, shows a long run relationship between the Istanbul Stock Exchange and a set of macroeconomics variables (the industrial production index, the U.S. exchange rate and the money supply). A study in the Thai market by Islam and Watanapalachaikul (2002) using the Dickey Fuller test and the Granger causality test, shows that, in the long-run, the stock index prices are positively related to the interest rate, the foreign exchange rate, the price-earnings ratio, and the market capitalization, and negatively related to bond prices and the consumer price index.

Using a statistical software[16] that permits an easy application of the Granger causality test, we run pairwise Granger causality tests between each potential variables and each spread over the January 1979 to December 1983 period and determine the

[16] EVIEWS software.

optimal lags to consider for each variables. We then estimate a set of models in an in-sample framework using the statistically significant publicly available macroeconomic and fundamental variables and generate out-of-sample monthly forecasts in a rolling window framework for each potential model. When this is done, using the highest conditional probability estimate of the likelihood that one particular index will outperform the others as an investment signal, we evaluate the out-of-sample performance of each model and select the model yielding the highest terminal wealth. According to the Granger causality test results, using a significance level of 15%, the specifications of the best multinomial logit are as follows:

Let:

Total = 1 + exp(LKVal) + exp(LKGro) + exp(SKGro)

Prob (Y= R1000V) = exp(LKVal / Total)

Prob (Y= R1000G) = exp(LKGro / Total)

Prob (Y= R2000G) = exp(SKGro/ Total)

Prob (Y= R2000V) = 1- Prob (Y= R1000V) - Prob (Y= R1000G) -Prob (Y= R2000G)

and :

$$LKVal_t = \alpha + \beta_1 WILSHIRELV_{t-1} + \beta_2 WILSHIRELV_{t-2} + \beta_3 WILSHIRELV_{t-3} + \beta_4 \Delta CONF_{t-1} + \beta_5 \Delta CONF_{t-2} + \beta_6 \Delta CONF_{t-3} + \beta_7 \Delta CONF_{t-4} + \beta_8 \Delta CPI_{t-1} + \beta_9 \Delta CPI_{t-2} + \beta_{10} \Delta CPI_{t-3} + \beta_{11} \Delta CPI_{t-4} + \beta_{12} HORPREM_{t-1}$$

$$LKGro_t = \alpha + \beta_1 HORPREM_{t-1} + \beta_2 HORPREM_{t-2} + \beta_3 HORPREM_{t-3} + \beta_4 EAYIELDGAP_{t-1} + \beta_5 EAYIELDGAP_{t-2} + \beta_6 EAYIELDGAP_{t-3} + \beta_7 EAYIELDGAP_{t-4} + \beta_8 SP500\ \mathrm{E/P}_{t-1} + \beta_9 SP500\ \mathrm{E/P}_{t-2} + \beta_{10} CURVESPREAD_{t-1}$$

$$SKGro_t = \alpha + \beta_1 USTB1MR_{t-1} + \beta_2 USTB1MR_{t-2} + \beta_3 USTB1MY_{t-1} + \beta_4 USTB1MY_{t-2} + \beta_5 USTB1MY_{t-3} + \beta_6 CURVESPREAD_{t-1} + \beta_7 CURVESPREAD_{t-2} + \beta_8 \mathrm{CURVESPREAD}_{t-3} + \beta_9 \mathrm{EAYIELDGAP}_{t-1} + \beta_{10} EAYIELDGAP_{t-2} + \beta_{11} LTGVTY_{t-1} + \beta_{12} DEFPREM_{t-1}$$

where WILSHIRELV represents the total return of the Wilshire large value index, CONF represents the Consumer Confidence index, CPI represents the Consumer Price index, HORPREM represents the U.S Bond Horizon premium[17], EAYIELDGAP represents the earnings yield gap[18], S&P500 E/P represents the earnings-price ratio of the S&P 500, CURVESPREAD represents the yield spread of the Long Term Government bond over the three-month T-Bills, USTB1MR represents the U.S 1 month Treasury Bills total return, USTB1MY represents the U.S 1 month Treasury Bills Yield, LTGVTY represents the Long term Government Bond yield and DEFPREM represents the U.S Bond Default premium[19].

[17] Computed as the geometric mean difference between the long term Government Bond and the U.S 30 day Treasury bills returns.
[18] Computed as the difference between the earnings to price ratio (E/P) of the S&P 500 and the long term Government bond yield.
[19] Computed as the geometric mean difference between long term Corporate and Government Bond returns.

3.2.3 Model's Mechanism

Before presenting our trading strategies, we first present a brief overview of the mechanism surrounding the implementation of the trading signals of our timing model. Using the specifications of our best model, the regression coefficients of the first 60 months of the sample (our in-sample period from January 1979 to December 1983) are estimated and fitted into the above equations along with the actual lagged values of the respective independent variables to obtain the conditional probability estimates of the likelihood that one particular index will outperform the others in January 1984. At the end of the month of January 1984, the regression coefficients are re-estimated using data from the 60 months preceding the forecasted month, and fitted into the equations with the new lagged values of the independent variables, to obtain, this time, the conditional probability estimates of the likelihood that one particular index will outperform the others in February 1984. As for the conditional probabilities of March 1984 and so on, until the last prediction month of December 2000, a similar procedure is repeated monthly using a five-year rolling window (60 months rolling window), by dropping the first month of data included in the estimation of the preceding prediction month and adding the data corresponding to the month preceding the new prediction month.

4. Trading Strategies

4.1 Portfolio Switching Strategies

Starting with an initial wealth of $100 at the end of the month of December 1983, our trading simulation assumes that at the beginning of each month an investor needs to take an asset allocation decision involving the four Frank Russell indexes and some other major asset classes widely used in the asset-allocation literature (i.e, T-bills and long-term government bonds). At the end of every month, we run our multinomial logit model, and look at the conditional probabilities estimated by our model to allocate the funds according to our rules. It should be noted that our trading simulation is implemented at the start of January 1984, and is repeated until December 2000, a period corresponding to our out-of-sample period mentioned earlier in the paper.

Before building any trading rules, we first decide to invest our portfolio according to the conditional probabilities generated by our model without applying a cutoff probability. In fact, following this strategy that we name the "default" strategy, our portfolio's assets are invested in the Frank Russell index with the highest conditional probabilities at the start of each month.

Starting now with the strategies that use simple cutoff probabilities, the trading rules taking the general form of "cutoff-30X", where the number in the rule represents the cutoff probability used in the allocation decision to classify the outcome, and the letters or the letter following the numbers identify the asset classes in which to invest the portfolio in the event that the conditional probabilities are lower than the cutoff point, we can distinguish five different types of trading rules. The first type of trading rule, which is followed by the letter "Q" at the end of the rule, invests a 100% of the portfolio in the index with the highest conditional probability if the probability is greater than the cutoff probability, and otherwise 25% in each of the 4 Russell indexes. The second type of trading rule, followed by the letter "M", invests the entire portfolio in the index with the highest conditional probability if the probability is greater than the cutoff probability, but leaves the portfolio invested in the same assets as the preceding month in months where no estimated probabilities are higher than the selected cutoff point. The third type of trading rule, followed by the letter "B", invests a 100% of the portfolio in the index with the highest conditional probability if the probability is greater than the cutoff probability, and otherwise invests the entire 100% in the long-term government bond asset-class. The strategies that end with the letter "T" follow the same principle as the strategies that end with the letter "B", but invest the entire portfolio in the 30 days T-bill asset class in the event that no estimated probabilities exceed the cutoff probability. The fifth type of strategy invests the entire 100% of portfolio in the index with the highest estimated conditional probability if the probability exceeds the selected cutoff point, but otherwise invests 50% in each of the indexes selected by the trading rule. It should be noted that "Lg", "Lv", "Sg", "Sv" standing for "Large Growth", "Large Value", "Small Growth", "Small Value", correspond to the Russell 1000 Growth index, the Russell 1000 Value index, the Russell 2000 Growth index and the Russell 2000 Value index, respectively.

As to the remaining strategies of our study, those strategies include a probability-neutral zone that lies between the upper cutoff bound and the lower cutoff bound identified by the trading rules. In fact, instead of facing a two-choice asset-allocation decision, investors are now faced with a three-choice asset-allocation decision. Those rules are categorized according to the following form,"X45-30/LY", where the numerator identifies the strategy to follow in the probability-neutral zone and the denominator, denoted by L, identifies the strategy to follow below the lower bound of the neutral zone. Depending on the prefixed letter in the numerator and the suffixed letter in the denominator, the investor needs to decide whether to spread the assets equally across the 4 indexes, to leave the assets in the same index as the preceding month, or to allocate the portfolio in the T-bills or the long-term government bond asset class when the highest probability estimate falls in one of these two zones. Therefore the rules "Q35-30/LM", "Q35-30/LB", "Q35-30/LT" invest all the funds in one of the four indexes if the highest conditional-probability estimate exceeds the upper bound of the probability-neutral zone, 25% of the funds in each of the four Russell indexes if the highest probability estimate falls within the neutral zone, and 100 % in the previous month's index, the T-bills or the bonds, respectively, if the estimate falls below the lower bound of the neutral zone. Similarly, the "M35-30/LQ", "M35-30/LB", "M35-30/LT" rules invest all the funds in one of the four indexes if the highest conditional probability estimate exceeds the upper bound of the probability-neutral zone, leaving the funds in the previous month's asset if the highest-probability estimate falls within the neutral zone, and invest 25% in each of the four indexes, a 100% T-bills, a 100% in bonds, respectively, if the monthly estimate falls below the lower bound of the neutral zone.

4.2 Buy-and-Hold Strategies

In order to evaluate the profitability of our style-timing model, the trading strategies that implement the signals of our timing model are compared to ten buy-and-hold strategies selected for their relevance. From these ten strategies, four strategies follow a unique style-consistency strategy. Those control portfolios consist of a Russell 1000 Growth buy-and-hold strategy, a Russell 1000 Value buy-and-hold strategy, a Russell 2000 Growth buy-and-hold strategy and a Russell 2000 Value buy-and-hold strategy. Three portfolios follow a multi-style type buy-and-hold strategies. They are: a portfolio spreading its money equally among the four Frank Russell indexes (Russell-25%), a portfolio investing 50% of its assets in each of the two large-cap Russell 1000 indexes (R1000-50%) and a strategy investing 50% of its assets in each of the two small-cap Russell 2000 indexes (R2000-50%). The last three strategies, which do not invest assets in style indexes, invest a 100% of their funds in the one-month T-bills asset class, the long-term government bond asset class and the S&P 500 index respectively.

5. Model's Results

5.1 Default Strategy's Analysis

In this section, we analyze the results that investors would have obtained if they had invested their portfolio by following the switching signals of the "default" strategy. In fact, taking into account that the monthly estimated conditional probabilities of our model reflect the likelihood that one particular index will outperform the others in the following month, the analysis of this strategy is of importance since its signals are not biased by the presence of a trading rule, therefore showing the true predictive ability of our model.

Figure 1 shows the portfolio wealth of the simple buy-and-hold equity strategies and the default switching strategy over the out-of-sample period. During the period from January 1984 to December 2000, the portfolio's value of our default style-timing strategy is generally higher than the portfolios' values of the buy-and-hold strategies. While the "default" strategy seems sometimes to outperform or underperform one or more of the Frank Russell indexes or the S&P 500 in the first four years (50 months to be precise) of the out-of-sample period (January 1984 to February 1988), our "default" strategy consistently outperforms the Russell indexes during the remaining 12 years (154 months to be precise) of the out-of-sample period. This can be seen be seen in Figure 1 as the widening of the gap between the cumulative portfolio values of the default rotation strategy and the cumulative portfolio values of the buy-and-hold strategies. In fact, during the first four years of the sample, according to Table 1, the "default" strategy underperformed one or more of the single-style buy-and-hold strategies in only 31 months of the 50 months. During those months, the default strategy's underperformance amounted to a mere $2.89 per month on average. Given this fact, and the fact that the 31 months represent only 15% of the entire period, this analysis suggests that our switching strategy performed quite well during the entire period.

Additional investigation that focuses on the entire out-of-sample period as documented in the last two rows of Table 2, illustrates the predictive ability of our model. In fact, our model selects the best-performing index 30.4% of the time (62 months out of 204 months), the second-best performing index 31.9% of the time (65 months out of 204), the third best performing index 19.1% of the time (39 months out of 204 months) and the worst performing index only 18.6% of the time (38 months out of 204). One can note that our model's propensity to select the best or the second best performing index is considerably larger than its selecting of the two worst indexes. Classifying the selection of the best or the second-best performing indexes as "good predictions" and the selection of the third and the worst performing indexes as "bad predictions", our model makes good predictions 62.3% of the time.

While the previous analysis suggests that our model is generally accurate in its predictions, a deeper analysis is required. According to Jeffrey (1984), a high prediction accuracy may not necessarily result in a high portfolio's value if one misses the few months when the absolute spread is very high. In other words, it is crucial that the model makes the right calls on the months that count the most. From Table 2, focusing on the months that have a return greater than 5%, it appears that our model is significantly successful in making accurate predictions during those months. In fact, our model selects the best-performing index 37.3% of the time compared to only 19.4% or 17.9% of the time for the third or the worst-performing index, respectively. It should be noted, from this, that our model's selection of the best performing index occurs two times more frequently than the selection of the worst performing index.

According to Jerry Wagner, president of the Society of Asset Allocators and Fund Timers, for him, what matters is not the full participation in the bull months that counts the most but the capacity to avoid the worst-performing months that counts. In an interview published in the January 1995 edition of the *Technical Analysis of Stocks and Commodities*, he said: "Avoiding the downside is more important than participating fully on the upside. That's really the secret — if there is one — of market timing, that avoiding the down periods is more important than catching the up periods to have long-term investments success". If we turn our attention to the scenario analyzing the months that have a return smaller than -5%, we note that our model chooses the best-performing index in 30.7% of the cases compared to only 5.2% of the cases for the worst-performing index. We therefore expect our model to select the best-performing index six times more frequently than the worst-performing index. If we apply the classification of "good" or "bad" predictions, as above, our model makes "good predictions" 76.9% of the time, suggesting that the underlying variables of the model forecast down periods with some accuracy. Similarly, an analysis of the scenarios in which not all indexes have a negative performance reveals that our model makes "good predictions" 72.3% of the time, demonstrating once again, the ability of our model to avoid down periods or perform relatively well during those periods.

Taking Jeffrey's and Wagner's perspectives together, our "default" strategy appears to have the characteristics of an efficient market-timing model. As illustrated in Table 3, the "default" strategy's portfolio value grows from $100 at the beginning of January 1984 to $2,926.42 at the end of December 2000, compared to a terminal value of

$1,227.61 for the best performing single-style buy-and-hold strategy (Russell 1000 Value strategy). In other words, investors following our model's signals would have earned more than twice[20] as much as money than if they had decided to pursue a single-style buy-and-hold strategy. If we compare performance using the default strategy's annualized return (21.97%) over the entire out-of-sample period, we see that it was considerably higher than the highest Russell single index buy-and-hold strategy's annualized return (15.89%). This means that an investor could have earned an excess return of a least 6.08% per year by following the recommendations of our model.

5.2 Trading Rules Strategies' Analysis

In this section, we attempt to improve the performance of the default strategy presented above by imposing probability thresholds (cutoffs). Given that the default timing strategy outperforms by far the buy-and-hold strategies, we must examine the possibility that investors could further enhance the performance of the default strategy by using trading rules.

Table 3 and 4 summarize the results of the enhanced strategies. Of the 116 portfolios formed by a trading rule, only 7 outperform the "default strategy" and, contrary to our expectations, the increase in performance is relatively modest. The best trading strategy of all strategies, the cut-35LgSg strategy, yields a terminal wealth of $3,322.06. This represents an improvement of only $395.63, or 13.5%, over the "default" strategy during the entire period. If we look at the annualized return data, this strategy earns a

[20] Around 2.4 times more.

relatively insignificant 0.91% per year more than the default strategy. The second-best (cut-35LgLv), third-best (Q35-30/LM), fourth-best (cutoff-35Q) and fifth-best (cutoff-35M) strategies yield a terminal wealth of $3,053.38, $3,016.34, $3,003.76 and $3,000.11, respectively. In percentage terms, this is a 4.3%, 3.07%, 2.64% and 2.51% improvement on the $2,926.43 terminal wealth of the default strategy. Not surprisingly, the performance gap between those strategies and the best-performing single-style index strategy (the Russell 1000 Value) slightly widen. If an investor decides to pursue the Q35-30/LM strategy, he would earn an annual excess return of 6.29% over the Russell 1000 Value index.

Of the remaining 100 portfolios formed by our trading strategies, one can note that the majority of the trading rules yield a terminal value greater than the S&P 500's control portfolio terminal value of $1,301.42, except for 40 trading rules. The reason behind the non-effectiveness of those 40 rules is due to the fact that the cutoff probability is set too high. Every strategy, with the exception of two (cutoff-40B and cutoff-40T), uses a cutoff probability of 45% or higher.

From the data shown on Table 4 and the data pertaining to the best 7 strategies, we note that the optimal cutoff probability for the model is 35%. In fact, from the set of strategies employing a cutoff probability of 35%, the worst performing strategy (cutoff-35T) yields a terminal value of $2,294.04. This strategy, ranked 23rd among all the strategies employed, still outperforms the best single-style buy-and-hold strategy by a significant 86.9%.

6. Robustness Checks

Having analyzed our timing strategies' results in the previous section, an important question needs to be answered at this time to further evaluate our model, that is: "Are the model's forecasts valuable for investors?"

6.1 Sharpe Ratios

We can run an initial check of the robustness of the investment recommendations of our model by computing the Sharpe ratios of our portfolio switching strategies and comparing them to the Sharpe ratios of the buy-and-hold strategies. Developed by Nobel Laureate William Sharpe, the Sharpe ratio is a portfolio-performance measure used to evaluate the return of a fund with respect to risk. It provides information on how much risk a portfolio had to bear to earn excess return over the risk-free rate. Computed as the return of the portfolio minus the risk-free rate divided by the portfolio's standard deviation, this ratio is of importance for us, since it allows us to evaluate whether the greater performance of our timing strategies is the result of higher risk.

Table 5 illustrates the computed Sharpe ratios of the buy-and-hold strategies and the best 25 portfolio-switching strategies as determined by the highest terminal wealth. The table also provides additional information, such as the risk and the mean return of each portfolio. Among all the buy-and-hold strategies, the buy-and-hold strategy with the highest Sharpe ratio corresponds to the Frank Russell 1000 Value Index. With a Sharpe ratio of 0.2062, this strategy is closely followed by the S&P 500 strategy (.2044) and the strategy that spreads 50% of the assets in the two Frank Russell 1000 indexes (.1984). The Sharpe ratio of the remaining buy-and-hold strategies lagged by far those mentioned above. It is interesting to note here, that while the S&P 500 has a greater terminal wealth than the Russell 1000 Value index ($1,301.42 vs $1,227.61), the S&P 500's Sharpe ratio is lower than the Russell 1000 Value index's Sharpe ratio (.2044 vs .2062). This can be explained by the fact that the S&P 500 portfolio is riskier than the Russell 1000 Value index, as illustrated by their respective standard deviations (4.35% for the S&P 500 vs 4.12% for the R1000V). When we look at the set of equity buy-and hold strategies, we note that the standard deviation range is from a low of 4.12% per month to a high of 6.70% per month. The table also shows that growth buy-and-hold strategies and small-cap buy-and hold strategies are riskier than value buy-and-hold strategies and large-cap buy-and-hold strategies, respectively.

If we take the best 25 portfolio-switching strategies altogether, we note that every single strategy possesses a Sharpe ratio that is significantly higher than the Sharpe ratio of the Russell 1000 Value index buy-and-hold strategy (0.2062). Among these 25 portfolio, 13 portfolios have a Sharpe ratio greater than 0.27, 21 portfolios have a Sharpe ratio greater than 0.26, and 23 portfolios have a Sharpe ratio greater than 0.25. The higher Sharpe ratio of these strategies, while slightly influenced by the higher risk-profile of the portfolio, is mainly the result of the higher excess return earned by these strategies over the risk-free rate. In fact, while the monthly standard deviation of the strategies increases on average by 17% compared to the Russell 1000 Value Index, its return increases by

36%. Among all the portfolio-switching strategies, the cut-35LgSg has the highest Sharpe ratios (.2793), followed by the cut-35LgLv strategy (.2779), the Q35-30/LM strategy (.2750) and the default strategy in seventh place (.2735). Therefore, according to the Sharpe ratio, the cut-35LgSg strategy outperforms all other strategies on a risk-adjusted basis, followed by the cut-35LgLv strategy, and so on. Additional evidence of the superiority, in terms of the Sharpe ratio, of other portfolios formed by a trading rule over the buy-and-hold strategies extends well beyond the 25th ranked portfolio[21]. Given those facts, investors can therefore generally add value to their portfolios by following the signals of our model without increasing the risk of their portfolio by a significant margin.

6.2 Henriksson and Merton Market Timing Test

As a second check to determine whether the predictions of our model is of value to investors, we apply the widely used Henriksson and Merton's (1981) non-parametric market-timing test. Based on the work by Merton (1981), the Henriksson and Merton's (1981) non-parametric market-timing test measures the ability of a model to predict accurately the direction of change of a particular predicted variable, rather than the magnitude of its change. According to Merton (1981) "a necessary and sufficient condition" for a rational prediction to have value is that the conditional probabilities.... $p1(t) + p2(t) > 1$ (where $p1(t)$ and $p2(t)$ are the probabilities of a correct prediction conditional upon an actual drop or no drop of variable, respectively). In fact, the larger the value of $p1(t) + p2(t)$, the more valuable the predictions are for investors. If the

[21] Data not provided in the table.

predictions are always accurate, p1(t) = p2(t) = 1, so the value of p1(t) + p2(t) = 2. If however, the predictions are always incorrect, the value of p1(t) + p2(t) = 1.

To apply the Henriksson and Merton's (1981) non-parametric market-timing test to our study, we perform two distinct non-parametric tests, one specific for the "default" recommendations of our model and another one applied to the recommendations of the enhanced strategies. For each distinct test, the Henriksson and Merton test statistics (p-stat) and the p-value of the p-stat are calculated. Let the Henriksson and Merton (HM) test statistics be computed as:

$$p-stat = \frac{n_1}{N_1} + \frac{n_2}{N_2}$$

The p-value of the p-stat is calculated as in Park and Switzer (1996):

$$p-value = \sum_{x=n_1}^{\min(N_1,n)} \binom{N_1}{x}\binom{N_2}{n-x} \Big/ \binom{N}{n}, \text{ where } N = N_1 + N_2 \text{ and } n = n_1 + n_3$$

6.2.1 HM Test for the Default Strategy

When the Henriksson and Merton's (1981) test is applied to the "default" recommendations of our model, the Henriksson and Merton's (1981) market-timing measure focuses on assessing the ability of our forecast model to accurately select the

Growth investment style over the Value investment style, or vice versa, in a given month. Following this line of reasoning, we have:

$$p - stat = \frac{n_1}{N_1} + \frac{n_2}{N_2}$$

where n_1 = number of times it was correct to go Growth; N_1 = number of times model says to go Growth; n_2 = number of times it was correct to go Value; N_2 = number of times model says to go Value; n_3 = number of times it was incorrect to go Growth. It should be noted, from the aforementioned specifications, that a prediction is classified as "correct", whenever the model selects one of the two best performing indexes in a given month.

According to the results obtained in Table 6, panel A, the Henrikson and Merton test statistic (p-stat) and its corresponding p-value are 1.2593 and 0.0024, respectively. When we take under consideration Merton's (1981) and Henriksson and Merton's (1981) necessary conditions, it appears that our model's predictions would be valuable to investors since the p-stat of 1.2593 is greatly superior to 1. In fact, according to the corresponding computed p-value, the Henriksson and Merton measure suggests a market-timing ability that is statistically significant at the 1% level. These findings further confirm our prior belief, that investors can use the "default" signals of our model to allocate their funds between the Russell large-cap and small-cap style indexes.

6.2.2 HM Test for the Enhanced Strategies

In this section, we employ the market-timing measure of Henriksson and Merton (1981) to assess the ability of our model to accurately determine whether an investor should invest 100% in 1 of the 4 Frank Russell indexes or adopt a different investment behavior.

To apply the test to the enhanced strategies, we define for each forecast series the following sample statistics: n_1 = number of times it was correct to go a 100% in one of the 4 Frank Russell indexes; N_1 = number of times model says to go a 100% in one of the 4 Frank Russell indexes; n_2 = number of times it was correct to spread the money in several indexes, to leave the money in the previous month index or not going with any of the Frank Russell indexes; N_2 = number of times model says to to spread the money in several indexes, to leave the money in the previous month index or not going with any of the Frank Russell indexes ; n_3 = number of times it was incorrect to go a 100% in one of the 4 Frank Russell indexes. It should be noted, from the above specifications, that a prediction is classified as "correct", whenever the model's decision yields a return superior to the return of a balanced portfolio, invested 50% in the S&P 500 and 50% in long term government bonds.

Table 6, panel B, reports the p-stat and the p-value of the 24 best-performing enhanced strategies. From this set of strategies, 5 strategies (cutoff-35LgLv, cutoff45-LgLv, cutoff-35M, M35-30/LQ and cutoff-45LgSg) have market timing ability at the 5%

level of significance, 6 strategies (cutoff-35Q, Q35-30/LM, cutoff-35LgSg, cutoff-30Q, cutoff-30M, cutoff-30LgLv) have market timing ability at the 10% level.

It is important to note that of the set of strategies having a terminal wealth greater than the default strategy (see Table 4), that all the strategies, with the exception of the last performing strategy (cutoff-35SgSv), possess market timing abilities at the 5% level or close to it. In fact, the cutoff-35LgLv strategy is ranked first, according to HM test with a p-stat of 1.2599 and p-value of 0.0101. This strategy is followed by the cutoff-35M strategy and the M35-30/LQ strategy (both with a p-stat of 1.2228 and a p-value of 0.0249), then by the cutoff-35Q strategy, the cutoff-35LgSg strategy, and the Q35-30/LM (with a p-stat of 1.1858 and a p-value of 0.0546).

Referring back to the HM test principles, according to Merton (1981) and Henriksson and Merton (1981), the higher the p-stat, the more valuable the predictions are to investors. However, this does not seem to be the case for some strategies in our study. In fact, from Table 6, panel B, the cutoff-30Q strategy, the cutoff-30M strategy and the cutoff-30LgLv strategy, have the highest p-stat (1.5871) but not the lowest p-values (0.0734). One possible explanation for this inconsistency is that the p-statistics seem to be biased by the low number of observations (3 observations) collected for N 2 at the 30% cutoff probability level. Since the p-stat is greatly affected by the collection of one additional correct forecast, the computation of the p-value does a good job in determining the true predictive ability of our model.

Overall, out of the 25 best strategies we found that 11 strategies have statistically significant predictive ability. From this set of strategies, the best performing strategies according to the Henriksson and Merton measure (the cutoff-35LgLv, the cutoff-35M strategy, the M35-30/LQ strategy, the cutoff-35Q strategy, the cutoff-35LgSg strategy, and the Q35-30/LM) correspond to the strategies with the highest Sharpe ratios (see Table 5). This constitutes additional evidence that investors can also rely on the signals generated by those five strategies to allocate their funds.

7. Transaction Costs

So far, we have analyzed the performance of our style-switching strategies without taking into consideration the effect of transaction costs. In fact, in order for our style-switching strategies to be a viable investment option for practitioners, those strategies, despite the fact that they are subject to a much higher turnover, need to earn a higher return than the buy-and-hold equivalents.

To verify whether our timing model's strategies could have been profitable in real life, we assume a round-trip transaction cost amounting to 50 basis points (25bps per sell or buy orders) of the transaction value. There are two reasons for the selection of this level of transaction cost. First, while this level may be high by current standards, it appears to be reasonable for the earlier period of the study. Second, while trading in small-cap stocks usually results in prohibitive transaction costs, this level seems to be appropriate in our study, since the Russell 2000 indexes encompass the largest small-cap stocks. As for our passive, buy-and-hold equity strategies, since the Frank Russell indexes provider rebalances the indexes at the end of the month of June of each year, we employ a calendar-rebalancing strategy whereby the buy-and-hold portfolios are rebalanced annually at this date. Assuming that our buy-and-hold portfolios are subject to a 4% turnover rate per year, 8% of the portfolio value will be transacted each year (4% for the sell order and 4% for the buy order). With the exception of the first year[22], annual trading costs in these portfolios will therefore amount to a negligible 4 bps[23] per year. With regards to the other asset classes, trading costs for long-term government bonds are assumed to be similar to the Frank Russell indexes even though evidence suggests that trading in the bond market is more expensive than trading in the equity market. As for the T-bills, trading costs in this asset class are assumed to be zero.

Table 7 presents the effects of transaction costs on the portfolio-switching strategies and the buy-and-hold strategies. Applying the trading costs of 4 bps for the buy-and-hold strategies, Table 7 depicts a terminal value of $1,216.24, $1,181.30, $766 and $403.43 for the Russell 1000 Value, the Russell 1000 Growth, the Russell 2000 Value and the Russell 2000 Growth, respectively. As for the S&P 500, or the portfolios that spread their assets across the four Frank Russell Indexes, the two Russell 1000 indexes and the two Russell 2000 indexes, their terminal value drops to $1,289.63, $861.68, $1,226.28 and $575.59, respectively. One can note that the portfolio value of each buy-and-hold equity strategy drops by less than 1% when transaction costs are taken into consideration, an insignificant factor.

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[22] First-year trading costs amount to 27bps (25 bps for buying a 100% of the index selected by our model and 2bps for selling 4% of the portfolio at the end of June).
[23] Computed as : 0.08*50bps =4bps.

However, a different story emerges when we look at the portfolio-switching strategies. Contrary to the buy-and-hold strategies that have only 17.5 round-trip transactions taking place in them during the entire period, the active portfolio strategies face a far greater number of round-trip transactions as a result of their higher turnover rates. Focusing only on the 25 best-performing portfolio-switching strategies, as shown in Table 7, the number of round-trip transactions in these portfolios varies between a low of 83.5 to a high of 114.5. However, we expect a slightly lower level of round-trip transactions for the portfolio-switching strategies that spread 50% of their money in two of the Frank Russell indexes and the strategies that leave their money in the same index as the previous month. This is because at some points less than a 100% or none of the portfolio is transacted. In accordance with our expectations, most of the strategies that stay invested in the same asset of the preceding have a lower level of turnover activity than the other strategies. We count 93.5, 96, 95.5 and 94.5 round-trip transactions for the cutoff-35M, the M35-30/LQ, the M35-30/LB and the M35-30/LT strategy, respectively. On the other hand, regarding the strategies that split the money between two of the Frank Russell indexes, those strategies result in a higher level of round trip-transactions (108 for cut-35LgSv, 112.5 for cut35-SgSv etc…) than expected, except for the cut-35LgLv strategy. While a lower level of transactions can be seen in Table 7 for these type of strategies (83.5 for cut-45LgLv), it is important to note that it is due to the higher probability threshold of 0.45.

From Table 7, starting with the default strategy, one can note that the terminal value of the default-strategy portfolio goes from $2,926.43 to $1,990.33, a drop of $936.1

or 31.99%. A similar scenario can be seen for the rest of the 25 best strategies. For example, the cut-35LgSg, the cut-35LgLv, the cutoff-35M, drop by 31.9%, 30.70% and 29.56%, respectively. In contrast to the buy-and-hold strategies, where the transaction costs have a negligible effect of less than 1%, the transaction costs in all the portfolio-switching strategies have a detrimental effect on the performance of those strategies. In fact, the percentage drop of the terminal wealth is 30 times bigger than for the buy-and-hold strategies. It is important to note however, that the percentage drop of the portfolios' value tends to diminish as the probability cutoff of the strategy increases (31.90% for the cut-35LgSg compared to 26.59% for the cut-45LgSg). Further evidence of transaction costs' harmful effects can be seen in the fall of the annual performance of the portfolio-switching strategies. To mention just one strategy, the default strategy annual performance drops from 21.97% to 19.24%, a drop of 2.73% per year.

Despite the fact that the transaction costs subtract almost one-third of the portfolios' value, pursuing a strategy following the signals of our model nonetheless remains a more profitable option than pursuing a buy-and-hold strategy. In fact, the terminal wealth net of transaction costs of the default strategy, the cutoff-35Q strategy, the cutoff-35M strategy and the cut-35LgLv strategy are $1,990.33, $2,048.10, $2,113.21 and $2,116.09, respectively. On the other hand, the terminal wealth of the best performing Frank Russell indexes (the Russell 1000 Value index) is only $1216.24 .The incremental benefits of the above strategies over the Russell 1000 Value index range therefore from $774.09 to $899.85. Even though the performance gap is narrower than if transaction costs are ignored, the strategies still outperform the Russell 1000 Value index by a least 63.64%. This translates to an annual excess return of at least 3.41% per annum. Given the fact that such a level of annual excess return is not negligible, investors would be wise to consider following the investment recommendations of some of the best strategies of our model.

As the results have demonstrated, the portfolio-switching strategies remained profitable in the presence of the level of transaction costs presented in the study. However, it is important to note that the viability of these strategies is highly dependent on the level of transaction costs actually involved. In fact, a level of round-trip transaction costs greater than 100 bps would make our portfolio-switching strategies unprofitable. Taking into consideration that transaction costs will continue to decrease over time, one should expect the profitability of our timing model to grow accordingly.

8. Alternative Implementation Vehicles

While executing our model's signals through buying the underlying stocks of the different Frank Russell indexes seems to be a profitable approach, the emergence and the existence of index-linked products could make the implementation of our timing model, an easier and more profitable "option" in the future. We can choose between two different types of instruments.

First, with the growing interest by the investment community (institutional or retail) for the exchange traded fund family products, the existence of exchange traded funds on the Russell indexes makes those products an easy option to purchase the entire index. In fact, with assets representing 1.047 billions dollars for the iShares Russell 1000 Value (IWD), 822 millions for the iShares Russell 1000 Growth (IWF), 713 millions for the iShares Russell 2000 Value (IWN) and 701 millions dollars for the iShares Russell 2000 Growth (IWO) in May 2003, the Russell ETFs family product is a highly liquid tradable vehicle.

Second, our model's signals can be implemented using a new generation of futures, based on the Russell iShares ETFs products[24] since February 24, 2003. In fact, because of their low transaction costs, their guaranteed liquidity and spread, and the low tracking error they offer, the Russell ETFs futures will be a valuable tool for Value/Growth style-timing strategies in the near future.

9. Conclusions

This study is, to the best of our knowledge, the first study in the style-timing "arena" that attempts to time a family of style indexes using a multinomial logit model. Using data from January 1979 to December 2000, we found that investors can add substantial value to their portfolio by timing the Russell large-cap growth, large-cap value, small-cap growth and small-cap value equity-style indexes with our model. According to our results, investors who would have invested a $100 in the best-performing buy-and-hold equity-style index (Russell 1000 Value Index) in January 1984

[24] Provided by NQLX (Nasdaq Liffe Markets).

would have obtained a terminal wealth of \$1,227.61[25] or \$1,216.24[26] in December 2000, compared to a terminal wealth of \$2,926.43[27] or \$1,990.33[28] by following the default signals of our model. This represents a 138.38% outperformance of our model over the Russell 1000 Value index for the scenario ignoring transaction costs and a 63.64% outperformance for the scenario with 50 bps round-trip transaction costs, suggesting that significant opportunities for "excess returns" can still be exploited regardless of transaction costs. While these results should already be appealing to practitioners, it should be noted that the profitability of our model's recommendation will increase over time with the ongoing decrease of transaction costs and the emergence of new generations of index-linked products. Given this fact, and the outstanding past outperformance obtained without incurring significant additional risks, investors who decide to pursue a style-investing philosophy are encouraged to manage their assets by relying on the investment signals of our model.

In addition to implementing the default signals of the model, investors can also decide to follow the signals of some of the enhanced strategies constructed in our study to earn extra "added value". Among all the 116 trading rules strategies available, the "cutoff35-M", the "cut-35LgSg", the "cut-35LgLv", the "Q35-30/LM" and the "cutoff-35Q" strategies appear to be the ideal candidates since they provide the highest risk-adjusted return[29] over the holding period and have the best Henriksson and Merton's (1981) test results. While in all probability improving the performance of their portfolio,

[25] Before transactions costs.
[26] After transactions costs.
[27] Ignoring transactions costs.
[28] After transactions costs.
[29] As measured by the Sharpe ratios.

investors will potentially reduce the transaction cost burden of their portfolio as a result of the slightly lower rebalancing rate required for some strategies.

Our study could have been extended in a number of ways. First, we could for comparison purposes have constructed a binary logit model dealing only with the large-cap Russell 1000 Growth and Value indexes, in addition to the current multinomial logit model. This extension would have allowed us to evaluate and determine whether investors are better off pursuing a timing strategy across the value/growth premium dimension only or across both the value/growth premium dimension and the market-capitalization dimension. Second, we could have developed a six-way asset model, as opposed to a four-way asset model. Instead of deciding to automatically invest our money in bonds or in T-bills when the conditional probabilities estimates do not exceed the threshold level, we could have made the long-term government-bond asset class and the treasury-bills asset class integral components of our multinomial logit model.

For future research, given the considerable benefits that we have derived from our multinomial logit model, one could build a similar model for the U.K, Japanese or Canadian style indexes. On the other hand, it would also be interesting to simulate the investment recommendations of our model using the Russell ETFs family when enough data are available for these relatively new products.

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FIGURE 1. Portfolio Wealth over the Out-of-sample period

This figure shows the portfolio wealth of the "Default" portfolio and the simple equity Buy-and-Hold strategies over the January 1984 to December 2000 period. Initial amount invested is $100.

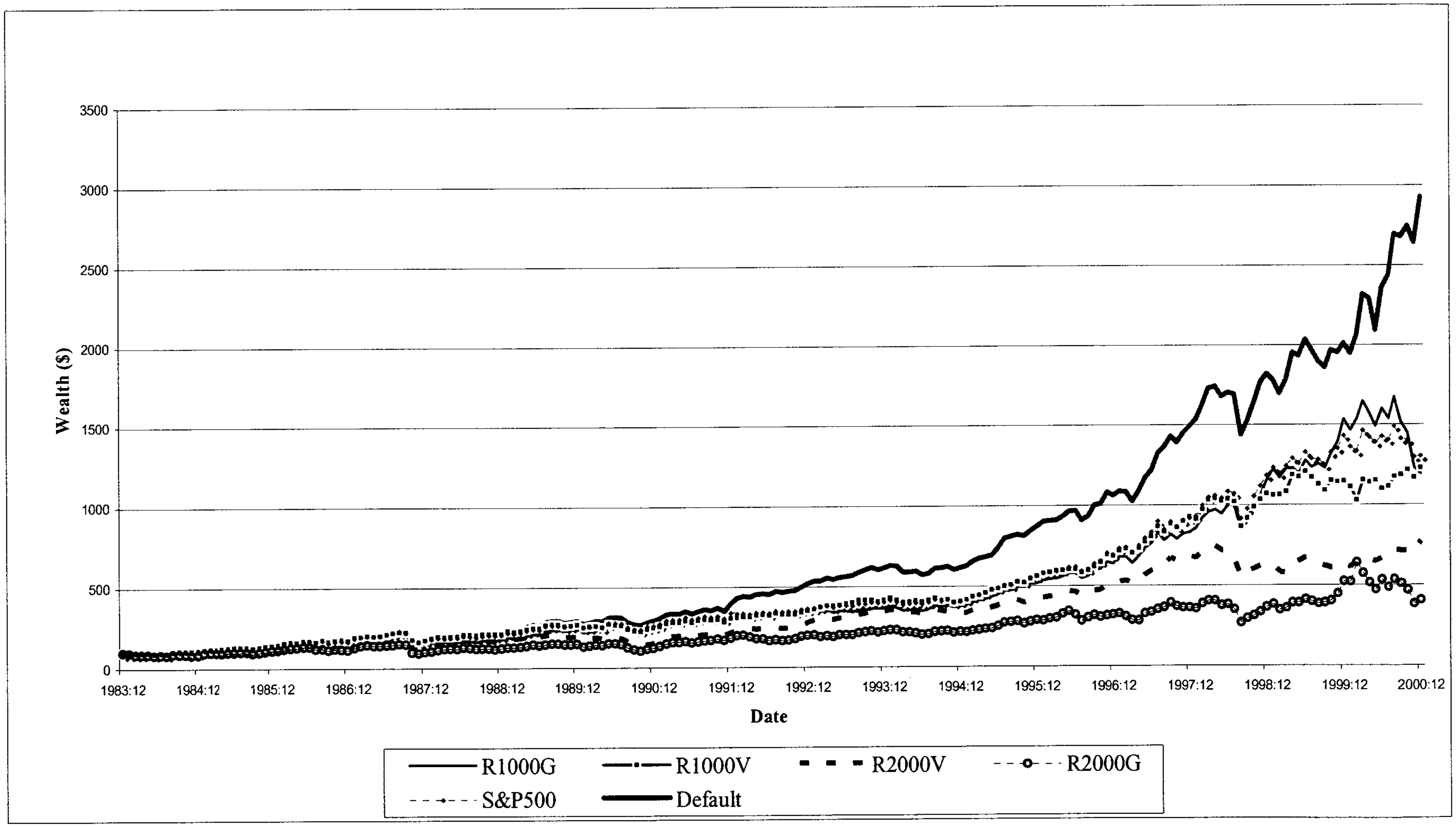

TABLE 1. Default Strategy Investment Recommendations

This table identifies the portfolio recommendations for the "Default" timing strategy during the January 1984 to December 2000 out-of-sample period based on our multionomial logit model. Recommendations of our strategy are illustrated by the darkened numbers. Data are in precentage terms.

	R1000V	R1000G	R2000G	R2000V
1984:01	1.66	-5.18	-4.40	**1.25**
1984:02	-3.17	-4.79	-6.73	**-4.69**
1984:03	1.20	1.85	-0.49	**1.66**
1984:04	**0.42**	0.57	-0.64	-0.49
1984:05	**-5.22**	-5.37	-5.82	-4.49
1984:06	**1.23**	3.85	3.60	2.14
1984:07	-1.49	**-1.69**	-6.11	-3.55
1984:08	**11.61**	11.40	13.34	10.16
1984:09	1.67	-1.65	-2.73	**1.28**
1984:10	**-0.09**	0.71	-2.81	-0.82
1984:11	0.10	-2.02	-4.34	**-0.93**
1984:12	**2.61**	2.55	1.67	1.56
1985:01	6.89	9.21	14.39	**12.08**
1985:02	1.74	1.59	**3.30**	2.08
1985:03	**0.59**	-0.73	-2.53	-1.56
1985:04	1.14	**-1.51**	-1.96	-0.53
1985:05	**5.97**	6.04	4.23	3.20
1985:06	1.90	1.90	0.95	**1.22**
1985:07	**-0.75**	-0.42	3.04	2.60
1985:08	0.24	**-0.92**	-1.53	-0.46
1985:09	**-3.72**	-3.53	-7.24	-4.90
1985:10	**5.14**	4.32	4.21	3.43
1985:11	**5.53**	8.62	7.28	7.11
1985:12	**3.57**	5.18	4.75	4.04
1986:01	1.35	**0.81**	2.28	0.87
1986:02	7.44	**7.95**	7.38	7.01
1986:03	4.62	**6.22**	4.54	5.16
1986:04	-2.29	**0.13**	2.45	0.51
1986:05	5.00	**5.77**	3.67	3.24
1986:06	1.15	**2.16**	0.32	-0.63
1986:07	-4.30	**-6.87**	-10.75	-7.99
1986:08	9.67	**4.61**	2.15	4.14
1986:09	**-6.83**	-9.90	-8.14	-4.36
1986:10	5.10	**5.75**	5.08	2.87
1986:11	1.79	**1.82**	-0.44	-0.23
1986:12	-2.99	**-2.41**	-3.36	-2.42
1987:01	11.54	**14.34**	12.87	10.42
1987:02	1.89	**6.80**	9.68	7.15

	R1000V	R1000G	R2000G	R2000V
1987:03	2.43	**1.61**	2.74	2.65
1987:04	-1.20	-1.92	**-3.10**	-2.63
1987:05	**0.33**	1.08	-0.70	0.06
1987:06	4.76	**4.73**	2.48	2.64
1987:07	3.98	**4.77**	2.39	3.84
1987:08	3.68	4.61	**2.89**	2.99
1987:09	-1.83	**-2.60**	-2.00	-1.69
1987:10	-20.16	**-23.23**	-32.95	-28.29
1987:11	**-6.84**	-8.63	-6.61	-4.20
1987:12	**5.60**	9.16	10.40	5.88
1988:01	7.77	1.17	**1.95**	6.75
1988:02	4.43	5.45	**9.31**	8.69
1988:03	-1.94	-3.36	**5.36**	4.05
1988:04	1.45	0.16	**2.42**	2.12
1988:05	1.46	**-0.36**	-3.30	-2.15
1988:06	4.73	**5.59**	7.38	6.90
1988:07	0.03	**-1.64**	-1.86	-0.06
1988:08	-1.97	**-3.66**	-3.64	-1.51
1988:09	3.26	**5.08**	2.83	2.46
1988:10	**2.27**	1.95	-1.66	-0.58
1988:11	**-1.21**	-1.89	-3.90	-2.79
1988:12	1.21	2.84	**4.89**	2.99
1989:01	6.86	**6.99**	4.27	4.65
1989:02	-1.58	**-2.33**	0.24	1.23
1989:03	2.20	**2.35**	2.78	1.93
1989:04	4.10	**6.02**	4.99	3.73
1989:05	3.99	**4.54**	4.79	3.80
1989:06	-0.38	-0.68	**-3.22**	-1.31
1989:07	6.75	**10.11**	4.69	3.11
1989:08	2.47	**1.65**	2.88	2.00
1989:09	-0.95	0.46	**1.15**	-0.52
1989:10	-3.57	-1.76	**-5.47**	-6.39
1989:11	1.15	**2.61**	0.89	0.39
1989:12	2.21	**1.87**	1.13	-0.35
1990:01	**-6.23**	-8.04	-10.32	-7.09
1990:02	**2.52**	0.71	3.79	2.41
1990:03	1.02	**3.98**	4.58	3.24
1990:04	-3.90	**-1.30**	-2.97	-3.59

	R1000V	R1000G	R2000G	R2000V
1990:05	**8.30**	10.39	8.92	5.13
1990:06	-2.27	**1.08**	0.59	-0.10
1990:07	-0.87	**-0.91**	-4.54	-4.22
1990:08	-8.79	**-9.59**	-14.48	-12.25
1990:09	**-4.84**	-5.39	-9.47	-8.31
1990:10	**-1.37**	0.40	-5.61	-6.60
1990:11	6.93	**6.74**	9.19	6.05
1990:12	2.54	**3.54**	4.77	3.05
1991:01	4.50	**5.12**	9.39	8.60
1991:02	6.65	**7.94**	11.49	10.92
1991:03	**1.48**	3.94	7.05	6.98
1991:04	0.74	**-0.47**	-1.19	0.77
1991:05	3.73	**4.46**	4.83	4.69
1991:06	**-4.21**	-4.74	-6.81	-4.68
1991:07	**4.19**	5.36	4.53	2.60
1991:08	1.82	**3.34**	4.41	3.04
1991:09	-0.74	**-1.74**	1.51	0.12
1991:10	1.66	1.56	**4.26**	1.14
1991:11	**-5.13**	-2.55	-5.22	-4.06
1991:12	8.38	**14.13**	9.58	6.48
1992:01	0.16	-2.42	**7.86**	8.37
1992:02	**2.45**	0.15	1.07	4.77
1992:03	**-1.45**	-2.73	-5.75	-1.09
1992:04	**4.31**	0.72	-5.81	-1.39
1992:05	**0.50**	0.74	-0.22	2.72
1992:06	**-0.62**	-2.52	-6.38	-3.24
1992:07	**3.86**	4.48	3.14	3.77
1992:08	-3.06	**-1.22**	-3.85	-1.95
1992:09	1.38	**1.16**	2.79	1.89
1992:10	0.09	**1.50**	4.11	2.33
1992:11	3.28	**4.35**	9.33	6.19
1992:12	2.38	1.00	2.74	**4.15**
1993:01	**2.90**	-1.15	1.24	5.31
1993:02	3.52	-1.58	-5.43	**0.40**
1993:03	**2.95**	1.93	2.58	3.79
1993:04	**-1.28**	-4.00	-3.17	-2.40
1993:05	**2.01**	3.50	6.00	3.15
1993:06	2.21	-0.92	0.24	**0.94**

TABLE 1. Default Strategy Investment Recommendations (continued).

	R1000V	R1000G	R2000G	R2000V
1993:07	**1.12**	-1.79	1.00	1.72
1993:08	**3.61**	4.10	4.79	3.91
1993:09	0.16	-0.75	3.30	**2.40**
1993:10	-0.07	2.78	2.89	**2.29**
1993:11	**-2.06**	-0.66	-4.05	-2.55
1993:12	1.90	**1.73**	3.95	2.94
1994:01	3.78	**2.31**	2.66	3.56
1994:02	-3.42	-1.82	**-0.44**	-0.29
1994:03	-3.72	-4.83	**-6.14**	-4.48
1994:04	1.92	0.48	**0.15**	0.98
1994:05	**1.15**	1.51	-2.24	-0.14
1994:06	-2.40	-2.95	**-4.27**	-2.60
1994:07	3.11	3.42	1.43	**1.85**
1994:08	2.87	**5.57**	7.34	3.93
1994:09	-3.32	-1.37	**0.42**	-1.06
1994:10	**1.39**	2.36	1.07	-1.83
1994:11	-4.04	**-3.20**	-4.05	-4.04
1994:12	1.15	**1.68**	2.36	3.00
1995:01	3.08	**2.13**	-2.04	-0.48
1995:02	3.95	**4.19**	4.62	3.70
1995:03	2.19	**2.93**	2.92	0.49
1995:04	3.16	2.19	**1.50**	2.97
1995:05	4.21	3.49	**1.31**	2.14
1995:06	1.36	3.86	**6.89**	3.42
1995:07	3.48	4.16	**7.79**	3.65
1995:08	1.41	0.11	**1.23**	2.97
1995:09	3.62	4.61	2.06	**1.49**
1995:10	**-0.99**	0.07	-4.92	-3.99
1995:11	5.07	**3.89**	4.41	3.97
1995:12	2.51	0.57	2.22	**3.10**
1996:01	3.12	**3.35**	-0.83	0.66
1996:02	**0.76**	1.83	4.56	1.57
1996:03	1.70	**0.13**	1.98	2.10
1996:04	0.38	2.63	7.68	**2.73**
1996:05	1.25	**3.49**	5.13	2.53
1996:06	0.08	**0.14**	-6.50	-1.18
1996:07	-3.78	**-5.86**	-12.21	-5.32
1996:08	2.86	**2.58**	7.40	4.34
1996:09	3.98	**7.28**	5.15	2.73
1996:10	3.87	**0.60**	-4.31	1.16
1996:11	7.25	**7.51**	2.78	5.38
1996:12	-1.28	**-1.96**	1.95	3.25
1997:01	4.85	7.01	**2.50**	1.54
1997:02	1.47	**-0.68**	-6.04	0.95
1997:03	-3.60	**-5.41**	-7.06	-2.68
1997:04	4.20	**6.64**	-1.16	1.47
1997:05	5.59	**7.22**	15.03	7.96
1997:06	4.29	**4.00**	3.39	5.06
1997:07	7.52	**8.84**	5.12	4.20
1997:08	-3.56	-5.85	**3.00**	1.59
1997:09	6.04	**4.92**	7.98	6.65
1997:10	**-2.79**	-3.70	-6.01	-2.72
1997:11	4.42	**4.25**	-2.38	1.10
1997:12	**2.92**	1.12	0.06	3.39
1998:01	-1.42	**2.99**	-1.33	-1.81
1998:02	6.73	7.52	8.83	**6.05**
1998:03	**6.12**	3.99	4.20	4.06
1998:04	**0.67**	1.38	0.61	0.49
1998:05	-1.48	-2.84	-7.27	**-3.54**
1998:06	**1.28**	6.13	1.02	-0.57
1998:07	-1.77	**-0.66**	-8.35	-7.83
1998:08	**-14.88**	-15.01	-23.08	-15.66
1998:09	**5.74**	7.68	10.14	5.65
1998:10	**7.75**	8.04	5.22	2.97
1998:11	4.66	**7.61**	7.76	2.71
1998:12	3.40	9.02	9.05	**3.14**
1999:01	0.80	5.87	4.50	**-2.27**
1999:02	-1.41	**-4.57**	-9.15	-6.83
1999:03	2.07	**5.27**	3.56	-0.83
1999:04	**9.34**	0.13	8.83	9.13
1999:05	**-1.10**	-3.07	0.16	3.07
1999:06	2.90	7.00	**5.27**	3.62
1999:07	-2.93	-3.18	**-3.09**	-2.37
1999:08	**-3.71**	1.63	-3.74	-3.66
1999:09	-3.50	-2.10	1.93	**-2.00**
1999:10	**5.76**	7.55	2.56	-2.00
1999:11	**-0.78**	5.40	10.57	0.52
1999:12	0.48	10.40	17.63	**3.07**
2000:01	**-3.26**	-4.69	-0.93	-2.62
2000:02	-7.43	4.89	23.27	**6.11**
2000:03	**12.20**	7.16	-10.51	0.47
2000:04	**-1.16**	-4.76	-10.10	0.59
2000:05	1.05	-5.04	**-8.76**	-1.53
2000:06	-4.57	7.58	**12.92**	2.92
2000:07	1.25	-4.17	-8.57	**3.33**
2000:08	5.56	9.05	**10.52**	4.47
2000:09	0.92	-9.46	-4.97	**-0.57**
2000:10	**2.46**	-4.73	-8.12	-0.36
2000:11	**-3.71**	-14.74	-18.16	-2.04
2000:12	5.01	-3.16	6.12	**10.75**

TABLE 2. Analysis of the Default Strategy's Recommendations

Descriptive analysis of the investment recommendations of the Default Strategy under different set of scenarios. Recommendations are evaluated on the basis of the propensity of the model to choose the best performing index, the second best performing index, the third best performing index or the worst performing index among the four Frank Russell Indexes. First row of each scenarios, represents the number of times (months) a particular recommendation is selected . Rows with number in parantheses express first rows data in percentage terms.

	Default Strategy's Recommendations				
	Best perf. index	2nd best perf. Index	3rd best perf. Index	Worst perf. index	Total
# of months where at least one of the index has a return > 5%	25	17	13	12	67
	(37.3%)	(25.4%)	(19.4%)	(17.9%)	
# of months where at least one of the index has a return < -5%	12	18	7	2	39
	(30.7%)	(46.2%)	(17.9%)	(5.2%)	
# of months where all indexes have a return < 0%	17	10	8	6	41
	(41.5%)	(24.4%)	(19.5%)	(14.6%)	
# of months where less than all indexes have a return < 0%	20	27	11	7	65
	(30.7%)	(41.6%)	(16.9%)	(10.8%)	
All months of the out-of-sample period combined	62	65	39	38	204
	(30.4%)	(31.9%)	(19.1%)	(18.6%)	

TABLE 3. Terminal Wealth and Out-of Sample performance of Multinomial logit Market timing Strategy

This table features the terminal wealth, the average monthly return and the annualized return of the control portfolios and all the portfolio switching strategies. Terminal wealth data are in \$, and represent the portfolio value at the end of December 2000, of \$100 a invested at the beginning of January 1984. Monthly and annualized return are in percentage terms.

Panel A: *Buy-and-Hold Strategies:*

	T-bills	LTGvtBond	S&P 500	R1000G	R1000V	R2000G	R2000V	Russell-25%	R1000-50%	R2000-50%
Term. Wealth $	261.4682	669.0262	1301.4279	1192.3436	1227.6102	407.2078	773.1638	869.5628	1237.4995	580.8580
Monthly Ret%	0.4723	0.9360	1.2658	1.2224	1.2368	0.6907	1.0077	1.0658	1.2408	0.8661
Annualized %	5.8167	11.8293	16.2931	15.6958	15.8944	8.6104	12.7850	13.5672	15.9491	10.9035

Panel B: *Market Timing Strategies:*

	Default	cutoff-30Q	cutoff-35Q	cutoff-40Q	cutoff-45Q	cutoff-50Q	cutoff-55Q	cutoff-60Q	cutoff-30M	cutoff-35M	cutoff-40M
Term. Wealth $	2926.4265	2880.6186	3003.7581	1870.5442	1914.6348	1465.2618	1426.2221	1151.1875	2926.4265	3000.1068	1798.7496
Monthly Ret%	1.6689	1.6610	1.6819	1.4460	1.4576	1.3247	1.3113	1.2049	1.6689	1.6812	1.4266
Annualized %	21.9706	21.8575	22.1579	18.8014	18.9643	17.1071	16.9212	15.4570	21.9706	22.1491	18.5282
	cutoff-45M	cutoff-50M	cutoff-55M	cutoff-60M	cutoff-30B	cutoff-35B	cutoff-40B	cutoff-45B	cutoff-50B	cutoff-55B	cutoff-60B
Term. Wealth $	1763.0097	1126.8324	1283.1411	935.7032	2686.3663	2341.0026	1122.6716	880.1393	614.1399	915.0691	866.0795
Monthly Ret%	1.4166	1.1943	1.2588	1.1022	1.6262	1.5577	1.1925	1.0718	0.8937	1.0911	1.0639
Annualized %	18.3884	15.3119	16.1964	14.0580	21.3580	20.3796	15.2868	13.6480	11.2676	13.9085	13.5404
	cutoff-30T	cutoff-35T	cutoff-40T	cutoff-45T	cutoff-50T	cutoff-55T	cutoff-60T	cut-30LgLv	cut-35LgLv	cut-40LgLv	cut-45LgLv
Term. Wealth $	2622.5790	2294.0431	820.2542	581.5244	347.1551	429.1538	390.8216	2923.0732	3053.3827	1893.5940	2017.3973
Monthly Ret%	1.6142	1.5476	1.0369	0.8667	0.6120	0.7166	0.6704	1.6683	1.6900	1.4521	1.4836
Annualized %	21.1866	20.2362	13.1779	10.9110	7.5958	8.9463	8.3483	21.9624	22.2757	18.8870	19.3308
	cut-50LgLv	cut-55LgLv	cut-60LgLv	cut-30LgSg	cut-35LgSg	cut-40LgSg	cut-45LgSg	cut-50LgSg	cut-55LgSg	cut-60LgSg	cut-30LvSv
Term. Wealth $	1625.2743	1816.1622	1504.6180	2876.5441	3322.0560	1943.5205	2147.9632	1551.7836	1331.5189	994.9809	2884.5856
Monthly Ret%	1.3762	1.4314	1.3379	1.6603	1.7321	1.4651	1.5148	1.3532	1.2772	1.1326	1.6617
Annualized %	17.8232	18.5954	17.2898	21.8473	22.8838	19.0692	19.7718	17.5030	16.4496	14.4709	21.8673
	cut-35LvSv	cut-40LvSv	cut-45LvSv	cut-50LvSv	cut-55LvSv	cut-60LvSv	cut-30SgSv	cut-35SgSv	cut-40SgSv	cut-45SgSv	cut-50SgSv
Term. Wealth $	2696.2333	1756.1882	1658.3034	1330.7884	1464.6288	1273.3315	2838.0455	2933.1588	1802.2519	1767.4171	1280.9067
Monthly Ret%	1.6280	1.4147	1.3862	1.2769	1.3245	1.2550	1.6536	1.6700	1.4276	1.4179	1.2579
Annualized %	21.3842	18.3614	17.9628	16.4459	17.1041	16.1439	21.7508	21.9871	18.5418	18.4058	16.1845
	cut-55SgSv	cut-60SgSv	Q35-30/LM	Q40-30/LM	Q45-30/LM	Q50-30/LM	Q40-35/LM	Q45-35/LM	Q50-35/LM	Q45-40/LM	Q50-40/LM
Term. Wealth $	1079.6618	846.1796	3016.3375	1899.7122	1944.4903	1488.1100	1902.3625	1947.2031	1428.3674	1805.0754	1363.0883
Monthly Ret%	1.1731	1.0523	1.6839	1.4537	1.4653	1.3324	1.4544	1.4660	1.3120	1.4283	1.2888
Annualized %	15.0222	13.3853	22.1879	18.9096	19.0727	17.2137	18.9194	19.0824	16.9316	18.5527	16.6102
	Q50-45/LM	Q35-30/LB	Q40-30/LB	Q45-30/LB	Q50-30/LB	Q40-35/LB	Q45-35/LB	Q50-35/LB	Q45-40/LB	Q50-40/LB	Q50-45/LB
Term. Wealth $	1308.9409	2801.2019	1744.4055	1785.5228	1366.4529	1457.8234	1141.9633	1141.9633	1149.1340	673.5668	673.5668
Monthly Ret%	1.2687	1.6471	1.4113	1.4229	1.2900	1.3222	1.2009	1.2009	1.2041	0.9394	0.9394
Annualized %	16.3325	21.6572	18.3145	18.4768	16.6272	17.0721	15.4024	15.4024	15.4449	11.8738	11.8738

TABLE 3. Terminal Wealth and Out-of Sample performance of Multinomial logit Market timing Strategy (continued)

	Q35-30/LT	Q40-30/LT	Q45-30/LT	Q50-30/LT	Q40-35/LT	Q45-35/LT	Q50-35/LT	Q45-40/LT	Q50-40/LT	Q50-45/LT	M35-30/LQ
Term. Wealth $	2734.6879	1702.9849	1743.1259	1334.0068	1431.5678	1462.2532	1119.0561	839.5884	642.5334	445.0381	2956.2769
Monthly Ret%	1.6351	1.3994	1.4110	1.2781	1.3131	1.3237	1.1909	1.0485	0.9161	0.7345	1.6739
Annualized %	21.4854	18.1474	18.3094	16.4624	16.9470	17.0929	15.2649	13.3331	11.5638	9.1795	22.0434
	M40-30/LQ	M45-30/LQ	M50-30/LQ	M40-35/LQ	M45-35/LQ	M50-35/LQ	M45-40/LQ	M50-40/LQ	M50-45/LQ	M35-30/LB	M40-30/LB
Term. Wealth $	1701.9966	1687.7904	1118.1735	1839.7755	1764.8872	1188.3596	1832.1880	1465.5447	1445.0363	2828.8593	1696.0761
Monthly Ret%	1.3991	1.3949	1.1905	1.4378	1.4171	1.2207	1.4357	1.3248	1.3178	1.6520	1.3974
Annualized %	18.1434	18.0851	15.2596	18.6856	18.3958	15.6731	18.6567	17.1084	17.0114	21.7276	18.1192
	M45-30/LB	M50-30/LB	M40-35/LB	M45-35/LB	M50-35/LB	M45-40/LB	M50-40/LB	M50-45/LB	M35-30/LT	M40-30/LT	M45-30/LT
Term. Wealth $	1662.3763	1069.9795	1527.5978	1588.0369	1053.8438	637.1834	685.7466	637.1834	2807.7334	1683.4099	1649.9617
Monthly Ret%	1.3874	1.1687	1.3454	1.3647	1.1611	0.9119	0.9483	0.9119	1.6482	1.3936	1.3837
Annualized %	17.9798	14.9613	17.3945	17.6627	14.8585	11.5089	11.9918	11.5089	21.6739	18.0671	17.9278
	M50-30/LT	M40-35/LT	M45-35/LT	M50-35/LT	M45-40/LT	M50-40/LT	M50-45/LT				
Term. Wealth $	1061.9889	1391.2004	1415.7684	880.4844	717.0828	423.5134	366.6137				
Monthly Ret%	1.1649	1.2989	1.3076	1.0720	0.9704	0.7101	0.6389				
Annualized %	14.9106	16.7504	16.8706	13.6506	12.2865	8.8616	7.9416				

Table 4. Year-to-Year Portfolio Values

This table presents the portfolio values of each control portfolio and each portfolio formed by a trading strategy at end of each year throughout the out-of-sample period for or a $100 initial investment. Portfolio values data are in $. Buy-and-Hold strategies and Portfolio Switching strategies are ranked in descending order according to their terminal wealth.

	1984:12	1985:12	1986:12	1987:12	1988:12	1989:12	1990:12	1991:12	1992:12	1993:12	1994:12	1995:12	1996:12	1997:12	1998:12	1999:12	2000:12
Buy-and Hold Strategies:																	
S&P 500	106.27	140.44	166.38	175.08	204.51	268.92	260.38	339.93	366.00	402.57	407.83	560.48	689.80	919.94	1182.87	1431.80	1301.43
R1000-50%	104.52	138.21	162.71	167.51	196.24	256.06	245.31	325.54	356.04	392.94	394.25	543.26	665.16	883.78	1120.48	1344.68	1237.50
R1000V	110.10	144.79	173.72	174.59	215.03	269.19	247.43	308.31	350.90	414.49	406.25	562.04	683.67	924.19	1068.63	1147.16	1227.61
R1000G	99.05	131.59	151.80	159.86	177.87	241.77	241.14	340.40	357.42	367.80	377.57	517.96	637.73	832.16	1154.25	1536.99	1192.34
Russell-25%	98.57	129.82	144.81	140.70	170.41	210.02	184.58	257.51	293.26	335.67	333.05	443.38	530.23	677.13	754.18	904.10	869.56
R2000V	102.27	133.98	143.91	133.68	173.08	194.59	152.22	215.69	278.54	344.95	339.61	427.06	518.31	683.06	638.98	629.48	773.16
LTGvtBond	115.49	151.26	188.35	183.24	200.95	237.32	251.96	300.50	324.70	383.90	354.05	466.13	461.84	535.12	605.06	550.67	669.03
R2000-50%	92.89	121.70	128.44	117.25	146.44	170.25	136.93	200.51	236.82	280.83	275.36	353.66	411.89	503.54	491.15	585.93	580.86
R2000G	84.17	110.24	114.19	102.22	123.05	147.87	122.12	184.63	198.98	225.56	220.08	288.39	320.87	362.41	366.87	524.96	407.21
T-bills	109.85	118.33	125.63	132.49	140.90	152.70	164.63	173.84	179.93	185.15	192.37	203.14	213.71	224.95	235.87	246.92	261.47
Portfolio Switching strategies:																	
cut-35LgSg	106.67	149.43	180.33	180.69	241.21	309.52	302.25	436.58	529.71	608.36	610.84	851.15	1035.31	1401.15	1686.22	2272.51	3322.06
cut-35LgLv	106.67	146.13	172.23	172.57	230.37	295.61	297.99	411.64	525.37	625.08	607.89	861.03	1052.34	1461.33	1812.69	2114.07	3053.38
Q35-30/LM	106.67	148.12	176.83	177.18	236.53	303.51	298.92	425.06	526.33	620.33	608.80	841.50	1051.75	1424.05	1731.03	2064.74	3016.34
cutoff-35Q	106.67	148.12	176.83	177.18	236.53	303.51	298.92	429.88	532.30	627.38	615.72	851.06	1046.11	1416.41	1723.81	2056.13	3003.76
cutoff-35M	106.67	143.79	171.54	171.88	229.44	294.42	295.50	414.52	538.31	657.20	664.78	911.44	1111.41	1561.21	1943.10	2061.86	3000.11
M35-30/LQ	106.67	143.79	171.54	171.88	229.44	294.42	295.50	414.40	538.14	657.00	664.58	911.16	1119.99	1573.26	1914.71	2031.74	2956.28
cut-35SgSv	106.67	150.09	181.48	181.84	242.74	311.49	299.55	448.14	537.87	627.74	621.59	838.06	1035.33	1365.92	1630.53	1985.29	2933.16
Default	106.67	142.83	170.39	170.73	227.91	292.46	293.53	402.00	522.04	617.10	616.52	871.69	1062.94	1493.13	1819.56	2011.22	2926.43
cutoff-30M	106.67	142.83	170.39	170.73	227.91	292.46	293.53	402.00	522.04	617.10	616.52	871.69	1062.94	1493.13	1819.56	2011.22	2926.43
cut-30LgLv	106.67	142.83	170.39	170.73	227.91	292.46	293.53	400.60	520.22	614.95	614.37	868.65	1057.97	1486.14	1817.48	2008.92	2923.07
cut-30LvSv	106.67	142.83	170.39	170.73	227.91	292.46	293.53	401.04	520.80	615.63	615.06	869.62	1048.66	1473.06	1793.55	1982.47	2884.59
cutoff-30Q	106.67	142.83	170.39	170.73	227.91	292.46	293.53	401.88	521.89	616.91	616.33	871.43	1045.05	1467.99	1791.08	1979.74	2880.62
cut-30LgSg	106.67	142.83	170.39	170.73	227.91	292.46	293.53	402.71	522.97	618.19	617.61	873.24	1041.42	1462.89	1788.55	1976.94	2876.54
cut-30SgSv	106.67	142.83	170.39	170.73	227.91	292.46	293.53	403.16	523.55	618.88	618.30	874.21	1032.03	1449.70	1764.61	1950.48	2838.05
M35-30/LB	106.67	143.79	171.54	171.88	229.44	294.42	295.50	396.83	515.33	629.15	636.41	872.53	1018.11	1430.15	1832.19	1944.17	2828.86
M35-30/LT	106.67	143.79	171.54	171.88	229.44	294.42	295.50	398.70	517.76	632.12	639.41	876.65	1023.03	1437.06	1818.50	1929.65	2807.73
Q35-30/LB	106.67	148.12	176.83	177.18	236.53	303.51	298.92	411.66	509.74	600.78	589.62	814.98	980.72	1327.87	1607.57	1917.48	2801.20
Q35-30/LT	106.67	148.12	176.83	177.18	236.53	303.51	298.92	413.60	512.14	603.62	592.40	818.82	955.81	1294.15	1569.40	1871.95	2734.69
cut-35LvSv	106.67	146.82	173.37	173.71	231.89	297.57	295.56	423.13	534.49	645.99	619.50	849.35	1054.96	1429.05	1758.51	1846.85	2696.23
cutoff-30B	106.67	142.83	170.39	170.73	227.91	292.46	293.53	384.84	499.76	590.76	590.20	834.48	979.73	1376.24	1670.30	1846.24	2686.37
cutoff-30T	106.67	142.83	170.39	170.73	227.91	292.46	293.53	386.66	502.12	593.55	592.99	838.42	954.84	1341.28	1630.64	1802.40	2622.58
cutoff-35B	106.67	139.55	164.94	165.27	220.62	283.10	301.09	369.66	460.96	553.48	508.73	733.22	855.55	1155.71	1480.59	1521.71	2341.00
cutoff-35T	106.67	137.14	164.25	164.57	219.70	281.92	315.00	386.14	482.31	560.70	524.05	733.91	856.45	1133.02	1433.76	1518.91	2294.04
cut-45LgSg	105.82	142.44	165.33	161.80	201.97	263.42	253.84	369.77	444.49	519.10	518.56	726.84	872.70	1152.69	1497.04	2017.06	2147.96
cut-45LgLv	108.07	141.38	168.34	168.69	212.89	279.15	276.85	361.43	447.27	523.53	521.02	748.98	921.34	1275.25	1623.11	1895.27	2017.40
Q45-35/LM	106.26	139.09	161.17	158.05	203.60	264.36	258.55	360.80	463.74	570.12	557.00	776.13	943.25	1313.55	1671.85	1758.44	1947.20
Q45-30/LM	106.26	141.20	163.62	160.46	206.70	268.38	257.57	359.43	440.51	522.81	510.78	711.72	886.58	1190.04	1479.31	1748.98	1944.49
cut-40LgSg	103.74	139.65	166.68	165.22	210.61	269.51	263.17	375.20	451.01	531.87	526.03	748.16	856.93	1156.33	1392.56	1825.07	1943.52

Table 4. Year-to-Year Portfolio Values (continued).

	1984:12	1985:12	1986:12	1987:12	1988:12	1989:12	1990:12	1991:12	1992:12	1993:12	1994:12	1995:12	1996:12	1997:12	1998:12	1999:12	2000:12
cutoff-45Q	106.26	141.20	163.62	160.46	206.70	268.38	257.57	359.43	440.51	522.81	510.78	711.72	871.92	1170.36	1456.59	1722.13	1914.63
Q40-35/LM	105.21	137.71	161.12	159.78	209.46	265.38	266.35	366.66	471.28	584.69	567.69	799.32	942.16	1325.81	1620.61	1717.95	1902.36
Q40-30/LM	105.21	139.81	163.57	162.21	212.65	269.42	265.34	365.27	447.67	536.17	520.58	732.99	885.56	1201.15	1433.97	1708.71	1899.71
cut-40LgLv	106.61	139.48	162.66	163.00	206.03	261.79	263.90	345.31	427.32	512.14	498.94	729.06	890.89	1238.84	1515.66	1778.96	1893.59
cutoff-40Q	105.21	139.81	163.57	162.21	212.65	269.42	265.34	365.27	447.67	536.17	520.58	732.99	870.91	1181.28	1411.95	1682.47	1870.54
M40-35/LQ	107.78	139.34	165.33	165.71	233.83	300.06	295.52	393.11	472.04	556.35	527.70	736.62	890.34	1205.50	1426.94	1661.74	1839.78
M45-40/LQ	104.26	138.54	159.72	155.24	202.87	263.78	247.12	338.60	414.99	499.98	488.47	681.12	831.58	1117.47	1393.87	1647.97	1832.19
cut-55LgLv	107.97	140.87	166.44	173.52	206.21	268.61	264.16	344.87	418.56	473.67	475.14	694.11	837.22	1199.08	1540.18	1798.43	1816.16
Q45-40/LM	108.85	138.61	162.77	159.63	221.34	291.08	284.68	376.65	474.32	573.83	547.68	738.05	912.46	1268.43	1598.78	1681.59	1805.08
cut-40SgSv	103.82	139.96	164.25	161.17	218.84	276.45	265.86	384.50	466.16	557.70	539.44	731.48	843.76	1115.58	1302.30	1570.80	1802.25
cutoff-40M	107.78	137.24	162.73	163.10	230.14	295.32	296.40	384.61	484.34	591.32	578.07	793.30	951.21	1336.18	1617.46	1675.69	1798.75
Q45-30/LB	106.26	141.20	163.62	160.46	206.70	268.38	257.57	344.19	421.83	500.65	489.13	681.55	817.42	1097.21	1358.37	1606.00	1785.52
cut-45SgSv	104.47	140.84	158.72	152.29	199.94	257.04	238.47	355.16	430.59	517.89	496.45	670.12	816.04	1061.51	1291.44	1540.44	1767.42
M45-35/LQ	106.80	138.08	162.81	154.40	217.20	286.03	267.96	355.15	426.46	505.61	476.50	658.71	818.44	1097.87	1321.06	1594.10	1764.89
cutoff-45M	106.80	136.00	160.24	151.97	213.77	281.52	273.43	353.49	445.16	546.70	532.72	724.81	893.39	1243.31	1529.97	1642.40	1763.01
cut-40LvSv	106.68	139.90	160.42	159.16	214.41	268.94	267.12	354.86	443.20	538.63	513.24	715.35	880.87	1200.95	1423.94	1534.20	1756.19
Q40-30/LB	105.21	139.81	163.57	162.21	212.65	269.42	265.34	349.78	428.69	513.44	498.51	701.91	816.48	1107.45	1316.74	1569.02	1744.41
Q45-30/LT	106.26	141.20	163.62	160.46	206.70	268.38	257.57	345.81	423.82	503.01	491.44	684.77	796.66	1069.34	1326.11	1567.86	1743.13
Q40-30/LT	105.21	139.81	163.57	162.21	212.65	269.42	265.34	351.43	430.71	515.87	500.86	705.22	795.74	1079.32	1285.47	1531.76	1702.98
M40-30/LQ	107.78	137.24	162.73	163.10	220.99	283.58	284.62	369.20	464.94	567.63	554.92	761.53	920.44	1292.96	1530.46	1585.56	1702.00
M40-30/LB	107.78	137.24	162.73	163.10	230.14	295.32	296.40	368.19	463.66	566.07	553.40	759.44	871.36	1224.01	1525.14	1580.04	1696.08
M45-30/LQ	106.80	136.00	160.24	151.97	209.68	273.51	265.64	343.32	432.35	530.97	517.39	703.96	874.65	1217.24	1464.70	1572.33	1687.79
M40-30/LT	107.78	137.24	162.73	163.10	230.14	295.32	296.40	369.93	465.85	568.75	556.01	763.02	875.57	1229.92	1513.75	1568.24	1683.41
M45-30/LB	106.80	136.00	160.24	151.97	213.77	281.52	273.43	338.40	426.15	523.36	509.98	693.87	818.39	1138.94	1442.64	1548.65	1662.38
cut-45LvSv	106.68	139.90	161.76	158.97	211.17	272.93	260.81	348.41	435.15	524.30	500.76	693.54	865.97	1181.10	1406.75	1448.69	1658.30
M45-30/LT	106.80	136.00	160.24	151.97	213.77	281.52	273.43	340.00	428.17	525.83	512.39	697.14	822.34	1144.44	1431.87	1537.09	1649.96
cut-50LgLv	107.97	141.80	165.66	168.65	200.42	265.78	261.37	341.23	422.27	484.54	486.04	701.95	840.08	1152.61	1480.49	1728.73	1625.27
M45-35/LB	106.80	140.90	164.48	155.99	219.43	288.97	318.04	359.85	435.15	525.58	459.31	654.32	771.75	1032.84	1308.25	1360.24	1588.04
cut-50LgSg	106.54	144.14	163.08	160.56	189.38	245.95	239.36	348.68	419.13	475.90	476.16	653.81	795.56	1027.00	1373.79	1851.00	1551.78
M40-35/LB	107.78	142.19	167.03	167.41	236.23	303.14	322.40	366.13	442.75	531.61	472.24	675.21	774.72	1046.52	1303.99	1308.47	1527.60
cut-60LgLv	104.76	136.69	161.50	166.30	192.23	250.40	239.83	316.48	382.03	435.43	436.88	635.23	765.35	1096.16	1400.16	1634.93	1504.62
Q50-30/LM	106.28	141.17	161.31	159.64	195.83	247.59	233.29	325.55	398.98	469.72	463.94	637.23	780.03	1036.37	1307.31	1545.63	1488.11
M50-40/LQ	104.07	138.23	171.92	172.16	216.79	270.73	244.59	335.14	410.74	490.88	481.08	670.81	799.17	1055.14	1316.13	1522.19	1465.54
cutoff-50Q	106.28	141.17	161.31	159.64	195.83	247.59	233.29	325.55	398.98	469.72	463.94	637.23	767.13	1019.23	1287.23	1521.90	1465.26
cut-55LvSv	105.98	136.70	157.78	156.25	199.16	238.59	217.54	290.60	366.30	443.96	432.64	603.47	730.32	1009.67	1202.05	1237.89	1464.63
Q45-35/LT	106.26	130.74	151.98	149.04	191.99	249.29	271.43	322.85	399.13	467.24	434.73	613.76	713.84	936.20	1211.50	1272.18	1462.25
Q40-35/LB	105.21	131.72	152.57	151.30	198.35	251.30	267.27	314.09	387.67	473.02	430.12	631.49	712.27	963.86	1212.73	1245.17	1457.82
M50-45/LQ	106.07	140.88	163.25	162.04	199.98	249.74	235.31	328.36	402.44	473.79	464.32	646.98	773.42	1020.01	1269.47	1500.89	1445.04
Q40-35/LT	105.21	129.44	151.93	150.67	197.52	250.24	279.61	328.10	405.62	480.19	444.00	633.41	714.51	946.91	1176.83	1245.48	1431.57
Q50-35/LM	106.28	139.06	158.90	157.25	192.90	243.89	234.18	326.79	420.03	490.98	484.93	666.06	795.47	1096.47	1416.17	1489.52	1428.37
cutoff-55Q	106.28	138.86	156.89	150.22	184.27	228.57	215.36	300.53	363.85	422.14	416.94	578.05	705.26	938.68	1185.51	1401.62	1426.22
M45-35/LT	106.80	136.82	161.85	153.49	215.91	284.34	326.91	369.33	447.35	523.14	467.83	620.73	732.21	959.67	1200.69	1286.82	1415.77
M40-35/LT	107.78	138.07	164.36	164.73	232.45	298.28	333.29	377.91	457.75	532.14	480.68	654.34	750.85	993.32	1222.54	1264.49	1391.20
Q50-30/LB	106.28	141.17	161.31	159.64	195.83	247.59	233.29	311.74	382.07	449.80	444.27	610.21	719.18	955.52	1200.43	1419.27	1366.45

Table 4. Year-to-Year Portfolio Values (continued).

	1984:12	1985:12	1986:12	1987:12	1988:12	1989:12	1990:12	1991:12	1992:12	1993:12	1994:112	1995:12	1996:12	1997:12	1998:12	1999:12	2000:12
Q50-40/LM	108.87	140.68	162.30	160.62	203.36	260.42	250.05	344.92	432.90	497.96	491.83	653.33	780.26	1073.61	1373.21	1444.34	1363.09
Q50-30/LT	106.28	141.17	161.31	159.64	195.83	247.59	233.29	313.22	383.87	451.93	446.37	613.09	700.92	931.25	1171.93	1385.57	1334.01
cut-55LgSg	106.54	140.97	155.74	144.07	169.94	218.15	212.30	309.27	359.37	398.51	398.73	549.33	674.60	863.62	1155.24	1556.53	1331.52
cut-50LvSv	105.98	138.17	159.34	158.50	202.02	248.59	226.65	302.78	378.15	460.94	449.18	617.05	733.77	1003.07	1194.19	1229.79	1330.79
Q50-45/LM	106.82	138.03	158.43	156.79	198.52	254.21	242.41	326.73	411.46	480.45	474.54	631.08	751.11	1034.66	1292.02	1386.96	1308.94
cutoff-55M	106.61	140.78	162.41	145.83	179.46	217.22	203.46	253.52	309.11	346.70	355.90	487.49	600.21	860.69	1059.13	1136.96	1283.14
cut-50SgSv	104.61	140.36	156.73	150.75	190.48	229.41	206.86	308.07	373.50	450.84	438.15	571.79	690.86	888.24	1102.64	1315.23	1280.91
cut-60LvSv	106.20	136.98	158.10	151.96	188.54	225.87	200.39	268.55	340.72	411.94	404.83	570.03	680.14	940.29	1072.83	1104.81	1273.33
M50-35/LQ	106.61	137.77	159.86	163.34	201.02	264.73	239.17	315.13	378.40	430.96	428.87	592.87	735.82	969.78	1166.94	1408.12	1188.36
cutoff-60Q	103.22	134.87	152.38	143.28	172.56	214.04	195.58	272.90	328.10	379.64	376.68	523.24	627.46	835.13	1012.36	1196.91	1151.19
Q45-40/LB	108.21	132.91	153.50	146.65	185.17	230.77	239.17	256.43	303.79	356.00	322.85	455.43	570.95	748.19	936.49	941.46	1149.13
Q45-35/LB	106.28	133.00	150.47	148.91	182.66	230.95	234.99	279.94	345.51	414.39	383.32	548.99	627.39	831.63	1105.61	1126.33	1141.96
Q50-35/LB	106.28	133.00	150.47	148.91	182.66	230.95	234.99	279.94	345.51	414.39	383.32	548.99	627.39	831.63	1105.61	1126.33	1141.96
cutoff-50M	106.61	140.78	162.41	165.95	204.22	268.95	251.91	313.89	395.29	443.35	455.13	619.24	762.43	1042.50	1282.87	1377.13	1126.83
cutoff-40B	107.14	131.60	153.46	148.26	190.50	231.66	246.38	260.59	308.73	365.10	329.04	469.04	570.29	755.17	907.79	919.78	1122.67
Q50-35/LT	106.28	130.70	149.84	148.28	181.90	229.98	245.84	292.42	361.51	419.79	394.87	549.51	628.05	815.30	1070.64	1124.26	1119.06
M50-30/LQ	106.61	140.78	162.41	165.95	204.22	268.95	251.91	316.00	397.94	446.34	458.19	623.40	773.71	1057.93	1273.01	1366.55	1118.17
cut-55SgSv	104.61	136.69	147.48	129.19	163.24	192.56	173.63	258.60	311.92	370.75	360.32	473.63	583.17	720.15	893.98	1066.35	1079.66
M50-30/LB	106.61	140.78	162.41	165.95	204.22	268.95	251.91	302.60	381.07	427.41	438.76	596.98	703.33	961.70	1218.14	1307.65	1069.98
M50-30/LT	106.61	140.78	162.41	165.95	204.22	268.95	251.91	304.03	382.87	429.43	440.84	599.79	706.73	966.34	1209.04	1297.89	1061.99
M50-35/LB	106.61	140.74	159.17	162.64	200.15	263.58	279.76	314.68	380.53	441.52	407.43	580.42	683.83	899.17	1138.93	1184.20	1053.84
cut-60LgSg	100.19	132.57	146.47	134.62	157.23	201.84	189.79	275.53	313.60	346.73	347.15	475.61	572.28	732.63	942.09	1269.35	994.98
cutoff-60M	106.61	140.78	162.41	145.83	175.95	239.15	212.39	264.65	273.43	308.30	303.52	396.68	466.78	669.35	814.53	874.38	935.70
cutoff-55B	97.37	122.63	170.10	204.39	238.56	287.17	284.60	315.81	381.30	457.17	404.70	571.88	566.86	739.50	790.73	696.63	915.07
M50-35/LT	106.61	127.05	146.78	149.97	184.57	243.06	269.50	302.68	366.62	411.85	388.92	516.02	608.02	782.97	979.61	1049.88	880.48
cutoff-45B	105.85	130.02	156.93	140.18	181.55	230.63	243.34	270.02	319.90	376.32	345.05	483.85	534.17	752.49	818.48	721.08	880.14
cutoff-60B	98.52	124.08	172.11	183.78	206.75	248.87	257.08	314.50	384.28	458.27	422.63	603.85	578.54	754.73	809.15	712.86	866.08
cut-60SgSv	101.69	132.88	143.37	122.63	153.54	181.12	157.69	232.30	277.80	326.05	319.69	423.83	504.54	623.06	715.60	853.57	846.18
Q45-40/LT	107.44	121.64	129.83	123.42	151.84	186.52	203.08	204.42	242.77	274.75	256.26	339.72	424.32	536.11	658.46	738.42	839.59
cutoff-40T	106.38	120.44	129.79	124.77	156.21	187.23	209.21	207.74	246.72	281.77	261.18	349.86	423.83	541.11	638.28	721.42	820.25
M45-40/LT	105.42	119.34	130.56	119.11	148.66	182.86	210.24	207.80	246.79	283.53	272.65	355.98	426.62	539.62	628.11	630.68	717.08
M50-40/LB	105.97	130.26	149.89	138.44	155.61	182.87	194.09	204.34	242.09	287.69	264.61	375.82	425.40	548.33	645.93	569.06	685.75
Q50-40/LB	105.87	129.99	154.72	139.47	172.01	212.77	220.40	244.57	289.75	338.10	313.41	433.21	469.98	655.32	723.32	637.24	673.57
Q50-45/LB	105.87	129.99	154.72	139.47	172.01	212.77	220.40	244.57	289.75	338.10	313.41	433.21	469.98	655.32	723.32	637.24	673.57
Q50-40/LT	107.46	121.61	128.00	122.80	143.86	172.07	183.94	185.15	219.89	246.85	232.76	304.16	373.33	466.88	581.90	652.57	642.53
M45-40/LB	105.66	129.88	158.15	142.99	162.38	190.83	189.13	209.87	248.64	292.19	268.75	376.85	398.67	551.79	600.18	528.76	637.18
M50-45/LB	105.66	129.88	158.15	142.99	162.38	190.83	189.13	209.87	248.64	292.19	268.75	376.85	398.67	551.79	600.18	528.76	637.18
cutoff-50B	97.37	119.68	151.40	132.96	155.19	200.25	198.46	220.23	260.91	306.61	271.42	382.83	388.11	541.00	578.48	509.64	614.14
cutoff-45T	106.30	120.34	126.43	116.60	143.61	177.51	191.21	188.71	224.11	248.60	239.06	300.76	355.35	468.69	509.37	511.46	581.52
Q50-45/LT	106.32	120.31	124.65	116.01	136.06	163.76	173.19	170.92	202.98	223.35	217.14	269.28	312.65	408.17	450.15	451.99	445.04
cutoff-55T	96.04	101.17	113.04	146.02	165.01	181.07	179.73	177.37	208.83	229.11	237.19	290.35	314.90	354.77	366.30	367.80	429.15
M50-40/LT	105.23	110.82	116.95	109.93	122.83	133.87	148.43	146.71	174.23	194.98	188.08	245.56	275.25	342.07	398.17	399.80	423.51
cutoff-60T	95.57	100.68	112.50	127.62	138.37	151.83	160.90	176.15	209.27	235.02	244.19	296.65	312.65	352.23	367.57	369.07	390.82
M50-45/LT	106.11	111.75	126.26	117.85	133.21	145.17	144.10	142.21	168.89	182.48	176.03	221.46	244.73	317.15	344.67	346.08	366.61
cutoff-50T	96.04	101.14	112.44	107.48	121.46	140.99	139.94	138.11	164.02	177.22	183.47	226.95	245.49	316.11	326.38	327.71	347.16

TABLE 5. Sharpe Ratios

This table presents the Sharpe ratios, the mean monthly return and the monthly standard deviations of all the buy-and hold strategies and the best 25 portfolio switching strategies in terms of highest terminal wealth as demonstrated in table 4. Monthly mean return data and standard deviation data are in percentage terms.

Buy-and-Hold strategies:

	T-bills	LTGvtBond	S&P 500	R1000G	R1000V	R2000G
Monthly Mean Return (%)	0.4724	0.9734	1.3616	1.3514	1.3228	0.9230
Standard Deviation (%)	0.1469	2.7595	4.3507	5.0461	4.1243	6.7037
Sharpe Ratio		**0.1816**	**0.2044**	**0.1742**	**0.2062**	**0.0672**

	R2000V	Russell-25%	R1000-50%	R2000-50%
Monthly Mean Return (%)	1.1160	1.1783	1.3371	1.0195
Standard Deviation (%)	4.5561	4.6646	4.3583	5.4276
Sharpe Ratio	**0.1413**	**0.1513**	**0.1984**	**0.1008**

Portfolio switching strategies:

	cut-35LgSg	cut-35LgLv	Q35-30/LM	cutoff-35Q	cutoff-35M	M35-30/LQ
Monthly Mean Return (%)	1.8552	1.8059	1.8016	1.7992	1.7983	1.7907
Standard Deviation (%)	4.9510	4.7978	4.8341	4.8277	4.8217	4.8168
Sharpe Ratio	**0.2793**	**0.2779**	**0.2750**	**0.2748**	**0.2750**	**0.2737**

	cut-35SgSv	Default	cutoff-30M	cut-30LgLv	cut-30LvSv	cutoff-30Q
Monthly Mean Return (%)	1.7926	1.7848	1.7848	1.7841	1.7773	1.7765
Standard Deviation (%)	4.9335	4.7994	4.7994	4.7974	4.7926	4.7904
Sharpe Ratio	**0.2676**	**0.2735**	**0.2735**	**0.2734**	**0.2723**	**0.2722**

	cut-30LgSg	cut-30SgSv	M35-30/LB	M35-30/LT	Q35-30/LB	Q35-30/LT
Monthly Mean Return (%)	1.7757	1.7689	1.7680	1.7638	1.7641	1.7520
Standard Deviation (%)	4.7886	4.7863	4.8020	4.7926	4.8200	4.8184
Sharpe Ratio	**0.2722**	**0.2709**	**0.2698**	**0.2695**	**0.2680**	**0.2656**

	cut-35LvSv	cutoff-30B	cutoff-30T	cutoff-35B	cutoff-35T	cut-45LgSg
Monthly Mean Return (%)	1.7433	1.7413	1.7293	1.6675	1.6547	1.6477
Standard Deviation (%)	4.7829	4.7824	4.7807	4.6735	4.6141	5.1358
Sharpe Ratio	**0.2657**	**0.2653**	**0.2629**	**0.2557**	**0.2562**	**0.2288**

	cut-45LgLv
Monthly Mean Return (%)	1.5908
Standard Deviation (%)	4.5994
Sharpe Ratio	**0.2432**

TABLE 6. Henriksson and Merton Market Timing Test Results

This table presents the Henriksson and Merton's (1981) market timing test results for the default strategy (Panel A) and the enhanced strategies (Panel B). Henriksson and Merton test statistics in Panel A and Panel B are not based on the same specifications. The p-stat in both panel is computed as p-stat = n1/N1 + n2/N2. The p-value is computed as in Park and Switzer (1996).

$$p-value = \sum_{x=n_1}^{\min(N_1,n)} \binom{N_1}{x}\binom{N_2}{n-x} / \binom{N}{n} \quad \text{where } N= N_1+N_2 \text{ and } n= n_1+ n_3$$

Panel A:

	Default
p-stat	1.2593
p-value	0.0024***

n1= number of times it was correct to go Growth, N1= number of times model says to go Growth, n2= number of times it was correct to go Value, N2 = number of times model says to go Value, n3= number of times it was incorrect to go growth.

Panel B:

	cut-35LgSg	cut-35LgLv	Q35-30/LM	cutoff-35Q	cutoff-35M	M35-30/LQ
p-stat	1.1858	1.2599	1.1858	1.1858	1.2228	1.2228
p-value	0.05457*	0.0101**	0.05457*	0.05457*	0.02494**	0.02494**

	cut-35SgSv	cutoff-30M	cut-30LgLv	cut-30LvSv	cutoff-30Q	cut-30LgSg
p-stat	1.0747	1.5871	1.5871	1.2537	1.5871	1.2537
p-value	0.2983	0.0734*	0.0734*	0.3756	0.0734*	0.3756

	cut-30SgSv	M35-30/LB	M35-30/LT	Q35-30/LB	Q35-30/LT	cut-35LvSv
p-stat	0.9204	1.1117	1.1488	1.0747	1.0747	1.2537
p-value	0.7986	0.1875	0.1066	0.2983	0.2983	0.3756

	cutoff-30B	cutoff-30T	cutoff-35B	cutoff-35T	cut-45LgSg	cut-45LgLv
p-stat	0.5871	0.5871	0.9266	0.8895	1.1412	1.1625
p-value	1.0000	1.0000	0.8253	0.9062	0.03048**	0.01459**

n1= number of times it was correct to go a 100% in one of the 4 Frank Russell indexes, N1= number of times model says to go a 100% in one of the 4 Frank Russell indexes, n2= number of times it was correct to spread the money in several indexes, to leave the money in the previous month index or not going with any of the Frank Russell indexes, N2= number of times model says to spread the money in several indexes, to leave the money in the previous month index or not going with any of the Frank Russell indexes, n3= number of times it was incorrect to go a 100% in one of the 4 Frank Russell indexes.

***, **, *, Denote statistical significance at the 1%, 5% and 10% levels, respectively.

TABLE 7. Portfolio Values and Transaction Costs

This table presents the portfolio values and the returns of the Buy-and-Hold strategies and the Portfolio Switching strategies after considering round-trip transaction costs of 50 bps. The "number of round-trip transactions" column contains sometimes none integer number since in some strategies, the portfolio do not require a 100% turnover every time. Annual Excess return are computed as the difference between the annualized return of the strategy after transaction costs and the best performing single style index buy-and-hold strategy (Russell 1000 Value Index).

	# of Round-tripTransa-ctions	Terminal Wealth before Transaction Costs in $	Terminal Wealth after Transaction Costs in $	Percentage drop due to Transac. costs	Monthly Average Return after Trans. Costs	Annualized Return after Transactions Costs	Annual Excess Return
Buy-and Hold strategies:							
T-bills	0	261.47	261.47	0.00%	0.47%	5.82%	-
LTGvtBond	17.5	669.03	662.83	0.93%	0.93%	11.77%	-
S&P 500	17.5	1301.43	1289.63	0.91%	1.26%	16.23%	-
R1000G	17.5	1192.34	1181.30	0.93%	1.22%	15.63%	-
R1000V	17.5	1227.61	1216.24	0.93%	1.23%	15.83%	-
R2000G	17.5	407.21	403.44	0.93%	0.69%	8.55%	-
R2000V	17.5	773.16	766.00	0.93%	1.00%	12.72%	-
Russell-25%	17.5	869.56	861.68	0.91%	1.06%	13.51%	-
R1000-50%	17.5	1237.50	1226.28	0.91%	1.24%	15.89%	-
R2000-50%	17.5	580.86	575.59	0.91%	0.86%	10.84%	-
Portfolio Switching strategies:							
cut-35LgSg	108	3322.06	2262.27	31.90%	1.54%	20.14%	4.31%
cut-35LgLv	102.5	3053.38	2116.09	30.70%	1.51%	19.67%	3.84%
Q35-30/LM	107.125	3016.34	2059.25	31.73%	1.49%	19.47%	3.64%
cutoff-35Q	107	3003.76	2048.10	31.82%	1.49%	19.44%	3.61%
cutoff-35M	93.5	3000.11	2113.21	29.56%	1.51%	19.66%	3.83%
M35-30/LQ	96	2956.28	2069.36	30.00%	1.50%	19.51%	3.68%
cut-35SgSv	112.5	2933.16	1960.27	33.17%	1.47%	19.13%	3.30%
Default	109.5	2926.43	1990.33	31.99%	1.48%	19.24%	3.41%
cutoff-30M	109.5	2926.43	1990.33	31.99%	1.48%	19.24%	3.41%
cut-30LgLv	110.5	2923.07	1998.04	31.65%	1.48%	19.26%	3.43%
cut-30LvSv	112	2884.59	1959.42	32.07%	1.47%	19.13%	3.30%
cutoff-30Q	112	2880.62	1957.96	32.03%	1.47%	19.12%	3.29%
cut-30LgSg	112	2876.54	1956.41	31.99%	1.47%	19.12%	3.28%
cut-30SgSv	113	2838.05	1922.99	32.24%	1.46%	18.99%	3.16%
M35-30/LB	95.5	2828.86	1977.68	30.09%	1.47%	19.19%	3.36%
M35-30/LT	94.5	2807.73	1977.71	29.56%	1.47%	19.19%	3.36%
Q35-30/LB	110.75	2801.20	1896.87	32.28%	1.45%	18.90%	3.07%
Q35-30/LT	107.75	2734.69	1865.79	31.77%	1.44%	18.78%	2.95%
cut-35LvSv	107	2696.23	1833.80	31.99%	1.44%	18.66%	2.83%
cutoff-30B	112.5	2686.37	1817.93	32.33%	1.43%	18.60%	2.77%
cutoff-30T	110.5	2622.58	1788.15	31.82%	1.42%	18.49%	2.66%
cutoff-35B	114.5	2341.00	1552.81	33.67%	1.35%	17.51%	1.68%
cutoff-35T	99.5	2294.04	1603.79	30.09%	1.37%	17.73%	1.90%
cut-45LgSg	92	2147.96	1576.87	26.59%	1.36%	17.61%	1.78%
cut-45LgLv	83.5	2017.40	1524.30	24.44%	1.34%	17.38%	1.55%

EXHIBIT 1. Trading Rules Description

This exhibit describes the mechanism of the different kind of portfolio switching strategies used in the study. While a probability level of 0.30 or 0.35 as been selected for illustrative purposes, the same procedure apply if a different cutoff probability is used.

Default	Invest a 100% of the portfolio in the index with the highest conditional probability, Prob (t+1)
cutoff-30Q	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest 25% in each of the Four Frank Russell Indexes.
cutoff-30M	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) leave a 100% of the portfolio invested in the same index as the previous month.
cutoff-30B	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest a 100% in the Long term Government Bond asset class.
cutoff-30T	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest a 100% in the 1 Month T-Bills asset class.
cut-30LgLv	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest 50% in both the Russell 1000 Growth index and the Russell 1000 Value Index .
cut-30LgSg	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest 50% in both the Russell 1000 Growth index and the Russell 2000 Growth Index .
cut-30LvSv	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest 50% in both the Russell 1000 Value index and the Russell 2000 Value Index .
cut-30SgSv	If (Probt+1 > 0.3) for one or more of the index, then invest 100% in the index with the highest conditional probability, else if (Prob t+1 ≤ 0.3) invest 50% in both the Russell 2000 Growth index and the Russell 2000 Value Index .
Q35-30/LM	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability invest 25% in each of the Four Frank Russell indexes, else if (Prob t+1 ≤ 0.3) invest 50% in both the Russell 2000 Growth index and the Russell 2000 Value Index .
Q35-30/LB	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability invest 25% in each of the Four Frank Russell indexes, else if (Prob t+1 ≤ 0.3) invest a 100% in the Long Trem Government Bond asset class .
Q35-30/LT	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability invest 25% in each of the Four Frank Russell indexes, else if (Prob t+1 ≤ 0.3) invest a 100% in the 1 Month T-Bills asset class .
M35-30/LQ	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability leave a 100% of the portfolio invested in the same index as the previous month, else if (Prob t+1 ≤ 0.3) invest 25% in each of the Four Frank Russell indexes.
M35-30/LB	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability leave a 100% of the portfolio invested in the same index as the previous month, else if (Prob t+1 ≤ 0.3) in the Long Trem Government Bond asset class.
M35-30/LT	If (Probt+1 > 0.35) for one or more of the index, then invest 100% in the index with the highest conditional probability, if (0.30 ≤Prob t+1 ≤ 0.35) for the highest conditional probability leave a 100% of the portfolio invested in the same index as the previous month, else if (Prob t+1 ≤ 0.3) invest a 100% in the 1 Month T-Bills asset class .