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Testing the Weak-form Efficiency of the Bulgarian Stock Market

Nikolay Angelov

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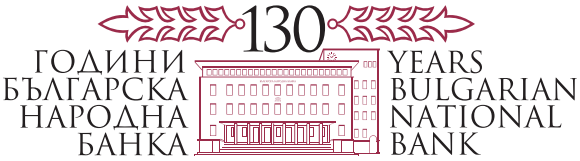
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Contents

SUMMARY. In this paper we test for the presence of weak-form efficiency in the Bulgarian stock market. Employing daily and weekly data for individual securities traded on the Bulgarian Stock Exchange, two artificial portfolios and the market index SOFIX, we apply statistical tests based on the estimated autocorrelation functions and the variances of the stock prices sampled at different frequencies. The random walk with drift model is not well supported over the entire sample period (October 2000 – November 2006). Furthermore and contrary to our initial expectations, the Bulgarian stock market is found closer to being efficient in the first sub-period of the sample (October 2000 – October 2003) than in the second one (October 2003 – November 2006). This suggests that no convergence towards weak-form efficiency occurred over the examined period, despite the increase in the number of listed securities, market capitalization and investors' interest. Additional evidence, coming from a comparison of the returns from trading based on filter rules and those from following a simple buy-and-hold approach, demonstrates that even if there are some inefficiencies present in the market, it is not so easy to convert them into abnormal profits.

Keywords: Efficient Markets hypothesis, Variance Ratios, Filter Rules;
JEL Classification: G14

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1. Introduction

The development of capital markets in transition and emerging market economies is a very important prerequisite for fostering their growth as it allows the available funds to be channeled easily to their best investment uses. An important question, in this respect, is how quickly the markets for capital in transition countries like Bulgaria can reach the stage of efficient functioning, so that the economies can fully benefit from their operation. There are several different dimensions to the concept of market efficiency. In this paper, we are going to focus on the one that concerns the asset price formation mechanism.

Market efficiency is a concept intimately related to the diffusion of information. More specifically, it concerns the mechanism according to which asset prices react to news and the speed with which the adjustment takes place. In a perfectly efficient market, the arrival of news should cause an instantaneous and full adjustment of the asset prices to their new *fair* values. In other words, the incorporation of the incoming information is so fast and accurate that no one is able to achieve abnormal profits by trading on the news flowing to the market. In such an environment, investors can not predict the future price movements and, therefore, should only expect to obtain a normal rate of return, corresponding to the risk profile of their portfolios.

The idea of market efficiency, defined above, differs in meaning from the concept of allocational efficiency also frequently attributed to the markets. The latter refers to the way scarce resources are distributed among competing uses and affects the overall increase in social welfare, resulting from the operation of the markets and the exchange among economic agents that takes place in them. The former, on the other hand, deals with the fairness of the asset prices at any point in time and the availability of profit opportunities stemming from improper price formation mechanisms.[1]

Why is the presence of market efficiency so important in reality? There are both theoretical and practical reasons for that. From theoretical point of view, the efficient markets hypothesis provides some of the assumptions upon which most of the asset pricing models are built. These include the "no arbitrage" argument and the random walk processes for the evolution of the prices of the underlying assets, conjectured by some derivatives pricing models. If, in reality, it turns out that markets are not efficient, then finance professionals will not be able to rely on the correctness of the asset prices derived from such models. Furthermore, new pricing models would have to

[1] Henceforth, when we say market efficiency we will refer to the aspect of it related to the asset price formation mechanism.

be developed to take into account the specific sort of inefficiency present in the financial market under investigation. From practical point of view, the violation of the market efficiency might imply the availability of (almost) riskless profit opportunities. They can be seized by devising a proper trading strategy which extracts signals from the incoming news to determine the right moment to buy/sell assets on the inefficient market.

In this paper, we focus on studying the efficiency of the Bulgarian capital market by using data for securities traded on the Bulgarian Stock Exchange. We look at the period from October 2000 to November 2006, when the market had in place already sufficient regulations and infrastructure to facilitate the trading activity. By choosing this period, we also aim to fill in the existing gap in the literature on the Bulgarian capital market and provide an opportunity for comparison with similar studies conducted for other transition economies.

We found Bulgarian Stock market to be an interesting object of investigation, because of two peculiarities it has: 1) it is quite young[2] and 2) it is rather small[3] in terms of both market capitalization and trading volumes. The relatively infant development stage of the Bulgarian Stock Exchange implies that the market microstructure may not have been built yet to a level sufficient to support the efficient price formation mechanism. This issue concerns both the way in which information is released to the market participants, and the way in which the trading activity is structured. The latter is crucial for the ability of the investors to react to news in their quest for abnormal returns. For example, as of the time of this writing, there was no possibility for short sales of stocks. If present, such opportunities would potentially allow market participants to take advantage of the incorrectly priced assets, to arbitrage away the price inconsistencies and thus to restore the equilibrium in the market.

The small size of the market implies that the frequency of trading with certain stocks may be relatively low and/or the traded volume too small. This may create substantial liquidity risks for those market participants who try to put in place trading strategies, based on technical or fundamental analysis. If such risks are present, the market may turn out to function in an inefficient way, because even if someone tries to take advantage of the presence of pricing inconsistencies he/she may not be able to do so, because of the low liquidity in the market.

[2]The trading of shares in Bulgaria after the collapse of the centrally planned economy started in the first-half of the 1990s. In its current form the stock market operates since late 1997.

[3]The total market capitalization of the various segments of the Bulgarian Stock Exchange as of March 2007 was about BGN 18.5 billion (EUR 9.5 billion).

These peculiar features of the Bulgarian Stock Market make the investigation of its efficiency quite an interesting and at the same time tricky endeavor. This is why we approach the issue cautiously and from two different angles. On the one hand, we apply statistical tests based on the estimated autocorrelation functions and the variances of the stock prices sampled at different frequencies, in order to test the validity of the random walk model of the evolution of asset prices. On the other hand, we attempt to establish the usefulness of some trading strategies in the quest for abnormal returns. This dual approach allows us to draw conclusions not only on the correctness of the efficient markets assumption in asset pricing models, but also on the possibility of market professionals to take advantage of market inefficiencies, should they be present.

The rest of the paper is structured as follows. Part 2 reviews the literature on financial market efficiency and presents some of the evidence for other transition economies. Part 3 describes the methodology employed in the paper and discusses the estimation procedures, while Part 4 explains the construction of the data set. Then, Part 5 presents in detail our empirical results and their implications for the validity of the efficient markets hypothesis. Finally, Part 6 concludes the discussion.

2. Literature Review

Undoubtedly, the efficiency of the capital markets is one of the most explored topics in the financial economics literature. Some of the earliest studies date back to the 1930s, with the main empirical contributions coming in the 1960s and 1970s (for a thorough review see, for example, Fama (1970) and (1991). As our interest in this paper is focused on a specific country – Bulgaria – we are only going to review the papers that provide the relevant statistical methodology and to summarize the empirical evidence for several other countries in Central and Eastern Europe.

Campbell, Lo and MacKinlay (1997) provide an excellent overview of the various approaches to testing market efficiency under different hypotheses for the evolution of the asset prices. They present empirical evidence for the (un)predictability of the asset returns at various frequencies, including not only tests with daily and weekly data, but also an investigation on the long-range dependence. We borrow their classification of random walks and employ the variance ratio tests defined in one of their earlier papers (Lo and MacKinlay (1988). For testing the profitability of trading strategies, based on technical analysis, we follow the approach of Fama and Blume (1966), which specifies a filter trading rule and compares its returns to those generated by a simple buy-and-hold strategy.

When it comes to studying the efficiency of the capital markets in our region of interest – Central and Eastern Europe – we should say that the literature is not so abundant, at least in terms of geographical coverage. Studies are available mainly on Russia and the three Baltic states (Lithuania, Latvia and Estonia). Yet, the variety of research methods used is quite wide, so we deem it worthwhile to review some of the good examples in the field.

Kvedras and Basdevant (2004) study the evolution of the capital markets in the Baltic states in the period from mid 1996 till late 2001. Seeking to establish the convergence towards market efficiency, the authors devise a time-varying version of the variance ratio test statistic, defined by Lo and MacKinlay (1988) and employ a Kalman filter model to estimate time-varying autocorrelation coefficients for the stock market indices of the three Baltic states. Using daily data on the indices LITIN (Lithuania), DJRSE (Latvia) and TALSE (Estonia) the authors find that the Lithuanian and Estonian stock markets exhibit pronounced trends towards market efficiency, while Latvia shows no clear pattern over the period.

The conclusions of Kvedaras and Basdevant (2004) are broadly supported by the findings of Mihailov and Linowski (2002). Instead of relying on statistical tests, however, they employ several trading rules based on technical analysis and estimate the relevant parameters (buy/sell indicators) using genetic algorithms. The results of such trading strategies are then compared to those of a simple buy-and-hold investment approach. Their sample consists of daily data on the RICI index (Riga Stock Exchange price index) and spans the period from November 1997 to January 2001. Using a variety of trading windows and other calibration parameters, the authors find evidence that trading strategies based on technical indicators can outperform the buy-and-hold strategy in a bearish market at low to moderate levels of transaction costs. However, the investment approach tested can not say which technical indicator should be used to consistently outperform the buy-and-hold rule, i.e. no adjustment for the ex-ante model risk is made in the comparison.

Moving to the evidence about Russia, we begin with a review of the findings of Abrosimova, Dissanaike and Linowski (2002). They employ classic statistical tests to assess the predictability of the RTS (Russian Trading System) Index returns at daily, weekly and monthly frequencies, hypothesizing a random walk with drift model. For the sample period from September 1995 till May 2001, the authors find some evidence of predictability of the daily and weekly returns. Yet, they conclude that the patterns unveiled are unlikely to allow the investors to devise a trading rule that consistently outperforms the market.

Hall and Urga (2002) devise a test for changing market efficiency based on time varying parameter model with GARCH–M structure of the residuals.

The sample features data on the two main indices of the Russian stock market – RTS and ASPGEN – for the period September 1995 to March 2000. The estimates obtained using Kalman filter technique reveal that the index of the most liquid Russian stocks (RTS) exhibits initial inefficiency patterns, but then in the course of a period of 2.5 years moves close to the state of efficiency. The results with the broader index ASPGEN demonstrate that the overall performance of the market remained predictable for most of the time and only towards the end of the period showed signs of improving efficiency.

The only paper studying the stock market efficiency in Bulgaria, of which we are aware, is Emerson, Hall and Zalewska–Mitura (1997). The authors employ a multi-factor model with time-varying coefficients and GARCH errors on a sample of weekly data for four shares covering the period between the first week of 1994 and the first week of 1996. In this early period of development of the Bulgarian stock market, the evidence obtained from their Kalman filter estimates suggests that the market undergoes three phases of development. In the first one, there are no clear signs of initial inefficiency just because the trading is very thin and very little information is available. In the second phase, when the market volumes increase, patterns of inefficiency appear and then get quickly reduced during the third phase. Our paper aims to provide further evidence about Bulgaria, by examining the efficiency of the Bulgarian stock market in a later stage of its development, when new legislation governs the trading and more securities and investors are present in the market.

3. Methodology

Any procedure for testing the efficiency of a given financial market requires two prerequisites: 1) specification of the information set, with respect to which the efficient functioning of the market will be tested; and 2) specification of a model for the evolution of the asset prices under the efficient markets hypothesis. For the purposes of our study we define these two as follows. We consider the information set that includes only the history of asset prices or the corresponding returns, i.e. we aim to examine the weak-form *efficiency*[4] of the Bulgarian stock market. We conjecture that if the market is efficient the asset prices should evolve according to the random walk with drift model, specified in Eq. (1):

[4] There are two other frequently mentioned information sets when it comes to testing market efficiency: 1) the set of all relevant *publicly* available information, which relates to the *Semi-strong form efficiency* of the financial markets; and 2) the set of all information known to *any* market partici pant, which relates to the *Strong form* of the efficient markets hypothesis.

$$p_t = \mu + p_{t-1} + \varepsilon_t \quad (1)$$

Where:

p_{t-1} – is the natural logarithm of the last observed price of the asset, sampled at daily, weekly, or other appropriate frequency;[5]

μ – is the drift term, which essentially measures the expected rate of return on the asset between time *t-1* and *t*;

ε_t – is a stochastic disturbance term, which incorporates the influence on the asset price of news arriving between time t-1 and t.

Depending on the specification of the stochastic term ε_t we distinguish three types of random walk, defined as follows:[6]

– *Random Walk 1 (RW1):* $\varepsilon_t \sim$ IID $(0, \sigma^2)$. This type of random walk features disturbance terms that are independently and identically distributed (IID). This assumption is very conservative when it comes to financial markets with very long history and many changes in the economic and institutional environment. Yet, for recently established stock markets like the Bulgarian one, it may not be completely implausible and hence is worth testing. This is why we devote some attention to it;

– *Random Walk 2 (RW2):* $\varepsilon_t \sim$ INID (independently and not identically distributed disturbance terms). Here the assumption of identically distributed disturbances of the RW1 model is relaxed to allow for a more general evolution of the asset prices, featuring changing volatility or even different underlying distributions from which ε_t is drawn at different dates. In general, testing for the validity of this model is very difficult due to the large number of processes that could fall under the null hypothesis. This is why, we do not attempt to test for RW2 in our paper and list it here only for completeness;

– *Random Walk 3 (RW3):* $\text{cov}(\varepsilon_t, \varepsilon_{t-k}) = 0$, for all $k \neq 0$. This is the most general version of the random walk process, in which even the independence assumption is relaxed to the extent that the disturbances ε_t are required only to be uncorrelated, i.e. linearly independent. Yet, this type of random walk does not exclude the possibility of correlation between non-linear functions of ε_t, and ε_{t-k}.

Having specified the setup under which we are going to test the efficiency of the Bulgarian stock market, we proceed by examining the test procedures that we employ. In our attempt to provide evidence from several

[5] Random walk processes are not usually specified in the natural logarithm of the variable, rather in the variable itself. In this case, the natural logarithm is necessary to avoid the small yet existing probability to observe negative asset prices when the support of the underlying distribution of ε_t is defined from $-\infty$ to $+\infty$.

[6] For a more detailed description see Campbell, J.Y., A.W. Lo and A. C. MacKinley, The Econometrics of Financial Markets, 1997, Princeton University Press, pp. 31–33, whose classification we borrow here.

different viewpoints, we take two different routes. The first one encompasses a battery of statistical tests for the validity of the random walk models defined above. The two relevant types of testing procedure that we put to use here are: 1) autocorrelation functions[7] together with tests based on them (e.g. Box–Pierce Portmanteau test), and 2) variance ratio tests. The second route we take is more practical as it tries to find ways for realizing superior returns by following certain trading strategies. We do so by employing filter rules to test whether one can obtain returns better than those of a simple buy-and-hold strategy.

The two groups of testing approaches outlined above are very different in nature. The tests based on autocorrelations and variance ratios have the random walk model as their null hypothesis. Consequently, if these tests fail to reject the null hypothesis, they will provide direct evidence for the correctness of the random walk assumption for the evolution of the asset prices. Unlike that, the filter rules are deviced with the underlying conjecture that the asset prices evolve according to a complicated non-linear model, i.e. the null hypothesis is that the market is not efficient. Hence, if this trading approach fails to provide superior returns, this will not necessarily imply that the market is efficient, rather that this specific null hypothesis is not supported by the data.

Clearly, using these two groups of tests in conjunction will allow us to gain better insight into the nature of the process underlying the evolution of the stock prices and to draw better implications for trading. We examine the mechanics behind the variance ratios and the filter rules below.

3.1. Variance Ratios

Under the random walk hypotheses, which we conjectured for the evolution of the securities prices, the variance of the continuously compounded asset returns should grow linearly with time. This means that the variance of the asset returns estimated over n-period intervals should be equal to n-times the variance of the 1-period asset returns. On the basis of this observation, Lo and MacKinlay (1998) define the following general variance ratio:

$$VR(q) \equiv \frac{Var[r_t(q)]}{q.Var[r_t]} = 1 + 2\sum_{k=1}^{q-1}(1-\frac{k}{q})\rho(k) \qquad (2)$$

[7] The methodology for the calculation of autocovariances is described in Appendix 3.

Where: $r_t(k) \equiv r_t + r_{t-1} + ... + r_{t-k+1}$

$\rho(k)$ – is the k-th order autocorrelation coefficient of the sequence of returns $\{r_t\}$;

The formula shows that the variance ratio is a linear function of the first *q-1* autocorrelations of the sequence of returns $\{r_t\}$. Hence, if the returns of a particular asset are not autocorrelated, as implied by the random walk model, the variance ratio should have a value of 1. Campbell, Lo and MacKinlay (1997) specify the ways to estimate the variance ratios under the RW1 and RW3 null hypotheses and present the corresponding test statistics, which we borrow for the purposes of the present study.[8]

3.2. Filter rules

In order to test the presence of weak-form market efficiency in the Bulgarian Stock Exchange from a practical perspective, we employ the *x* per cent filter rule of Sydney S. Alexander.[9] He devised his data filtering approach starting from the assumption that stock prices may adjust only gradually to news arriving to the market.

> The professional analysts operate in the belief that there exist certain trend generating facts, knowable today, that will guide a speculator to profit if only he can read them correctly. These facts are assumed to generate trends rather than instantaneous jumps because most of those trading in speculative markets have imperfect knowledge of these facts, and the future trend of price will result from a gradual spread of awareness of these facts throughout the market [Alexander (1961), p. 7].

The *x* per cent filter rule of Alexander is defined as follows: "If the daily closing price of a particular security moves up at least *x* per cent, buy and hold the security until its price moves down at least *x* per cent from a subsequent high, at which time simultaneously sell and go short. The short position is maintained until the daily closing price rises at least x percent above a subsequent low, at which time one covers and buys. Moves less than *x* per cent in either direction are ignored" (Fama and Blume (1966), pp. 227–228). In simpler words, the idea of Alexander is to filter the trends (price movements exceeding the filter value) from the noise (price movements not exceeding the filter value), believing that once a trend appears it will be present for a while, before prices settle or start to move in the opposite direction. If such filter is to work, there must be certain degree of persistence (positive dependence) in the stock price movements, instead of the independence implied by the random walk model.

[8] The test statistics were originally defined by Lo and MacKinlay (1988). The formulas and sampling distributions are summarized in Appendix 2.

[9] See Alexander (1961) and Alexander (1964).

In this paper, we use the *x* per cent filter rule calculations as described in Fama and Blume (1966). We employ 24 different filter values, which allows us to figure out what is the dependence of the filter performance on the value of the filter. The readers interested in the mechanics of the calculations and the relevant formulas should refer to that paper (pp. 232–233).

4. Data description

The recent history of the capital market in Bulgaria began in 1991, shortly after the democratic reforms. Initially the market was quite chaotic, with no prompt regulations in place and very few traded securities. In its current version, the Bulgarian Stock Exchange was launched in October 1997 with two sub-markets – official and unofficial one. The first companies to be listed were those that were mass-privatized. Later to them were added also the mass privatization funds, after they have been converted into holding companies.

For the purpose of testing the efficiency of the Bulgarian capital market, we use a sample containing individual stocks traded on the Bulgarian Stock Exchange, two portfolios made up of these stocks with different weights and the market index SOFIX. The latter was introduced on October 20, 2000 with base value of 100 and during most of its existence included 12 to 14 securities weighted by their market capitalization and meeting certain requirements about market capitalization, free float, minimum number of investors, as well as frequency and volume of trading.[10]

All the data used in the present study were downloaded from the data base of the Bulgarian Stock Exchange, freely accessible through its web-site. The time series stored there were adjusted for dividend payments, splits and dilution after capital increases. On the one hand, this adjustment of the data facilitates better estimation of test statistics, as it helps us to capture better the underlying price evolution process. On the other hand, it limits the quality of the inference as it does not allow proper evaluation of the performance of trading rules based on actually observed prices.

Despite the fact that data were available for the period since the beginning of 1998, we decided to use a sample spanning the period from October 20, 2000 to November 23, 2006. The initial date of the sample was chosen to coincide with the introduction of SOFIX, in order to make our results internally consistent[11] and at the same time to keep them comparable

[10] For more details about the calculation of Sofix, the criteria for inclusion of companies and its current members please refer to the web-site of the Bulgarian Stock Exchange at: www.bse-sofia.bg

[11] By internally consistent, we mean results that are based on the same sample period for the individual stocks and the market index.

to those of other studies that use only market indices. In addition to that, by selecting a later starting date, we tried to alleviate the influence of two problems peculiar to stock markets in the early stages of their existence: low trading volumes and infrequent trading. The first one is, anyway, impossible to tackle, while the second one can be somehow overcome. Unfortunately, it was not possible to get completely rid of these two market phenomena and still have long and wide enough sample.

While selecting our sample, we took two steps to alleviate the influence of the infrequent trading problem: 1) carefully selecting only stocks that are traded frequently enough (with as few missing values as possible); 2) using two alternative methodologies to impute missing values and then studied the sensitivity of the estimation results to the imputation method used. Another alternative was to employ a statistical data correction approach like the one suggested, in Miller, Muthuswamy, and Whaley (1994). To correct for the effects of thin trading, they suggest the estimation of a moving average model that reflects the number of non-trading days and then adjusting the returns accordingly. However, given the difficulties in identifying the non-trading days, Miller, et al. showed that an equivalent approach is to estimate an AR(1) model of the form:

$$r_t = a_1 + a_2 r_{t-1} + \varepsilon_t$$

and then calculating the adjusted returns using the following formula:

$$r_t^{adj} = \frac{\hat{\varepsilon}}{(1-a_2)}$$

We decided not to correct our data using such an approach, in order to ensure that the results from the test statistics that we estimate are comparable to those obtained from the filter rule techniques, which require the estimation to be performed with the actually observed data.

In order to get better understanding of how the market efficiency evolved over time, we defined two sub-periods in our time series sample. The first one includes the observations taken between Octover 20, 2000 and October 20, 2003, a period characterized with both bullish and bearish phases. The second period spans the rest of the sample (observations taken between October 21, 2003 and November 23, 2006) and is characterized by pronounced upward trend and annual growth rates in excess of 40 percent. This devision of the sample into sub-periods is quite arbitrary, with the main idea being to consider time horizons of roughly equal length. We calculated all test statistics for both the whole period and for each of its two sub-periods.

After performing our sample selection procedure, we were left with time series for the prices of 11 individual stocks and the values of the market index

SOFIX.[12] We calculated the continuously compounded returns at daily and weekly frequency for each of these 12 price series. In addition to that, we constructed two portfolios: one that has initial weights based on the market cap of the 11 stocks in the beginning of the sample period (October 23, 2000) and another one with equal initial weights. With these 14 time series we performed all the calculations described in the following section.

5. Estimation results

5.1. Autocorrelation function analysis with daily and weekly data

We begin with an analysis of the estimated autocorrelation functions and the corresponding Box – Pierce Q-statistics for daily and weekly stock returns for our set of 11 individual stocks, one stock market index and two portfolios.[13] Table 1 presents the estimates with daily data for the whole sample period October 20, 2000 – November 23, 2006, together with results for its two sub-periods. The reported first-order autocorrelation coefficients $\rho(1)$ for SOFIX, the equally-weighted and the market capitalization weighted portfolios, over the whole period are –9.1 per cent, 12.8 per cent and 5.2 per cent, respectively. Under the RW1 hypothesis, the asymptotic distribution of $\rho(1)$ is normal with mean 0 and standard deviation $1/\sqrt{T}$, which for a sample of 1525 observations implies a standard error of the estimates of 2.56 per cent. This means that at the 95 per cent confidence level, we have statistically significant estimates of non-zero autocorrelations for SOFIX and the equally-weighted portfolio, with the market capitalization weighted portfolio being on the margin. For the individual stocks the results are a bit more in favour of the efficient markets hypothesis, with only two first order autocorrelations out of eleven, exceeding in absolute value the level of 7.5 per cent. Three more interesting findings are worth noting: 1) 6 out of the 14 time series exhibit sign reversals, i.e. the sign of $\rho(1)$ in the first sub-period differs from the one in the second sub-period; 2) in 9 of the 14 cases, $\rho(1)$ for the second sub-period exceeds the one for the first sub-period, which suggests that there is no movement towards market efficiency; 3) it is not uncommon for the time-series to exhibit significant higher-order autocorrelations. The latter finding is supported by the values of the Box – Pierce Q-statistics. For 11 of the 14 series, the test statistics with 4, 8 and 12 autocorrelations estimated over the

[12] For complete description of the sample selection process we used please refer to Appendix 2.
[13] A summary of the results analyzed in this section is presented in Table 7.

whole sample period are statistically significant at the 5 per cent level.

Moving to the estimates with weekly data (see Table 2), we observe that the first-order autocorrelations for SOFIX, the equally-weighted and the market capitalization weighted portfolios stand at – 8.6 per cent, 20.9 per cent and 10.0 per cent respectively. The relevant standard error of the estimates that we need to use here for a sample of 307 observations is 5.71 per cent, which means that only one of these three autocorrelations is significantly different from zero. Out of the 11 individual stocks, we have 5 with $\rho(1)$ exceeding 10 per cent and 6 with sign reversals in the second sub-period as compared to the first one. The Q-statistic estimated with 4 autocorrelations over the whole sample period is statistically significant in only 5 of the cases versus 11 with daily data, but when the number of autocorrelations is increased to 8 and 12, we have respectively 8 and 10 cases with significant Box–Pierce statistic. This last finding suggests the presence of significant higher-order autocorrelations in some of the time series, which is not in-line with the efficient markets hypothesis. Further support for such a conclusion comes from the observation that there are at least 4 individual securities (ALBHL, PET, AFH and ALB), for which $\rho(1)$ is large and positive (negative) in the first sub-period, large and negative (positive) in the second sub-period, but very close to 0 over the whole sample period. Such patterns indicate that the autocorrelations functions are quite unstable over time and that the inference is sensitive to the period under consideration. In order to examine these findings in more detail, we continue with the variance ratio tests under RW1 and RW3 null hypotheses.

5.2. Variance ratio tests with daily and weekly data

The variance ratios estimated under the RW1 hypothesis with daily data, and with 2, 4, 8, 12 and 16 autocorrelations are presented in Table 3. Over the whole period, SOFIX tends to reject the null hypothesis only for the version of the variance ratio with 2 and 4 autocorrelations. The value of the ratio is below 1, which is due to the presence of negative first and third order serial correlation. On the other hand, the two portfolios in our sample exhibit variance ratio values of above 1, with those for the equally–weighted portfolio consistently higher than those for the market capitalization weighted portfolio. In both cases, however, the RW1 hypothesis is rejected. When it comes to the individual stocks, there is only 1 security (SFARM), which consistently exhibits behavior in line with the RW1 model. For the other securities, we observe mixed patterns across sub-periods and number of autocorrelations, included in the test statistic. For the whole sample, the

variance ratios are significantly different from 1 in 6 to 8 of the 14 time series, depending on the number of the autocorrelations used in estimating the test statistic.

The results for the same version of the variance ratio, but with weekly data shed slightly different light on the validity of the RW1 model in the Bulgarian Stock market (see Table 4). The estimates for SOFIX fail to reject the null hypothesis even in a single occasion, although the values of the variance ratios vary substantially across the sub-periods of our sample. As in the case with daily data, the null hypothesis is consistently rejected for the two portfolios, especially when more autocorrelations are used in the estimation. Overall, the RW1 is not supported in 4 to 7 of the 14 time series we study, which is less than the case with daily data. One more fact is worth noting: the variance ratios tend to be significantly different from 1 more often in the second sub-period than in the first one. This finding runs contrary to the conjecture that as the Bulgarian stock market gets more developed it should come closer to being weak form efficient. Let's not forget, however, that the RW1 model is quite restrictive and hence less likely to be supported by the data coming from a young and small market, like the Bulgarian one. This is why, we need to examine and put more emphasis on the evidence coming from the variance ratios computed under the RW3 null hypothesis. We analyze these in turn.[14]

With daily data, the variance ratio estimates for SOFIX under the RW3 model exhibit quite a peculiar pattern (see Table 5). The values of the ratio in the first sub-period are strictly below 0.9 and the null hypothesis is never rejected. When we consider the second sub-period, however, we find variance ratio values of above 1.2, with the RW3 model rejected in all of the cases (with 2, 4, 8, 12 and 16 autocorrelations). Even more interestingly, for the whole sample period the values of the ratio gravitate around 0.9 and again, as in the first sub-period, the RW3 model is not rejected even in a single occasion. The two portfolios in our sample exhibit a very different behavior. The values of the variance ratio for them is consistently above 1 across sub-periods and number of included autocorrelations and the null hypothesis is rejected in almost all cases, except for those with 2 autocorrelations for the market capitalization weighed portfolio. When it comes to the individual securities, the null hypothesis is rejected less often than in the case of the RW1 model. Furthermore, there are at least six securities (ALB, GAMZA, AFH, PET, SFARM and IHLBL), which clearly exhibit

[14] A summary of the results analyzed in this section is presented in Table 8.

behavior entirely in line with the RW3 hypothesis. Over the whole sample period, the weak-form market efficiency hypothesis is not confirmed in 3 to 6 of the 14 time series (depending on the number of autocorrelations used in the test statistic), however, we observe again that in the early period of our sample, the RW3 model is rejected considerably less often in the later period.

Moving on to the weekly data (see Table 6), we find similar patterns with certain qualifications, which we will address. SOFIX again exhibits different behavior in the earlier sub-period relative to the later one, but unlike the case with daily data, this time the RW3 model is not rejected even in a single occasion. The equally-weighted portfolio again runs contrary to the weak-form efficient behavior, while the market capitalization weighted portfolio frequently tends not to reject the null hypothesis when the variance ratios are estimated with smaller number of autocorrelations. The individual securities tend to lend strong support to the weak-form efficient price formation mechanism, especially in the period from late 2000 to late 2003, when there is not even a single security that rejects the RW3 model.

It is really challenging to provide a good explanation for this result. Conceivably, part of it may be attributed to the imputation of a lot of missing values in the first sub-period with the resulting modification on the true, yet unobserved price formation process. Indeed when we compare the results for the two different methods that we use for imputing missing values, we find that the results are mostly sensitive in the first part of our sample. Even taking that into account, however, the RW model is still rejected more frequently in the second sub-period. So, there must be other factors at play.

Lastly and before we go to the filter rules, we need to mention that in Appendix 4 we present the estimates of the autocorrelation functions and variance ratios for daily and weekly returns, obtained using the data set with linear interpolation of the missing values. Without going into details, we should say that our original conjecture that linear interpolation tends to reinforce the autocorrelations was confirmed and therefore we found more often rejection of the efficient markets hypothesis than in the case when we imputed the last observed price to fill in the missing price observations.

5.3. Filter rules (x per cent filter)

In this sub-section, we present a different sort of evidence regarding the validity of the efficient markets hypothesis in the Bulgarian Stock Exchange. We leave the statistical tests aside and try to establish whether one could achieve returns superior to those of a buy-and-hold strategy by using a filter trading rule. For the purpose of carrying our calculations, we use only the sample with daily observations, in which the missing values have been

substituted by the last observed value.[15] We employ twenty-four different filter values, ranging from 0.5 per cent to 50 per cent.[16] For each filter value and security in our sample, we calculate the annualized rate of return that would have been achieved if the filter rule were applied and then compare it to the annualized return over the same period of a buy-and-hold strategy. The results of these estimations under the assumption of zero transaction costs (brokerage fees and fees to the stock exchange) for the period, when the positions were open under the various filter values, are reported in Table 9.

Two conclusions can be easily made from examining the results. First, it is apparent that the filter rule technique had very limited ability to outperform the buy-and-hold strategy throughout our sample period. Out of the 207 cases examined[17] the filter rule approach generated superior returns in only 23. Second and more important from investors' viewpoint, our filter rule tended to generate quite often negative returns and this happened throughout the whole range of filter values. The main reason for such a result is the bullish market during most of the sample period,[18] which made it extremely tricky to realize positive returns on short positions.[19] Another interesting observation is related to the result that there was not a single filter value to clearly dominate all other values. In our case, there were four filter values (0.015, 0.02, 0.07 and 0.14), which generated superior returns for two (out of the eleven) securities. Fifteen filter values generated superior returns for a single security, while the remaining five values completely failed to outperform the buy-and-hold strategy. This finding implies the presence of certain risk for the investors in choosing, which filter value to use if they decide to follow this trading strategy. Of course, it is reasonable to expect (and this conjecture is confirmed by our results) that when transaction costs are taken into account the filter values that provide the highest total return

[15] In this way, we ensure that the imputation of values does not trigger trading under any of the filter rules, i.e. no transaction can take place in a day when there was no actual trading with the particular security.

[16] We use the same filter values as in Fama and Blume (1966) to allow comparability of the results.

[17] In principle the total number of cases is 264 (11 securities x 24 filter values per security), but for some of the high filter values there were no transactions completed and hence no returns could be calculated and compared.

[18] The average annual returns of the market index SOFIX in most of the years in our sample was close to 40 percent.

[19] To provide further support to this conclusion, we need to say that for two of the securities in our sample (SFARM and AFH) and for several filter values, we run into a situation, in which the loss on a single short position exceeded 100 percent (when this happened we could not calculate compounded return for the transaction and concluded that the buy-and-hold strategy is superior).

should lie in the middle range (between 5 and 20 per cent).[20] This is due to the ability of such filter values to ensure that: 1) the first position is entered into early enough; 2) the investor does not need to trade too often and hence can save on transaction costs.

In order to gain further insight, we compare the average returns per security for all filter values, presented in Table 10. The key finding here is that short positions consistently generate negative average annualized returns. This, however, is only simulated evidence as short sales are actually not allowed on the Bulgarian Stock Exchange and hence could not influence the price processes that we actually observed over our sample period. This is why, it is a lot more relevant for us to use the breakdown of returns in Table 10, to figure out whether the filter rule technique provides good signals for entering into long positions. The evidence in this respect is somewhat ambiguous. The average annualized returns from taking long positions for 4 of the securities exceed those from following a buy-and-hold investment strategy and in the cases of ALBHL, PETHL and BHC the difference is rather substantial. For the other 7 securities, however, the opposite situation prevails. Furthermore, the performance of the filter rules differs markedly across individual securities. For example, there are 5 securities in our sample for which none of the 24 filter values yields superior returns to those of a buy-and-hold strategy. On the other hand, 21 of the 23 filter rules, superior to those from the buy-and-hold strategy, pertain to only 3 securities[21] (13 to BHC, 4 to PETHL and 4 to GAMZA). So, it turns out that the filter rules either work superbly for a specific security or do not work at all. This result, obviously, lends evidence neither in favor of the efficient markets hypothesis, nor against it.

Lastly, we examine the average performance for each of our 24 filter values. The upper panel of Table 11 presents the estimation results not corrected for transaction costs, while the lower panel contains results computed under the assumption of 0.5 per cent cost incurred in each transaction. Here, the inability of the filter rule technique to outperform the buy-and-hold approach becomes even more evident. There is only one filter value (0.50) with average return across the 11 securities higher than the

[20] For example, with 0.5 percent transaction costs introduced into the calculations the number of cases in which the filter rule outperforms the buy-and-hold strategy drops from 23 to 9, with 8 of the cases produced by filter values in the range from 0.07 to 0.18.

[21] We tried to figure out whether the performance of the filter rule has anything to do with the number of missing values (i.e. the number of days with non-trading) for each individual security. BHC has, for example, 367 missing values or 24.1 percent of all observations and is the security in our sample with the highest number of missing values. The other two securities, PETHL and GAMZA, are in the opposite extreme with only 18 and 140 missing values, respectively (1.2 percent and 9.2 percent of all observations). Hence, we do not find convincing evidence that relates the frequency of trading to the performance of the trading rules.

respective value for the buy-and-hold approach. This number grows to 5 when we take the average return for the long positions only. Yet, it is worth noting that only half of the filter values produce positive average returns, with none of the filter values being below 0.05. This confirms once more the idea that the best filter values are in the middle range (in this case from 0.07 to 0.16) regardless of whether we take into account the transaction costs.

6. Conclusion

In this paper, we tried to examine the degree to which a young and small capital market, the one in Bulgaria, was close to being weak-form efficient during the period from late 2000 to late 2006. Using daily and weekly data for a set of individual securities, a market index and two artificially constructed portfolios, we discovered that standard statistical tests do not entirely support the random walk model for the evolution of stock prices. More specifically, we found significant first and higher order autocorrelations in the asset returns, with the pattern more pronounced for daily than for weekly data. Furthermore, there were several cases of significant first order autocorrelation coefficients that change sign in the second sub-period of our sample with respect to the first one. This suggests variability in the serial correlation functions, which deserves further investigation, perhaps with a Kalman filter model, which captures time variation in the underlying parameters.

Estimates of variance ratios under the RW1 and RW3 null hypotheses also revealed certain departures from the random walk with drift model. As expected, the number of rejections under the RW3 hypothesis was somewhat smaller, lending certain support to the conjecture that in broad terms the market was not so far away from being efficient. Interestingly enough, the test statistics revealed that the random walk hypothesis was rejected less often for the individual securities than for the market index SOFIX and the two artificial portfolios. Unfortunately, we could not compare this result to those obtained in similar studies for other transition countries, as the other studies used data on either market indices or on individual stocks only.

Our most surprising finding, however, was that the degree of weak form efficiency of the Bulgarian Stock Exchange was higher in the earlier sub-period (from October 2000 till October 2003), i.e. it seems that the market diverged from the state of efficiency instead of converging to it. Yet, even if that was the case, we could not find a filter rule approach to generate profits superior to those of a simple buy-and-hold strategy. In other words, the lack of support for the random walk model does not necessarily imply the inefficiency of the price formation mechanism of the Bulgarian Stock Exchange.

APPENDICES

APPENDIX 1

Table 1

AUTOCORRELATIONS AND BOX-PIERCE Q-STATISTIC FOR DAILY STOCK RETURNS (P-VALUES IN PARENTHESES)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
ALBHL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.028	-0.084	-0.086	0.020	-0.024	11.55	13.87	15.45
						(0.021)	(0.085)	(0.218)		
Oct 21, 2003 - Nov 23, 2006	776	0.002	0.022	0.146	0.143	0.099	-0.061	42.98	51.88	53.53
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.025	0.005	0.002	0.050	-0.037	6.04	11.89	13.76
								(0.196)	(0.156)	(0.316)
IHLBL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.029	-0.097	0.120	-0.053	0.076	24.22	26.82	29.55
								(0.000)	(0.001)	(0.003)
Oct 21, 2003 – Nov 23, 2006	776	0.003	0.030	-0.011	0.113	-0.049	0.091	18.30	39.22	51.07
								(0.001)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.030	-0.058	0.113	-0.064	0.097	45.07	59.41	67.96
								(0.000)	(0.000)	(0.000)
PETHL										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.020	-0.018	0.121	0.085	0.004	16.61	22.97	23.28
								(0.002)	(0.003)	(0.025)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.029	0.157	0.089	0.084	0.033	31.58	41.73	42.11
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.025	0.111	0.108	0.082	0.012	47.05	64.32	64.94
								(0.000)	(0.000)	(0.000)
DOVUHL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.037	-0.094	-0.144	0.010	0.010	22.31	23.37	34.00
								(0.000)	(0.003)	(0.001)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.026	0.157	0.085	0.025	0.023	25.60	28.57	31.90
								(0.000)	(0.000)	(0.001)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.032	-0.006	-0.064	0.015	0.013	6.94	7.43	14.37
								(0.139)	(0.491)	(0.278)
SFARM										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.075	-0.003	0.007	-0.007	-0.099	7.43	8.31	9.85
								(0.115)	(0.403)	(0.629)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.017	-0.056	0.043	-0.044	-0.037	6.41	18.50	21.99
								(0.171)	(0.018)	(0.038)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.054	-0.005	0.009	-0.008	-0.096	14.24	16.12	19.12
								(0.007)	(0.041)	(0.086)
LEV										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.017	-0.126	-0.063	-0.011	-0.143	30.24	39.28	48.65
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.014	-0.246	0.064	-0.040	0.044	52.95	55.14	57.23
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.016	-0.176	-0.011	-0.030	-0.060	54.25	63.78	69.32
								(0.000)	(0.000)	(0.000)
PET										
Oct 23, 2000 – Oct 20, 2003	749	0.004	0.049	-0.038	0.040	0.166	-0.024	23.28	28.36	33.41
								(0.000)	(0.000)	(0.001)
Oct 21, 2003 – Nov 23, 2006	776	0.000	0.027	-0.190	-0.003	-0.021	-0.020	28.81	30.69	33.50
								(0.000)	(0.000)	(0.001)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.039	-0.073	0.032	0.121	-0.021	32.77	38.15	43.56
AFH										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.046	-0.015	0.041	-0.024	-0.028	2.43	34.11	42.47
								(0.657)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.033	-0.109	0.032	0.141	0.056	27.86	37.89	45.78
								(0.000)	(0.000)	(0.000)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	$\rho 1$	ρ2	ρ3	ρ4	Q4	Q8	Q12
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.040	-0.047	0.039	0.034	0.002	7.38	23.00	31.34
								(0.117)	(0.003)	(0.002)
GAMZA										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.033	-0.059	-0.084	-0.080	-0.048	14.38	19.17	23.73
								(0.006)	(0.014)	(0.022)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.032	0.034	-0.014	-0.046	0.002	2.66	9.55	12.08
								(0.616)	(0.298)	(0.439)
Oct 23, 2000 – Nov 23, 2006	1525	0.000	0.032	-0.013	-0.049	-0.062	-0.023	10.57	16.19	22.36
								(0.032)	(0.040)	(0.034)
ALB										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.023	-0.065	-0.145	0.010	-0.002	18.94	21.70	26.00
								(0.001)	(0.005)	(0.011)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.018	-0.057	0.043	0.091	-0.030	11.09	38.31	45.24
								(0.026)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.020	-0.062	-0.073	0.041	-0.013	16.68	28.47	34.31
								(0.002)	(0.000)	(0.001)
BHC										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.060	0.074	0.038	0.055	0.049	9.26	22.80	31.14
								(0.055)	(0.004)	(0.002)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.036	-0.027	0.005	0.075	0.061	7.76	8.71	17.11
								(0.101)	(0.368)	(0.145)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.049	0.047	0.030	0.060	0.052	14.34	26.56	40.83
								(0.006)	(0.001)	(0.000)
SOFIX										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.026	-0.131	0.045	-0.054	-0.004	16.50	22.56	35.74
								(0.002)	(0.004)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.009	0.202	0.102	-0.004	0.055	42.12	51.95	61.89
								(0.000)	(0.000)	(0.000)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.019	-0.091	0.052	-0.048	0.004	20.19	29.51	46.12
								(0.000)	(0.000)	(0.000)
Equally-weighted portfolio										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.015	0.063	0.051	0.092	0.063	14.23	28.89	31.68
								(0.007)	(0.000)	(0.002)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.014	0.198	0.174	0.069	0.052	59.74	79.99	80.43
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.014	0.128	0.109	0.081	0.057	57.99	86.24	87.77
								(0.000)	(0.000)	(0.000)
MarketCap-weighted portfolio										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.018	0.069	0.083	0.105	0.041	18.12	23.58	25.73
								(0.001)	(0.003)	(0.012)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.014	0.022	0.096	0.024	0.019	8.28	18.29	18.48
								(0.082)	(0.019)	(0.102)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.016	0.052	0.088	0.075	0.033	26.18	34.71	36.35
								(0.000)	(0.000)	(0.000)

Table 2

AUTOCORRELATIONS AND BOX-PIERCE Q-STATISTIC FOR WEEKLY STOCK RETURNS (P-VALUES IN PARENTHESES)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
ALBHL										
Oct 24, 2000 – Oct 21, 2003	149	0.006	0.057	-0.078	0.000	-0.033	0.131	3.62	10.15	18.95
								(0.460)	(0.254)	(0.090)
Oct 22, 2003 – Nov 21, 2006	158	0.010	0.060	0.077	0.131	-0.038	0.134	6.71	27.07	33.44
								(0.152)	(0.001)	(0.001)
Oct 24, 2000 – Nov 21, 2006	307	0.008	0.059	0.006	0.069	-0.036	0.134	7.37	28.53	37.05
								(0.117)	(0.000)	(0.000)
IHLBL										
Oct 24, 2000 – Oct 21, 2003	149	0.005	0.069	0.026	-0.068	-0.038	-0.170	5.30	6.71	12.36
								(0.258)	(0.568)	(0.417)
Oct 22, 2003 – Nov 21, 2006	158	0.015	0.067	0.395	0.296	0.181	0.139	46.64	57.49	75.47
								(0.000)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.010	0.068	0.214	0.117	0.074	0.000	20.00	24.73	41.81
								(0.000)	(0.002)	(0.000)
PETHL										
Oct 24, 2000 – Oct 21, 2003	149	0.000	0.052	0.170	-0.024	0.012	0.032	4.55	14.48	17.42
								(0.336)	(0.070)	(0.134)
Oct 22, 2003 – Nov 21, 2006	158	0.011	0.079	0.227	-0.036	-0.063	0.075	9.88	31.51	32.20
								(0.043)	(0.000)	(0.001)
Oct 24, 2000 – Nov 21, 2006	307	0.006	0.067	0.201	-0.044	-0.040	0.077	15.30	36.02	37.44
								(0.004)	(0.000)	(0.000)
DOVUHL										
Oct 24, 2000 – Oct 21, 2003	149	0.007	0.067	-0.041	-0.211	0.012	0.017	6.96	8.50	9.83
								(0.138)	(0.386)	(0.631)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	$\rho 1$	ρ2	ρ3	ρ4	Q4	Q8	Q12
Oct 22, 2003 – Nov 21, 2006	158	0.006	0.065	0.157	-0.050	0.130	0.096	8.43	27.46	34.69
								(0.077)	(0.001)	(0.001)
Oct 24, 2000 – Nov 21, 2006	307	0.006	0.066	0.044	-0.122	0.073	0.073	8.43	17.21	20.45
								(0.077)	(0.028)	(0.059)
SFARM										
Oct 24, 2000 – Oct 21, 2003	149	0.005	0.166	-0.114	0.024	0.057	0.086	3.63	4.02	9.23
								(0.459)	(0.855)	(0.683)
Oct 22, 2003 – Nov 21, 2006	158	0.009	0.035	-0.026	0.128	0.027	-0.024	2.90	6.84	10.70
								(0.575)	(0.554)	(0.555)
Oct 24, 2000 – Nov 21, 2006	307	0.007	0.118	-0.110	0.030	0.055	0.080	6.89	7.44	16.79
								(0.142)	(0.490)	(0.158)
LEV										
Oct 24, 2000 – Oct 21, 2003	149	0.002	0.030	-0.151	0.042	-0.130	0.185	11.25	13.88	15.23
								(0.024)	(0.085)	(0.229)
Oct 22, 2003 – Nov 21, 2006	158	0.004	0.027	-0.081	0.014	-0.147	-0.152	8.12	8.74	9.86
								(0.087)	(0.364)	(0.628)
Oct 24, 2000 – Nov 21, 2006	307	0.003	0.029	-0.117	0.034	-0.115	0.051	9.44	11.43	12.94
								(0.051)	(0.178)	(0.373)
PET										
Oct 24, 2000 – Oct 21, 2003	149	0.019	0.117	0.121	-0.036	-0.094	-0.023	3.76	5.84	14.26
								(0.440)	(0.665)	(0.284)
Oct 22, 2003 – Nov 21, 2006	158	0.001	0.057	-0.230	-0.038	0.077	0.026	9.59	18.31	23.88
								(0.048)	(0.019)	(0.021)
Oct 24, 2000 – Nov 21, 2006	307	0.010	0.091	0.059	-0.027	-0.049	-0.004	2.04	6.65	21.37
								(0.729)	(0.575)	(0.045)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
AFH										
Oct 24, 2000 – Oct 21, 2003	149	0.002	0.105	-0.122	-0.420	0.073	0.011	29.30	30.50	33.19
								(0.000)	(0.000)	(0.001)
Oct 22, 2003 – Nov 21, 2006	158	0.011	0.073	0.191	0.204	0.283	0.159	29.05	40.87	48.12
								(0.000)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.006	0.090	-0.013	-0.203	0.146	0.065	20.53	23.47	26.32
								(0.000)	(0.003)	(0.010)
GAMZA										
Oct 24, 2000 – Oct 21, 2003	149	-0.001	0.064	-0.108	-0.120	0.043	-0.146	7.30	10.39	11.82
								(0.121)	(0.239)	(0.460)
Oct 22, 2003 – Nov 21, 2006	158	0.007	0.072	0.054	-0.071	-0.016	0.030	1.45	28.06	43.79
								(0.836)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.003	0.068	-0.011	-0.088	0.011	-0.041	2.96	25.61	37.95
								(0.564)	(0.001)	(0.000)
ALB										
Oct 24, 2000 – Oct 21, 2003	149	0.009	0.048	-0.209	-0.032	0.012	0.223	14.06	17.98	19.77
								(0.007)	(0.021)	(0.072)
Oct 22, 2003 – Nov 21, 2006	158	0.007	0.039	0.331	-0.013	-0.049	0.113	19.69	30.11	43.04
								(0.001)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.008	0.044	0.016	-0.023	-0.016	0.175	9.70	16.36	24.74
								(0.046)	(0.038)	(0.016)
BHC										
Oct 24, 2000 – Oct 21, 2003	149	0.004	0.141	0.167	-0.085	-0.251	-0.169	18.94	19.41	20.67
								(0.001)	(0.013)	(0.055)
Oct 22, 2003 – Nov 21, 2006	158	0.004	0.077	0.096	-0.040	0.105	0.000	3.44	20.50	24.46
								(0.486)	(0.009)	(0.018)
Oct 24, 2000 – Nov 21, 2006	307	0.004	0.113	0.146	-0.074	-0.160	-0.123	20.79	22.78	23.64
								(0.000)	(0.004)	(0.023)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	ρ1	ρ2	ρ3	ρ4	Q4	Q8	Q12
SOFIX										
Oct 24, 2000 – Oct 21, 2003		149	0.010	0.055	-0.128	-0.052	0.052	0.065	3.89	4.97	5.85
									(0.422)	(0.761)	(0.923)
Oct 22, 2003 – Nov 21, 2006		158	0.006	0.024	0.110	0.010	-0.006	-0.011	1.96	9.63	10.88
									(0.744)	(0.292)	(0.539)
Oct 24, 2000 – Nov 21, 2006		307	0.008	0.042	-0.086	-0.038	0.045	0.056	4.29	5.56	6.92
									(0.368)	(0.697)	(0.863)
Equally-weighted portfolio											
Oct 24, 2000 – Oct 21, 2003		149	0.008	0.036	0.196	0.002	-0.088	-0.014	6.91	23.00	30.69
									(0.141)	(0.003)	(0.002)
Oct 22, 2003 – Nov 21, 2006		158	0.007	0.039	0.222	0.080	0.087	0.157	13.89	36.19	47.46
									(0.008)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006		307	0.007	0.038	0.209	0.045	0.010	0.083	16.25	51.25	65.26
									(0.003)	(0.000)	(0.000)
MarketCap-weighted portfolio											
Oct 24, 2000 – Oct 21, 2003		149	0.009	0.047	0.125	0.070	0.005	0.064	3.66	14.68	26.92
									(0.455)	(0.066)	(0.008)
Oct 22, 2003 – Nov 21, 2006		158	0.006	0.034	0.053	0.064	0.060	0.085	2.81	8.48	17.14
									(0.591)	(0.388)	(0.144)
Oct 24, 2000 – Nov 21, 2006		307	0.008	0.041	0.100	0.071	0.028	0.075	6.60	19.98	37.66
									(0.158)	(0.010)	(0.000)

Table 3

VARIANCE RATIOS FOR DAILY STOCK RETURNS (RW1 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.92	0.80	0.75	0.75	0.75
			(-2.23)*	(-2.86)*	(-2.33)*	(-1.81)
(-1.58)						
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.42	1.65	1.83	1.96
		(4.11)*	(6.27)*	(6.12)*	(6.13)*	(6.08)*
Oct 23, 2000 – Nov 23, 2006	1525	1.01	1.04	1.09	1.15	1.19
		(0.24)	(0.8)	(1.15)	(1.59)	(1.73)
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	0.90	0.92	1.02	1.05	1.04
		(-2.69)*	(-1.12)	(0.16)	(0.4)	(0.26)
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.05	1.31	1.58	1.80
		(-0.68)	(0.8)	(2.88)*	(4.34)*	(5.08)*
Oct 23, 2000 – Nov 23, 2006	1525	0.94	1.00	1.17	1.34	1.45
		(-2.21)*	(-0.1)	(2.26)*	(3.53)*	(3.99)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	0.97	1.10	1.29	1.38	1.42
		(-0.87)	(1.5)	(2.66)*	(2.77)*	(2.64)*
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.37	1.64	1.81	1.88
		(4.37)*	(5.49)*	(6.05)*	(6.04)*	(5.59)*
Oct 23, 2000 – Nov 23, 2006	1525	1.11	1.32	1.56	1.72	1.78
		(4.37)*	(6.68)*	(7.34)*	(7.46)*	(6.92)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.72	0.62	0.55	0.53
		(-2.53)*	(-4.09)*	(-3.47)*	(-3.32)*	(-2.91)*
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.33	1.51	1.57	1.61
		(4.26)*	(4.98)*	(4.76)*	(4.22)*	(3.86)*
Oct 23, 2000 – Nov 23, 2006	1525	0.99	0.94	0.93	0.89	0.89
		(-0.22)	(-1.31)	(-0.97)	(-1.2)	(-1.02)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.00	1.01	0.89	0.86	0.87
		(-0.01)	(0.11)	(-0.98)	(-0.99)	(-0.83)
Oct 21, 2003 – Nov 23, 2006	776	0.95	0.94	0.89	0.97	1.02
		(-1.48)	(-0.84)	(-1.01)	(-0.2)	(0.14)
Oct 23, 2000 – Nov 23, 2006	1525	1.00	1.00	0.89	0.86	0.86
		(-0.16)	(0.01)	(-1.5)	(-1.47)	(-1.25)
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.75	0.56	0.50	0.47
		(-3.38)*	(-3.68)*	(-4.11)*	(-3.63)*	(-3.31)*
Oct 21, 2003 – Nov 23, 2006	776	0.76	0.58	0.53	0.51	0.49
		(-6.81)*	(-6.25)*	(-4.39)*	(-3.64)*	(-3.2)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 23, 2000 – Nov 23, 2006	1525	0.83	0.71	0.59	0.55	0.53
		(-6.82)*	(-5.99)*	(-5.4)*	(-4.66)*	(-4.13)*
PET						
Oct 23, 2000 – Oct 20, 2003	749	0.96	1.07	1.23	1.27	1.25
		(-0.97)	(1.08)	(2.15)*	(1.96)	(1.57)
Oct 21, 2003 - Nov 23, 2006	776	0.81	0.70	0.64	0.58	0.57
		(-5.25)*	(-4.4)*	(-3.41)*	(-3.13)*	(-2.69)*
Oct 23, 2000 – Nov 23, 2006	1525	0.93	0.99	1.09	1.11	1.10
		(-2.82)*	(-0.3)	(1.2)	(1.1)	(0.86)
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.99	1.02	0.83	0.56	0.42
		(-0.33)	(0.23)	(-1.54)	(-3.22)*	(-3.6)*
Oct 21, 2003 – Nov 23, 2006	776	0.89	0.95	1.16	1.37	1.59
		(-2.98)*	(-0.82)	(1.55)	(2.77)*	(3.75)*
Oct 23, 2000 - Nov 23, 2006	1525	0.95	0.99	0.94	0.84	0.82
		(-1.78)	(-0.23)	(-0.74)	(-1.69)	(-1.57)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.79	0.66	0.60	0.59
		(-1.55)	(-3.01)*	(-3.11)*	(-2.91)*	(-2.52)*
Oct 21, 2003 – Nov 23, 2006	776	1.04	1.02	1.07	1.13	1.15
		(1.03)	(0.34)	(0.7)	(0.95)	(0.92)
Oct 23, 2000 – Nov 23, 2006	776	0.99	0.90	0.86	0.86	0.86
		(-0.46)	(-2)*	(-1.82)	(-1.49)	(-1.23)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.77	0.68	0.64	0.65
		(-1.72)	(-3.41)*	(-2.96)*	(-2.61)*	(-2.19)*
Oct 21, 2003 – Nov 23, 2006	776	0.94	1.01	1.20	1.40	1.49
		(-1.58)	(0.14)	(1.86)	(2.96)*	(3.07)*
Oct 23, 2000 – Nov 23, 2006	1525	0.94	0.86	0.87	0.93	0.96
		(-2.4)*	(-3)*	(-1.69)	(-0.73)	(-0.33)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.08	1.18	1.37	1.43	1.39
		(2.1)*	(2.63)*	(3.43)*	(3.12)*	(2.44)*
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.01	1.13	1.15	1.16
		(-0.69)	(0.14)	(1.23)	(1.13)	(1.03)
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.13	1.31	1.36	1.34
		(1.88)	(2.81)*	(4.14)*	(3.79)*	(3.05)*
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.83	0.77	0.73	0.74
		(-3.51)*	(-2.51)*	(-2.08)*	(-1.99)*	(-1.61)
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.41	1.65	1.83	1.88
		(5.64)*	(6.08)*	(6.13)*	(6.19)*	(5.6)*
Oct 23, 2000 – Nov 23, 2006	1525	0.91	0.89	0.87	0.85	0.87
		(-3.5)*	(-2.19)*	(-1.67)	(-1.57)	(-1.2)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.07	1.20	1.50	1.61	1.65
		(1.81)	(2.93)*	(4.66)*	(4.42)*	(4.05)*
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.51	1.89	2.15	2.34
		(5.6)*	(7.62)*	(8.36)*	(8.57)*	(8.45)*
Oct 23, 2000 – Nov 23, 2006	1525	1.13	1.35	1.67	1.84	1.95
		(5.05)*	(7.2)*	(8.89)*	(8.79)*	(8.38)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.07	1.25	1.51	1.63	1.74
		(1.95)	(3.61)*	(4.71)*	(4.59)*	(4.57)*
Oct 21, 2003 – Nov 23, 2006	776	1.02	1.15	1.31	1.44	1.54
		(0.69)	(2.19)*	(2.91)*	(3.26)*	(3.39)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.21	1.43	1.55	1.64
		(2.08)*	(4.33)*	(5.65)*	(5.69)*	(5.71)*

Notes: Test statistic values in parenthesis.
*indicates significance at 5 per cent level.

Table 4

VARIANCE RATIOS FOR WEEKLY STOCK RETURNS (RW1 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.93	0.89	1.10	1.15	0.99
		(-0.85)	(-0.69)	(0.39)	(0.47)	(-0.02)
Oct 21, 2003 – Nov 23, 2006	776	1.09	1.27	1.82	2.29	2.68
		(1.13)	(1.79)	(3.46)*	(4.34)*	(4.81)*
Oct 23, 2000 – Nov 23, 2006	1525	1.01	1.08	1.44	1.75	1.94
		(0.19)	(0.73)	(2.61)*	(3.52)*	(3.74)*
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	1.04	0.97	0.65	0.44	0.52
		(0.49)	(-0.2)	(-1.46)	(-1.83)	(-1.34)
Oct 21, 2003 – Nov 23, 2006	776	1.41	2.02	2.87	3.58	4.30
		(5.13)*	(6.85)*	(7.93)*	(8.66)*	(9.43)*
Oct 23, 2000 – Nov 23, 2006	1525	1.22	1.49	1.81	2.07	2.44
		(3.86)*	(4.59)*	(4.78)*	(5.01)*	(5.75)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	1.14	1.11	1.00	0.89	0.85
		(1.69)	(0.71)	(0.01)	(-0.35)	(-0.41)
Oct 21, 2003 – Nov 23, 2006	776	1.24	1.31	1.75	2.25	2.58
		(2.99)*	(2.1)*	(3.2)*	(4.2)*	(4.52)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 23, 2000 – Nov 23, 2006	1525	1.21	1.26	1.53	1.83	2.02
		(3.64)*	(2.45)*	(3.14)*	(3.9)*	(4.07)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.74	0.69	0.65	0.64
		(-0.74)	(-1.7)	(-1.27)	(-1.12)	(-1.01)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.29	1.88	2.38	2.78
		(2.07)*	(1.95)	(3.76)*	(4.64)*	(5.07)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.00	1.24	1.42	1.55
		(0.85)	(-0.02)	(1.41)	(1.96)*	(2.2)*
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	0.90	0.92	1.05	1.21	1.36
		(-1.24)	(-0.55)	(0.22)	(0.68)	(0.99)
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.14	1.22	1.07	0.93
		(-0.21)	(0.92)	(0.94)	(0.24)	(-0.21)
Oct 23, 2000 – Nov 23, 2006	1525	0.90	0.91	1.02	1.13	1.21
		(-1.82)	(-0.84)	(0.15)	(0.59)	(0.85)
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.86	0.78	0.88	0.87	0.83
		(-1.69)	(-1.47)	(-0.52)	(-0.41)	(-0.48)
Oct 21, 2003 – Nov 23, 2006	776	0.83	0.70	0.55	0.53	0.49
		(-2.17)*	(-2.04)*	(-1.92)	(-1.59)	(-1.45)
Oct 23, 2000 – Nov 23, 2006	1525	0.89	0.81	0.82	0.76	0.69
		(-1.95)	(-1.75)	(-1.1)	(-1.11)	(-1.24)
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.14	1.14	1.18	1.38	1.66
		(1.65)	(0.93)	(0.76)	(1.25)	(1.84)
Oct 21, 2003 – Nov 23, 2006	776	0.78	0.68	0.67	0.59	0.56
		(-2.76)*	(-2.14)*	(-1.42)	(-1.36)	(-1.26)
Oct 23, 2000 – Nov 23, 2006	1525	1.07	1.06	1.10	1.25	1.47
		(1.15)	(0.54)	(0.61)	(1.17)	(1.87)
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.89	0.45	0.25	0.11	0.10
		(-1.35)	(-3.56)*	(-3.1)*	(-2.91)*	(-2.5)*
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.69	2.56	3.22	3.66
		(2.57)*	(4.62)*	(6.62)*	(7.45)*	(7.6)*
Oct 23, 2000 – Nov 23, 2006	1525	0.99	0.87	1.01	1.12	1.24
		(-0.13)	(-1.24)	(0.08)	(0.56)	(0.94)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.90	0.76	0.64	0.54	0.51
		(-1.16)	(-1.56)	(-1.5)	(-1.51)	(-1.36)
Oct 21, 2003 – Nov 23, 2006	776	1.07	1.04	1.44	1.77	2.10
		(0.85)	(0.28)	(1.86)	(2.58)*	(3.16)*
Oct 23, 2000 – Nov 23, 2006	776	1.00	0.92	1.08	1.21	1.36
		(-0.09)	(-0.76)	(0.47)	(1)	(1.45)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.80	0.69	0.86	1.04	1.21
		(-2.43)*	(-2.03)*	(-0.6)	(0.13)	(0.59)
Oct 21, 2003 – Nov 23, 2006	776	1.34	1.48	1.90	2.19	2.52
		(4.31)*	(3.21)*	(3.84)*	(3.98)*	(4.34)*
Oct 23, 2000 – Nov 23, 2006	1525	1.02	1.01	1.25	1.43	1.65
		(0.37)	(0.09)	(1.48)	(2.01)*	(2.57)*
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.17	1.04	0.65	0.44	0.45
		(2.07)*	(0.26)	(-1.46)	(-1.81)	(-1.53)
Oct 21, 2003 – Nov 23, 2006	776	1.11	1.20	1.55	1.91	2.24
		(1.36)	(1.33)	(2.32)*	(3.04)*	(3.53)*
Oct 23, 2000 – Nov 23, 2006	1525	1.15	1.09	0.88	0.79	0.84
		(2.68)*	(0.81)	(-0.73)	(-0.98)	(-0.63)
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.81	0.86	0.90	0.91
		(-1.47)	(-1.24)	(-0.59)	(-0.31)	(-0.24)
Oct 21, 2003 – Nov 23, 2006	776	1.12	1.21	1.30	1.18	1.08
		(1.5)	(1.43)	(1.25)	(0.59)	(0.23)
Oct 23, 2000 – Nov 23, 2006	1525	0.92	0.87	0.92	0.92	0.93
		(-1.45)	(-1.22)	(-0.48)	(-0.37)	(-0.27)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.21	1.30	1.58	2.08	2.54
		(2.57)*	(1.98)*	(2.39)*	(3.51)*	(4.28)*
Oct 21, 2003 – Nov 23, 2006	776	1.23	1.51	2.24	2.84	3.32
		(2.94)*	(3.39)*	(5.25)*	(6.16)*	(6.61)*
Oct 23, 2000 – Nov 23, 2006	1525	1.22	1.39	1.88	2.36	2.78
		(3.79)*	(3.65)*	(5.23)*	(6.35)*	(7.09)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.14	1.31	1.66	2.21	2.73
		(1.69)	(2.01)*	(2.71)*	(3.94)*	(4.81)*
Oct 21, 2003 – Nov 23, 2006	776	1.06	1.21	1.55	1.74	1.95
		(0.79)	(1.43)	(2.33)*	(2.49)*	(2.71)*
Oct 23, 2000 – Nov 23, 2006	1525	1.11	1.26	1.59	1.95	2.33
		(1.87)	(2.41)*	(3.47)*	(4.42)*	(5.31)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table 5

VARIANCE RATIOS FOR DAILY STOCK RETURNS (RW3 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.92	0.80	0.73	0.73	0.72
		(-1.73)	(-1.73)	(-1.47)	(-1.26)	(-1.19)
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.41	1.62	1.78	1.89
		(2.5)*	(3.57)*	(3.46)*	(3.53)*	(3.56)*
Oct 23, 2000 – Nov 23, 2006	1525	1.00	1.03	1.08	1.14	1.17
		(0.13)	(0.41)	(0.59)	(0.87)	(0.99)
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	0.90	0.95	1.05	1.11	1.11
		(-1.2)	(-0.37)	(0.24)	(0.39)	(0.35)
Oct 21, 2003 – Nov 23, 2006	776	0.99	1.07	1.32	1.59	1.79
		(-0.18)	(0.66)	(1.93)	(2.87)*	(3.35)*
Oct 23, 2000 – Nov 23, 2006	1525	0.94	0.99	1.17	1.34	1.45
		(-1.14)	(-0.07)	(1.24)	(1.98)*	(2.29)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	0.98	1.14	1.32	1.46	1.53
		(-0.17)	(0.7)	(1.2)	(1.49)	(1.61)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.37	1.62	1.77	1.82
		(2.5)*	(3.16)*	(3.48)*	(3.53)*	(3.3)*
Oct 23, 2000 – Nov 23, 2006	1525	1.11	1.32	1.54	1.69	1.75
		(2.02)*	(3.11)*	(3.61)*	(3.85)*	(3.69)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.72	0.62	0.54	0.52
		(-2.4)*	(-3.48)*	(-2.85)*	(-2.72)*	(-2.42)*
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.33	1.48	1.53	1.55
		(2.7)*	(3.22)*	(3.18)*	(2.89)*	(2.71)*
Oct 23, 2000 – Nov 23, 2006	1525	0.99	0.93	0.92	0.88	0.87
		(-0.2)	(-1.03)	(-0.8)	(-0.97)	(-0.87)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.00	1.00	0.88	0.84	0.83
		(-0.17)	(-0.01)	(-1.44)	(-1.06)	(-0.87)
Oct 21, 2003 – Nov 23, 2006	776	0.94	0.94	0.88	0.95	0.99
		(-0.72)	(-0.48)	(-0.64)	(-0.22)	(-0.04)
Oct 23, 2000 – Nov 23, 2006	1525	0.99	1.00	0.88	0.85	0.84
		(-0.33)	(-0.1)	(-1.5)	(-1.06)	(-0.86)
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.74	0.54	0.49	0.45
		(-3.11)*	(-3.45)*	(-2.9)*	(-2.46)*	(-2.24)*
Oct 21, 2003 – Nov 23, 2006	776	0.75	0.67	0.65	0.63	0.62
		(-2.9)*	(-2.31)*	(-1.92)	(-1.81)	(-1.73)
Oct 23, 2000 – Nov 23, 2006	1525	0.82	0.71	0.59	0.54	0.53
		(-4.14)*	(-3.96)*	(-3.47)*	(-3.06)*	(-2.79)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
PET						
Oct 23, 2000 – Oct 20, 2003	749	0.96	1.07	1.21	1.23	1.20
		(-0.71)	(0.7)	(1.4)	(1.28)	(0.99)
Oct 21, 2003 – Nov 23, 2006	776	0.81	0.70	0.63	0.57	0.56
		(-2.88)*	(-2.65)*	(-2.3)*	(-2.26)*	(-2.05)*
Oct 23, 2000 – Nov 23, 2006	1525	0.93	0.98	1.08	1.09	1.08
		(-1.68)	(-0.23)	(0.68)	(0.62)	(0.46)
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.99	1.01	0.82	0.54	0.40
		(-0.32)	(0.09)	(-1.12)	(-1.86)	(-1.97)*
Oct 21, 2003 – Nov 23, 2006	776	0.89	0.94	1.14	1.34	1.54
		(-1.81)	(-0.56)	(0.88)	(1.71)	(2.39)*
Oct 23, 2000 – Nov 23, 2006	1525	0.95	0.99	0.94	0.83	0.81
		(-1.25)	(-0.23)	(-0.53)	(-0.99)	(-0.9)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.79	0.65	0.59	0.58
		(-0.75)	(-1.49)	(-1.71)	(-1.69)	(-1.55)
Oct 21, 2003 – Nov 23, 2006	776	1.03	1.02	1.06	1.10	1.10
		(0.59)	(0.14)	(0.34)	(0.47)	(0.43)
Oct 23, 2000 – Nov 23, 2006	776	0.99	0.90	0.85	0.84	0.84
		(-0.26)	(-1.11)	(-1.11)	(-0.97)	(-0.85)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.93	0.76	0.67	0.62	0.62
		(-1.35)	(-1.71)	(-1.56)	(-1.52)	(-1.39)
Oct 21, 2003 – Nov 23, 2006	776	0.94	1.00	1.18	1.39	1.46
		(-0.84)	(0.03)	(1.01)	(1.75)	(1.83)
Oct 23, 2000 – Nov 23, 2006	1525	0.94	0.85	0.87	0.92	0.95
		(-1.57)	(-1.49)	(-0.91)	(-0.47)	(-0.28)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.07	1.18	1.37	1.43	1.39
		(2.21)*	(2.79)*	(3.11)*	(2.4)*	(1.73)
Oct 21, 2003 – Nov 23, 2006	776	0.97	1.00	1.11	1.12	1.12
		(-0.52)	(0.03)	(0.76)	(0.66)	(0.57)
Oct 23, 2000 - Nov 23, 2006	1525	1.05	1.13	1.30	1.35	1.32
		(1.67)	(2.46)*	(3.13)*	(2.48)*	(1.82)
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.82	0.77	0.72	0.73
		(-1.43)	(-1.24)	(-1.26)	(-1.33)	(-1.15)
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.40	1.64	1.80	1.83
		(3.09)*	(3.56)*	(3.85)*	(3.91)*	(3.52)*
Oct 23, 2000 – Nov 23, 2006	1525	0.91	0.89	0.88	0.86	0.86
		(-1.12)	(-0.85)	(-0.76)	(-0.79)	(-0.65)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.06	1.19	1.48	1.56	1.59
		(1.77)	(2.8)*	(4.27)*	(3.75)*	(3.23)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.51	1.87	2.11	2.27
		(3.57)*	(4.91)*	(5.6)*	(5.9)*	(5.91)*
Oct 23, 2000 – Nov 23, 2006	1525	1.13	1.34	1.66	1.82	1.91
		(3.94)*	(5.61)*	(7.02)*	(6.91)*	(6.52)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.07	1.24	1.48	1.58	1.67
		(1.86)	(3.43)*	(4.29)*	(4.1)*	(4.06)*
Oct 21, 2003 – Nov 23, 2006	776	1.02	1.14	1.30	1.41	1.49
		(0.37)	(1.33)	(1.93)	(2.21)*	(2.3)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.20	1.42	1.53	1.61
		(1.6)	(3.44)*	(4.56)*	(4.63)*	(4.69)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table 6

VARIANCE RATIOS FOR WEEKLY STOCK RETURNS (RW3 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.92	0.87	1.02	1.12	1.13
		(-0.54)	(-0.59)	(0.07)	(0.32)	(0.32)
Oct 21, 2003 – Nov 23, 2006	776	1.08	1.23	1.68	2.04	2.28
		(0.58)	(1.06)	(2.1)*	(2.48)*	(2.56)*
Oct 23, 2000 – Nov 23, 2006	1525	1.01	1.06	1.38	1.64	1.78
		(0.06)	(0.39)	(1.7)	(2.27)*	(2.33)*
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	1.03	0.95	0.69	0.53	0.58
		(0.25)	(-0.27)	(-1.21)	(-1.47)	(-1.13)
Oct 21, 2003 – Nov 23, 2006	776	1.39	1.97	2.69	3.25	3.80
		(2.79)*	(4.01)*	(4.98)*	(5.49)*	(5.89)*
Oct 23, 2000 – Nov 23, 2006	1525	1.21	1.47	1.74	1.95	2.24
		(2.38)*	(3.12)*	(3.39)*	(3.48)*	(3.89)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	1.17	1.24	1.08	0.89	0.81
		(1.26)	(1.15)	(0.28)	(-0.28)	(-0.43)
Oct 21, 2003 – Nov 23, 2006	776	1.23	1.27	1.62	1.98	2.16
		(1.25)	(0.91)	(1.55)	(1.97)*	(2.01)*
Oct 23, 2000 – Nov 23, 2006	1525	1.20	1.24	1.47	1.72	1.85
		(1.47)	(1.06)	(1.56)	(1.92)	(1.96)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.96	0.73	0.65	0.60	0.56
		(-0.52)	(-1.34)	(-1.18)	(-1.16)	(-1.14)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.25	1.75	2.10	2.33
		(1.46)	(1.36)	(2.82)*	(3.25)*	(3.33)*
Oct 23, 2000 – Nov 23, 2006	1525	1.04	0.98	1.19	1.34	1.43
		(0.66)	(-0.14)	(0.96)	(1.38)	(1.53)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	0.89	0.88	0.99	1.08	1.23
		(-1.5)	(-0.68)	(-0.05)	(0.28)	(0.68)
Oct 21, 2003 – Nov 23, 2006	776	0.97	1.10	1.16	1.01	0.87
		(-0.18)	(0.42)	(0.46)	(0.03)	(-0.3)
Oct 23, 2000 – Nov 23, 2006	1525	0.89	0.89	1.00	1.08	1.20
		(-1.51)	(-0.64)	(-0.01)	(0.27)	(0.63)
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.85	0.75	0.88	0.95	0.95
		(-0.88)	(-0.86)	(-0.27)	(-0.1)	(-0.08)
Oct 21, 2003 – Nov 23, 2006	776	0.92	0.82	0.59	0.51	0.44
		(-0.78)	(-1.06)	(-1.58)	(-1.59)	(-1.66)
Oct 23, 2000 – Nov 23, 2006	1525	0.88	0.80	0.81	0.80	0.77
		(-1.13)	(-1.14)	(-0.71)	(-0.63)	(-0.67)
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.12	1.10	1.08	1.20	1.39
		(1.3)	(0.62)	(0.27)	(0.5)	(0.83)
Oct 21, 2003 – Nov 23, 2006	776	0.77	0.66	0.63	0.54	0.49
		(-2.05)*	(-1.75)	(-1.22)	(-1.24)	(-1.2)
Oct 23, 2000 – Nov 23, 2006	1525	1.06	1.04	1.06	1.17	1.34
		(0.74)	(0.28)	(0.23)	(0.51)	(0.88)
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.44	0.23	0.15	0.12
		(-0.97)	(-1.27)	(-1.2)	(-1.19)	(-1.16)
Oct 21, 2003 – Nov 23, 2006	776	1.19	1.63	2.36	2.83	3.05
		(1.48)	(2.55)*	(3.67)*	(4.01)*	(3.88)*
Oct 23, 2000 – Nov 23, 2006	1525	0.99	0.85	0.97	1.09	1.15
		(-0.14)	(-0.49)	(-0.06)	(0.17)	(0.29)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.89	0.74	0.59	0.47	0.42
		(-0.84)	(-1.22)	(-1.31)	(-1.4)	(-1.35)
Oct 21, 2003 – Nov 23, 2006	776	1.05	1.00	1.33	1.57	1.78
		(0.39)	(0.01)	(0.94)	(1.27)	(1.48)
Oct 23, 2000 – Nov 23, 2006	776	0.99	0.90	1.04	1.14	1.25
		(-0.12)	(-0.61)	(0.15)	(0.45)	(0.69)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.79	0.66	0.79	0.93	1.07
		(-1.26)	(-1.28)	(-0.59)	(-0.18)	(0.17)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 21, 2003 – Nov 23, 2006	776	1.33	1.46	1.78	1.94	2.13
		(2.31)*	(1.98)*	(2.21)*	(2.1)*	(2.15)*
Oct 23, 2000 – Nov 23, 2006	1525	1.02	0.99	1.20	1.35	1.53
		(0.14)	(-0.04)	(0.79)	(1.15)	(1.54)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.17	1.04	0.65	0.55	0.53
		(1.48)	(0.18)	(-0.92)	(-1.01)	(-0.98)
Oct 21, 2003 – Nov 23, 2006	776	1.10	1.16	1.43	1.73	1.94
		(0.62)	(0.6)	(1.18)	(1.65)	(1.82)
Oct 23, 2000 – Nov 23, 2006	1525	1.15	1.07	0.84	0.80	0.81
		(1.57)	(0.37)	(-0.54)	(-0.56)	(-0.48)
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.78	0.80	0.81	0.83
		(-1.02)	(-1.08)	(-0.74)	(-0.6)	(-0.47)
Oct 21, 2003 – Nov 23, 2006	776	1.11	1.17	1.20	1.07	0.93
		(0.98)	(0.87)	(0.68)	(0.18)	(-0.15)
Oct 23, 2000 – Nov 23, 2006	1525	0.91	0.86	0.88	0.86	0.86
		(-0.81)	(-0.84)	(-0.51)	(-0.49)	(-0.44)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.19	1.25	1.49	1.89	2.35
		(2.18)*	(1.55)	(1.89)	(2.68)*	(3.5)*
Oct 21, 2003 – Nov 23, 2006	776	1.22	1.45	2.07	2.50	2.77
		(1.67)	(2.06)*	(3.29)*	(3.65)*	(3.68)*
Oct 23, 2000 – Nov 23, 2006	1525	1.21	1.36	1.81	2.21	2.55
		(2.51)*	(2.57)*	(3.79)*	(4.46)*	(4.88)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.12	1.26	1.57	2.00	2.51
		(1.59)	(1.79)	(2.35)*	(3.18)*	(4.06)*
Oct 21, 2003 – Nov 23, 2006	776	1.05	1.17	1.44	1.54	1.63
		(0.5)	(0.91)	(1.44)	(1.41)	(1.42)
Oct 23, 2000 – Nov 23, 2006	1525	1.10	1.23	1.54	1.85	2.19
		(1.57)	(2.02)*	(2.82)*	(3.43)*	(4.14)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table 7

SUMMARY OF THE TEST STATISTICS PRESENTED IN SECTION 5.1

Panel A: Summary of the results related to the autocorrelation coefficients

Sample period	ρ1	ρ2	ρ3	ρ4	ρ1	ρ2	ρ3	ρ4
Number of sign reversals in r across sub-periods					*(per cent)*			
– daily data	6	5	2	4	42.9	35.7	14.3	28.6
– weekly data	7	4	8	7	50.0	28.6	57.1	50.0
Number of larger r in the second sub-period as compared to the first one					*(per cent)*			
– daily data	9	6	7	8	64.3	42.9	50.0	57.1
– weekly data	7	6	8	7	50.0	42.9	57.1	50.0

Panel B: Number of statistically significant Box – Pierce, Q-statistics

Sample period	Number of observations	Q4	Q8	Q12	Q4	Q8	Q12
Daily data					*(per cent)*		
Oct 23, 2000 – Oct 20, 2003	749	12	13	12	85.7	92.9	85.7
Oct 21, 2003 – Nov 23, 2006	776	9	13	11	64.3	92.9	78.6
Oct 23, 2000 – Nov 23, 2006	1525	11	11	11	78.6	78.6	78.6
Weekly data					*(per cent)*		
Oct 24, 2000 – Oct 21, 2003	149	5	5	3	35.7	35.7	21.4
Oct 22, 2003 – Nov 21, 2006	158	5	11	11	35.7	78.6	78.6
Oct 24, 2000 – Nov 21, 2006	307	5	8	10	35.7	57.1	71.4

Table 8

SUMMARY OF THE TEST STATISTICS PRESENTED IN SECTION 5.2

Panel A: Summary data for the tests of the RW1 null hypothesis

Number of times RW1 hypothesis rejected (out of 14 possible cases)

Sample period	Number q of base observations aggregated to form variance ratio					Number q of base observations aggregated to form variance ratio				
	2	4	8	12	16	2	4	8	12	16
	daily data					*weekly data*				
Oct 23, 2000 – Oct 20, 2003	6	9	11	10	9	3	4	3	3	3
Oct 21, 2003 – Nov 23, 2006	8	8	9	11	11	8	7	9	10	10
Oct 23, 2000 – Nov 23, 2006	8	8	6	6	6	4	4	5	7	7

Number of reversals of the value of the VR statistics with respect to 1 across sub-periods

	daily data					*weekly data*				
	6	8	7	7	8	7	8	7	7	9

Panel B: Summary data for the tests of the RW1 null hypothesis

Number of times RW3 hypothesis rejected out (of 14 possible cases)

Sample period	Number q of base observations aggregated to form variance ratio					Number q of base observations aggregated to form variance ratio				
	2	4	8	12	16	2	4	8	12	16
	daily data					weekly data				
Oct 23, 2000 – Oct 20, 2003	3	5	5	5	5	1	0	1	2	2
Oct 21, 2003 – Nov 23, 2006	7	7	6	8	9	3	4	6	7	7
Oct 23, 2000 – Nov 23, 2006	3	5	5	6	5	2	3	3	4	5

Number of reversals of the value of the VR statistics with respect to 1 across sub-periods

	daily data					*weekly data*				
	6	7	7	7	7	7	8	8	8	7

Table 9

RATES OF RETURN BEFORE COMMISSIONS UNDER THE FILTER RULE (F) AND BUY-AND-HOLD STRATEGY (B)

Stocks	Filter size 0.005		0.01		0.015		0.02		0.025		0.03	
	F	B	F	B	F	B	F	B	F	B	F	B
ALBHL	-0.124	0.409	-0.112	0.408	-0.018	0.421	-0.061	0.418	0.096	0.424	0.243	0.422
IHLBL	-0.791	0.568	-0.794	0.545	-0.642	0.547	-0.617	0.548	-0.602	0.565	-0.402	0.546
PETHL	0.376	0.344	0.262	0.360	0.311	0.366	0.267	0.370	0.239	0.363	0.203	0.361
DOVUHL	-0.371	0.370	-0.345	0.372	-0.209	0.386	-0.247	0.387	-0.216	0.385	-0.213	0.378
SFARM	n.a.	1.208	n.a.	1.209	n.a.	1.210	n.a.	1.210	n.a.	1.210	n.a.	1.210
LEV	-0.402	0.166	-0.402	0.178	-0.430	0.184	-0.384	0.179	-0.424	0.179	-0.363	0.182
PET	-0.999	0.611	-1.034	0.605	-1.050	0.602	-1.027	0.604	-0.925	0.603	-0.984	0.609
AFH	-0.575	0.371	-0.506	0.373	-0.537	0.367	-0.484	0.372	-0.522	0.373	-0.435	0.382
GAMZA	0.008	0.186	0.073	0.186	0.217	0.182	0.242	0.188	0.212	0.190	0.104	0.191
ALB	-0.248	0.432	-0.207	0.433	-0.092	0.434	-0.194	0.440	-0.322	0.441	-0.252	0.441
BHC	0.286	0.305	0.202	0.307	0.420	0.327	0.429	0.334	0.286	0.322	0.358	0.311
Sofix	0.063	0.404	0.017	0.402	0.049	0.401	0.122	0.402	0.045	0.403	0.013	0.404

Note: n.a. is used to denote cases where daily return can not be calculated (it happens when while having a short possition we incur a loss of more than 100 per cent).

Stocks	Filter size 0.035		0.04		0.045		0.05		0.06		0.07	
	F	B	F	B	F	B	F	B	F	B	F	B
ALBHL	0.215	0.405	0.243	0.406	0.305	0.407	0.211	0.399	0.127	0.416	0.186	0.438
IHLBL	-0.369	0.554	-0.324	0.551	-0.024	0.709	-0.071	0.711	-0.017	0.694	0.237	0.722
PETHL	0.249	0.368	0.240	0.369	0.183	0.371	0.146	0.369	0.252	0.333	0.337	0.336
DOVUHL	-0.255	0.379	-0.199	0.382	-0.109	0.391	-0.041	0.387	-0.005	0.381	0.001	0.368
SFARM	n.a.	1.210	n.a.	1.212	n.a.	1.214	n.a.	1.216	n.a.	1.243	n.a.	1.245
LEV	-0.414	0.181	-0.295	0.178	-0.145	0.173	-0.105	0.198	-0.096	0.205	-0.061	0.204
PET	-0.949	0.611	-0.857	0.614	-0.755	0.610	-0.480	0.603	-0.129	0.592	-0.110	0.583
AFH	-0.413	0.372	-0.454	0.371	-0.388	0.373	-0.326	0.378	-0.239	0.371	-0.188	0.424
GAMZA	0.080	0.195	0.024	0.191	0.043	0.187	-0.030	0.234	-0.038	0.228	-0.221	0.222
ALB	-0.151	0.442	-0.092	0.441	-0.051	0.459	0.220	0.519	0.275	0.512	0.269	0.489
BHC	0.360	0.308	0.422	0.318	0.370	0.305	0.438	0.309	0.346	0.309	0.521	0.320
Sofix	-0.023	0.417	-0.110	0.407	-0.017	0.408	0.080	0.409	0.022	0.410	0.271	0.499

(continued)

(continued)

Stocks	Filter size 0.08		0.09		0.1		0.12		0.14		0.16	
	F	B	F	B	F	B	F	B	F	B	F	B
ALBHL	0.051	0.577	0.100	0.545	0.171	0.537	0.120	0.538	0.360	0.598	0.757	0.708
IHLBL	0.299	0.733	0.409	0.747	0.645	1.046	0.497	0.965	0.746	0.987		
PETHL	0.288	0.332	0.545	0.650	0.636	0.670	0.564	0.649	0.738	0.597	0.377	0.525
DOVUHL	-0.048	0.509	0.001	0.485	-0.103	0.488	-0.225	0.493	0.057	0.560	0.190	0.606
SFARM	n.a.	1.370	n.a.	1.377	n.a.	1.364	n.a.	1.518	0.374	0.617	0.266	0.825
LEV	0.017	0.202	-0.041	0.211	-0.028	0.210	-0.052	0.220	-0.825	0.008		
PET	-0.059	0.568	-0.278	0.583	-0.214	0.592	0.067	0.585	0.137	0.583	0.166	0.541
AFH	-0.101	0.421	-0.113	0.420	-0.094	0.484	-0.053	0.548	n.a.	1.201	0.248	0.294
GAMZA	-0.185	0.228	-0.176	0.226	-0.037	0.233	0.064	0.251	-0.318	-0.407		
ALB	0.298	0.618	0.335	0.660	0.294	0.643	0.337	0.629	0.436	0.607		
BHC	0.390	0.310	0.426	0.321	0.398	0.305	0.377	0.301	0.148	0.293	-0.021	0.240
Sofix	0.220	0.498	0.091	0.508	0.155	0.505						

Stocks	Filter size 0.18		0.2		0.25		0.3		0.4		0.5	
	F	B	F	B	F	B	F	B	F	B	F	B
ALBHL												
IHLBL												
PETHL	0.413	0.342										
DOVUHL												
SFARM	0.143	0.833	0.338	0.827	-0.593	0.798	0.434	0.787	-0.016	0.940	0.249	-0.249
LEV												
PET	0.114	0.560	0.195	0.555	0.373	0.540						
AFH												
GAMZA												
ALB												
BHC	-0.132	0.283	-0.050	0.233	-0.845	0.171						
Sofix												

Table 10

ANNUAL RATES OF RETURN BY SECURITY: AVERAGED OVER ALL FILTER VALUES

Stocks	Average Return Filter	Average Return Filter (long positions)	Average Return Filter (short positions)	Average Return Buy-and-hold	Profitable Filters	Superior Filters	Active Filters
ALBHL	0.160	0.619	-0.348	0.471	14	1	18
IHLBL	-0.107	0.489	-0.867	0.691	6	0	17
PETHL	0.349	0.967	-0.071	0.425	19	4	19
DOVUHL	-0.130	0.286	-0.651	0.428	4	0	18
SFARM	n.a.	0.439	n.a.	1.067	6	1	24
LEV	-0.262	-0.132	-0.483	0.180	1	0	17
PET	-0.419	0.139	-1.179	0.588	6	0	21
AFH	n.a.	0.141	n.a.	0.439	1	0	18
GAMZA	0.004	0.219	-0.185	0.171	10	4	17
ALB	0.050	0.451	-0.589	0.508	8	0	17
BHC	0.244	0.574	-0.173	0.297	17	13	21
Sofix	0.066	0.391	-0.536	0.432	12	0	15
				Average:	8.4	2.1	18.8

Note: n.a. is used to denote cases where daily return can notbe calculated (it happens when while having a short possition we incur a loss of more than 100 per cent). Averages are calculated excluding the index SOFIX (as it is not tradable directly).

Table 11

ANNUAL RATES OF RETURN BY FILTER: AVERAGED OVER ALL SECURITIES

Panel A: no transaction costs

	Filter size							
	0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04
Average return filter	-0.284	-0.286	-0.203	-0.208	-0.218	-0.174	-0.165	-0.129
Average return filter (long)	0.140	0.155	0.241	0.255	0.224	0.266	0.277	0.307
Average return filter (short)	-0.641	-0.641	-0.572	-0.590	-0.586	-0.554	-0.541	-0.543
Average return (buy-and-hold)	0.452	0.452	0.457	0.459	0.459	0.458	0.457	0.458
Profitable securities	4	4	4	4	5	5	4	4
Average number of transactions	476.8	367.0	287.4	246.6	212.9	182.3	161.5	141.2

	Filter size							
	0.045	0.05	0.06	0.07	0.08	0.09	0.1	0.12
Average return filter	-0.057	-0.004	0.048	0.097	0.095	0.121	0.167	0.170
Average return filter (long)	0.376	0.422	0.468	0.509	0.523	0.524	0.622	0.572
Average return filter (short)	-0.488	-0.453	-0.393	-0.353	-0.418	-0.488	-0.466	-0.542
Average return (buy-and-hold)	0.473	0.484	0.480	0.487	0.534	0.566	0.597	0.670
Profitable securities	4	5	5	7	7	7	6	7
Average number of transactions	120.1	104.7	83.1	66.7	56.8	50.8	42.5	30.6

	Filter size							
	0.14	0.16	0.18	0.2	0.25	0.3	0.4	0.5
Average return filter	0.185	0.283	0.134	0.161	-0.355	0.434	-0.016	0.249
Average return filter (long)	0.412	0.652	0.538	0.496	0.122	1.159	0.783	
Average return filter (short)	-0.421	-0.447	-0.611	-0.642	-1.561	-0.374	-1.200	0.249
Average return (buy-and-hold)	0.564	0.534	0.505	0.538	0.503	0.787	0.940	-0.249
Profitable securities	8	6	3	2	1	1		1
Average number of transactions	20.7	17.1	18.0	18.0	7.3	3.0	3.0	1.0

Panel B: 0.05 per cent transaction costs

	Filter size							
	0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04
Average return filter	-0.786	-0.682	-0.513	-0.476	-0.448	-0.372	-0.343	-0.285
Average return filter (long)	-0.594	-0.441	-0.214	-0.141	-0.112	-0.016	0.018	0.083
Average return filter (short)	-0.956	-0.886	-0.766	-0.759	-0.729	-0.679	-0.654	-0.648
Average return (buy-and-hold)	0.450	0.451	0.456	0.458	0.459	0.457	0.456	0.457
Profitable securities			2	2	2	3	3	3
Average number of transactions	476.8	367.0	287.4	246.6	212.9	182.3	161.5	141.2

(continued)

(continued)

	Filter size							
	0.045	0.05	0.06	0.07	0.08	0.09	0.1	0.12
Average return filter	-0.19	-0.13	-0.05	0.02	0.02	0.06	0.11	0.12
Average return filter (long)	0.19	0.26	0.34	0.41	0.45	0.46	0.57	0.52
Average return filter (short)	-0.58	-0.54	-0.46	-0.41	-0.47	-0.54	-0.52	-0.59
Average return (buy-and-hold)	0.47	0.48	0.48	0.49	0.53	0.57	0.60	0.67
Profitable securities	3	4	4	6	5	6	6	7
Average number of transactions	120.1	104.7	83.1	66.7	56.8	50.8	42.5	30.6

	Filter size							
	0.14	0.16	0.18	0.2	0.25	0.3	0.4	0.5
Average return filter	0.144	0.245	0.102	0.133	-0.392	0.418	-0.036	0.236
Average return filter (long)	0.390	0.614	0.504	0.470	0.089	1.147	0.771	
Average return filter (short)	-0.468	-0.489	-0.646	-0.675	-1.611	-0.395	-1.231	0.236
Average return (buy-and-hold)	0.439	0.531	0.502	0.536	0.500	0.787	0.940	-0.250
Profitable securities	8	6	3	2	1	1		1
Average number of transactions	20.7	17.1	18.0	18.0	7.3	3.0	3.0	1.0

APPENDIX 2

SAMPLE SELECTION PROCEDURE AND SAMPLE COMPOSITION

At the time when we began selecting our sample of stocks (in November 2006), there were some 314 companies listed for trading on the Bulgarian Stock Exchange and not in the state of bankruptcy or liquidation[24]. Out of these 314 stocks, 202 had been listed for trading before the beginning date of the sample period (October 20, 2000). Potentially, our sample could have included all of these 202 stocks. Unfortunately, most of them were traded only rarely, so they could not provide enough information for the underlying price processes.

In order to solve the problem with the infrequent trading, we estimated and analyzed the fraction of days throughout the sample period, in which there was no trading with each of the 202 individual securities. The problem turned out to be quite severe, so we had to strike a very delicate balance between having enough stocks in our sample and not running into the need to impute too many missing price observations[25]. We tried several thresholds for the fraction of the missing price observations and at the end selected the value of 25 per cent[26]. With this criterion in place, only 11 companies qualified to become part of our sample. The overall number of missing observations for the whole sample stood at 2446, i.e. some 14.6 per cent of the total (see tables A1.1. and A1.2. below for further details).

Table A1.1

NUMBER OF MISSING VALUES IN THE SAMPLE UNDER DIFFERENT THRESHOLD LEVELS

	5%	10%	15%	20%	25%	30%
Before 20.10.2003	18	246	813	1033	2265	2265
After 20.10.2003	0	7	8	50	181	181
Whole sample	18	253	821	1083	2446	2446
Number of companies satisfying the criterion	1	3	6	7	11	11

[24]There were also several companies that were listed for trading on the BSE, but no deal was ever done with their shares. These were also not included in the 314 companies that we used in selecting our final sample.

[25]We realized that imputing missing price observations could distort the underlying price evolution process and in this way introduce bias in the test statistics we calculate.

[26]No individual stock, which was not traded in at least 75 per cent of the trading days on BSE, was eligible to be included in the sample.

Table A1.2

PERCENTAGE MISSING VALUES IN THE SAMPLE UNDER DIFFERENT THRESHOLD LEVELS

	5%	10%	15%	20%	25%	30%
Before 20.10.2003	2.4%	10.9%	18.1%	19.7%	27.5%	27.5%
After 20.10.2003	0.0%	0.3%	0.2%	0.9%	2.1%	2.1%
Whole sample	1.2%	5.5%	9.0%	10.1%	14.6%	14.6%
Number of companies satisfying the criterion	1	3	6	7	11	11

The 11 stocks that met the sample selection criterion are listed in Table A1.3. Most of them belong to the group of the mass (voucher) privatization funds, established in 1996 and later transformed into holding companies, listed on BSE.

Table A1.3

COMPANIES SELECTED IN THE SAMPLE

Ticker	Company name	Industry
ALBHL	Albena Invest Holding AD-Albena	Holding company (tourism)
IHLBL	Industrial Holding Bulgaria PLC-Sofia	Holding company
PETHL	Synergon Holding AD-Sofia	Holding company (fuels)
DOVUHL	Doverie United Holding PLC-Sofia	Holding company
SFARM	Sopharma AD-Sofia	Pharmaceuticals
LEV	Zlaten Lev AD-Sofia	Holding company
PET	Petrol AD-Sofia	Fuels
AFH	Favorit Hold AD-Sofia	Holding company
GAMZA	Severcoop Gamza Holding AD-Sofia	Holding company
ALB	Albena AD-Albena	Tourism
BHC	Bulgarian Holding Company AD-Sofia	Holding company

After narrowing down the sample to 11 companies, we faced the issue of how to cope with the missing values in order to be able to estimate autocorrelation functions and the other test statistics. We used the following two methods for imputing missing price observations:

1) Method 1: based on the assumption that the price of a stock can change only if a transaction is concluded. Hence, in days when there is no trading with the stock, the price remains the same as its last observed value;

2) Method 2: features linear interpolation of the missing values between any two available price observations;

The second method implies certain assumptions about the price evolution process, which may not be entirely consistent with the efficient markets hypothesis. Yet, we decided to employ this method for reference, i.e. as a way to check to what extent the test statistics that we calculate are sensitive to the method used for imputing missing values.

Besides the 11 individual stocks and the index SOFIX, we included in our sample two portfolios. They were constructed from the 11 stocks in the sample and one of them had equal initial weights, while the other one was weighted on the basis of the market capitalization of the stocks as of October 23, 2000. We did not keep the weights constant throughout the whole sample period. Instead, we fixed them only initially and then allowed them to vary in line with the changes in the prices of the individual securities (see Table A1.4. for the weight values we used). In other words, we formed two portfolios using buy-and-hold strategy and tracked their returns over the sample period.

Table A1.4

NUMBER OF MISSING OBSERVATIONS BY WEEKDAY

Day	ALBHL	IHLBL	PETHL	DOVUHL	SFARM	LEV	PET	AFH	GAMZA	ALB	BHC	Sofix	Total missin
Monday	22	51	5	44	65	37	78	68	37	65	84	5	561
Tuesday	14	32	4	19	60	25	61	55	21	38	69	1	399
Wednesday	19	48	4	38	60	35	75	77	35	57	68	1	517
Thursday	20	36	2	42	60	34	64	65	25	45	71	3	467
Friday	18	49	3	41	56	29	78	60	20	55	70	2	481

Note: the total number of observations in the table does not add to 1525, because there are 16 Saturdays in which BSE had trading sessions.

The returns of the individual stocks were calculated as continuously compounded returns based on closing prices. The returns of the two portfolios, that we constructed, were calculated from the simple returns of the individual stocks, but are themselves continuously compounded. Weekly returns were calculated from Tuesday to Tuesday, as it turned out to be the weekday, with the smallest number of missing price observations (see Table A1.5. for more details). When the closing price in a particular Tuesday was not available, due to the lack of deals in that day, we calculated the return for that week using the closing prices for the next and previous Tuesday and then scaled the return to take into account the fact that it referred to a period longer than one week.

Table A1.5

MARKET CAPITALIZATION OF THE COMPANIES IN OUR SAMPLE

	ALBHL	IHLBL	PETHL	DOVUHL	SFARM	LEV	PET	AFH	GAMZA	ALB
Number of shares	5500000	21003235	14122649	13149848	66000000	6481959	1.09E+08	2356923	2673899	4273126
Price at closing	1.37	0.24	1.15	0.34	0.76	2.4	0.21	0.91	1.23	5.93
Company capitalization	7535000	5040776	16241046	4470948	50160000	15556702	22942419	2144800	3288896	25339637
Share	4.79%	3.20%	10.32%	2.84%	31.87%	9.88%	14.58%	1.36%	2.09%	16.10%

APPENDIX 3

TECHNICAL NOTES ABOUT SOME OF THE TEST STATISTICS EMPLOYED

In this Appendix, we present in detail some of the test statistics, which we use to test the weak-form efficiency of the BSE, and their sampling properties. In doing this, we entirely follow the exposition of Lo and MacKinlay (1988) – the paper where these test statistics were originally presented.

Autocovariances and Autocorrelations:

The autocorrelation coefficient is a natural time-series extension of the well-known correlation coefficient between two random variables *x* and *y*.

$$Corr[x, y] = \frac{Cov[x, y]}{\sqrt{Var[x]}\sqrt{Var[y]}}$$

Given a covariance-stationary time series $\{r_t\}$, the *k*-th order autocovariance and autocorrelation coefficients, $\gamma(k)$ and $\rho(k)$, respectively are defined as follows:

$$\gamma(k) \equiv Cov[r_t, r_{t+k}]$$

$$\rho(k) \equiv \frac{Cov[r_t, r_{t+k}]}{\sqrt{Var[r_t]}\sqrt{Var[r_{t+k}]}} = \frac{Cov[r_t, r_{t+k}]}{\sqrt{Var[r_t]}} = \frac{\gamma(k)}{\gamma(0)}$$

Where the second equality in the last equation follows from the covariance-stationarity of $\{r_t\}$. For a given sample, auto covariance and autocorrelation coefficients may be estimated in the natural way by replacing population moments with sample counterparts:

$$\hat{\gamma}(k) = \frac{1}{T}\sum_{t=1}^{T-k}(r_t - \bar{r}_T)(r_{t+k} - \bar{r}_T), 0 \le k < T$$

$$\hat{\rho}(k) = \frac{\hat{\gamma}(k)}{\hat{\gamma}(0)}$$

$$\bar{r}_t \equiv \frac{1}{T}\sum_{t=1}^{T} r_t$$

The sampling theory for $\hat{\rho}(k)$ and $\hat{\gamma}(k)$ depends on the datagenerating process for $\{r_t\}$. For more details, please refer to Campbell, Lo and MacKinlay (1997), Chapter 2.

Box – Pierce Q-Statistic

The Box-Pierce (1970) Q-Statistic also known as Portmanteau Statistic is defined as:

$$Q_m \equiv T\sum_{k=1}^{m}\rho^2(k)$$

Under the RW1 null hypothesis, this test statistic is asympothically distributed as $\lambda_m^{\ 2}$.

Variance Ratio statistic to test for RW1:

Let p_t denote the log price process and $r_t \equiv p_t - p_{t-1}$ continuously compounded returns.

The null hypothesis that corresponds to RW1 can be stated as:

$H_0: \ r_t = \mu + \varepsilon_t, \ \varepsilon_t \sim IIDN(0,\sigma)$

Let our sample consist of $nq + 1$ observations $\{p_0, p_1, \ldots, p_{nq}\}$ where q is any integer greater than one. The following estimators should be defined:

$$\hat{\mu} = \frac{1}{nq}\sum_{k=1}^{nq}(p_k - p_{k-1}) = \frac{1}{nq}(p_{nq} - p_0)$$

$$\hat{\sigma}_a^2 = \frac{1}{nq}\sum_{k=1}^{nq}(p_k - p_{k-1} - \hat{\mu})^2$$

$$\hat{\sigma}_b^2(q) = \frac{1}{nq}\sum_{k=1}^{n}(p_{qk} - p_{qk-q} - q\hat{\mu})^2$$

$$\hat{VR}(q) = \frac{\hat{\sigma}_b^2(q)}{\hat{\sigma}_a^2}$$

In order to improve the finite sample properties of this test statistic, Lo and MacKinlay propose two important refinements. The first is to use overlapping q-period returns in estimating the variances by defining the following alternative estimator for σ_2:

$$\hat{\sigma}_c^2(q) = \frac{1}{nq^2}\sum_{k=q}^{nq}(p_k - p_{k-q} - q\hat{\mu})^2$$

This estimator contains *nq-q+1* terms, whereas the estimator $\hat{\sigma}_b^2(q)$ contains only *n* terms. Using overlapping *q*-period returns yields a more efficient estimator and hence a more powerful test.

The second refinement involves correcting the bias in the variance estimators of $\hat{\sigma}_a^2$ and $\hat{\sigma}_c^2(q)$ before dividing one by the other. Denote the unbiased estimators as $\bar{\sigma}_a^2$ and $\bar{\sigma}_c^2(q)$, where:

$$\bar{\sigma}_a^2 = \frac{1}{nq-1}\sum_{k=1}^{nq}(p_k - p_{k-1} - \hat{\mu})^2$$

$$\bar{\sigma}_c^2(q) = \frac{1}{m}\sum_{k=q}^{nq}(p_k - p_{k-q} - q\hat{\mu})^2$$

$$m \equiv q(nq-q+1)\left(1-\frac{q}{nq}\right)$$

Consequently the test statistic becomes:

$$\overline{VR}(q) = \frac{\bar{\sigma}_c^2(q)}{\bar{\sigma}_a^2}$$

Under the null hypothesis H_0, the asymptotic distribution of the variance ratio is given by:

$$\sqrt{nq}\,(\overline{VR}(q)-1) \overset{a}{\sim} N\left(0, \frac{2(2q-1)(q-1)}{3q}\right)$$

On the basis of this asymptotic distribution, Lo and MacKinlay define the following standardized test statistic:

$$\psi(q) \equiv \sqrt{nq}\,(\overline{VR}(q)-1)\left(\frac{2(2q-1)(q-1)}{3q}\right)^{-1/2} \overset{a}{\sim} N(0,1)$$

Variance Ratio statistic to test for RW3:

The standardized test statistic used under the RW3 null hypothesis is defined as follows:

$$\psi^*(q) = \frac{\sqrt{nq}\,(\overline{VR}(q)-1)}{\sqrt{\hat{\theta}}} \overset{a}{\sim} N(0,1)$$

Where

$$\hat{\theta}(q) \equiv 4\sum_{k=1}^{q-1}\left(1-\frac{k}{q}\right)^2 \hat{\delta}_k$$

$$\hat{\delta}_k = \frac{nq\sum_{j=k+1}^{nq}(p_j - p_{j-1} - \hat{\mu})^2 (p_{j-k} - p_{j-k-1} + \hat{\mu})^2}{\left[\sum_{j=1}^{nq}(p_j - p_{j-1} - \hat{\mu})^2\right]^2}$$

Filter rule test procedure:

Here, we cite the definition of the filter rule test statistic as provided by Fama and Blume (1966), p. 232:

In applying the filter technique, the data determine whether the first position taken will be long or short. With an *x* per cent filter, an initial position is taken as soon as there is an up-move or a down-move (whichever comes first) where the total price change is equal or greater than *x* per cent. The position is assumed to be taken on the first day for which the price change equals or exceeds the *x* per cent limit. Any positions open at the end of the sampling period are disregarded. Thus only completed transactions are included in the calculations.

The closing price on the day a position is opened defines a reference price: a peak in the case of a long transaction and a trough in the case of a short transaction. On each subsequent day it is necessary to check whether the position should be closed, i.e. whether the current price is *x* per cent below the reference (peak) price in a long position or *x* per cent above the reference (trough) price if the open position is short. If the current position is not to be closed, it is then necessary to check whether the reference price must be changed. In a long position this will be necessary when the current price exceeds the reference price so that a new peak has been attained, whereas in a short position a new trough will be defined when the current price is below the reference price. Of course, when the reference price changes all subsequent testing uses the new value as base.

On ex-dividend days the reference price is adjusted by adding back the amount of the dividend. Such an adjustment is necessary in order to insure that the filter will not be triggered simply because the stock's price typically falls on an ex-dividend date. In addition, if a split occurs when a position is open, the price of the security subsequent to the split is adjusted upward by the appropriate factor until the position is closed.

APPENDIX 4

Additional estimation results (data set with linear interpolation)

Table A3.1

AUTOCORRELATIONS AND BOX-PIERCE Q-STATISTIC FOR DAILY STOCK RETURNS (P-VALUES IN PARENTHESES)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
ALBHL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.026	-0.086	-0.029	-0.013	-0.005	6.39	9.38	13.43
								(0.172)	(0.311)	(0.338)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.022	0.146	0.143	0.099	-0.061	42.98	51.88	53.53
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.024	0.012	0.043	0.034	-0.027	6.01	13.24	16.64
								(0.198)	(0.104)	(0.164)
IHLBL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.026	-0.050	0.159	-0.066	0.121	35.17	39.13	40.53
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.003	0.030	-0.011	0.113	-0.049	0.091	18.30	39.22	51.07
								(0.001)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.028	-0.034	0.129	-0.071	0.118	55.97	73.61	84.57
								(0.000)	(0.000)	(0.000)
PETHL										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.019	0.009	0.092	0.108	0.036	16.14	23.71	24.20
								(0.003)	(0.003)	(0.019)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.029	0.157	0.089	0.084	0.033	31.58	41.73	42.11
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.025	0.121	0.100	0.089	0.022	50.14	68.15	68.80
								(0.000)	(0.000)	(0.000)
DOVUHL										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.032	-0.032	-0.101	-0.020	0.043	10.14	14.50	20.64
								(0.038)	(0.070)	(0.056)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.026	0.157	0.085	0.025	0.023	25.60	28.57	31.90
								(0.000)	(0.000)	(0.001)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.029	0.047	-0.023	-0.001	0.033	5.86	8.95	11.18
								(0.210)	(0.346)	(0.513)
SFARM										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.040	0.227	0.154	0.086	-0.022	62.18	66.47	72.17
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.017	-0.060	0.058	-0.052	-0.044	8.96	21.03	24.09
								(0.062)	(0.007)	(0.020)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.031	0.183	0.139	0.065	-0.025	87.59	97.41	107.27
								(0.000)	(0.000)	(0.000)
LEV										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.014	-0.059	-0.076	0.014	-0.059	9.66	15.59	35.77
								(0.046)	(0.049)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.014	-0.246	0.064	-0.040	0.044	52.95	55.13	57.22
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.014	-0.157	-0.003	-0.024	0.001	38.62	44.01	54.11
								(0.000)	(0.000)	(0.000)
PET										
Oct 23, 2000 – Oct 20, 2003	749	0.004	0.040	0.003	0.071	0.135	0.005	17.35	27.95	30.09
								(0.002)	(0.000)	(0.003)
Oct 21, 2003 – Nov 23, 2006	776	0.000	0.027	-0.184	-0.014	-0.010	-0.026	26.97	28.77	31.57
								(0.000)	(0.000)	(0.002)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.034	-0.054	0.046	0.090	-0.002	20.06	30.65	31.21
								(0.000)	(0.000)	(0.002)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
AFH										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.031	0.381	0.134	-0.075	-0.123	137.52	273.44	280.40
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.033	-0.108	0.045	0.143	0.043	27.90	38.81	46.58
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.032	0.119	0.087	0.042	-0.033	37.77	71.47	81.25
								(0.000)	(0.000)	(0.000)
GAMZA										
Oct 23, 2000 – Oct 20, 2003	749	0.000	0.030	-0.091	-0.027	-0.040	-0.066	11.23	23.41	25.25
								(0.024)	(0.003)	(0.014)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.031	0.035	-0.013	-0.049	0.004	3.00	9.90	12.61
								(0.558)	(0.272)	(0.398)
Oct 23, 2000 – Nov 23, 2006	1525	0.000	0.031	-0.024	-0.019	-0.044	-0.028	5.57	14.52	18.11
								(0.233)	(0.069)	(0.112)
ALB										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.020	-0.002	-0.050	-0.034	-0.051	4.71	7.44	15.02
								(0.318)	(0.490)	(0.240)
Oct 21, 2003 – Nov 23, 2006	776	0.002	0.017	-0.067	0.070	0.085	-0.026	13.32	40.65	46.74
								(0.010)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.019	-0.030	0.003	0.019	-0.040	4.43	20.90	32.51
								(0.351)	(0.007)	(0.001)
BHC										
Oct 23, 2000 – Oct 20, 2003	749	0.001	0.039	0.382	0.233	0.217	0.132	197.75	204.42	231.46
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.036	-0.025	0.001	0.077	0.061	8.07	9.08	17.57
								(0.089)	(0.336)	(0.129)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.037	0.190	0.124	0.151	0.098	128.49	131.59	158.40
								(0.000)	(0.000)	(0.000)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
SOFIX										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.025	-0.131	0.055	-0.063	-0.001	18.00	25.00	36.08
								(0.001)	(0.002)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.009	0.202	0.103	-0.004	0.055	42.12	51.94	61.89
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.019	-0.091	0.061	-0.056	0.007	22.83	33.47	47.12
								(0.000)	(0.000)	(0.000)
Equally-weighted portfolio										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.012	0.176	0.173	0.143	0.054	62.97	82.95	89.30
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.014	0.208	0.174	0.075	0.045	62.83	84.43	84.59
								(0.000)	(0.000)	(0.000)
Oct 23, 2000 – Nov 23, 2006	1525	0.001	0.013	0.194	0.173	0.103	0.048	122.60	157.30	159.07
								(0.000)	(0.000)	(0.000)
MarketCap-weighted portfolio										
Oct 23, 2000 – Oct 20, 2003	749	0.002	0.014	0.170	0.169	0.143	0.043	59.70	78.46	80.89
								(0.000)	(0.000)	(0.000)
Oct 21, 2003 – Nov 23, 2006	776	0.001	0.013	0.031	0.100	0.029	0.011	9.28	21.00	21.49
								(0.054)	(0.007)	(0.044)
Oct 23, 2000 – Nov 23, 2006	1525	0.002	0.014	0.105	0.137	0.090	0.028	58.91	81.77	83.58
								(0.000)	(0.000)	(0.000)

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table A3.2

AUTOCORRELATIONS AND BOX-PIERCE Q-STATISTIC FOR WEEKLY STOCK RETURNS (P-VALUES IN PARENTHESES)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
ALBHL										
Oct 24, 2000 – Oct 21, 2003	149	0.0013	0.0321	0.119	0.087	0.042	-0.033	4.25	11.73	14.32
								(0.373)	(0.164)	(0.281)
Oct 22, 2003 – Nov 21, 2006	158	0.0010	0.0389	0.382	0.233	0.217	0.132	6.71	27.07	33.44
								(0.152)	(0.001)	(0.001)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	9.41	31.08	36.53
								(0.052)	(0.000)	(0.000)
IHLBL										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	5.44	8.03	13.47
								(0.245)	(0.430)	(0.336)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	46.64	57.49	75.47
								(0.000)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.0015	0.0130	0.194	0.173	0.103	0.048	24.68	29.03	47.08
								(0.000)	(0.000)	(0.000)
PETHL										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	6.88	18.33	20.69
								(0.143)	(0.019)	(0.055)
Oct 22, 2003 – Nov 21, 2006	158	0.0008	0.0360	-0.025	0.001	0.077	0.061	9.88	31.51	32.20
								(0.043)	(0.000)	(0.001)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	16.88	38.58	39.91
								(0.002)	(0.000)	(0.000)
DOVUHL										
Oct 24, 2000 – Oct 21, 2003	149	-0.0004	0.0305	-0.091	-0.027	-0.040	-0.066	5.11	7.90	9.15
								(0.276)	(0.444)	(0.690)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	8.43	27.46	34.69
								(0.077)	(0.001)	(0.001)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	6.83	17.48	20.92
								(0.145)	(0.025)	(0.052)
SFARM										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	15.92	17.66	25.95
								(0.003)	(0.024)	(0.011)
Oct 22, 2003 – Nov 21, 2006	158	0.0009	0.0374	0.190	0.124	0.151	0.098	2.94	6.60	10.30
								(0.567)	(0.581)	(0.590)
Oct 24, 2000 – Nov 21, 2006	307	0.0019	0.0143	0.170	0.169	0.143	0.043	27.86	29.99	43.56
								(0.000)	(0.000)	(0.000)
LEV										
Oct 24, 2000 – Oct 21, 2003	149	0.0013	0.0315	0.035	-0.013	-0.049	0.004	4.30	6.43	7.21
								(0.367)	(0.599)	(0.843)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	8.12	8.74	9.86
								(0.087)	(0.364)	(0.628)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	2.16	4.23	5.70
								(0.707)	(0.836)	(0.930)
PET										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	11.90	22.22	27.00
								(0.018)	(0.005)	(0.008)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	8.68	16.57	20.82
								(0.070)	(0.035)	(0.053)
Oct 24, 2000 – Nov 21, 2006	307	0.0011	0.0133	0.031	0.100	0.029	0.011	7.21	17.81	25.76
								(0.125)	(0.023)	(0.012)
AFH										
Oct 24, 2000 – Oct 21, 2003	149	0.0005	0.0310	-0.024	-0.019	-0.044	-0.028	35.80	37.97	40.90
								(0.000)	(0.000)	(0.000)
Oct 22, 2003 – Nov 21, 2006	158	0.0020	0.0255	-0.131	0.055	-0.063	-0.001	28.93	40.54	47.62
								(0.000)	(0.000)	(0.000)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	20.39	27.31	32.43
								(0.000)	(0.001)	(0.001)
GAMZA										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	6.89	9.34	12.63
								(0.142)	(0.315)	(0.396)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	1.45	28.05	43.77
								(0.835)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.0015	0.0138	0.105	0.137	0.090	0.028	2.78	26.32	41.58
								(0.595)	(0.001)	(0.000)
ALB										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	14.71	18.85	20.69
								(0.005)	(0.016)	(0.055)
Oct 22, 2003 – Nov 21, 2006	158	0.0012	0.0092	0.202	0.103	-0.004	0.055	19.48	29.88	42.83
								(0.001)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	10.36	17.45	25.65
								(0.035)	(0.026)	(0.012)
BHC										
Oct 24, 2000 – Oct 21, 2003	149	0.0019	0.0199	-0.002	-0.050	-0.034	-0.051	34.51	35.25	37.26
								(0.000)	(0.000)	(0.000)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	3.40	20.25	24.16
								(0.494)	(0.009)	(0.019)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	29.77	33.51	35.04
								(0.000)	(0.000)	(0.000)
SOFIX										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	4.32	5.37	6.26
								(0.365)	(0.717)	(0.903)
Oct 22, 2003 – Nov 21, 2006	158	0.0016	0.0190	-0.091	0.061	-0.056	0.007	1.96	9.63	10.88
								(0.744)	(0.292)	(0.539)

(continued)

(continued)

Sample period	Number of obs.	Mean Value	St. Dev.	r1	r2	r3	r4	Q4	Q8	Q12
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	4.88	6.09	7.43
								(0.300)	(0.637)	(0.828)
Equally-weighted portfolio										
Oct 24, 2000 – Oct 21, 2003	149	0.0015	0.0174	-0.067	0.070	0.085	-0.026	16.25	41.33	52.46
								(0.003)	(0.000)	(0.000)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	14.29	36.53	47.52
								(0.006)	(0.000)	(0.000)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	24.65	67.17	83.72
								(0.000)	(0.000)	(0.000)
MarketCap-weighted portfolio										
Oct 24, 2000 – Oct 21, 2003	149	0.0000	0.0000	0.000	0.000	0.000	0.000	11.90	33.61	47.59
								(0.018)	(0.000)	(0.000)
Oct 22, 2003 – Nov 21, 2006	158	0.0000	0.0000	0.000	0.000	0.000	0.000	3.05	7.84	15.71
								(0.550)	(0.449)	(0.205)
Oct 24, 2000 – Nov 21, 2006	307	0.0000	0.0000	0.000	0.000	0.000	0.000	14.38	34.00	50.98
								(0.006)	(0.000)	(0.000)

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table A3.3

VARIANCE RATIOS FOR DAILY STOCK RETURNS (RW1 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.92	0.84	0.83	0.85	0.85
		(-2.29)*	(-2.32)*	(-1.61)	(-1.12)	(-0.96)
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.42	1.65	1.83	1.96
		(4.11)*	(6.27)*	(6.12)*	(6.13)*	(6.08)*
Oct 23, 2000 – Nov 23, 2006	1525	1.01	1.08	1.17	1.25	1.30
		(0.53)	(1.73)	(2.19)*	(2.57)*	(2.64)*
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	0.95	1.02	1.18	1.25	1.26
		(-1.43)	(0.3)	(1.67)	(1.81)	(1.59)
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.05	1.31	1.58	1.80
		(-0.68)	(0.8)	(2.88)*	(4.34)*	(5.08)*
Oct 23, 2000 – Nov 23, 2006	1525	0.97	1.04	1.26	1.45	1.58
		(-1.29)	(0.91)	(3.37)*	(4.67)*	(5.15)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	0.99	1.12	1.34	1.44	1.49
		(-0.15)	(1.81)	(3.13)*	(3.23)*	(3.07)*
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.37	1.64	1.81	1.88
		(4.37)*	(5.49)*	(6.05)*	(6.04)*	(5.59)*
Oct 23, 2000 – Nov 23, 2006	1525	1.12	1.33	1.58	1.74	1.81
		(4.77)*	(6.89)*	(7.6)*	(7.72)*	(7.16)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.97	0.84	0.76	0.67	0.66
		(-0.85)	(-2.35)*	(-2.24)*	(-2.39)*	(-2.13)*
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.33	1.51	1.57	1.61
		(4.26)*	(4.98)*	(4.76)*	(4.22)*	(3.86)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.05	1.06	1.03	1.03
		(1.86)	(1.05)	(0.85)	(0.27)	(0.25)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.23	1.55	1.72	1.87	2.07
		(6.3)*	(8.01)*	(6.7)*	(6.31)*	(6.64)*
Oct 21, 2003 – Nov 23, 2006	776	0.94	0.95	0.90	0.98	1.03
		(-1.59)	(-0.74)	(-0.96)	(-0.14)	(0.19)
Oct 23, 2000 – Nov 23, 2006	1525	1.18	1.45	1.58	1.71	1.88
		(7.19)*	(9.39)*	(7.7)*	(7.39)*	(7.79)*
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.85	0.78	0.71	0.66
		(-1.53)	(-2.2)*	(-2.03)*	(-2.12)*	(-2.11)*
Oct 21, 2003 – Nov 23, 2006	776	0.76	0.58	0.53	0.51	0.49
		(-6.81)*	(-6.25)*	(-4.39)*	(-3.64)*	(-3.2)*
Oct 23, 2000 – Nov 23, 2006	1525	0.84	0.75	0.71	0.66	0.64
		(-6.1)*	(-5.18)*	(-3.88)*	(-3.5)*	(-3.16)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.01	1.15	1.37	1.51	1.54
		(0.16)	(2.22)*	(3.41)*	(3.75)*	(3.33)*
Oct 21, 2003 – Nov 23, 2006	776	0.82	0.71	0.64	0.59	0.59
		(-5.06)*	(-4.35)*	(-3.36)*	(-3.03)*	(-2.58)*
Oct 23, 2000 – Nov 23, 2006	1525	0.95	1.01	1.14	1.23	1.25
		(-2.06)*	(0.29)	(1.91)	(2.4)*	(2.22)*
AFH						
Oct 23, 2000 – Oct 20, 2003	749	1.38	1.68	1.34	0.86	0.65
		(10.5)*	(9.95)*	(3.12)*	(-1.06)	(-2.18)*
Oct 21, 2003 – Nov 23, 2006	776	0.89	0.96	1.18	1.39	1.62
		(-2.96)*	(-0.58)	(1.72)	(2.93)*	(3.92)*
Oct 23, 2000 – Nov 23, 2006	1525	1.12	1.29	1.25	1.14	1.17
		(4.72)*	(6.1)*	(3.3)*	(1.47)	(1.47)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.82	0.73	0.67	0.67
		(-2.42)*	(-2.59)*	(-2.53)*	(-2.41)*	(-2.07)*
Oct 21, 2003 – Nov 23, 2006	776	1.04	1.02	1.07	1.13	1.15
		(1.06)	(0.34)	(0.7)	(0.95)	(0.92)
Oct 23, 2000 – Nov 23, 2006	776	0.98	0.93	0.91	0.91	0.92
		(-0.88)	(-1.52)	(-1.22)	(-0.94)	(-0.73)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	1.00	0.94	0.84	0.81	0.82
		(0.01)	(-0.95)	(-1.46)	(-1.39)	(-1.1)
Oct 21, 2003 – Nov 23, 2006	776	0.93	1.02	1.22	1.43	1.52
		(-1.84)	(0.28)	(2.09)*	(3.18)*	(3.26)*
Oct 23, 2000 – Nov 23, 2006	1525	0.97	0.97	1.00	1.08	1.13
		(-1.17)	(-0.65)	(0.06)	(0.85)	(1.11)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.38	1.91	2.48	2.63	2.51
		(10.51)*	(13.33)*	(13.67)*	(11.86)*	(9.4)*
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.01	1.13	1.15	1.16
		(-0.66)	(0.13)	(1.23)	(1.13)	(1.03)
Oct 23, 2000 – Nov 23, 2006	1525	1.19	1.49	1.86	1.96	1.91
		(7.48)*	(10.24)*	(11.38)*	(9.98)*	(8.08)*
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.83	0.78	0.73	0.74
		(-3.51)*	(-2.44)*	(-2.06)*	(-1.98)*	(-1.63)
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.41	1.65	1.83	1.88
		(5.64)*	(6.09)*	(6.13)*	(6.19)*	(5.6)*
Oct 23, 2000 – Nov 23, 2006	1525	0.91	0.90	0.88	0.85	0.86
		(-3.49)*	(-2.1)*	(-1.63)	(-1.54)	(-1.21)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.18	1.52	1.97	2.18	2.24
		(4.89)*	(7.58)*	(9)*	(8.61)*	(7.73)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio 2	4	8	12	16
Oct 21, 2003 – Nov 23, 2006	776	1.21	1.53	1.91	2.19	2.37
		(5.86)*	(7.87)*	(8.57)*	(8.8)*	(8.68)*
Oct 23, 2000 – Nov 23, 2006	1525	1.20	1.52	1.92	2.16	2.28
		(7.64)*	(10.84)*	(12.15)*	(12.03)*	(11.33)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.17	1.51	1.93	2.19	2.35
		(4.72)*	(7.4)*	(8.62)*	(8.66)*	(8.42)*
Oct 21, 2003 – Nov 23, 2006	776	1.03	1.17	1.34	1.48	1.58
		(0.92)	(2.47)*	(3.16)*	(3.54)*	(3.66)*
Oct 23, 2000 – Nov 23, 2006	1525	1.11	1.34	1.64	1.84	1.97
		(4.14)*	(7.17)*	(8.48)*	(8.73)*	(8.59)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table A3.4

VARIANCE RATIOS FOR WEEKLY STOCK RETURNS (RW1 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio 2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	1.01	1.00	1.25	1.30	1.15
		(0.07)	(0.01)	(1.02)	(0.98)	(0.42)
Oct 21, 2003 – Nov 23, 2006	776	1.09	1.27	1.82	2.29	2.68
		(1.13)	(1.79)	(3.46)*	(4.34)*	(4.81)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.14	1.53	1.86	2.07
		(0.85)	(1.27)	(3.13)*	(4.02)*	(4.27)*
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	1.08	1.03	0.69	0.47	0.55
		(0.95)	(0.22)	(-1.26)	(-1.74)	(-1.25)
Oct 21, 2003 – Nov 23, 2006	776	1.41	2.02	2.87	3.58	4.30
		(5.13)*	(6.85)*	(7.93)*	(8.66)*	(9.43)*
Oct 23, 2000 – Nov 23, 2006	1525	1.25	1.54	1.88	2.16	2.55
		(4.32)*	(5.08)*	(5.21)*	(5.41)*	(6.16)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	1.18	1.17	1.07	0.96	0.92
		(2.15)*	(1.12)	(0.28)	(-0.12)	(-0.23)
Oct 21, 2003 – Nov 23, 2006	776	1.24	1.31	1.75	2.25	2.58
		(2.99)*	(2.1)*	(3.2)*	(4.2)*	(4.52)*
Oct 23, 2000 – Nov 23, 2006	1525	1.22	1.28	1.56	1.87	2.07
		(3.86)*	(2.64)*	(3.32)*	(4.09)*	(4.25)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.72	0.73	0.70	0.68
		(-1.44)	(-1.84)	(-1.1)	(-0.98)	(-0.88)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.29	1.88	2.38	2.78
		(2.07)*	(1.95)	(3.76)*	(4.64)*	(5.07)*
Oct 23, 2000 – Nov 23, 2006	1525	1.03	1.01	1.29	1.49	1.63
		(0.51)	(0.05)	(1.73)	(2.29)*	(2.52)*
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.09	1.39	1.84	2.22	2.42
		(1.13)	(2.57)*	(3.47)*	(3.98)*	(3.95)*
Oct 21, 2003 – Nov 23, 2006	776	0.99	1.14	1.22	1.07	0.93
		(-0.18)	(0.96)	(0.95)	(0.25)	(-0.2)
Oct 23, 2000 – Nov 23, 2006	1525	1.08	1.35	1.73	2.00	2.08
		(1.35)	(3.28)*	(4.33)*	(4.65)*	(4.31)*
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.84	0.95	0.97	0.93
		(-0.67)	(-1.03)	(-0.2)	(-0.1)	(-0.19)
Oct 21, 2003 – Nov 23, 2006	776	0.83	0.70	0.55	0.53	0.49
		(-2.17)*	(-2.04)*	(-1.92)	(-1.59)	(-1.45)
Oct 23, 2000 – Nov 23, 2006	1525	0.93	0.85	0.85	0.80	0.73
		(-1.17)	(-1.4)	(-0.91)	(-0.93)	(-1.08)
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.25	1.27	1.47	1.87	2.30
		(3.1)*	(1.76)	(1.93)	(2.84)*	(3.59)*
Oct 21, 2003 – Nov 23, 2006	776	0.80	0.72	0.70	0.63	0.59
		(-2.57)*	(-1.89)	(-1.28)	(-1.25)	(-1.17)
Oct 23, 2000 – Nov 23, 2006	1525	1.14	1.14	1.31	1.59	1.90
		(2.44)*	(1.34)	(1.82)	(2.76)*	(3.58)*
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.89	0.46	0.26	0.10	0.09
		(-1.29)	(-3.55)*	(-3.06)*	(-2.91)*	(-2.54)*
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.69	2.56	3.22	3.66
		(2.54)*	(4.62)*	(6.62)*	(7.45)*	(7.6)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.09	1.42	1.65	1.82
		(0.88)	(0.8)	(2.48)*	(3.03)*	(3.27)*
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.90	0.75	0.64	0.53	0.52
		(-1.2)	(-1.6)	(-1.49)	(-1.52)	(-1.32)
Oct 21, 2003 – Nov 23, 2006	776	1.07	1.04	1.44	1.77	2.10
		(0.84)	(0.28)	(1.86)	(2.57)*	(3.15)*
Oct 23, 2000 – Nov 23, 2006	776	1.00	0.92	1.09	1.23	1.39
		(-0.08)	(-0.75)	(0.53)	(1.06)	(1.54)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.80	0.71	0.89	1.08	1.26
		(-2.39)*	(-1.9)	(-0.45)	(0.25)	(0.72)
Oct 21, 2003 – Nov 23, 2006	776	1.34	1.48	1.90	2.19	2.52
		(4.29)*	(3.21)*	(3.83)*	(3.98)*	(4.34)*
Oct 23, 2000 – Nov 23, 2006	1525	1.03	1.03	1.28	1.46	1.68
		(0.46)	(0.25)	(1.64)	(2.14)*	(2.71)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio 2	4	8	12	16
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.29	1.20	0.77	0.56	0.59
		(3.5)*	(1.29)	(-0.93)	(-1.43)	(-1.13)
Oct 21, 2003 – Nov 23, 2006	776	1.11	1.20	1.55	1.91	2.24
		(1.34)	(1.33)	(2.32)*	(3.04)*	(3.53)*
Oct 23, 2000 – Nov 23, 2006	1525	1.23	1.21	1.05	0.99	1.08
		(3.98)*	(2.01)*	(0.31)	(-0.04)	(0.3)
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.80	0.85	0.90	0.91
		(-1.46)	(-1.28)	(-0.6)	(-0.32)	(-0.24)
Oct 21, 2003 – Nov 23, 2006	776	1.12	1.21	1.30	1.18	1.08
		(1.5)	(1.43)	(1.25)	(0.59)	(0.23)
Oct 23, 2000 – Nov 23, 2006	1525	0.92	0.87	0.92	0.92	0.93
		(-1.44)	(-1.26)	(-0.49)	(-0.37)	(-0.27)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.32	1.46	1.86	2.50	3.07
		(3.9)*	(3.03)*	(3.54)*	(4.89)*	(5.74)*
Oct 21, 2003 – Nov 23, 2006	776	1.24	1.52	2.26	2.86	3.35
		(3.01)*	(3.49)*	(5.34)*	(6.25)*	(6.7)*
Oct 23, 2000 – Nov 23, 2006	1525	1.26	1.47	2.04	2.57	3.03
		(4.62)*	(4.41)*	(6.14)*	(7.34)*	(8.09)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.27	1.49	2.02	2.77	3.37
		(3.33)*	(3.2)*	(4.21)*	(5.77)*	(6.58)*
Oct 21, 2003 – Nov 23, 2006	776	1.07	1.24	1.58	1.78	1.99
		(0.94)	(1.61)	(2.47)*	(2.62)*	(2.84)*
Oct 23, 2000 – Nov 23, 2006	1525	1.18	1.37	1.80	2.25	2.67
		(3.24)*	(3.47)*	(4.75)*	(5.85)*	(6.67)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table A3.5

VARIANCE RATIOS FOR DAILY STOCK RETURNS (RW3 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio 2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.83	0.81	0.82	0.81
		(-1.16)	(-1.24)	(-0.99)	(-0.8)	(-0.77)
Oct 21, 2003 – Nov 23, 2006	776	1.15	1.41	1.62	1.78	1.89
		(2.5)*	(3.57)*	(3.46)*	(3.53)*	(3.56)*
Oct 23, 2000 – Nov 23, 2006	1525	1.01	1.08	1.16	1.23	1.27
		(0.25)	(0.87)	(1.17)	(1.47)	(1.57)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	0.95	1.05	1.23	1.31	1.34
		(-0.5)	(0.28)	(0.85)	(0.96)	(0.91)
Oct 21, 2003 – Nov 23, 2006	776	0.99	1.07	1.32	1.59	1.79
		(-0.18)	(0.66)	(1.93)	(2.87)*	(3.35)*
Oct 23, 2000 – Nov 23, 2006	1525	0.97	1.04	1.25	1.45	1.58
		(-0.61)	(0.42)	(1.7)	(2.41)*	(2.72)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	1.01	1.16	1.38	1.53	1.61
		(0.08)	(0.8)	(1.39)	(1.71)	(1.83)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.37	1.62	1.77	1.82
		(2.5)*	(3.16)*	(3.48)*	(3.53)*	(3.3)*
Oct 23, 2000 – Nov 23, 2006	1525	1.12	1.33	1.56	1.72	1.77
		(2.16)*	(3.19)*	(3.73)*	(3.97)*	(3.8)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.97	0.84	0.76	0.66	0.64
		(-0.56)	(-1.53)	(-1.59)	(-1.81)	(-1.69)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.33	1.48	1.53	1.55
		(2.7)*	(3.22)*	(3.18)*	(2.89)*	(2.71)*
Oct 23, 2000 – Nov 23, 2006	1525	1.05	1.05	1.06	1.01	1.01
		(1.13)	(0.62)	(0.5)	(0.11)	(0.07)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.23	1.54	1.70	1.82	2.00
		(3.38)*	(4.48)*	(3.86)*	(3.69)*	(3.94)*
Oct 21, 2003 – Nov 23, 2006	776	0.94	0.94	0.88	0.96	1.00
		(-0.76)	(-0.43)	(-0.61)	(-0.19)	(-0.01)
Oct 23, 2000 – Nov 23, 2006	1525	1.18	1.44	1.57	1.69	1.85
		(3.15)*	(4.31)*	(3.68)*	(3.6)*	(3.88)*
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.94	0.84	0.77	0.69	0.64
		(-0.82)	(-1.23)	(-1.24)	(-1.37)	(-1.41)
Oct 21, 2003 – Nov 23, 2006	776	0.75	0.67	0.65	0.63	0.62
		(-2.9)*	(-2.31)*	(-1.92)	(-1.81)	(-1.73)
Oct 23, 2000 – Nov 23, 2006	1525	0.84	0.75	0.70	0.66	0.63
		(-2.81)*	(-2.62)*	(-2.28)*	(-2.26)*	(-2.18)*
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.00	1.14	1.34	1.47	1.48
		(0.05)	(1.22)	(1.95)	(2.22)*	(2)*
Oct 21, 2003 – Nov 23, 2006	776	0.82	0.71	0.64	0.58	0.57
		(-2.7)*	(-2.56)*	(-2.24)*	(-2.18)*	(-1.96)*
Oct 23, 2000 – Nov 23, 2006	1525	0.95	1.01	1.14	1.21	1.23
		(-1.08)	(0.12)	(1.03)	(1.36)	(1.28)
AFH						
Oct 23, 2000 – Oct 20, 2003	749	1.38	1.67	1.31	0.83	0.62
		(1.39)	(1.46)	(0.52)	(-0.25)	(-0.52)
Oct 21, 2003 – Nov 23, 2006	776	0.89	0.95	1.16	1.36	1.56
		(-1.76)	(-0.41)	(0.98)	(1.8)	(2.49)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
Oct 23, 2000 – Nov 23, 2006	1525	1.12	1.29	1.24	1.12	1.14
		(0.91)	(1.31)	(0.82)	(0.37)	(0.4)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.82	0.71	0.66	0.65
		(-1.15)	(-1.27)	(-1.36)	(-1.37)	(-1.25)
Oct 21, 2003 – Nov 23, 2006	776	1.04	1.02	1.06	1.10	1.10
		(0.61)	(0.14)	(0.34)	(0.47)	(0.43)
Oct 23, 2000 – Nov 23, 2006	776	0.98	0.92	0.90	0.90	0.90
		(-0.49)	(-0.87)	(-0.76)	(-0.64)	(-0.55)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	1.00	0.93	0.83	0.79	0.79
		(-0.02)	(-0.47)	(-0.81)	(-0.85)	(-0.75)
Oct 21, 2003 – Nov 23, 2006	776	0.93	1.01	1.21	1.41	1.49
		(-0.98)	(0.1)	(1.14)	(1.87)	(1.94)
Oct 23, 2000 – Nov 23, 2006	1525	0.97	0.97	1.00	1.07	1.11
		(-0.55)	(-0.34)	(-0.02)	(0.4)	(0.56)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.38	1.91	2.50	2.65	2.54
		(4.36)*	(5.68)*	(6.31)*	(5.71)*	(4.71)*
Oct 21, 2003 – Nov 23, 2006	776	0.97	1.00	1.11	1.12	1.12
		(-0.5)	(0.02)	(0.76)	(0.66)	(0.57)
Oct 23, 2000 – Nov 23, 2006	1525	1.19	1.49	1.85	1.93	1.88
		(3.64)*	(5.04)*	(5.88)*	(5.3)*	(4.38)*
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.83	0.78	0.73	0.73
		(-1.42)	(-1.2)	(-1.24)	(-1.31)	(-1.16)
Oct 21, 2003 – Nov 23, 2006	776	1.20	1.40	1.64	1.80	1.83
		(3.09)*	(3.57)*	(3.85)*	(3.91)*	(3.52)*
Oct 23, 2000 – Nov 23, 2006	1525	0.91	0.90	0.88	0.86	0.86
		(-1.11)	(-0.81)	(-0.74)	(-0.77)	(-0.65)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.18	1.51	1.94	2.12	2.16
		(3.37)*	(5.28)*	(6.2)*	(5.84)*	(5.26)*
Oct 21, 2003 – Nov 23, 2006	776	1.21	1.52	1.89	2.14	2.30
		(3.67)*	(5)*	(5.68)*	(6.02)*	(6.04)*
Oct 23, 2000 – Nov 23, 2006	1525	1.19	1.52	1.91	2.13	2.24
		(4.92)*	(7.08)*	(8.19)*	(8.29)*	(7.98)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.17	1.49	1.90	2.13	2.27
		(3.22)*	(5.26)*	(6.07)*	(6.04)*	(5.93)*
Oct 21, 2003 – Nov 23, 2006	776	1.03	1.16	1.32	1.45	1.53
		(0.49)	(1.48)	(2.06)*	(2.38)*	(2.48)*
Oct 23, 2000 – Nov 23, 2006	1525	1.10	1.34	1.63	1.82	1.93
		(2.57)*	(4.72)*	(5.83)*	(6.12)*	(6.13)*

Notes: Test statistic values in parenthesis.
*indicates significance at 5 per cent level.

Table A3.6

VARIANCE RATIOS FOR WEEKLY STOCK RETURNS WITH LINEAR INTERPOLATION (RW3 NULL HYPOTHESIS)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
ALBHL						
Oct 23, 2000 – Oct 20, 2003	749	1.00	0.97	1.16	1.27	1.31
		(-0.02)	(-0.14)	(0.53)	(0.73)	(0.74)
Oct 21, 2003 – Nov 23, 2006	776	1.08	1.23	1.68	2.04	2.28
		(0.58)	(1.06)	(2.1)*	(2.48)*	(2.56)*
Oct 23, 2000 – Nov 23, 2006	1525	1.04	1.12	1.47	1.75	1.89
		(0.46)	(0.77)	(2.06)*	(2.58)*	(2.63)*
IHLBL						
Oct 23, 2000 – Oct 20, 2003	749	1.06	1.02	0.74	0.57	0.62
		(0.55)	(0.09)	(-0.96)	(-1.28)	(-0.96)
Oct 21, 2003 – Nov 23, 2006	776	1.39	1.97	2.69	3.25	3.80
		(2.79)*	(4.01)*	(4.98)*	(5.49)*	(5.89)*
Oct 23, 2000 – Nov 23, 2006	1525	1.24	1.53	1.81	2.03	2.34
		(2.57)*	(3.34)*	(3.59)*	(3.67)*	(4.06)*
PETHL						
Oct 23, 2000 – Oct 20, 2003	749	1.21	1.31	1.16	0.96	0.87
		(1.43)	(1.38)	(0.49)	(-0.09)	(-0.27)
Oct 21, 2003 – Nov 23, 2006	776	1.23	1.27	1.62	1.98	2.16
		(1.25)	(0.91)	(1.55)	(1.97)*	(2.01)*
Oct 23, 2000 – Nov 23, 2006	1525	1.21	1.26	1.50	1.76	1.89
		(1.52)	(1.13)	(1.62)	(1.98)*	(2.01)*
DOVUHL						
Oct 23, 2000 – Oct 20, 2003	749	0.91	0.72	0.69	0.64	0.61
		(-0.68)	(-1.21)	(-0.98)	(-0.99)	(-0.99)
Oct 21, 2003 – Nov 23, 2006	776	1.16	1.25	1.75	2.10	2.33
		(1.46)	(1.36)	(2.82)*	(3.25)*	(3.33)*
Oct 23, 2000 – Nov 23, 2006	1525	1.02	0.99	1.25	1.41	1.51
		(0.29)	(-0.08)	(1.19)	(1.62)	(1.77)
SFARM						
Oct 23, 2000 – Oct 20, 2003	749	1.08	1.35	1.74	2.01	2.32
		(0.49)	(1.29)	(1.97)*	(2.37)*	(2.85)*
Oct 21, 2003 – Nov 23, 2006	776	0.98	1.11	1.16	1.01	0.87
		(-0.16)	(0.43)	(0.46)	(0.03)	(-0.29)
Oct 23, 2000 – Nov 23, 2006	1525	1.07	1.33	1.69	1.92	2.18
		(0.48)	(1.32)	(1.98)*	(2.33)*	(2.74)*
LEV						
Oct 23, 2000 – Oct 20, 2003	749	0.93	0.83	1.00	1.09	1.10
		(-0.41)	(-0.57)	(0.01)	(0.19)	(0.2)
Oct 21, 2003 – Nov 23, 2006	776	0.92	0.82	0.59	0.51	0.44
		(-0.78)	(-1.06)	(-1.58)	(-1.59)	(-1.66)
Oct 23, 2000 – Nov 23, 2006	1525	0.93	0.85	0.86	0.85	0.82
		(-0.75)	(-0.92)	(-0.57)	(-0.51)	(-0.59)

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio				
		2	4	8	12	16
PET						
Oct 23, 2000 – Oct 20, 2003	749	1.24	1.22	1.34	1.63	1.93
		(2.02)*	(1.06)	(1.08)	(1.59)	(2.03)*
Oct 21, 2003 – Nov 23, 2006	776	0.79	0.69	0.67	0.57	0.51
		(-1.92)	(-1.58)	(-1.12)	(-1.17)	(-1.16)
Oct 23, 2000 – Nov 23, 2006	1525	1.13	1.12	1.26	1.49	1.74
		(1.4)	(0.75)	(1.03)	(1.57)	(2.06)*
AFH						
Oct 23, 2000 – Oct 20, 2003	749	0.88	0.44	0.24	0.17	0.14
		(-0.76)	(-1.17)	(-1.1)	(-1.08)	(-1.06)
Oct 21, 2003 – Nov 23, 2006	776	1.19	1.63	2.36	2.83	3.05
		(1.46)	(2.55)*	(3.67)*	(4.01)*	(3.88)*
Oct 23, 2000 – Nov 23, 2006	1525	1.04	1.07	1.36	1.58	1.70
		(0.45)	(0.25)	(0.93)	(1.31)	(1.44)
GAMZA						
Oct 23, 2000 – Oct 20, 2003	749	0.89	0.74	0.59	0.46	0.43
		(-0.9)	(-1.3)	(-1.33)	(-1.43)	(-1.34)
Oct 21, 2003 – Nov 23, 2006	776	1.05	1.00	1.33	1.57	1.78
		(0.39)	(0.01)	(0.94)	(1.27)	(1.48)
Oct 23, 2000 – Nov 23, 2006	776	0.99	0.90	1.05	1.15	1.27
		(-0.11)	(-0.61)	(0.19)	(0.49)	(0.75)
ALB						
Oct 23, 2000 – Oct 20, 2003	749	0.80	0.68	0.82	0.96	1.12
		(-1.21)	(-1.17)	(-0.49)	(-0.09)	(0.26)
Oct 21, 2003 – Nov 23, 2006	776	1.33	1.45	1.78	1.94	2.13
		(2.3)*	(1.98)*	(2.21)*	(2.1)*	(2.15)*
Oct 23, 2000 – Nov 23, 2006	1525	1.02	1.01	1.23	1.38	1.56
		(0.18)	(0.05)	(0.87)	(1.22)	(1.62)
BHC						
Oct 23, 2000 – Oct 20, 2003	749	1.29	1.21	0.80	0.71	0.71
		(2.19)*	(0.87)	(-0.5)	(-0.64)	(-0.6)
Oct 21, 2003 – Nov 23, 2006	776	1.09	1.16	1.42	1.73	1.94
		(0.61)	(0.6)	(1.18)	(1.65)	(1.82)
Oct 23, 2000 – Nov 23, 2006	1525	1.22	1.19	1.01	1.00	1.03
		(2.17)*	(1.03)	(0.03)	(-0.01)	(0.09)
SOFIX						
Oct 23, 2000 – Oct 20, 2003	749	0.87	0.78	0.79	0.81	0.83
		(-1.01)	(-1.1)	(-0.75)	(-0.6)	(-0.47)
Oct 21, 2003 – Nov 23, 2006	776	1.11	1.17	1.20	1.07	0.93
		(0.98)	(0.87)	(0.68)	(0.18)	(-0.15)
Oct 23, 2000 – Nov 23, 2006	1525	0.92	0.85	0.88	0.86	0.86
		(-0.81)	(-0.87)	(-0.52)	(-0.49)	(-0.44)
Equally-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.30	1.41	1.75	2.28	2.86
		(2.7)*	(2.09)*	(2.55)*	(3.36)*	(4.18)*
Oct 21, 2003 – Nov 23, 2006	776	1.23	1.47	2.08	2.52	2.79
		(1.7)	(2.11)*	(3.32)*	(3.69)*	(3.72)*

(continued)

(continued)

Sample period	Number of observations	Number q of base observations aggregated to form variance ratio 2	4	8	12	16
Oct 23, 2000 – Nov 23, 2006	1525	1.26	1.44	1.96	2.41	2.78
		(2.79)*	(2.88)*	(4.17)*	(4.83)*	(5.23)*
MarketCap-weighted portfolio						
Oct 23, 2000 – Oct 20, 2003	749	1.26	1.44	1.92	2.53	3.17
		(2.49)*	(2.4)*	(3.25)*	(4.19)*	(5.08)*
Oct 21, 2003 – Nov 23, 2006	776	1.06	1.20	1.47	1.58	1.67
		(0.6)	(1.04)	(1.52)	(1.49)	(1.5)
Oct 23, 2000 – Nov 23, 2006	1525	1.18	1.35	1.75	2.14	2.55
		(2.37)*	(2.6)*	(3.57)*	(4.26)*	(4.95)*

Notes: Test statistic values in parenthesis.
* indicates significance at 5 per cent level.

Table A3.7

SUMMARY OF THE RESULTS FOR AUTOCORRELATION COEFFICIENTS AND BOX-PIERCE, Q-STATISTIC FOR THE DATASET WITH LINEAR INTERPOLATION

Panel A: Summary of the results related to the autocorrelation coefficients

Sample period	ρ1	ρ2	ρ3	ρ4	ρ1	ρ2	ρ3	ρ4
Number of sign reversals in r across sub-periods					*(per cent)*			
– daily data	8	5	7	5	57.1	35.7	50	35.7
– weekly data	8	5	9	6	57.1	35.7	64.3	42.9
Number of larger r in the second sub-period as compared to the first one					*(per cent)*			
– daily data	8	4	6	4	57.1	28.6	429	28.6
– weekly data	7	6	7	5	50.0	42.9	50.0	35.7

Panel B: Number of statistically significant Box – Pierce, Q-statistics

Sample period	Number of observations	Q4	Q8	Q12	Q4	Q8	Q12
Daily data				*(per cent)*			
Oct 23, 2000 – Oct 20, 2003	749	10	10	11	71.4	71.4	78.6
Oct 21, 2003 – Nov 23, 2006	776	11	13	12	78.6	92.9	85.7
Oct 23, 2000 – Nov 23, 2006	1525	10	12	12	71.4	85.7	85.7
Weekly data				*(per cent)*			
Oct 24, 2000 – Oct 21, 2003	149	8	9	6	57.1	64.3	42.9
Oct 22, 2003 – Nov 21, 2006	158	5	10	10	35.7	71.4	71.4
Oct 24, 2000 – Nov 21, 2006	307	7	10	12	50.0	71.4	85.7

Table A3.8

SUMMARY OF THE RESULTS FOR VARIANCE RATIONS UNDER RW1 AND RW3 FOR THE DATASET WITH LINEAR INTERPOLATION

Panel A: Summary data for the tests of the RW1 null hypothesis

Number of times RW1 hypothesis rejected (out of 14 possible cases)

Sample period	Number q of base observations aggregated to form variance ratio					Number q of base observations aggregated to form variance ratio				
	2	4	8	12	16	2	4	8	12	16
	daily data					*weekly data*				
Oct 23, 2000 – Oct 20, 2003	8	11	11	10	10	6	4	4	5	5
Oct 21, 2003 – Nov 23, 2006	8	8	10	11	11	8	6	9	10	10
Oct 23, 2000 – Nov 23, 2006	9	8	9	9	9	6	6	7	10	10

Number of reversals of the value of the VR statistics with respect to 1 across sub-periods

	daily data					*weekly data*				
	10	8	7	8	7	7	6	7	7	8

Panel B: Summary data for the tests of the RW1 null hypothesis

Number of times RW3 hypothesis rejected out (of 14 possible cases)

Sample period	Number q of base observations aggregated to form variance ratio					Number q of base observations aggregated to form variance ratio				
	2	4	8	12	16	2	4	8	12	16
	daily data					*weekly data*				
Oct 23, 2000 – Oct 20, 2003	4	4	4	5	5	4	2	3	3	4
Oct 21, 2003 – Nov 23, 2006	7	7	7	8	9	2	4	6	7	7
Oct 23, 2000 – Nov 23, 2006	6	6	6	7	7	4	3	5	6	7

Number of reversals of the value of the VR statistics with respect to 1 across sub-periods

	daily data					*weekly data*				
	8	8	7	8	8	8	7	8	9	8

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