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# Risk, Return and Volatility of Faith-Based Investing

## *The Case of the Dow Jones Islamic Index*

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**ABSTRACT**

Ethical investing refers to funds that exclude stocks mainly for ethical or religious reasons. Most studies that have examined the performance of unit trusts in the U.S. and the U.K. have found that they do not outperform the market. This underperformance of ethical investing may result from increased monitoring costs, a smaller investment universe and restricted diversification potential. Islamic investors represent a unique ethical investment market. The Islamic investment funds are growing at an estimated annual rate of 15%. This paper empirically examines the issues of market efficiency and the time-varying risk return relationship for the Dow Jones Islamic Index (DJIM) over the 1996-2000 period. This paper employs serial correlation, variance ratio and Dickey Fuller tests to examine the market efficiency of DJIM index. The results show that DJIM returns are normally distributed. The returns show that DJIM index returns are efficient. This paper also examines calendar anomalies of the DJIM and the results show that there is no turn-of-calendar-year, turn-of-financial-year, or month effect of DJIM index returns. Utilizing a GARCH econometric framework, this paper examines the volatility of the DJIM index returns. The results show a significant positive relationship between conditional volatility and DJIM equity index returns. Finally, this paper discusses various policy options to improve the functioning of the Islamic capital market.

### I. INTRODUCTION

Ethical investing refers to the exclusion of stocks from funds mainly for ethical or religious reasons. Most studies examining the performance of unit trusts in the U.S. and the U.K. have found that they do not outperform the market. This underperformance of ethical investing may result from increased monitoring costs, the smaller size of the investment universe and restricted potential for diversification.

A mutual fund is an open-end investment company that combines the funds of investors who have purchased shares or ownership in the investment company and then invests that money in a diversified portfolio of securities issued by various corporations and/or governments. Shares are generally offered for sale on a continuous basis, with the fund standing ready to buy back shares on demand. There are two types of returns a mutual fund investor can expect from owning shares in a mutual fund. The first return is from distributions, which includes both dividend distributions and capital gains distributions. Dividend distributions come from the interest and dividend income received from securities owned by the fund. Capital gains distributions represent the net gains (capital gains minus capital losses) that a fund realizes on its sale of securities from its portfolio during the year. Capital gains distributions are usually made on an annual basis, often in the month of December. The second type of return from mutual funds comes from share prices appreciation. The investor hopes that, over time, the market price of the fund's shares and the net asset value (NAV) will increase.

It is estimated that the world's one billion Muslims have roughly $100 billion to invest, an amount that is growing by 15% each year. Needless to say, this fact has caught the attention of investment firms around the world that are interested in capturing this market. Interest in Islamic investments continues to grow as evidenced by the creation of the Dow Jones Islamic Market Index which was launched in December 1995. It is estimated that only $1 to $2 billion are invested in Islamic products. Thus the market is virtually untapped.

However, investment firms must tread carefully to succeed in the Islamic mutual fund market. Although most of their clients would be delighted to have portfolios of Philip Morris, Citigroup, and Seagram, devout Muslims would be less than pleased. Muslims' actions are governed by their strict adherence to their religious tenets, even where investments are concerned. Critical to the success of the fund is the product's structure and performance, *shari*$^{c}$*a* oversight, human resource and cultural issues, and distribution.

In this paper, we apply a serial correlation test, variance ratio tests of Lo and MacKinlay (1988) and ADF unit root tests to investigate the behavior of DJIM indices within the general framework of market efficiency and the

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random walk hypothesis. We examine the risk and return volatility of DJIM within a GARCH framework. Then, we examine the calendar anomalies of DJIM. Finally, we examine the issue of thin trading and non-linearity of DJIM by conducting a series of tests that consider such issues.

Dow Jones has created a family of equity indices for people who wish to invest according to Islamic investment guidelines. The Dow Jones Islamic Market Indexes track *shari*$^{c}$*a*-compliant stocks from around the world, providing Islamic investors with comprehensive tools based on a truly global investing perspective. The Dow Jones Islamic Market Indexes currently include the DJ Islamic Market Index (DJIM), the DJ Islamic Market U.S. Index (IMUS), the DJ Islamic Market Technology Index (IMTEC), the DJ Islamic Market Extra Liquid Index (IMXL), the DJ Islamic Market Canadian Index (IMCAN), the DJ Islamic Market UK Index (IMUK), the DJ Islamic Market Europe Index (IMEU), and the DJ Islamic Market Asia/Pacific Index (IMAP).

The Dow Jones Islamic Market Indices are constructed from the 2,700 stocks in the Dow Jones Global Indices family, which means they are accessible to investors and are well traded. The DJGI methodology removes issues that are not suitable for global investing. The Dow Jones Islamic Market Indices include the most liquid securities meeting the *shari*$^{c}$*a* investment criteria in the market, and reflect an industry-wise breakdown of the global market. The Indices are capitalization weighted and are calculated and disseminated to major market data vendors in real time. Index calculation is based on Laspeyres' formula; it does not include reinvested dividends.

Certain businesses are incompatible with the *shari*$^{c}$*a*. Thus, stocks of companies whose primary business is in areas not suitable for Islamic investment purposes are excluded from the Dow Jones Islamic Market Index. Excluded products include alcohol, pork-related products, conventional financial services (banking, insurance, etc.), and entertainment (hotels, casinos/gambling, cinema, pornography, music, etc.). *Shari*$^{c}$*a* scholars also do not advise investments in companies that deal in tobacco, defense or weapons. These incompatible lines of business, represented by 18 of the 122 industry groups within Dow Jones Global Indexes, are removed from the "universe" of stocks considered for the Dow Jones Islamic Market Index. Other companies classified in other industry groups also may be excluded if they are deemed to have a material ownership in or revenues from prohibited business activities.

After removing companies with unacceptable primary business activities, the remaining universe is tested by three financial-ratio "filters." The purpose is to remove companies with unacceptable financial ratios. The filters exclude companies if Total Debt divided by Total Assets is equal to or greater than 33% (where Total Debt = Short-Term Debt + Current Portion of Long-Term Debt + Long-Term Debt), if Accounts Receivables divided by Total Assets is equal to or greater than 45%. (Where Accounts Receivables = Current Accounts Receivables + Long-Term Receivables), and if the sum of Non-Operating Interest Income plus other impure income divided by Revenues is equal to or greater than 5%.

The Dow Jones Islamic Market Indexes use 31 December 1995 as their baseline. The base value is set at 1000. The Dow Jones Islamic Market Indices are reviewed quarterly, with component changes implemented on the third Friday of March, June, September and December. This frequency insures that the indices reflect the latest trends and developments in the global stock market.

## II. Literature Review of Ethical Investments

The Ethical Investment Research Service defines ethical funds as those that exclude one or more company groups from their portfolio for non-financial reasons. Most trust brochures indicate the types of investments they positively seek out: conservation/anti-pollution, community responsibility, charitable giving, safety of product, employment practices, advertising policies and customer relations. Any extraordinary performance that ethicals may exhibit is unlikely to be directly attributable to a common strand of uniformly defined ethicality. As a group they are neither cohesive nor highly specialized and differences in performance relative to the market, to the extent that they exist, may be attributable to commonalties other than ethicality. Small companies have a lower probability of being invested in some potentially objectionable activity. It may therefore be the case that the portfolios of ethical trusts are dominated by smaller companies and hence the characteristics of their returns will be influenced by the well-known "small company effect."

There is weak evidence of some over-performance, on a risk-adjusted basis, by "ethical" unit trusts. Ethical trusts have U.K. investment portfolios more skewed toward small market capitalization than the market as a whole. They tend to invest in low dividend yield companies. The degree of international diversification varies between ethical trusts and is clear that a suitable international benchmark may be needed to separate out any ethical effect.

Consumers appear to have grown increasingly concerned about ethical misconduct of business. This is reflected in a number of surveys. A Business Week/Harris poll shows that 49% of the respondents view white-collar crime as very common. A Gallup poll shows that only the U.S. government scored lower marks than corporations in

terms of trustworthiness. According to Schlegelmilch (1997), only 17% of the public rate the honesty of top business people as "high."

Corporations have been taking steps to incorporate ethics into their organization. Nearly all Fortune 1000 companies have now formulated corporate codes of ethics. More than half of the largest corporations teach ethics to their employees.

Ethical investment is clearly moving beyond the small niche that it occupied some ten years ago. The San Francisco-based Women's Equity Fund specializes in women's issues, the Amana Income Fund invests only according to Islamic principles, and the Boston-based Union Standard Equity channels its money only into "union-friendly companies."

Exact data on the proportion of investments that is ethically screened are difficult to establish, since there is a lack of consensus on how to define ethical investments. One definition proposed by Tennant (1991: 32) says that ethical investment is widely understood to mean investment according to personal principles that have commonly precluded investment in such areas as South Africa, arms, alcohol, gambling, etc. In a definition proposed by Langbein and Posner (1980: 73), ethical investment involves "[e]xcluding the securities of certain otherwise attractive companies from an investor's portfolio because the companies are judged to be socially irresponsible and including the securities of certain otherwise unattractive companies because they are judged to be behaving in a socially laudable way."

Some experts advance the theoretical view that ethical portfolios are unsound investments as they increase risk unnecessarily. Langbein and Posner agree that ethical stocks are riskier, but point out that social investment should not yield significantly worse returns, since even ethical investors do not invest in clearly unprofitable stock. Comparing the actual performance of ethically screened funds against the Standard and Poor Index (S&P 500) or the FT All-Share Index usually yields mixed results, depending on which funds are compared and which time periods are considered (Cooper and Schlegelmilch 1993). Lloyd Kurtz states that his research found no correlation between a portfolio's ethics and its performance. Further evidence reports that the performance of the average socially screened mutual fund did better than 58% of all mutual funds for the 12 months ending September 1994. In the U.K., ethical investment funds outperformed other funds in their sector over one-, two-, and three-year periods. A comparison between ethical investment performance and unrestricted investments can be made using the Domini Social Index (DSI 400). Although this index shows ethically screened investments faring slightly better than the S&P index, the difference is small and may well be explained by the fact that DSI 400 includes more retail stocks and small companies.

More research needs to be conducted on the motivation behind ethical investments, to investigate, for example, the relationship between altruism and social reputation, or internal motivation versus approval seeking. From a company's perspective, it becomes necessary to actively communicate social and environmental commitments in order to ensure endorsements of investment professionals. Future research needs to focus on individual investors, rather than investment professionals.

An analysis of the composition of the investment portfolios of "ethical" unit trusts in the U.K. has shown that "ethical" investing is found to be correlated with at least three factors that may have an impact on realized returns: low market capitalization, international diversification, and low dividend yield. Luther and Matatko measure trusts' portfolio performance not only against the 'risk free rate' and the usual market proxy, the FT All-Share Index, but also against a small-company benchmark, the Hoare Govett Smaller Companies Index (HGSC). The ethical trusts (being open-ended) are constrained by liquidity requirements to hold a proportion of their funds in easily marketable large equities, but they are, nevertheless, indisputably small-company funds. Nine U.K. ethical unit trusts form the basis of the study. The empirical results indicate that regardless of the benchmark used, be it a value-weighted market index, a small company index, or both, mean abnormal returns are almost always significantly different from zero. The "systematic" component of ethical trust returns does appear to be better described by a benchmark made up of both a "market" and a small company index, than by either index singly.

Fletcher examines the performance of British and American trusts. He addresses three main issues. The first is whether trusts exhibit superior performance. The second is the relationship between performance and various trust characteristics, for example, size and expenses, while the final issue relates to the predictability of trust performance. The sample consists of 85 British and American unit trusts from January 1985 through December 1996. All trusts that were identified in the 1985 Unit Trust Yearbook and invested more than 70% or more in the U.S. were included in the sample. No survivorship requirements were imposed on the trusts. Fifty of the trusts have continuous return data. Transfers of unit trusts and name changes were treated as a continuation of the original trust.

The performance evaluation of unit trusts uses both the Jensen (1968) measure and the conditional Jensen measure of Ferson and Schadt (1996). In examining the relationship between various trust characteristics and abnormal performance, three factors are considered:

- size of trust,
- initial (load) charge, and
- annual charge.

The returns used are gross of the load charge and other trading costs but net of the annual charge. There should be no relationship between the load charge and performance if the markets are efficient. If annual charges are positively correlated with trading costs, then there should be no relationship between annual charge and performance if markets are efficient. This implies that net abnormal returns will be lower for trusts with higher annual charges because of the higher trading costs.

There are three main conclusions of this paper. First, there is no evidence that British/North American unit trusts on average or individually deliver significant abnormal returns. Second, there is no evidence of the relationship between the charges of the trust and abnormal performance. Finally, there is no evidence of any significant predictability in trust performance.

Mallin, Saadouni and Briston (1995) concentrate on analyzing the performance of the ethical and non-ethical funds using the "traditional" risk-adjusted measures used in the majority of studies previously carried out, i.e., the Jensen, Sharpe and Treynor measures. It has been argued that the possible failure of the Jensen methodology to detect superior performance appears to arise from two main causes, namely, a failure to identify correctly the relationship between superior performance based on superior information and appropriate tests of superior performance, and possibly more importantly, the weakness of the statistical tests used. This is the real reason why so many empirical investigations have been forced to accept the null hypothesis of no evidence of superior performance.

The financial performance of the total population of British ethical investment funds over the period 1986-1993 is analyzed. The null hypotheses to be tested are as follows:

- Ethical investment funds do not outperform (or underperform) the market
- The performance of ethical investment funds is no different from that of non-ethical investment funds.

The performance of the funds is then analyzed using several different one-parameter performance measures to evaluate the portfolios:

- The excess return to variability measure (Sharpe, 1966)
- The excess return to non-diversifiable risk (Treynor, 1965), and
- The differential return with risk measured by betas (Jensen, 1969)

By analyzing the mean excess returns, ethical trusts appear to underperform both non-ethical and the market generally. There is weak evidence that non-ethical trusts outperform the market in this sample. On a risk-adjusted basis both the ethical and non-ethical trusts tend to underperform the market, and increasingly the ethical trusts tend to outperform the non-ethical trusts. Taking the ranking of all three measures, Jensen, Treynor and Sharpe, again it is the ethical trusts that outperform the non-ethical ones.

Luther, Matatko and Corner (1992) argue that from the purely financial point of view, growth in investing in ethical companies may be expected to produce gains in shares with a "positive" ethical rating and losses on others. On the other hand, it may be that ethical investment offers inferior performance due to increased monitoring costs, a smaller investment universe, and restricted potential for portfolio diversification. Some studies have shown a positive relationship between financial performance on the one hand and environmental performance or social disclosure performance on the other. The authors review the investment performance of ethical unit trusts with specific reference to the following questions:

- Have ethical trusts offered superior or inferior investment performance?
- Can an ethical effect be separated out from other well-known phenomena?

Ethical companies tend to be small companies and they investigate the portfolios of ethical funds with respect to the market capitalization of constituent companies.

## III. ISLAMIC MUTUAL FUNDS

In addition to using a conventional portfolio management process, investment firms must use a *shari*$^{c}$*a* process to manage the fund. The *shari*$^{c}$*a* is a comprehensive code of behavior that governs both private and public activities; accordingly, Islamic mutual funds maintain *shari*$^{c}$*a* advisory boards. The primary purpose of the advisory board is consumer advocacy. The board is used to assure Muslim investors that their money is being invested in accordance with Muslim law. The *shari*$^{c}$*a* board is also responsible for portfolio purification, screening of stocks, monitoring stocks, monitoring management, monitoring fees, monitoring fund documentation, and *zakat*. Thus, the *shari*$^{c}$*a* advisory board is responsible for both religious and fiduciary matters. (Bauer and Keigher, 2001; DeLorenzo, 2001; Hamid, 1999; Moran, 1999; Valpey, 2001)

The *shari*$^{c}$*a* advisory board should be composed of independent scholars who are intimate with the *shari*$^{c}$*a*. While a knowledge of investments may be helpful to an advisor, it is not necessary to ensure that the mutual fund is *shari*$^{c}$*a*-compliant. A supervisor usually leads the advisors. In some instances in which a fund is composed of stocks in *shari*$^{c}$*a*-based indices, such as the Dow Jones Islamic Market Index, the fund's *shari*$^{c}$*a* supervision may be undertaken by only one person.

Screening is the practice of including or excluding publicly traded securities from investment portfolios or mutual funds based on the religious and ethical precepts of the *shari*$^{c}$*a*. Generally, Muslim investors seek to own profitable companies that make positive contributions to society. Certain businesses are incompatible with *shari*$^{c}$*a* laws. Therefore, stocks of companies whose primary business is not permissible according to *shari*$^{c}$*a* are excluded. In addition, most of the *shari*$^{c}$*a* screens currently in use by fund managers include the three financial ratio filters already mentioned.

The Islamic law of transactions is governed by *riba*. Basically, this is the prohibition of interest in any form. Muslims believe that profit should be based on effort. Therefore one who lends money has expended little effort. His money is working for him while he sits idle. It is up to the *shari*$^{c}$*a* advisory board to ensure that the fund portfolio purifies itself of these ill-gotten gains. Often companies that are *shari*$^{c}$*a*-compliant have non-operating income from interest-bearing investments. These impure funds are placed in a separate account and are distributed to suitable charities according to *shari*$^{c}$*a*.

In addition to the purification of *riba* from the portfolio, the portfolio must also be morally purified. At the heart of Islam is the belief that the community should be benefited from its people's actions. Therefore a company that is *shari*$^{c}$*a*-compliant that purchases or merges with a company that is not *shari*$^{c}$*a*-compliant must be eliminated from the portfolio. Moral purification also entails making the management of major corporations aware of issues that are important to Muslims. This can be done through attending annual meetings or by casting proxy or absentee ballots.

Because very little remains the same, the board is also faced with monitoring the compliance of the fund's stocks. In instances where a stock is linked to an index, pertinent information must be provided to the index. Thus, *shari*$^{c}$*a* advisors may evaluate the stock. However, when a stock is not linked to an index, information gathering is added to the list of tasks that the board must complete. Once the information is gathered, computer programs are available to assist *shari*$^{c}$*a* boards in the supervision of their portfolios. This software helps the board identify its problem areas, but it is ultimately up to the board to correct these problems.

Of importance to the *shari*$^{c}$*a* advisory board is the management of the mutual fund itself. Often those managing the mutual fund are not as well versed in the *shari*$^{c}$*a* as the advisory board, as is the case with western investment firms. Most western funds managers feel that they must be fully invested at all times. This policy leads to the creation of *riba*. The board must be careful that management avoids earning interest on cash that is idle, or that the firm does not change its strategy to include high quality, short-term securities and money-market instruments. Another item that the board must watch for is the purchase of securities on margin. According to Islamic law, gambling is sinful, and in the eyes of Islam purchasing securities on margin is considered a form of gambling and must be avoided.

In its consumer advocacy role, the advisory board must monitor the fees charged by the mutual fund. This entails ensuring that the fee structure is reasonable and that it is clearly stated in the fund's literature. By looking out for the interests of the consumer in this manner, the *shari*$^{c}$*a* supervisory board is actually adding value to the fund. In the consumer's interest, the board should also monitor fund documentation. The board should ensure that all filings are made timely and accurately with regulatory agencies like the Securities and Exchange Commission. The board should also review all marketing publications as they will almost all reference the *shari*$^{c}$*a* and the Islamic nature of the fund to ensure that such references are correct and not misleading.

It is also the responsibility of the *shari*$^{c}$*a* board to keep abreast of issues specific to the industry in which they operate. As the *shari*$^{c}$*a* board is composed of academics and professionals, they must comprehend issues in a

broader marketplace perspective. The attention brought to bear on the issues by the board will result in the board's decisions being more informed and ultimately of more value to the investor.

The advisory board should also prepare guidelines for the calculation of *zakat* on financial investments. *Zakat* is a financial obligation that Muslims must fulfill yearly by donating one-fortieth of their capital. The guidelines established by the board should be published for investors. However, the ultimate calculation of *zakat* is dependent upon each investor's financial condition.

Finally, one of the most important functions of a *shari*$^{c}$*a* supervisory board is to prepare reports on the status of the fund it supervises. Such reports are best issued quarterly and should address issues of *shari*$^{c}$*a*-compliance in the portfolio and on the part of management. The reports should also tell investors of the purification process and the ways in which purified proceeds have been distributed to various charities.

## IV. CAPITAL MARKET EFFICIENCY TESTS OF DJIM

The efficient market hypothesis (EMH) assumes that stock prices contain all available information and adjust rapidly to the infusion of any new information. Based upon the random walk hypothesis, early studies presumed that stock prices fluctuated randomly. Fama (1970) first formalized the EMH theory in terms of a fair game and classified them into three groups in terms of information subset. The weak form of the EMH states that stock prices reflect all historical information such as historical prices, trading volumes and any market related information. The semi-strong form of the EMH states that stock prices reflect all publicly available information such as accounting information. Finally, the strong form of the EMH states that stock prices reflect all information, both public and private. Fama (1970) also notes that EMH and asset pricing models such as CAPM are inseparable joint-hypothesis. We use serial correlation, variance ratio tests and unit root tests to examine the market efficiency of DJIM.

### A. Serial Correlation Coefficient Test

The serial correlation coefficient measures the relationship between the value of a random variable at time t and its value in the previous period. The weak-form EMH is expressed as

$$Pt = a+b\ Pt\text{-}1 + \xi t \quad \ldots (1)$$

where Pt is the stock price in period t, Pt-1 is the stock price in the preceding period, and ξt is the error term. According to the EMH, the sequence of stock prices is assumed to fluctuate randomly with a rising trend, where E(ξt) = 0, E (ξt, ξs) = 0 (t ≠ s), and the Var (ξt) is finite, so that news comes in randomly. Thus the error term ξt is a white noise process without serial correlation. This provides us the basis to conduct a joint test of serial correlation and the EMH, which is dependent on the randomness of stock prices.

### B. The Variance Ratio Test

The Lo and MacKinlay (1988) variance ratio test for random walk is based on the premise that the variance of random walk increments in finite sample is linear in the sampling interval. The variance ratio test is sensitive to correlated price changes but robust with respect to many forms of heteroskedasticity and non-normality of the stochastic disturbance term. The variance ratio test is more powerful than the Dickey-Fuller test.[i]

If a time series follows a random walk process, the variance of a *k*th-difference variable is *k* time as large as that of the first-difference interval. Hence, for equally spaced intervals, we partition the stock price into *nk + 1* segments denoting them by $y_0, y_1 \ldots y_{nk}$. For a time series characterized by random walks, one *k*th of the variance of $P_t - P_{t-k}$ is expected to be the same as the variance of $P_t - P_{t-1}$ or

$$VR(k) = \sigma_k^2/\sigma_1^2 \quad \ldots (2)$$

where $\sigma_k^2$ is the unbiased estimator of one *k*th of the variance of $\ln P_t - \ln P_{t-k}$, and $\sigma_1^2$ is the unbiased estimator of the variance of $\ln P_t - \ln P_{t-1}$. These estimators can be conveniently calculated as following:

$$\delta_k^2 = \frac{1}{k(T-k+1)(1-\frac{k}{T})}\sum_{t=k}^{T}(Y_t - Y_{t-k} - k\hat{\mu})^2$$

… (3)

$$\delta_k^2 = \frac{1}{T-1}\sum_{t=k}^{T}(Y_t - Y_{t-k} - \hat{\mu})^2$$

… (4)

in which $T$ is the sample size and $\hat{\mu} = \psi y_T - y_o$. With the assumption of homoskedasticity, the asymptotic variance of the VR statistic is shown to be:

$$\Phi(k) = \frac{2(2k-1)(k-1)}{3kT}$$

… (5)

The VR statistic (Lo and MacKinlay, 1988) asymptotically approaches normality or:

$$Z(k) = \frac{VR(k)-1}{[\Phi(k)]^{1/2}} \xrightarrow{a} N(0,1)$$

… (6)

where $\xrightarrow{a}$ denotes that the distributional equivalence is asymptotic.

As is well documented in the literature, variances of most stock returns are conditionally heteroskedastic with respect to time (Hamao et al., 1990; Koutmos et al., 1993, 1994). As a result, there may not exist a linear relation over the observation intervals. To overcome this difficulty, Lo and MacKinlay (1988) derive the heteroskedasticity-consistent variance estimator $\Phi^*(k)$:

$$\Phi^*(k) = \sum_{j=1}^{k-1}\left[\frac{2(k-j)}{k}\right]\hat{\delta}(j)$$

… (7)

in which:

$$\hat{\delta}(j) = \frac{\sum_{t=j+1}^{T}(s_t - s_{t-1} - \hat{\mu})^2(s_{t-j} - s_{t-j-1} - \hat{\mu})^2}{\sum_{t=1}^{T}(S_t - S_{t-1} - \hat{\mu})^2}$$

… (8)

Thus, the variance ratio test statistic can be standardized asymptotically to a standard normal variable or:

$$Z^*(k) = \frac{VR(k)-1}{[\Phi^*(k)]^{1/2}} \xrightarrow{a} N(0,1)$$

… (9)

**C. The Dickey-Fuller Test**

Another important alternative approach to examining the random walk hypothesis is the Dickey-Fuller (DF) unit root test. More specifically, the augmented Dickey-Fuller (ADF) test is often used to model the time series

data that are not generated by the pure AR(1) process and the data which are fraught with non-white noise error terms. Typically, the ADF test is based on the following formulation:

$$\Delta Y_t = \alpha + \rho \Delta Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-1} \varepsilon_i \quad \ldots (10)$$

where $\Delta y_t = y_t - y_{t-1}$ is a drift term with the null hypothesis $H_o$: $\rho = 0$ and its alternative hypothesis $H_o$: $\rho < 0$. Note that failing to reject $H_o$ implies the time series has the property of random walk.

**D. Data and Empirical Results**

Daily and monthly data for DJIM from January 1996 through December 2000 were collected to conduct statistical analysis. Monthly data from January 1996 through December 2000 were used to perform statistical tests of five DJIM regional indices. The general test statistics of DJIM aggregate index, and five regional indices are given in Table 1a and 1b. The Jarque-Berra normality tests show that DJIM indices are normally distributed.

Table 2a presents the results of unit root tests of market efficiency of DJIM indices. Unit root tests are necessary (but not sufficient) conditions for market efficiency, and are widely used as tests of market efficiency (Fama, 1970). Based on unit root tests, the DJIM aggregate index and the five regional indices show unit roots in the level of stock prices, that is, the series are non-stationary. However, after taking the first difference on the indices, it appears that stock prices show random walk or are stationary in the first differences. However, the existence of random walk components in stock prices does not necessarily imply that stock returns are unpredictable. Since DJIM indices are integrated of I(1), there exist some predictable components. While ADF unit root tests are both convenient and effective in detecting the existence of random walk components in a time series, they cannot distinguish the serial correlation components from short-term fluctuations. The purpose of the variance ratio (VR) approach is to detect if the short-term fluctuations dominate the stochastic trend components, while the ADF approach is formulated to examine only the existence of stochastic trend components. Lo and MacKinlay (1989) demonstrate via Monte Carlo simulations the superiority of the VR over ADF in terms of statistical power.

Table 2b presents the VR tests of DJIM index and its five regional indices. Under the assumption of homoskedasticity, the VR rejects the null hypothesis of random walk of DJIM daily index. However, under the assumption of heteroskedasticity, VR cannot reject the random walk of DJIM daily index. When monthly data are used, the aggregate DJIM and its five regional indices all show random walk. In the light of a long literature on the efficiency of stock market and inconclusive nature of empirical results, the results for DJIM are encouraging. While the traditional stock indices from both developed and developing countries show various forms of inefficiency, the DJIM shows remarkable market efficiency.

**TABLE 1A: STATISTICS OF DJIM INDICES (MONTHLY DATA)**

| | DJIM-Europe | DJIM-Pacific | DJIM-Tech | DJIM-UK | DJIM-USA | DJIM-World |
|---|---|---|---|---|---|---|
| Mean | 1737.563 | 1105.986 | 3110.193 | 1645.781 | 1852.850 | 1647.773 |
| Median | 1767.797 | 1063.657 | 2437.072 | 1774.004 | 1860.232 | 1615.138 |
| Maximum | 2515.176 | 1583.747 | 6970.611 | 2285.347 | 2695.639 | 2351.868 |
| Minimum | 1006.236 | 769.9472 | 1015.349 | 981.1274 | 1024.989 | 1021.841 |
| Std. Dev. | 451.5201 | 194.5427 | 1761.608 | 357.3548 | 531.3427 | 408.9486 |
| Skewness | -0.107517 | 0.615254 | 0.713001 | -0.442671 | -0.096058 | 0.061168 |
| Kurtosis | 1.645480 | 2.671383 | 2.315847 | 2.011442 | 1.634956 | 1.727448 |
| Jarque-Berra | 4.780785 | 4.122932 | 6.358101 | 4.476071 | 4.829809 | 4.153988 |
| Probability | 0.091594 | 0.127267 | 0.041625 | 0.106668 | 0.089376 | 0.125306 |
| Observations | 61 | 61 | 61 | 61 | 61 | 61 |

*The Jarque-Berra statistic is given by:* $T\text{-}k/\sigma\,[\,s^2 + 1/4(K-3)^2]$*, where* T *is the number of observations,* k *is zero for an ordinary series,* s *is skewness and* K *is the kurtosis. Under the null hypothesis of normality, the Jarque-Berra statistic is distributed as* $\chi^2$ *with 2 degrees of freedom.*

**TABLE 1B: GENERAL STATISTICS OF DJIM (DAILY DATA)**

| | |
|---|---|
| Mean | 0.000355 |
| Median | 2.44E-05 |
| Maximum | 0.523292 |
| Minimum | -0.500928 |
| Std. Dev. | 0.019033 |
| Skewness | 1.372022 |
| Kurtosis | 599.4978 |
| Jarque-Berra | 26033957 |
| Probability | 0.000000 |
| Observations | 1756 |

**TABLE 2A: RESULTS OF DICKEY-FULLER UNIT ROOT TESTS (MONTHLY DATA)**

| | DJIM-Europe | DJIM-Pacific | DJIM-Tech | DJIM-UK | DJIM-USA | DJIM-World |
|---|---|---|---|---|---|---|
| x | -1.427 | -1.273 | -1.345 | -2.056 | -1.533 | -1.475 |
| dx | -4.112* | -2.886* | -3.808* | -4.823* | -4.055* | -3.881* |

x = *Stock Price;* dx = *first difference of* x*; * denotes 1% significance based on McKinnon critical values for rejection of hypothesis of a unit root.*

**TABLE 2B: VARIANCE RATIO ESTIMATES FOR DJIM**

**A. Variance Ratio Estimates of DJIM Aggregate (Daily Data)**

| | 24 | 72 | 96 | 120 | 144 |
|---|---|---|---|---|---|
| Z(q) | -6.128* | -3.577* | -3.135* | -2.876* | -2.634* |
| Z*(q) | -1.372 | -1.415 | -1.435 | -1.475 | -1.481 |

*Number of days* (q) *of base observations interval*

**B. Variance Ratio Estimates for Individual DJIM Aggregates (Monthly Data)**

| | 6 | 12 | 24 | 48 | 60 |
|---|---|---|---|---|---|
| U.S. | | | | | |
| Z(q) | -0.936 | -0.700 | -1.077 | 0.269 | 0.103 |
| Z*(q) | -0.968 | -0.945 | -1.884* | 0.665 | 0.285 |
| Europe | | | | | |
| Z(q) | 0.192 | -0.468 | -0.921 | 0.199 | 0.028 |
| Z*(q) | -1.372 | -1.372 | -1.415 | -1.435 | -1.475 |
| U.K. | | | | | |
| Z(q) | -0.097 | 0.707 | -0.378 | 2.285 | 0.799 |
| Z*(q) | -0.074 | 0.752 | -0.552 | 4.709 | 1.8436 |
| Pacific | | | | | |
| Z(q) | 0.807 | 1.609 | 2.269 | 0.122 | 0.063 |
| Z*(q) | 0.850 | 2.148 | 3.960 | 0.299 | 0.1723 |

*The variance ratio VR(q) is defined as* $[\sigma_c(q)]/[\sigma_a(q)]$*, where* $\sigma_c(q)$ *is an Unbiased estimator of* 1/q *of the variance of the* q*th difference of stock price and* $\sigma_a(q)$ *is an unbiased estimator of the variance of the first difference of stock price.* Z (q) *is the homoskedasticity test statistic and* Z* (q) *is the heteroskedasticity robust test statistic. * Indicates that ratios are statistically different from one at the 5% level of significance.*

## V. TIME VARYING RISK AND RETURN BEHAVIOR OF DJIM

### A. GARCH Methodology

The Autoregressive Conditional Heteroskedasticity (ARCH) model introduced by Engle (1982) allows the variance of the error term to vary over time, in contrast to the standard time series regression models which assume a

constant variance. Bollerslev (1986) generalized the ARCH process by allowing for a lag structure for the variance. The generalized ARCH models, GARCH models, have been found to be valuable in modeling of the time series behavior of stock returns (Hassan et al., 2000; Baillie and DeGennaro, 1990; Akgiray, 1989; French et al., 1987; Koutmos, 1992; Koutmos et al., 1993). Bollerslev (1986) allows the conditional variance to be a function of period errors squared as well as of its past conditional variances.

The GARCH model has the advantage of incorporating heteroskedasticity into the estimation procedure. All GARCH models have martingale difference, implying that all expectations are unbiased. GARCH models capture the tendency for volatility clustering in financial data. Volatility clustering in stock returns implies that large (small) price changes follow large (small) price changes of either sign. Modeling and forecasting volatility helps one to analyze the risk of holding an asset. Forecast confidence intervals may be time-varying, so that more accurate intervals can be obtained by modeling the variance of the errors. Moreover, more efficient estimators can be obtained if heteroskedasticity in the errors is handled properly. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables.

In the standard GARCH(1,1) specification:

$$yt = \chi t\gamma + \xi t \quad \ldots (11)$$

$$\sigma t^2 = \omega + \propto \xi t\text{-}12 + \beta\ \sigma t\text{-}1^2 \quad \ldots (12)$$

The mean equation given in (11) is written as a function of exogenous variables with an error term. Since $\sigma t^2$ is the one-period-ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified in (12) is a function of three terms:

- The mean: $\omega$.
- News about volatility from the previous period, measured as the lag of the squared residual from the mean equation: $\xi t\text{-}12$ (the ARCH term).
- Last period's forecast equation: $\sigma t\text{-}12$ (the GARCH term).

The (1,1) in GARCH(1,1) refers to the presence of a first-order GARCH term (the first term in parentheses) and a first-order ARCH term (the second term in parentheses). An ordinary ARCH model is a special case of a GARCH specification in which there are no lagged forecast variances in the conditional variance equation.

This specification is often interpreted in a financial context, where an agent or trader predicts this period's variance by forming a weighted average of a long-term average (the constant), the forecasted variance from last period (the GARCH term), and information about volatility observed in the previous period (the ARCH term). If the asset return was unexpectedly large in either the upward or downward direction, then the trader will increase the estimate of the variance for the next period. This model is also consistent with the volatility clustering often seen in financial returns data, where large changes in returns are likely to be followed by further large changes. We start with identifying the ARMA(p,q) process for modeling the autocorrelation structure of the stock returns for the DJIM index. GARCH(1,1) is employed to control for the autoregressive conditional heteroskedasticity. Residuals from the GARCH(1,1) model are then used in the ARMA(p,q) models. If after accounting for the GARCH effects, the ARMA coefficients remain significant, the stock returns could then be considered predictable.

**B. Empirical Results**

The GARCH results are presented in Table 3. Before testing our hypothesis concerning the behavior of volatility, it is important to check the existence of an ARCH and GARCH process in the data series and their lag length. Table 3 shows that the coefficient ($\alpha_1$) for the ARCH process is highly significant. ($\alpha_1$) is the coefficient for the first lag of the squared error term ($e^2_{t-1}$). Both coefficients $\alpha$ (the coefficient of the lagged square error) and $\beta$ (the lagged variance) are significant at 1%. If $\alpha + \beta = 1$, this implies that a current shock persists indefinitely in conditioning the future variance. Moreover, if $\alpha + \beta > 1$, this implies that the response function of volatility increases with time. This particular result is worthy of further analysis. Volatility increases over time, implying that there is still operational inefficiency with the DJIM that needs to be corrected to make the risk behavior of the DJIM stable over time.

**TABLE 3: ESTIMATES FOR GARCH (1,1) MODEL DJIM**

| (p,q) | (1,1) |
|---|---|
| $\alpha_0$ | 0.05208 (2.53**) |
| $\alpha_1$ | 0.000045 (18.7551*) |
| $\beta_1$ | 5.9698 (18.14127*) |
| $I(\theta)$[3] | 6818.883 |
| S.E.E[4] | 0.017487 |
| Jarque-Berra test of normality of residuals | 26033957 |
| Breusch-Goldfry LM test[5] | Insignificant |
| Ljung-Box Q test[5] | Insignificant |
| Number of observations | 1756 |

*The whole sample period 1996-2000*

## VI. MARKET EFFICIENCY AND CALENDAR ANOMALIES IN DJIM

### A. Methodology

Capital market inefficiency exhibits itself in many different forms. One of these forms is calendar anomalies or seasonalities. Calendar anomalies refer to abnormally high or low returns on certain times in the year. This phenomenon has been referred to in the literature as the day-of-the-week, weekend, time-of the-month, turn-of-the-month, month-of-the-year, turn-of-the-year, and holiday effects. The day-of-the-week effect refers to abnormally high or low returns on certain days of the week. For example, observing high returns on Fridays and low returns on Mondays has been referred to as the weekend effect. An explanation for the weekend effect is that the change in the stock price on Monday represents the change in the price during the weekend. Calendar anomalies have widely documented in many mature and emerging capital markets around the world.

The null hypothesis that the differences between turn of the month returns and other day of the month returns are zero is tested by estimating the following regressions:

$$Rt = \propto 0 + \propto 1\ DTy + et \quad \ldots (13)$$

$$Rt = \propto 0 + \propto 1\ DTfy + et \quad \ldots (14)$$

DTy is a binary variable for the turn of the year, with values 1 for the last 6 trading days of each year and the first 6 trading days of the year (last 6 trading days in Dec. and first 6 trading days of Jan.) and zero otherwise. DTfy is a binary variable for the turn of the fiscal year. It takes a value of 1 for the last 6 trading days of each fiscal year (ends on the 30th of June) and the first 6 trading days for the beginning of the fiscal year (last 6 trading days of June and first 6 trading days of July). It takes a value of zero otherwise.

### B. Empirical Results

The calendar anomalies results are presented in Tables 4a and 4b. With respect to the results of parameters and F test, neither the end-of-calendar-year nor the end-of-fiscal-year effect has been found in the DJIM index using daily data. In addition, no month-of-the-year effect is found in the DJIM index. No one can profit by making trading rules to benefit from DJIM stock trading. This implies DJIM market efficiency.

**TABLE 4A: TURN OF THE YEAR AND TURN OF THE FINANCIAL YEAR EFFECT IN DJIM (1996-2000)**

| Turn of the Year effect<br>$Rt = \alpha_1 + \alpha_2 DTy + Ut$ | | | |
|---|---|---|---|
| **$\alpha_1$ T-stats** | **$\alpha_2$ T-stats** | **No. of Observations** | **F** |
| 0.0003 | 0.0012 | 1756 | 0.583 |
| (0.647) | (0.002) | | |
| Turn of the Fiscal Year effect<br>$Rt = \alpha_1 + \alpha_2 Dtfy + Ut$ | | | |
| **$\alpha_1$ T-stats** | **$\alpha_2$ T-stats** | **No. of Observations** | **F** |
| 0.0004 | 0.002 | 1756 | 0.567 |
| (0.650) | (0.572) | | |

*DTy* is a binary variable for the turn of the year, with values 1 for the last 6 trading days of each year and the first 6 trading days of the year (last 6 trading days in December and first 6 trading days of January) and zero otherwise.

*DTfy* is a binary variable for the turn of the fiscal year. It takes a value of 1 for the last 6 trading days of each fiscal year (ends on June 30) and the first 6 trading days for the beginning of the fiscal year (last 6 trading days of June and first 6 trading days of July), and zero otherwise.

With respect to the results of parameters and F test, neither the end of the calendar year nor the end of the fiscal year has been displayed in the DJIM index.

**TABLE 4B: THE MONTH OF THE YEAR EFFECT FOR THE DJIM (1996-2000)**

| $Rt = \alpha_1 + \alpha_2 Dm + Ut$ | | | |
|---|---|---|---|
| **$\alpha_1$ T-stats** | **$\alpha_2$ T-stats** | **No of Observations** | **F** |
| 0.0004 | 0.00001 | 1756 | 0.991 |
| (0.555) | (0.011) | | |

*Dm* is a binary variable with value 1 for the first 15 trading days of the month and 0 otherwise. The results show that there is no month of the year effect of the DJIM.

## VII. THIN TRADING, NON-NORMALITY AND MARKET EFFICIENCY METHODOLOGY

### A. Methodology

Market efficiency is concerned with whether prices follow a random walk or are predictable. The assumptions behind the concept of market efficiency imply a linear generation process. However, non-linearity may take place due to non-linear feeding back mechanism in price movement, market imperfection, and the microstructure of the market. Empirical research has in fact spotted non-linearity in both mature markets and emerging markets. Hassan et al. (2002, 2001, 2000) and Haj et al. (2001, 2002, 2003) studied extensively three international stock markets employing a variety of econometric methods that incorporate thin trading, non-normality and time varying risk premia. Both Bollerslev (1987) and Akgiray (1989) support the same claim. They both conclude that the independence assumption of successive price change is incorrect. The same conclusion is reached from studies on other countries. Koutmos (1992) examines nonlinear dependence in the daily stock returns of the following countries: Belgium, Canada, France, Germany, Great Britain, Italy, Japan, Netherlands, and Switzerland. All the indices exhibit negative skewness and high leptokurtosis. The primary results also indicate that strong nonlinear dependence exists in all of the indices. Asset returns may be generated by deterministic chaos in which case the forecasting error grows exponentially so that the process appears stochastic. Stock returns may also follow a non-linear process. Since non-linearity is found in mature markets, one can expect to find it in emerging markets. In fact, the current nature of these markets may lead to non-linearity. Regulatory changes to enhance trading conditions, disclosure, and listing requirements may be one factor causing non-linearity. Other factors include thin trading, unreliable information, overreaction, high transaction costs, and inside information. In fact Swell, Stansell, Lee, and Pan (1993) examine the daily indices of four emerging Asian markets (Hong Kong, Korea, Singapore, and Taiwan), the Japanese Stock market, and the United States stocks. They reject the independence hypotheses for all emerging markets in question. Therefore, market efficiency based on linear models may wrongly lead to the acceptance or rejection of the null hypothesis. Furthermore, thin trading may introduce serial correlation, which may

be thought of as evidence of price dependence and predictability. Therefore, in testing efficiency we have to take non-linearity, thin trading and structural changes in emerging markets into account.

To account for possible non-linearity in the generating process of return, the logistic map equation will be used. This equation takes into account non-linear behavior in stock prices, but does not determine the exact nature of non-linearity.

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R^2_{t-1} + \alpha_3 R^3 + \xi_r \quad \ldots (15)$$

where $R_t$ is the return at time t. For a market to be efficient $\alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = 0$, and $\xi_t$ has to be a white noise process.

In addition, emerging markets are characterized by thin trading. Many studies have investigated the effects and consequences of this aspect. These studies include Dimson (1979), Lo and MacKinlay (1990), Stoll and Whaley (1990), and Miller, Muthuswamy and Whaley (1994). The bias of the infrequently traded shares is brought by prices that are recorded at the end of a time period that have a tendency to represent an outcome of a transaction that occurred prior to the period in question. Hence, thin trading induces serial correlation in the time series of returns. To correct for thin trading, Miller, Muthuswamy, and Whaley's (1994) method will be adapted. According to this method, to remove the effect of thin trading we need a moving average model (MA) that reflects the number of non-trading days and then returns must be adjusted accordingly. However, given the difficulties in identifying the number of non-trading days, Miller has shown that it is equivalent to estimate an AR (1) model from which the non-trading adjustment can be obtained. The AR (1) equation is as follows:

$$R_t = a_0 + a_1 R_{t-1} + e_t \quad \ldots (16)$$

Using the residuals from equation (2) to adjust return, the adjusted return is estimated as follows:

$$R_t^{adj} = e_{t/(1-a_2)} \quad \ldots (17)$$

where Rtadj is the return at time t adjusted for thin trading. Miller, Muthuswamy, and Whaley find that thin trading adjustment reduces the negative correlation among returns. The model above assumes that non-trading adjustment is constant over time. While this assumption may be correct for highly liquid markets, it is not the case for emerging markets. Therefore, equation (3) will be estimated recursively. In testing for efficiency, equation (2) is estimated using corrected returns calculated recursively from equation (4). Moreover, efficiency will be examined using the linear and non-linear model to see if the results of both models are different. To trace the effect of structural changes over time, the previous models will be estimated on a daily basis using daily data.

**B. Empirical Results**

Table 5a shows the coefficient of the linear model. Daily data on DJIM index are used to conduct statistical tests. The results show that DJIM is efficient, which is consistent with the serial correlation test. To take into account any possible non-linearity in the return generating process that might affect the efficiency of the DJIM, a non-linear term is incorporated into the model. It is clear from Table 5b that the conclusion about market efficiency does not change. The coefficient of the third nonlinear term is significant. Even though the non-linear terms in the equation are statistically significant at 1% significance level, still the market efficiency of the DJIM cannot be rejected.

Thin trading is one of the characteristics of the DJIM. If it is not taken into account when studying market efficiency, one can reach a wrong conclusion. Table 5c gives the result when adjusted for thin trading in the linear model. It is clear that the coefficient of adjusted lag return is not significantly different from zero. Therefore, the DJIM is efficient during the period of study.

Table 5d gives the results when the model is adjusted for thin trading and non-linearity. It is clear that the coefficient of the lagged return is not significantly different from zero, which implies that the market is efficient.

To investigate how the efficiency of the DJIM evolves over time, the yearly results of the basic linear model adjusted for thin trading and non-linearity are given in Tables 5e and 5f, respectively. We estimate equations (2) and (3) on a yearly basis. The results in 5e show that the coefficients of lagged return are not significantly

different from zero. Therefore, the market efficiency of DJIM cannot be rejected. Finally, Table 5f gives the coefficient estimates of the linear model, adjusted for thin trading and non-linearity. Based upon these yearly results, the aggregate test statistics show DJIM market efficiency.

**TABLE 5A: RANDOM WALK MODEL WITHOUT NON-LINEARITIES FOR UNCORRECTED RETURNS FOR DJIM INDEX**

$R_t = \alpha_0 + \alpha_1 R_{t-1} + \varepsilon_t$

| Periods | $\alpha_0$ (T-statistics) | $\alpha_1$ (T-statistics) | $\chi^2(2)$ [1] | $F^{(2)}\chi^2$ |
|---|---|---|---|---|
| 1996-2000 | 0.0005 | -0.3961 | 307.258 | 165.56* |
| | (1.179) | (-18.062*) | | 145.23* |

** indicates Significant at 1%.*
*1/ white test for heteroskedasticity.* Ho*: is the series is homoskedastic. Ha: is otherwise.*
*2/ Ramsey RESET Test.* Ho*: the functional form is correct. Ha: otherwise.*
*3/ Ljung-Box Q test is significant for the residuals is found to be significant for 52 lags.*

**TABLE 5B: RANDOM WALK MODEL WITH NON-LINEARITIES FOR UNCORRECTED RETURNS FOR DJIM INDEX**

$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R^2_{t-1} + \alpha_3 R^3_{t-1} + \varepsilon_t$

| Periods | $\alpha_0$ (T-statistics) | $\alpha_1$ (T-statistics) | $\alpha_2$ (T-statistics) | $\alpha_3$ (T-statistics) |
|---|---|---|---|---|
| 1996-2000 | -0.0001 | 0.0520 | 1.0886 | -2.1988 |
| | (-0.114) | (1.203) | 27.818* | (-12.109*) |

*1/* indicates Significant at 1%.*
$\chi^2(9)$ *is Chi-square statistics for White's test for heteroskedasticity and it is equal to 756.19,* Ho *is the series is homoskedastic.*
F *and* $\chi^2$ *test is for Ramsey RESET Test for functional form.* Ho*: the functional form is correct.* Ha*: otherwise.* F *statistics is 3.235, and for* $\chi^2$ *statistics are 3.234*
*Ljung-Box Q test is significant for the residuals are found to be significant for 52 lags.*

**TABLE 5C: RANDOM WALK MODEL WITHOUT NON-LINEARITIES FOR CORRECTED RETURNS FOR DJIM INDEX**

$R_t = \alpha_0 + \alpha_1 R^{adj}_{t-1} + \varepsilon$

| Periods | $\alpha_0$ (T-statistics) | $\alpha_1$ (T-statistics) | $\chi^2(2)$ [1] | $F^{(2)}\chi^2$ |
|---|---|---|---|---|
| 1996-2000 | -0.0001 | -0.0755 | 412.72 | 21.543* |
| | (-0.004) | (-3.170) | | 34.768* |

*1/ white test for heteroskedasticity.* Ho*: is the series is homoskedastic.* Ha*: is otherwise.*
*2/ Ramsey RESET Test.* Ho*: the functional form is correct.* Ha*: otherwise.*
*3/ Ljung-Box Q test is significant for the residuals is found to be significant for 52 lags.*

**TABLE 5D: RANDOM WALK MODEL WITH NON-LINEARITIES FOR CORRECTED RETURNS FOR DJIM INDEX**

$R^{adj}_t = \alpha_0 + \alpha_1 R^{adj}_{t-1} + \alpha_2 R^{2adj}_{t-1} + \alpha_2 R^{3adj}_{t-1} + \varepsilon_t$

| Periods | $\alpha_0$ (T-statistics) | $\alpha_1$ (T-statistics) | $\alpha_2$ (T-statistics) | $\alpha_3$ (T-statistics) |
|---|---|---|---|---|
| 1996-2000 | -0.0004 | 0.2917 | 1.2328 | -1.304 |
| | (-1.245) | (7.568*) | (12.923*) | (-4.250*) |

** indicates significant at 1%.*
1/ $\chi2(9)$ *is Chi-square statistics for White's test for heteroskedasticity. Its statistics are 1226.79.*
*2/* F *and* $\chi2$ *test is for Ramsey RESET Test for functional form. Ho: the functional form is correct.* Ha*: otherwise.* F *statistics is 0.7586. And the* $\chi2$ *statistics is 0.7253.*
*3/ Ljung-Box Q test is significant for the residuals is found to be significant for 52 lags.*

**TABLE 5E: RANDOM WALK TEST ON A DAILY BASIS WITHOUT NON-LINEARITIES FOR ADJUSTED RETURN FOR DJIM**

$R_t = \alpha_0 + \alpha_1 R^{adj}_{t-1} + \varepsilon$

| Year | $\alpha_0$ (T-stat) | $\alpha_1$ (T-stat) | $\chi^2(2)$ (1) | $F^{(2)}\chi^2$ | Q-stats(3) | #of obs. |
|---|---|---|---|---|---|---|
| 1996 | 0.000060 | 0.0017 | 0.95872 | 5.46215* | 16 | 348 |
| | 0.04712 | 0.01518 | | 11.4561* | | |
| 1997 | 0.0000035 | -0.0001565 | 121.48* | 1.55623 | 16 | 365 |
| | 0.00249 | -0.00253 | | 1.52354 | | |
| 1998 | -0.000005 | 0.000145 | 153.902* | 9.45263* | 24 | 366 |
| | -0.0091 | 0.00222 | | 17.2563* | | |
| 1999 | -0.000008 | -0.0293 | 56.0* | 9.253645* | 52 | 365 |
| | -0.04 | -0.484 | | 22.45358* | | |
| 2000 | -0.0000007 | -0.00124 | 147.36* | 4.25368* | 52 | 313 |
| | -0.0016 | -0.02015 | | 10.2535* | | |

*1/ white test for heteroskedasticity.* Ho*: is the series is homoskedastic.* Ha*: is otherwise.*
*2/ Ramsey RESET Test.* Ho*: the functional form is correct.* Ha*: otherwise.*
*3/ Ljung-Box Q test is significant for the residuals of the lag indicated.*

**TABLE 5F: RANDOM WALK TEST ON A DAILY BASIS WITH NON-LINEARITIES FOR ADJUSTED RETURN FOR DJIM**

$R^{adj}_t = \alpha_0 + \alpha_1 R^{adj}_{t-1} + \alpha_2 R^{2adj}_{t-1} + \alpha_3 R^{3adj}_{t-1} + \varepsilon_t$

| Year | $\alpha_0$ (T-stat) | $\alpha_1$ (T-stat) | $\alpha_2$ (T-stat) | $\alpha_3$ (T-stat) | $\chi^2(9)$ (1) | $F^{(2)}\chi^2$ | Q-stats(3) | #of obs. |
|---|---|---|---|---|---|---|---|---|
| 1996 | -0.00046 | 0.3443 | 1.949 | -92.515 | 46.849* | 0.267547 | 52 | 348 |
| | -0.40004 | 3.981* | 1.452 | 4.02* | | 0.272711 | | |
| 1997 | -0.0023 | 0.112 | 3.506 | -10.928 | 37.0* | 1.658888 | 52 | 365 |
| | -1.279 | 1.17 | 2.7468* | -0.439 | | 1.685216 | | |
| 1998 | 0.0015 | 0.50675 | -4.182 | -68.556 | 195.41* | 0.459844 | 36 | 366 |
| | 1.412 | 5.55* | -6.175* | -6.992* | | 0.468115 | | |
| 1999 | 0.0004 | 0.3558 | -11.06 | -1010.73 | 14.32 | 3.92414** | 52 | 365 |
| | 0.789 | 3.82* | -2.785* | -5.404* | | 3.98186** | | |
| 2000 | -0.00021 | 0.0547 | 7.396 | 81.35 | 154.91* | 2.496213 | 52 | 313 |
| | -0.4676 | 0.599 | 1.58 | 1.32 | | 2.531276 | | |

*1/ white test for heteroskedasticity.* Ho*: is the series is homoskedastic.* Ha*: is otherwise.*
*2/ Ramsey RESET Test.* Ho*: the functional form is correct.* Ha*: otherwise.*
*3/ Ljung-Box Q test is significant for the residuals of the lag indicated.*

## VIII. ETHICS, EFFICIENCY AND REGULATION OF THE ISLAMIC EQUITY MARKET

The major goals of stock market regulation are to promote efficiency and to ensure ethics and fairness in markets. However, a conflict exists between efficiency and ethics, and sometimes there must be a trade-off. Islamic norms and ethics are defined by the *shari$^c$a* for Islamic markets. (Obaidullah, 2000)

Allocative efficiency implies that funds are channeled into desirable projects. Prices signal the flow of funds and reflect intrinsic worth of stocks in both the primary market where initial public offerings are made and in the secondary market where stocks are continuously traded. Pricing efficiency (prices of stocks must equal their respective fundamental values at all times) is a prerequisite for allocative efficiency. Equality between prices and the value of a stock may be achieved only when there is informational efficiency, i.e., there are no lags in the dissemination and assimilation of information. Both informational efficiency and operational efficiency (i.e., transactions should be executed at minimal costs) are prerequisites for pricing efficiency.

Any move or regulation that reduces transaction costs, simplifies the trading system, increases the availability and accuracy of information, or improves information processing by participants is a step toward improving allocative efficiency. In an efficient market, violent price swings are also ruled out. While promotion of efficiency is the primary goal of the stock market regulator, another goal is to ensure ethics and fairness in the markets.

**A. Ethics and Efficiency Issues in Conventional and Islamic Investing**

Shefrin and Statman (1992) present a much broader framework and identify the following seven classes of market fairness:

- Freedom from coercion: Investors have the right not to be coerced into a transaction.
- Freedom from misrepresentation: All investors have the right to rely on information voluntarily disclosed as truthful.
- Equal information: All investors are entitled to have equal access to a particular set of information.
- Equal processing power: It entitles all investors to a competency floor of information processing ability and protection against cognitive errors.
- Freedom from impulse: It entitles all investors to protect themselves from imperfect self-control.
- Efficient prices: It entitles all investors to trade at prices they perceive as efficient or correct.
- Equal bargaining power: It entitles all investors to equal power in negotiations leading to a transaction.

Shefrin and Statman (1992) also analyze the following six major stock market regulations: Merit or blue sky regulations, mandatory disclosure regulations, suitability regulations, margin regulations, trading-interruption regulations and regulation of insider trading. Regulations would vary across country markets because of difference in the relative importance given to concerns about ethics and efficiency by regulators. This author believes that in many countries that have embarked upon a process of Islamization of stock markets, regulators seem to have adopted the framework of governance that exists in the U.S. as a benchmark, hence, the ethics-efficiency notions underlying the U.S. model, subjecting them to an Islamic evaluation.

The Islamic system does not define ethics in terms of rights or entitlements alone. Rights in the Islamic framework are subsumed under the broader concept of *haqq* which emphasizes both rights and obligations. The *shari$^{c}$a* as formulated through various judicial schools contains commands and prohibitions in five broad categories: obligatory acts, recommended acts, permitted actions, acts that are discouraged and regarded as reprehensible but not strictly forbidden and acts that are categorically forbidden. Both ethics and efficiency notions involve *masalih* which underlie all *shari$^{c}$a* rulings that form the basis of legislation and regulation in an Islamic system. The objectives (*maqasid*) of rulings or regulations in the Islamic system comprise benefits or *maslaha*. Regulations in conventional markets, such as the U.S., have continuously evolved over time. Their present shape may be traced to decades of debate, discussions in the light of new events, practices in markets and experiential learning of regulators and policy makers. All regulations and rules in an Islamic system must be derived from the Qur'an, the Sunna, and *ijma$^{c}$*. The process of extracting or deriving legal rules from the sources of the law is termed *ijtihad*, which means an endeavor involving total expenditure of efforts. The methods of *ijtihad* found in Sunni Muslim jurisprudence are *qiyas*, *istihsan*, and *istislah*. Of the various methods of *ijtihad*, the one that is most easily comprehensible to the secular regulator is *istislah* or *maslaha mursala* that refers to unrestricted public interest or public benefit.

**B. Ethics and Regulation of Islamic Stock Markets**

- *Freedom of Contract*: Neither conventional markets nor Islamic markets provide total freedom from coercion. Conventional markets are characterized by merit regulations and trading halts. In the primary market, merit regulations regulate the issuance and sale of securities. This regulation diminishes the right to freedom from coercion and makes sense only in a world where investors are likely to commit cognitive errors and lack perfect self-control. Regulations requiring mandatory disclosures improve informational efficiency of the market. As far as the secondary markets are concerned, trading halt regulations permit an exchange to suspend trading temporarily. Similar regulations also attempt to introduce price limits—upper and lower bounds outside which trading cannot take place, and disallow short-sale when prices are declining. In an Islamic market, there are far greater constraints on freedom. A constraint that has a direct impact on the size of the Islamic stock market relates to the object of the exchange. In an Islamic market, the object of the contract must be lawful. Equity or stock as a contract has been subjected to much scrutiny and has been generally found to be acceptable in an Islamic system. However, while stocks of all kinds of companies may be traded in a conventional market, the universe of permissible stocks is considerably smaller in an Islamic market. Based on *shari$^{c}$a*-compatibility, only about 22% of stocks that are part of the Dow Jones Global Index are found to be permissible.
- *Prohibition of Riba*: Prohibition of *riba* is central to Islamic financial law and also unique to Islamic stock markets. The Qur'an and the *hadith* are explicit in condemning *riba* and leave little room for divergence of views or interpretation. The *riba*-related norms require that stocks of conventional banks and financial institutions that explicitly deal in interest-based activities are excluded from the universe of permissible

stocks. Another major requirement is that stocks must reflect ownership interests in real assets and not in debts or money in order to be tradable at a market price. When a stock represents ownership interests in money or debt, these can only change hands without any increase or *riba*. Interest-based borrowing that is part of the market microstructure, such as margin trading, is also forbidden.

- *Prohibition of Gharar*: The Arabic word *gharar* means risk, uncertainty and hazard. Some degree of *gharar* is acceptable in the Islamic stock market. Only conditions of excessive *gharar* need be avoided. There are several types of *gharar*:
  - Settlement Risk (when the seller has no control over the subject matter, i.e., a sale without taking possession),
  - Inadequacy and Inaccuracy of Information (*gharar* or uncertainty caused by lack of adequate value-relevant information),
  - Complexity in Contracting (*gharar* also refers to undue complexity in contracts; *shari*$^{c}$*a* does not permit interdependent contracts, for instance, combining two sales in one is not permitted according to a number of authenticated *ahadith*) and
  - Games of Chance (the Qur'an prohibits contracts based on uncertainty or pure games of chance).
- Al-Suwailem (1999) shows that a *gharar* transaction is a zero-sum game with uncertain payoffs. Zero-sum games, by definition, are games in which the interests of the two parties are in direct opposition. The set of Islamic rules and regulations, such as the prohibition of *gharar*, seek to ensure that exchange is undertaken for achieving win-win outcomes, and excluding transactions leading to win-lose or lose-lose outcomes. A legitimate question arises concerning the difference between buying a lottery ticket and buying a share in the stock market. A clear difference is that a lottery is a zero-sum game. The winner of a lottery only wins at the expense of the others. In a stock market, all participants might win when economic conditions are favorable. The implication is that since collective winning is possible in a stock market, it certainly does not involve *gharar* and is therefore permissible. But Al-Suwailem (1999) provides very useful regulatory rules for the stock market as far as *gharar* is concerned. From the above discussion, it is evident that the regulator would need to be extremely vigilant, play a dynamic role and ensure that speculation is minimal, even if not entirely eliminated. But the microstructure of conventional markets is often designed to facilitate such speculation. With minimization of speculation as the most important motive of the regulator, the regulator should focus on curbing the anomalies which arise primarily due to the presence of speculation fuelled by availability of *riba*-based financing of stock transactions, stock lending systems, margin trading and periodic settlement system.
- *Free and Fair Price*: At a macro level, Islam envisages a free market where prices are determined by forces of demand and supply. There should be no interference in the price formation process even by the regulators. Islam condemns any attempts to influence prices through creating artificial shortage of supply (*ihtikar*). Similarly, any attempt to bid up the price by creating artificial demand is considered unethical. The presence of *ghubn* (the difference between the price at which a transaction is executed and the fair price) makes a transaction unethical. Speculation is against the norms of Islamic ethics and an Islamic market would be free from any mechanism that encourages speculation. However, since the distinction between speculation and genuine investment is largely a matter of intention of the individual, the former cannot be directly prohibited. Of course, the observed difference is generally in terms of the difference in time horizon. To curb speculation it is suggested to impose a minimum holding period requirement.

**C. Efficiency of Islamic Markets**

The absence of professional speculators, liquidity and operational efficiency adversely affects the Islamic markets but it would certainly have a salutary impact on its allocative efficiency. Keynes (1936) shows that prices of stock deviate significantly from their underlying values because of the undue emphasis of liquidity. Even the so-called presence of informed and professional investors is not likely to ensure pricing efficiency or equality between prices and values. Subsequent developments in stock market literature brought back the emphasis on liquidity as the efficient market theory gained wide acceptance. Stock prices are at all times equal to their values in an efficient market. The efficient market theory was the dominant paradigm for about four decades till the eighties. The second half of the 1980s witnessed the birth of a new body of literature which questioned the fundamental assumption underlying the efficient market theory, that the markets are dominated by informed traders. This brings the focus back to the need for ensuring equality between prices and values. In the Islamic framework, this is sought to be achieved through stringent restrictions on all form of speculation. What is condonable in an Islamic market is mild speculation and marginal discrepancy between price and value, not because these are desirable, but because it is difficult to fully eliminate them, since intentions and perceptions play a role.

## IX. CONCLUSION

This paper empirically examines the issues of market efficiency and the time-varying risk return relationship for the Dow Jones Islamic Index (DJIM) over the 1996-2000 period. This paper employs serial correlation, variance ratio and Dickey Fuller tests to examine the market efficiency of DJIM index. The results show that DJIM returns are normally distributed. The returns show that DJIM index returns are efficient. This paper also examines calendar anomalies of the DJIM and the results show that there is no turn-of-calendar-year, turn-of-financial-year, and month effect of DJIM index returns. Utilizing a GARCH econometric framework, this paper examines volatility of the DJIM index returns. The results show a significant positive relationship between conditional volatility and DJIM equity index returns.

There is a great degree of commonality between the notions of Islamic ethics and the secular notions of ethics and efficiency underlying regulations in conventional markets. However, what makes an Islamic market distinct is its emphasis on *riba* prohibition and curbs on speculation. Regulation is a dynamic process and the *shari*$^{c}$*a* scholar should be part of a process of continuous monitoring and surveillance of the market and of devising regulatory rules based on the realities in a given market. Islamization of the stock market does not hamper market efficiency within the Islamic ethics. A clear focus on Islamic ethics as a goal would ensure stability and allocative efficiency to a large extent by reducing disparity between prices and stock values.

A consensus is emerging that there should be a clean separation between Islamic and conventional banking. Instead of having Islamic finance windows within conventional banks, the industry is moving toward establishing separate subsidiaries or separate banks. Therefore, a case could be made for a clear separation between Islamic and conventional stock markets. The case for banking is obvious since Islamic finance instruments have distinct characteristics in terms of contracting, risk, liquidity and return. These characteristics lead to unique systemic risks and the *shari*$^{c}$*a* concerns that justify the separation between Islamic and conventional banking in terms of operations and regulations. The difference between Islamic and conventional stock markets may not be as stark as those of banks. Nonetheless, the Islamic stock market is different from conventional ones in three broad areas: permissibility of transactions, contracting, and trading. First, given the *shari*$^{c}$*a* prohibition of certain transactions, trading is permitted only in companies that do not engage in these transactions. This prohibition should not be sector-based. For example, the business of hotel companies is in essence permissible; only when they engage in prohibited transactions should they be excluded. Second, the *shari*$^{c}$*a* stipulates certain ways of drafting contracts. This means that even if the company's business is permissible, investing in it may still be prohibited because of violations in its basic establishment contract (e.g., allowing the issuance of preferred stocks, or not explicitly banning prohibited transactions even if approved by the majority shareholders). Finally, trading in stock must conform to Islamic rules that are based on the prohibition of *gharar* and *ghubn*. In essence, Islamic banks differentiate themselves because they want to raise (through deposits taking) and invest funds in *shari*$^{c}$*a*-compliant ways. While those who are not concerned with Islamic finance principles may find Islamic banking products convenient and profitable, the main impetus behind Islamic banking are investors (bank owners), depositors, and borrowers who want to conduct their business in *shari*$^{c}$*a*-compliant ways. Similarly, one could argue that those who want to raise capital (through equity issuing) and invest in *shari*$^{c}$*a*-complaint ways must be enabled to do so in an Islamic stock market.

In order for an Islamic Mutual Fund to succeed, it must be successfully promoted. Retail bank employees are not knowledgeable enough of investments to sell mutual funds. Their jobs are focused on selling banking products. A qualified investment advisor may be capable of selling mutual funds, but they must also be versed in Islamic practices to promote Islamic funds. Investment firms must avoid customer confusion at all costs. Once again the knowledge of the *shari*$^{c}$*a* board is quite useful in this situation by providing recommendations on how to promote the Islamic mutual fund.

Another key to growth in the Islamic mutual fund industry is patience. The concept of equity investing is new to Muslims, who are typically accustomed to real estate or leasing investments. Therefore, time must also be spent educating the investor. The process may be time-consuming at first, but will lead to increased consumer participation.

The final step necessary for a successful Islamic mutual fund is distribution. A fund may either be marketed through a distributor such as Al-Rajhi, a national organization operating in the field of finance, or a financial investment firm (such as Fidelity) may create its own fund. Either way the company should have a solid reputation for successful investments and customer service.

At this time, the reputation of the *shari*$^{c}$*a* advisory board must also be considered. In order for the fund to get widespread Muslim approval, the *shari*$^{c}$*a* members must be well-respected members of the community. In many ways the success of the fund is based on the board's reputation. The fund must be easily accessed through multiple

distribution channels. These channels include automated telephone systems, communication with a broker, or the Internet. A key ingredient in today's financial markets is the ability to access investment accounts via the Internet.

There exist opportunities for fund managers in marketing Islamic investments worldwide. The demand for Islamic mutual funds comes from one-fifth of the world population. These investors as well as ethical investors want to own profitable companies that make contributions to society and help economic growth. Mutual fund companies can target these investors by customizing their operations, products and services. Of the estimated $100 billion that the Muslim community has to invest, only 2% to 3% is invested in equities. There is no question then that there is a sizeable, yet untapped market for Islamic mutual funds. If financial institutions want to capitalize on this market, they must be knowledgeable of *shari*$^{c}$*a* precepts and structure their products accordingly. Of most importance to Islamic investors is that their religious tenets are followed and respected. They desire to invest in profitable companies that make a positive contribution to society. As evidenced by the profitability of existing Islamic mutual funds, these religious precepts can lay the foundation for a successful investment portfolio.

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[i] There are important departures from the random walk that the Dickey-Fuller unit root test cannot detect. The variance ratio test is more appropriate than the Dickey-Fuller test when the attribute of interest is uncorrelatedness of increments.