Milly, Maher and Sultan, Jahangir, Portfolio diversification during financial crisis: Analysis of Islamic investment strategies, In: *Building Bridges Across Financial Communities: The Global Financial Crisis, Social Responsibility, and Faith Based Finance*, edited by Ali, S. Nazim. Cambridge, Massachusetts: Harvard Law School, ILSP, Islamic Finance Project, 2012, pp.31-68

Portfolio Diversification during Financial Crisis: Analysis of Islamic Investment Strategies

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Introduction

It is still early to determine the full impact of the combined total loss of more than $29 trillion in global equity markets during the recent economic and financial crisis. However, it is already apparent that the demand for safer asset allocation has become a paramount concern among investors.[1] Hence, the question that comes to mind is: what types of investment strategies would have performed well by limiting downside losses for international equity funds during the financial crisis? This study conducts a comparative performance analysis among equity portfolios devised according to conventional, Islamic and Socially Responsible Investing (SRI)[2] investment strategies.

In contrast to conventional or socially responsible investment funds, Islamic equity funds comply with the rules set forth in the *shari'a*, the divine Islamic law. The Islamic asset allocation process is based on Islam's ethical values of economic justice, its emphasis on profit-loss sharing and real asset-backed investments, as well as various constraints with regards to permissible business transactions. The core dimensions of these restrictions relate to charging interest (*riba*), gambling and speculation (*maisir*), and vague or indeterminate contractual agreements (*gharar*). In addition, Islamic funds are prohibited from investing in companies that profit from activities deemed unethical in Islam, such as the sale of alcohol, arms, adult entertainment and pork products.

Our focus on alternative investment models is consistent with the emergence of a new class of investors that, in addition to profit motives, is also driven by their desire to live ethically and invest morally. Compared to the conventional financial system, Islamic finance is a newcomer to the global

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financial world, encompassing somewhere between $750 billion to $1 trillion of investments in firms and projects that are classified as *shari'a* compliant.[3] Yet, over the past few years Islamic investments have become more competitive and consequently attractive not only to Muslim but to non-Muslim investors seeking alternative investment opportunities, which offer investors high ethical but also nominal performance standards. As a result, the number of Islamic mutual funds and exchange traded funds world-wide has increased considerably from merely 8 before 1992 to more than 550 in 2007, with an estimated market capitalization of $300 billion.[4] Numerous traditional U.S.-based financial institutions are joining this development. Similarly, the SRI class of funds is a relative newcomer that has gained popularity in recent years. Since the early 2000s, we have seen a dramatic interest in socially responsible investing that poured billions of dollars into companies known for their efforts to offer ethical investments and projects that promoted environmental sustainability.

Our interest in examining the performance of various asset allocation strategies is timely, given the recent financial market turmoil. The hypothesis tested is that the Islamic investment strategy may be safer during times of economic distress, because Islamic funds have much less exposure to credit market conditions than conventional portfolios. An Islamic investment model might have proven beneficial due to its exclusion of highly leveraged companies and emphasis on high-level of asset-backing. Employing the Greenblatt's stock screening process (alpha screening)[5] and subsequent Markowitz minimum-variance optimization, our study will compare the performance of a *shari'a*-compliant equity portfolio with that of an SRI and as well as a more traditional equity portfolio. Both in-sample and out-of-sample performance analysis will be performed to judge how well these investment strategies may have performed during the recent global financial crisis.

Islamic Mutual Fund Industry

Recent History

To fully comprehend the celerity of the Islamic Fund industry expansion, it is necessary to place it in the context of the development of the Islamic Finance industry as a whole. After a period of slow progress from its inception in the 1970s to the beginning of the 1990s, the Islamic finance industry has undergone a rapid transformation.[6] As the oil business in the region gained traction and dollars started flowing into the oil rich Gulf nations, the demand for a regional financial system based on Islamic principles strengthened significantly since the 1990s. Even though "Islamic assets [only] stood at about $150 billion in the mid-1990s," the Standard Poor's *Islamic Finance Outlook 2008* goes on to state that they have grown at more

than 10 percent annually over the past ten years.[7] In fact, the growth trend of the Islamic finance industry has been accelerating, reaching annual growth rates of 15 percent from 2005 to 2008.[8]

Current State

Within this broad industry development, the Islamic mutual fund industry itself has "expanded significantly, growing at a compound annual growth rate of 22 percent" over the past five years, according to a recent Moody's report.[9] In order to accommodate this industry expansion, the number of Islamic financial institutions increased from only a handful in the 1970s to over 300 by 2007 (Siddiqui, 2007).[10] Moreover, major Western stock exchanges initiated listing Islamic indices, such as the Dow Jones Islamic Market Index (DJIM) and the FTSE Global Islamic Index Series, that would further the industry's development. The *Shari'a* Supervisory Board of the DJ Islamic Market Index (listed in 1999) ensures that the security universe is only composed of *shari'a*-compliant companies. As of Feb. 27, 2009, the index included 2,540 companies from 55 countries with a total market capitalization of $10,691.5 billion.[11] The number of Islamic equity funds and ETFs worldwide exceeded 325 in 2008, mirroring the growing demand for Islamic investment vehicles.[12] Major banking institutions of the West, including UBS, Citibank, HSBC and Deutsche Bank, joined the industry and now offer their own Islamic mutual funds as well as other Islamic financial products and services. According to a recent survey by Ernst & Young, by the end of 2009, while global assets under management (AUM) reached a level of $22 trillion, *shari'a*-compliant investment funds are estimated to manage about US$52.3 billion in investments. In addition, by the end of 2009, there were approximately 700 Islamic mutual funds.[13]

Future of Islamic Funds

The ongoing global financial crisis has affected the Gulf region, around which most of the activities in the Islamic finance industry revolve.[14] Yet, according to the aforementioned size and growth figures, it seems that the Islamic finance industry has proven rather resilient in the face of this worldwide financial debacle and fared relatively well compared to conventional financial industries in the West. This outcome stems from the fact that "to some extent, today's global economic troubles can be traced to excessive leveraged financing activities that diverged from real economic activities." Since "the principles of Islamic finance […] are firmly rooted in […] real economic activity," Islamic equity funds, which comply with *shari'a* regulations and avoid highly-leveraged companies, have become very attractive to today's risk-averse investor.[15] As such, the future bodes well for the Islamic finance industry and consequently the sub-sector of Islamic mutual funds.

Besides the apparent attractiveness of Islamic investment vehicles during the current financial crisis, the mere fact that Muslims comprise 21.01 percent of the world's population,[16] while the Islamic finance industry accounts "for only about 1 percent of the financial assets in the overall banking and insurance sectors [...] suggests that there is still ample room for growth on the supply side in the provision of Islamic financial products."[17] The combined gross domestic product of the 57 member states of the Organization of the Islamic Conference (OIC) based on purchasing power parity amounts to approximately $7 trillion,[18] while the six-member Gulf Cooperation Council (GCC) alone is estimated to hold $2.5 trillion in private wealth.[19] In fact, a joint study by the Islamic Development Bank and the Islamic Financial Services Board expects the Islamic finance industry to undergo "an annual growth of 15 percent until 2010 [. . . expanding to] US$1.4 trillion by 2010 and to US$2.8 trillion by 2015."[20] In light of the current global financial crisis and the rising demand for *shari'a*-compliant investments by Muslim as well as non-Muslim investors worldwide, the Islamic equity funds and Islamic finance industry as a whole are poised to undergo further expansion.[21] To achieve this projection, Islamic funds are expected to meet investor expectations in terms of returns by shifting assets away from investment accounts to investment funds. Furthermore, as the E&Y report indicates, as investors are moving away from capital preservation to capital appreciation, the Islamic funds will need to deliver higher returns through strategic allocation of investment funds. In order to appreciate the future growth potential of Islamic finance, it becomes necessary to first understand its fundamental characteristics, structure and origin, which will be outlined in the next section.

Principles of Islamic Finance

Shari'a

In contrast to SRI or conventional investment funds, Islamic mutual funds have to be in compliance with the *shari'a*. As the divine code of law, the *shari'a* serves as "the guide for human action, which encompasses every aspect of human life and [...] operationalizes the understanding of the Divine Will in terms of human actions."[22] The framework of the *shari'a* is based on the Quran, the written revelation of God's Word, and the Sunna, which is comprised of the teachings and practices of the Prophet Muhammad. Deriving its rulings from the Quran and Sunna, the *shari'a* is instilled with divine authority. Hence, the guidelines set forth in the *shari'a* become imperative to all Muslims and govern all aspects of life, whether they are of personal, social, political, economic or financial nature.

The unitary perspective of life in Islam, which includes an economic system, essentially strives to establish harmony, equality and balance within the individual and society as a whole in a worldly context, but also between the individual and God in a spiritual sense. Since the "rules governing permissible and forbidden economic behavior […], as well as questions of property rights and of production and distribution of wealth, are all based on the fundamental Islamic concept of justice," it becomes evident that the notions of economic justice and equitable distribution of wealth represent two fundamental pillars of the Islamic economic system.[23]

Prohibitions in Islamic finance

In order to assist the development of such an Islamic economic framework, the *shari'a* stipulates certain rules that restrict economic and financial processes, so that business dealings are just and fair and may benefit not only the individual, but society as a whole. The three key prohibitions relevant to Islamic finance relate to the concepts of *riba*, the charging of interest; *gharar,* uncertainty or immoderate risk in contractual agreements; and *maisir*, gambling and speculation.

The prohibition of interest is clearly expressed in the Quran, which states that "God hath permitted trade and forbidden usury"[24] and represents the most striking difference between Islamic finance and the conventional financial system. The actual Arabic word for usury used in the verse is *riba*, which "means […] any increase over and above the principle amount payable in a contract obligation, not covered by a corresponding increase in labor, commodity, risk or expertise."[25] Accordingly, with the exception of allowed profit sharing, the creditor is only entitled to the principal of the loan, which is further articulated in the same section of the Quran, which reads (in translation):

> O, believers, fear God, and give up what is still due to you from Riba if you are true believer. If you do not do so, then take notice of war from God and his Messenger. But, if you repent, you can have your principal. Neither commit injustice nor should you be subjected to it.[26]

The second prohibition refers to disproportionate *gharar* due to uncertainty in financial contracts. The uncertainty as it relates to the relevant exchanged goods or terms of a particular transaction thus includes any ambiguity in terms of quantity, quality or deliverability of the subject matter.[27] The last restriction of gambling and speculation (*maisir*) is plainly outlined in the fifth Surah (chapter) of the Quran, which states (in translation), "O you who believe! Intoxicants and gambling, sacrificing to stones

and divination by arrows are abominable actions of Satan; so abstain from them, that you may prosper."[28] Therefore, any accumulation or acquisition of wealth derived through gambling, games of chance or speculation is forbidden. Within the context of these constraints, it becomes apparent that Islamic fund management practices and procedures will differ from SRI and conventional funds. The implications of these three fundamental restrictions of Islamic finance on *shari'a*-compliant fund management are further elaborated in the subsequent discussion.

Portfolio Asset Allocation Process of Islamic, Sri and Conventional Funds

General Comparison of Fund Objectives

Although SRI funds were initially conceived in a religious context as well, socially responsible investing has expanded to take into consideration "the so-called 'triple bottom line,' commonly known as the 'three P's rule: people, planet and profit.'"[29] Most recently, assets under SRI management were estimated to be $3.07 trillion at the beginning of 2010.[30] The premise of the "three P's rule" is reflected in a definition of socially responsible investing, which can be found in the *2005 Report on SRI Trends in the United States* released by the Social Investment Forum:

> Socially responsible investing (SRI) is an investment process that considers the social and environmental consequences of investments, both positive and negative, within the context of rigorous financial analysis . . . It is a process of identifying and investing in companies that meet certain standards of Corporate Social Responsibility (CSR).[31]

Therefore, SRI fund management aspires to establish an investment strategy that results in financial profit, while realizing the commanding responsibility toward our society and environment.

Our selection of Islamic and SRI investment strategies is in line with the recent interest in the performance of faith based investing, with its overarching goal to promote the betterment of society, relative to conventional investment strategies, which lack such ethical motivation. In terms of the portfolio allocation and structure, Islamic investments and socially responsible investing (SRI) funds exhibit strong similarities, whereas traditional mutual funds, represented in our study through a portfolio only subject to an alpha stock selection filter adapted from Joel Greenblatt's methodology, are not subject to any other qualitative or quantitative constraints.[32] The congruence of Islamic and SRI funds stems from the fact that both do not have profit maximization as their sole objective, but rather strive to fulfill a paramount, ethical obligation and a social-utilitarian function. In the case of Islamic funds, the religious responsibilities and regulations outlined in

the *shari'a* take precedence over profit in order to further the establishment of a moral Islamic economic system and a just society.

In contrast, profit maximization is the dominant objective in traditional fund management. Conventional equity portfolio strategies include neither positive nor negative screens, whose purpose it is to align the portfolio with certain ethical, qualitative standards. As such, conventional funds are not often subject to the qualitative screening procedures that are so imperative to Islamic and SRI funds.

Additionally, Islamic funds differ from SRI and conventional ones, since their provisions incorporate quantitative screens that are based on ethical paradigms found in the interpretation of the Quran and the Sunna by some *shari'a* scholars working for the funds. Furthermore, Islamic funds have to comply with certain income purification requirements, which are derived from the teachings of the Quran and Sunna. The distinctions between each of the three fund types are further elaborated in the subsequent sections in the context of the screening and income purification process.

Security Universe Restrictions

The qualitative screening of Islamic and SRI funds is very similar. Both employ negative screens to exclude companies from their portfolios, which they deem as being engaged in unethical business activities. In fact, while Islamic screens eliminate "all banks and insurance companies whose activity is interest-based [...] as well as all companies involved in alcohol, tobacco and armaments manufacturing and trading, or involved in entertainment businesses,"[33] SRI screens preclude companies involved in "alcohol, gambling, tobacco, weapons production or distribution" and actively filter for companies "showing [...] good performance in the areas of animal welfare, board diversity, community relations, corporate governance, environment, human rights, indigenous peoples rights, product safety and impact, and workplace practices."[34] A study by Ghoul and Karam finds that with the exception of "interest income [...], the requirement of certain financial ratio standards, and the objection to pork and music companies."[35] Islamic and SRI screening methodologies are fairly congruent from a qualitative point of view.

Whereas traditional portfolio screening procedures lack a qualitative component derived from ethical norms, Islamic, SRI and conventional portfolio allocation methods rely on quantitative screens that specify certain filters.[36] All three fund types utilize quantitative screens as filters to earn superior alpha (excess returns), which set their portfolios apart from competitors in their respective category. However, Islamic funds employ certain quantitative screens on top of the preliminary qualitative ones to

arrive at a basic investment universe of securities, which is *shari'a* compliant. More specifically, the financial ratio analysis of Islamic funds aims to screen out companies with excessive reliance on debt, where the typical maximum level of total debt to market capitalization is set at 33 percent.[37] Analogous tolerance levels of 33 percent apply to the ratio of the sum of a company's cash and interest-bearing securities to market capitalization and accounts receivables to market capitalization in order to guarantee that the capitalization structure and business activities of every company in an Islamic fund conform to *shari'a* principles.[38]

Income Purification

By investing in conglomerates, Islamic equity funds find themselves in an intricate predicament, as the income streams of a diversified company may partially derive from *haram*[39] business activities. The issue of partial income from objectionable sources does not impact SRI funds as much, because they either simply exclude such companies via their qualitative screens from the beginning on or do not have to worry about certain issues, such as income from interest, at all. Conventional funds do not face this problem in any manner, as they are allowed to invest in companies no matter whether their business activities are considered permissible or not according to a given code of ethics. Yet, the question remains as to whether Islamic funds may invest in such companies at all; and if they are allowed to, how one should manage the portion of total profits derived from *haram* income streams. To avoid this predicament, *shari'a* scholars have come to the general conclusion that an Islamic fund is still allowed to invest in these corporations, as long as the *haram* income component is limited and appropriately "purified."[40]

In general, income from forbidden activities should be kept at a minimum and must be purified by donating a corresponding percentage of the fund's payouts to charity. According to the Malaysian *shari'a* Advisory Council, *riba* income should account for "no more than 5 percent of [...] profits."[41] The directed "purification process is done either by the fund manager before any distribution of income, or by reporting the necessary financial ratios [to] investors."[42] In the case that management does not perform its duty, the Muslim investor has to make sure to dispose the percentage of his returns that was attributable to a company's non-halal business activities to charity. Actually, the latter approach is preferable, as it would not place unnecessary financial burden on traditional investors, thus making Islamic funds more attractive to non-Muslims.[43] In essence, this regulation ensures that companies with minimal income from *haram* activities are not screened out altogether by Islamic funds, which can consequently

tap into a greater investment universe that allows for sufficient diversification. At the same time, it prescribes Islamic funds a manner by which to purify their earnings and maintain their ethical integrity in accordance to *shari'a* standards.

Governance Structure and Composition of Islamic, SRI and Conventional Funds

Although Islamic financial products can be structured in a variety of ways to form equity, commodity, lease-back (*ijara*), cost-plus sale (*murabaha/sukuk*) or mixed funds (Bose & Mcgee, 2008), this study solely focuses on Islamic equity funds. Although the actual portfolio composition of the Islamic fund naturally resembles that of a regular open-ended, long only mutual fund, Islamic equity funds are based on a "*mudaraba*" contractual structure in terms of the fund's management arrangement. *Mudaraba* fund management structures are characterized by the Islamic profit and loss sharing principle, in which "an economic agent with capital (*rabb-al-mal*) can form a partnership with another agent with skills (*mudarib*), with an agreement to share the profits." [44] Under the *mudaraba* contract, losses from an equity fund are generally to be suffered by the capital providers (investors) only. Nevertheless, in the case that the losses can be attributed to negligence or misconduct by the *mudarib*, he may be liable instead of the *rabb-al-mal*.[45]

The structure and portfolio composition of SRI funds and traditional funds are not restricted in terms of specific investment vehicles, as long as these financial instruments passed their screening and filtering process and are in compliance with their investment policy statements. Islamic equity funds, on the other hand, have to conform to a certain fund structure and composition that incorporates consideration for the prohibitions of *riba, gharar* and *maisir*.

Due to the prohibition of interest, Islamic funds are not allowed to invest in "any fixed income securities, such as corporate bonds, treasury bonds and bills, certificates of deposit, [and] preferred stocks."[46] Similarly, Islamic funds cannot trade on margin or exploit short-selling processes. For the former, one would be relying on interest-based debt to finance the investment, while the latter entails not only borrowing a security with interest for trading purposes, but also excessive risk due to potentially unlimited losses (ignoring margin requirement calls). These two exclusions stand in stark contrast to SRI and conventional funds, but especially to hedge funds, which make extensive use of these two trading techniques.

Furthermore, the prohibition of *gharar* precludes Islamic equity fund management from a myriad of financial instruments, which are usually employed by SRI and traditional funds. Since *gharar* bans excessive uncertainty or

risk in contractual agreements, Islamic funds are not allowed to utilize any "financial derivative instruments, forwarding contracts, [or] future agreements."[47] Keeping in mind that an option is the exchange of funds for a right and no promise of an actual asset-based transaction, "a right, without an obligation, makes [an option] dependent upon future events and creates *gharar*,"[48] thus rendering it a forbidden financial instrument under *shari'a* law. Forwards and future contracts are equally forbidden, as they rely on a partial and not full payment at the initial transaction settlement and consequently raise the issue of selling promises instead of actual assets. The only notable, widely-accepted exception to the abovementioned restrictions due to *riba* and *gharar* is presented in the form of a *Salam* contract. A *Salam* transaction corresponds to a "deferred delivery [where] money is paid on the spot but the commodity will be delivered at a future date."[49] Expanding this concept, an Islamic equity fund can actually proxy a short-selling transaction via a *Salam* sale as long as it owns the underlying security at the onset of the transaction. Consequently, Islamic equity funds can emulate this particular hedging technique, regularly employed by SRI and traditional funds, without overstepping the boundaries set forth by the *shari'a*. Yet, in contrast to SRI and conventional funds, the strict prohibitions of *riba* and *gharar* are in full effect and apply to all the other aforementioned cases, thus severely restricting the number of permissible financial instruments and ultimately the composition as well as structure of Islamic funds.

Financial Crisis and Islamic Funds

For the purposes of our study, July 2007 was chosen to mark the beginning of the financial crisis. During this month Bear Stearns started releasing data that some of its funds were essentially worthless, while the U.S. government injected a combined $62 billion into the financial system the following month as an emergency intervention.[50] The origin of the financial crisis can be traced back to the sub-prime mortgage problem, which was a result of risky loans being extended to individuals with poor credit histories. These loans were bundled into mortgage-backed securities (MBS) and sold to investors across the world. As interest rates rose, the underlying risky loans of MBS became subject to higher default rates and consequently the MBSs' value dropped significantly. Due to uncertainty and higher default rates, banks tightened lending and the credit crunch ensued, restricting much needed liquidity. As the global financial crisis was spreading, governments across the globe were struggling to turn the world economy around.[51]

At the same time, the Islamic finance system has weathered the financial turmoil much better than its Western counterpart. Islamic banks, operating on a system that prohibits interest, have not suffered as much as Western

banks from the credit crunch. This phenomenon can in part be explained by the Islamic banks' safeguard against the "liquidity problem due to [inter-bank] lending in the money markets, merger and resales of [debt-ridden] companies" as well as their lending practices that evaluate "complete investment risks instead of mere credit risks."[52]

More specifically, although the financial crisis has negatively affected the performance of *shari'a*-compliant funds, "their five-year total returns have [still] managed to fare better than the S&P 500 and their peers" in the mutual fund industry.[53] For example, while the five-year return on the Russell 2000 index amounted to a 5.20 percent loss, the income and growth funds of the Amana Mutual Funds Trust, one of the most prominent Islamic mutual funds in the U.S., yielded a profit of 5.69 percent and 4.97 percent respectively.[54]

As previously mentioned, the root cause of the current financial crisis can be found in sub-prime lending practices and the dependent secondary market for MBS. In contrast to Islamic principles, "debt braced with high interest was being extended to persons who simply could not afford to pay back loans [-this] was usury."[55] Moreover, the securitization of "mortgage debts, turning them into interest-bearing securities" is strictly forbidden due to the *riba* element and consequently Islamic funds are not allowed to invest in these vehicles.[56] Because of the credit crunch, the financial sector was hit the hardest, as the industry's high leverage level hurt banks, insurance companies and financial institutions. Moreover, the derivative market—and especially the secondary market for MBS—collapsed during the financial crisis as the value of the underlying assets in these markets deteriorated with increased default rates. According to the prohibitions of *riba, gharar* and *maisir*, Islamic mutual funds are forbidden to trade on margin or short-sell by borrowing funds, invest in highly-leveraged firms, MBS, or risky derivates and have thus been fairly immunized from the credit crisis (which negatively affected all these investment vehicles and techniques), ultimately resulting in superior returns for Islamic equity funds in general compared to their conventional counterparts.

Data and Methodology

General Overview

The universe formation and alpha stock ranking process, modeled according to a Greenblatt filter, were carried out in FactSet, utilizing its Universal Screening feature. In addition, fundamental data for each security was retrieved from the FactSet. Historical prices of the relevant securities and indexes were retrieved from DataStream. The alpha ranking scores along with the securities' historical price information were imported into SAS.

Based on the ranking, portfolios composed of the best 50 securities for each asset allocation strategy were exported to Excel. Finally, Excel's Solver add-in was used to perform portfolio optimization and calculate relevant quantitative portfolio performance measures.

Security Universe Formation

In an effort to begin the asset allocation for each of the equity portfolios, first, the appropriate security universes were formed. The initial universe for the conventional, Islamic and SRI fund were proxied via the Dow Jones Global World Index (DJGI), Dow Jones Islamic Market World Index (DJIM) and Dow Jones Sustainability World Index (DJSI), respectively.

Since the indices' components were based on 2009 data, a filter was implemented to only include stocks that actually existed in 2000, the year that marks the beginning of the in-sample period. Similarly, securities, for which the necessary 2006 fundamental data for the alpha generation ranking screen is not available, are excluded from the universes. In order to prevent security overlap among the three equity portfolios, which would deteriorate the strength of the study's findings, the DJSI universe components are excluded from the DJIM and their combined security components are excluded from the DJGI universe. To further establish relevant security universes, from which even larger equity funds could have chosen stocks, firms with a 2006 market capitalization of less than $1 billion are excluded. The resulting universes consisted of 171, 802 and 958 potential securities for the SRI, Islamic and conventional equity portfolio, respectively.[57]

Alpha Screen Ranking

In addition, a quantitative ranking screen, devised according to the methodology presented in Joel Greenblatt's *The Little Book That Beats the Market* (2005), is run on each of the universes to select superior securities. Greenblatt's ranking screen methodology was chosen because he is one of the most prominent investment gurus of our time and his investment strategy has proven consistently successful in extensive back-testing analyses.[58] Greenblatt's investment philosophy is based on the principle of buying good companies at bargain prices. In an effort to aid this process, Greenblatt devised a screen that ranks companies by earnings yield (EY) and return on capital (ROC) ratios. While the high earnings yield filters for undervalued companies, the return on capital ratio yields companies that can reinvest their earnings at a high rate—resulting in potentially high earnings growth—and most likely have a sustainable competitive advantage. The earnings yield and return on capital ratios are calculated as follows:[59, 60]

- EY = EBIT/Enterprise Value
- ROC = EBIT/(Working Capital + Net Plant, Property and Equipment)

Thereafter, the EY and ROC ranks are added together for each security to generate its final combined ranking.[61]

General Approach to In-Sample Optimization and Out-of-Sample Evaluation
For the purpose of Markowitz minimum-variance optimization, this study divides the period from 2000 to 2009 into an in-sample and an out-of-sample period. The optimized portfolios will be determined using data from the in-sample time period, which spans from January 2000 to June 2007 and represents relatively normal global economic activity with regular economic contractions and expansions. Subsequently, the performance of the optimized portfolios will be tested during the out-of-sample period, which spans from July 2007 to April 2009, is characterized by a global financial crisis and hence represents a time of economic distress.

Relying on in-sample period data, the Excel Solver utilizes Markowitz's portfolio theory to form optimized equity portfolios. The Markowitz model's optimization process is based on the following two parameters:

$$\text{Min } \sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$$

Subject to $w_1 + w_2 + \ldots + w_N = 1$

$$C = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \text{Cov}\,(r_i r_j) + \lambda_1\left(1 - \sum_{i=1}^{n} W_i\right)$$

r_p is the return of the portfolio, r_i the return of a particular security, w_i is its weight in the portfolio, cov is the covariance between the returns of the securities, σ_p^2 is the variance of the portfolio, C is the Lagrangian function, λ_1 is the Lagrange multiplier and ρ_{ij} is the correlation between securities. The investor minimizes the variance subject to a target return by changing the weights assigned to each security. Once the optimal weights have been established, the portfolio's performance is evaluated for the out-of-sample time period and appropriate performance measures are computed, as discussed in further detail in the subsequent sections.

In-Sample Portfolio Optimization
For the in-sample portfolio optimization, first the weekly historical prices of the securities in each portfolio for the period from Jan. 3, 2000 to July 2, 2007 are imported from DataStream into Excel. The weekly continuous-compounding returns are calculated using log transformation of prices. Next, the return of the portfolio is calculated for each week. According to generally-accepted calculation procedures, the average weekly standard deviation is annualized by multiplying the weekly portfolio deviation by the square root of the number of weeks in a year, while the average weekly portfolio return is annualized by multiplying by the number of weeks in a year.

The Excel Solver is then used to optimize the portfolio via risk minimization according to Markowitz portfolio theory. The solver is set up to minimize the annualized standard deviation by modifying the weights of the securities in each portfolio. Additional restrictions include a minimum weight of 0 percent for each security, since a negative weight would correspond to short-selling, which is not allowed in the *shari'a*h compliant long-only investment policy. Furthermore, the cumulative weight of all the securities in each portfolio is capped at one, since a weight greater than this value would imply margin trading, which is also not allowed in the selected fund structure. A maximum weight[62] for each security is set at 10 percent, so that the solver devises a portfolio with a sufficiently large number of securities, which benefits from diversification and is less exposed to firm-specific risk. Using the available data and subject to the aforementioned restrictions, the Excel Solver finally determines the appropriate security weights to form optimized conventional, Islamic and SRI equity funds.

Out-of-Sample Forecasting and Performance Measure Calculations
In order to assess the performance of each of the investment philosophies during the financial crisis, the optimized portfolios' performances are evaluated over the out-of-sample period from July 2, 2007 to April 27, 2009. In order to carry out quantitative performance analysis, the annualized mean portfolio return and standard deviation for each equity fund are calculated using the optimum security weights from the in-sample period. The two performance measures are calculated in the same manner as for the in-sample episode, except that the calculations are based on the time horizon from July 2007 to April 2009, characterized by the financial meltdown.

In terms of portfolio management style, it would be incorrect to classify these portfolios as indexed portfolios, because the initial screening method is similar to alpha scoring models that are utilized at portfolio management firms (active management). Thus, the management style of the study's portfolios should be classified as enhanced indexing. It is important to note that although we report the tracking error (TE), $TE = \sigma(r_p - r_i)$,[63] for each portfolio, we do not use this ratio to measure performance. The tracking error would be a critical indicator of performance if we had set out to construct indexed portfolios.

For a more conclusive portfolio performance evaluation, the Sharpe Ratio (SR) is calculated. This is:

$$SR = \frac{(\mu - r_f)}{\sigma_p},$$

where μ is the portfolio's annualized mean return, r_f is the risk-free rate (three-month U.S. Treasury bill rate [average of weekly rates during time periods '00–'07 and '07–'09]) and σ_p represents the portfolio's annualized standard deviation. The Sharpe ratio provides a risk-adjusted performance measure and represents the portfolio's excess return above the risk-free rate per standard deviation of risk.

Interpreting the Sharpe ratio based on the portfolio's data during the financial meltdown from July 2007 to April 2009 is a bit more complicated, because the negative mean returns result in negative Sharpe ratios. Negative Sharpe ratios make conclusions a bit more difficult and sometimes even ambiguous, as a more negative Sharpe ratio can be due to a higher negative return—an undesirable attribute—or a lower standard deviation—an arguably attractive attribute. To avoid contradictory performance results, the modified Sharpe ratio (MSR) is calculated as:

$$SR = (\mu - r_f) / \sigma_p^{\{(\mu - r_f)/Abs(\mu - r_f)\}}$$

where μ is the portfolio's annualized mean return, r_f is the risk-free rate proxied via the appropriate average three month Treasury bill rate, σ_p is the portfolio's annualized standard deviation and *Abs* is the absolute value operator. The modified Sharpe[64] ratio makes comparison of the performances of the conventional, Islamic and SRI equity portfolios intuitive and logical when excess returns are negative. Note that when excess returns are positive, the modified Sharpe ratio is identical to the regular Sharpe ratio.

Empirical Results

Performance Evaluation of Equity Funds (Comprehensive and Size-Based Portfolio Groups)

As indicated in Tables 1–4, the performances of the conventional, Islamic, and SRI investment strategies are evaluated using comprehensive portfolios as well as small-, mid- and large-cap ones, which were constructed to control for potential size bias. Generally speaking, the empirical results confirm the study's hypothesis that an investment philosophy for international equity funds in accordance to Islamic law would have limited downside losses and resulted in risk-adjusted return improvements over traditional and SRI investment methodologies during times of economic and financial crisis.

Comprehensive Portfolio Group

As can be seen in Table 1, the comprehensive Islamic fund outperforms the conventional and SRI equity portfolios in both the in-sample and out-of-sample periods. However, during '00–'07, the performance of the Islamic portfolio is markedly superior with a modified Sharpe ratio (MSR) of

Table 1. Portfolio Performance

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
	Portfolio Group: Comprehensive (all sizes)					
Average Return	0.26%	0.40%	0.22%	–0.63%	–0.57%	–0.69%
Standard Deviation	1.80%	2.09%	1.70%	4.50%	4.86%	4.78%
Annualized Avg. Return	13.38%	20.72%	11.65%	–32.69%	–29.63%	–36.09%
Annualized Std. Deviation	12.96%	15.06%	12.26%	32.43%	35.06%	34.46%
Tracking Error	1.54%	1.93%	1.55%	1.66%	1.66%	1.40%
Number of Stocks	21	23	22	21	23	22
Sharpe Ratio	0.7909	1.1677	0.6943	–1.0644	–0.8975	–1.1009
Modified Sharpe Ratio (MSR)	0.7909	1.1677	0.6943	–0.1120	–0.1103	–0.1307
Improvement in MSR over Nearest Competitor		47.64%			1.50%	
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**2**	**1**	**3**	**2**	**1**	**3**

1.1677, while the conventional one ranks second with an MSR of .7909 and the SRI third with an MSR of .6843. In the subsequent out-of-sample period, the relative improvement in the Islamic fund's MSR over the nearest competitors shrunk considerably from 47.64 percent to 1.5 percent, but is nonetheless still higher than the other two alternatives with a value of –.1103, while the conventional and SRI portfolios have MSRs of –.1120 and –.1307, respectively. Although this outperformance decline might initially cause concerns, the later performance analysis of the size-based portfolios sheds light on the underlying cause and reaffirms the conclusion that the construction of equity portfolios according to Islamic investment principles resulted in return improvements over funds devised in accordance to conventional or SRI methodologies during times of economic distress. The size-based portfolio performance analysis points to the fact that the

outperformance decline is most likely due to the inclusion of securities from each of the three size categories, which happen to exhibit the lowest risk characteristics, but at the same time, suffer from weaker return figures. In accordance to the Markowitz portfolio optimization procedure, these securities would be included in the comprehensive Islamic equity portfolio despite their weak return characteristics, because they contribute to a reduction of the portfolio's overall standard deviation. Hence, in order to correctly assess each of the investment strategies, it becomes necessary to evaluate their performance in the context of comprehensive as well as size-controlled portfolios.

The superior performance of the comprehensive Islamic equity fund is further visually represented in charts found in appendices 1 and 2. The charts display the base-indexed portfolio performance of each of the three investment strategies. In order to construct these base-indexed charts, the prices of each security are indexed with the first price in the relevant time period serving as the base. In this manner, the subsequent security prices are deflated by their relevant base price. Applying the optimized security weights from the Markowitz optimization, the base-indexed prices are added together to yield the portfolio index, which naturally starts at 1, or 100 percent. In this manner, it becomes possible to compare the relative performance of all portfolios over time on the same scale. While the chart in appendix 2 shows that investing in the Islamic fund during the financial crisis would have protected an investor's assets most effectively, the chart in appendix 1 additionally demonstrates that such an investment would have actually outperformed the other two fund investment alternatives by an even larger margin during times of regular economic activity. In fact, over the course of the second investment horizon from '07–'09, the Islamic, traditional and SRI equity fund would have resulted in cumulative returns of –38.42 percent, –42.27 percent and –44.28 percent respectively, while the same would have yielded 653 percent, 397 percent, and 314 percent during the initial investment period. As such, not only did the Islamic equity strategy most effectively shield investors' assets from losses during times of economic turmoil, but it also yielded the highest returns during tranquil market periods.[65]

Size-Based Portfolio Groups

As previously deliberated, an analysis of each of the three investment methodologies utilizing size-based equity funds is chosen to control for potential size bias and complement the performance evaluation of the comprehensive portfolio group. For this purpose, sub-universes are created from each of the three initial universes based on company size, proxied via year

2006 market capitalization figures.[66] As Tables 2–4 indicate, the funds in the small, medium and large cap portfolio groups, devised in line with Islamic investment principles, are most successful in limiting downside losses during the recent financial crisis from '07–'09, clearly outperforming their respective conventional and SRI counterparts. Moreover, with the exception of the large cap Islamic fund, an Islamic investment strategy would have also yielded the highest returns during periods marked by regular economic activity.

In fact, as shown in Table 2, in the small cap portfolio group, the Islamic fund performs the best during the in-sample period with an MSR of 1.0415 compared to MSRs of .7969 for the traditional and .6943 for the SRI portfolio. Over the course of the subsequent investment horizon, the Islamic, conventional and SRI funds exhibit MSRs of –.0607, –.0987 and –.1307, respectively. Hence, the *shari'a*-compliant Islamic investment strategy results in an equity portfolio that exhibits a 30.71 percent and 38.56 percent

Table 2. Portfolio Performance

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Small			
Average Return	0.23%	0.30%	0.22%	–0.61%	–0.38%	–0.69%
Standard Deviation	1.53%	1.69%	1.70%	4.08%	3.92%	4.78%
Annualized Avg. Return	11.92%	15.83%	11.65%	–31.71%	–19.62%	–36.09%
Annualized Std. Deviation	11.03%	12.19%	12.26%	29.43%	28.27%	34.45%
Tracking Error	1.64%	1.83%	1.55%	1.65%	1.86%	1.40%
Number of Stocks	26	18	22	26	18	22
Sharpe Ratio	0.7969	1.0415	0.6943	–1.1399	–0.7588	–1.1008
Modified Sharpe Ratio (MSR)	0.7969	1.0415	0.6943	–0.0987	–0.0607	–0.1307
Improvement in MSR over Nearest Competitor		30.71%			38.56%	
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**2**	**1**	**3**	**2**	**1**	**3**

improvement in MSR over its nearest competitor during times of normal economic activity and financial distress, respectively. Similarly, charts in appendix 3 and 4 reflect these performance characteristics. While the Islamic fund only loses 28 percent of its value during the financial crisis, the traditional and SRI funds lose 40 percent and 52 percent. During '00–'07, the Islamic portfolio would have yielded a cumulative return of 391 percent, while the SRI fund comes in second with 307 percent, closely followed by the conventional fund with 299 percent. These figures further support the conclusion that an Islamic investment strategy would have been successful during times of regular economic activity, but most importantly invaluable to the objective of safeguarding investors' assets amidst financial market turmoil.[67]

An analysis of the medium sized equity portfolios corroborates our aforementioned finding of superior performance of the Islamic strategy during times of economic distress as well as regular development. As such, an in-depth review of quantitative results is omitted in the interest of brevity. Nevertheless, the relevant MSR and additional supporting performance figures can be extracted from Table 3 and appendices 5 and 6. Whilst the Islamic fund again ranks first in the mid-sized portfolio group, it is interesting to note that the relative ranking of the other two has changed, with the mid-sized SRI fund actually performing better than the conventional one during both time periods.

Reviewing the performances within the large-cap portfolio group in Table 4, it becomes clear that the MSR results for the second investment horizon from '07–'09 validate the study's hypothesis of Islamic funds' capacity to protect investors' assets during financial crises. Accordingly, the Islamic portfolio has the highest MSR of –.0588 and suffers the lowest cumulative losses of 31.38 percent during '07–'09, as demonstrated in the chart of appendix 8. At the same time, the conventional and SRI fund yield MSRs of –.0769 and –.0851 and total cumulative losses of 36.55 percent and 36.99 percent, respectively. Yet, this portion of our analysis also offers a cautionary note with regards to our supplementary conclusion that Islamic equity funds may even provide superior returns during times of regular economic activity. Contrary to the findings based on the comprehensive and other two size-based portfolio groups, the large-cap Islamic fund this time ranks third in terms of MSR performance during the period from '00–'07, with a value of .1396. A plausible explanation for this finding is that as firms become larger, they tend to be driven increasingly by overall market conditions and not their own idiosyncratic factors, thus exhibiting risk and return characteristics similar to the corresponding market. While all other portfolio groups demonstrate that investors can profit considerably

Table 3. Portfolio Performance

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Medium			
Average Return	0.16%	0.25%	0.19%	–0.83%	–0.36%	–0.50%
Standard Deviation	1.52%	1.51%	1.53%	4.20%	3.74%	3.65%
Annualized Avg. Return	8.50%	12.87%	9.98%	–43.01%	–18.56%	–26.07%
Annualized Std. Deviation	10.94%	10.89%	11.04%	30.25%	26.99%	26.30%
Tracking Error	1.61%	1.91%	1.59%	1.74%	1.70%	1.80%
Number of Stocks	20	26	22	20	26	22
Sharpe Ratio	0.4905	0.8939	0.6209	–1.4825	–0.7556	–1.0611
Modified Sharpe Ratio (MSR)	0.4905	0.8939	0.6209	–0.1357	–0.0551	–0.0734
Improvement in MSR over Nearest Competitor		43.97%			25.02%	
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**3**	**1**	**2**	**3**	**1**	**2**

by investing in Islamic equity funds even in periods of tranquil market conditions, the analysis of the large-cap fund group indicates that awareness of a particular security's market capitalization class becomes crucial when deciding to adhere to a *shari'a* compliant investment strategy during normal economic times. With regards to the study's initial hypothesis, the analysis of the large-cap portfolio class along with the evaluations of all other portfolio groups comprehensively verifies the finding that the Islamic investment strategy is most effective at protecting investor's capital during financial crises.

Performance Evaluation Excluding Relevant Industries

Besides the performance evaluation of size-based equity portfolios for each of the three investment strategies, additional analyses were performed

Table 4. Portfolio Performance

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Large			
Average Return	0.20%	0.09%	0.18%	–0.50%	–0.42%	–0.53%
Standard Deviation	1.62%	1.55%	1.79%	3.84%	3.43%	4.01%
Annualized Avg. Return	10.56%	4.69%	9.57%	–25.97%	–21.90%	–27.56%
Annualized Std. Deviation	11.71%	11.19%	12.87%	27.67%	24.77%	28.95%
Tracking Error	1.54%	1.78%	1.41%	1.53%	1.84%	1.33%
Number of Stocks	22	23	20	22	23	20
Sharpe Ratio	0.6346	0.1396	0.5002	–1.0050	–0.9582	–1.0154
Modified Sharpe Ratio (MSR)	0.6346	0.1396	0.5002	–0.0769	–0.0588	–0.0851
Improvement in MSR over Nearest Competitor		–72.08%			23.60%	--
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**1**	**3**	**2**	**2**	**1**	**3**

excluding relevant industries from the respective security universes to further test the robustness of our results. Due to the fact that financial and real estate companies[68] suffered the most during the recent financial crisis, securities from these industries are excluded from the relevant universes.

Acknowledging slight nominal differences, the quantitative performance measures essentially mirror the study's previous findings (see Tables 5–8). Of course the superior performance of the Islamic investment methodology can in part be attributed to its prohibition to invest in banks and most real estate companies, whose stocks happened to suffer the most during the credit crunch and ensuing economic crisis. Yet, the results from this supplementary analysis further ascertain the conclusion that, even when controlling for the aforementioned issue, portfolios constructed in accordance with Islamic

Table 5. Portfolio Performance (excluding Financial/Real Estate Firms)

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
	Portfolio Group: Comprehensive (all sizes)					
Average Return	0.28%	0.40%	0.20%	–0.68%	–0.57%	–0.73%
Standard Deviation	1.83%	2.09%	1.69%	4.71%	4.86%	4.76%
Annualized Avg. Return	14.53%	20.72%	10.34%	–35.52%	–29.63%	–37.93%
Annualized Std. Deviation	13.21%	15.06%	12.22%	33.94%	35.06%	34.33%
Tracking Error	1.50%	1.93%	1.57%	1.74%	1.66%	1.51%
Number of Stocks	21	23	22	21	23	22
Sharpe Ratio	0.8624	1.1677	0.5903	–1.1007	–0.8975	–1.1584
Modified Sharpe Ratio (MSR)	0.8624	1.1677	0.5903	–0.1268	–0.1103	–0.1365
Improvement in MSR over Nearest Competitor		35.39%			12.99%	
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Sum	1	1	1	1	1	1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**2**	**1**	**3**	**2**	**1**	**3**

investment principles are more successful than conventional and SRI equity funds in limiting potential downside losses during financial crises.

General Performance Comparison of Benchmark Index Universes

In an effort to analyze the investment strategies from a macro perspective, the performance of the conventional, Islamic and SRI funds is compared to that of their respective indices. Accordingly, first the performances of each of the indices are compared over the course of the two investment horizons. Thereafter, the performances of the constructed equity portfolios are placed in the context of the respective index universes' performance to determine the effectiveness of the chosen quantitative alpha ranking filter and Markowitz optimization model.

Table 6. Portfolio Performance (excluding Financial/Real Estate Firms)

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Small			
Average Return	0.21%	0.30%	0.25%	–0.55%	–0.38%	–0.73%
Standard Deviation	1.49%	1.69%	1.77%	3.93%	3.92% 4.85%	Annualized
Avg. Return	11.13%	15.83%	12.86%	–28.77%	–19.62%	–38.15%
Annualized Std. Deviation	10.76%	12.19%	12.76%	28.32%	28.27%	34.95%
Tracking Error	1.67%	1.83%	1.74%	1.72%	1.86%	1.58%
Number of Stocks	26	18	19	26	18	19
Sharpe Ratio	0.7434	1.0415	0.7623	–1.0805	–0.7588	–1.1441
Modified Sharpe Ratio (MSR)	0.7434	1.0415	0.7623	–0.0867	–0.0607	–0.1398
Improvement in MSR over Nearest Competitor		36.63%			30.01%	
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Sum	1	1	1	1	1	1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**3**	**1**	**2**	**2**	**1**	**3**

The conventional, Islamic and SRI universes are proxied via the modified DJGI, DJIM and DJSI, and the indices' price data is base-indexed to allow for comparative analysis on the same chart.[69] As illustrated in appendix 9, the DJIM index lost 15.93 percent of its value, the DJSI only lost 3.85 percent, but the DJGI actually gained 27.48 percent in value in the time period from '00–'07, which is characterized by regular economic activity. Yet, as displayed in appendix 10, in the recent financial crisis from '07–'09, the DJIM suffered the least cumulative loss, amounting to 42.78 percent, while the DJGI and DJSI lost 48.27 percent and 53.08 percent, respectively. Hence, it becomes clear that although the Islamic index wasn't able to benefit as much as the conventional and SRI during up market, it was able to better protect investors from downside losses during the financial crisis from '07–'09.

Table 7. Portfolio Performance (excluding Financial/Real Estate Firms)

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Medium			
Average Return	0.16%	0.25%	0.19%	–0.79%	–0.36%	–0.45%
Standard Deviation	1.57%	1.51%	1.46%	3.89%	3.74%	3.57%
Annualized Avg. Return	8.24%	12.87%	9.99%	–40.88%	–18.56%	–23.58%
Annualized Std. Deviation	11.33%	10.89%	10.55%	28.03%	26.99%	25.76%
Tracking Error	1.60%	1.91%	1.58%	1.76%	1.70%	1.91%
Number of Stocks	21	26	23	21	26	23
Sharpe Ratio	0.4505	0.8939	0.6501	–1.5237	–0.7556	–0.9867
Modified Sharpe Ratio (MSR)	0.4505	0.8939	0.6501	–0.1198	–0.0551	–0.0655
Improvement in MSR over Nearest Competitor		37.49%			15.94%	
Optimization Constraints						
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Sum	1	1	1	1	1	1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**3**	**1**	**2**	**3**	**1**	**2**

With regards to the in-sample period, the cumulative yields of the comprehensive equity portfolios stand in stark contrast to indices' returns. A comparison between the two groups on the same chart in appendix 11 reveals that the study's alpha screen, devised according to Greenblatt's ranking methodology, and mean-variance optimization model are very effective in the period from '00–'07. All three equity portfolios undoubtedly perform significantly better than the index group. At the same time, it is evident from the chart in appendix 12 that the alpha returns of the same portfolios are significantly less over the second period from '07–'09, as the performance of the equity portfolios becomes more aligned with that of the indices. Although the Greenblatt quantitative ranking filter and Markowitz

Table 8. Portfolio Performance (excluding Financial/Real Estate Firms)

	January 2000–June 2007			July 2007–April 2009		
	Conventional	**Islamic**	**SRI**	**Conventional**	**Islamic**	**SRI**
			Portfolio Group: Large			
Average Return	0.20%	0.09%	0.18%	-0.52%	-0.42%	-0.53%
Standard Deviation	1.62%	1.55%	1.79%	3.88%	3.43%	4.01%
Annualized Avg. Return	10.24%	4.69%	9.57%	-26.80%	-21.90%	-27.56%
Annualized Std. Deviation	11.65%	11.19%	12.87%	27.98%	24.77%	28.95%
Tracking Error	1.53%	1.78%	1.41%	1.52%	1.84%	1.33%
Number of Stocks	21	23	20	21	23	20
Sharpe Ratio	0.6101	0.1396	0.5002	-1.0236	-0.9582	-1.0154
Modified Sharpe Ratio (MSR)	0.6101	0.1396	0.5002	-0.0801	-0.0588	-0.0851
Improvement in MSR over Nearest Competitor		-77.11%			26.62%	
Optimization Constraints						
Minimum Weight	0	0	0	0	0	0
Maximum Weight	0.1	0.1	0.1	0.1	0.1	0.1
Sum	1	1	1	1	1	1
Risk Free Rate	3%	3%	3%	2%	2%	2%
Ranking	**1**	**3**	**2**	**2**	**1**	**3**

optimization procedure are generally successful in creating value in the form of superior portfolio returns relative to the indices' performance, the extent of this advantage decreased during the out-of-sample period.

An extended assessment based on statistical analysis is undertaken to determine the extent to which portfolio returns are driven by market performance. The statistical analysis calculates beta, which measures a portfolio's exposure to general market movements, while R^2 represents the amount of variation in portfolio returns explained by variation in market returns. Accordingly, for each comprehensive equity portfolio, the 388 in-sample and 99 out-of-sample weekly returns are regressed against each strategy-specific index returns, using the ARIMA procedure with 5 lags on the residuals.

Table 9. Statistical Analysis of Comprehensive Portfolio Group

Portfolio Type	In-Sample Period (00–07)		Out-of-Sample Period (07–09)	
	Beta	R^2	Beta	R^2
Conventional	.59	.53	.96	.88
Islamic	.56	.43	1.08	.89
SRI	.56	.57	.97	.92

The figures in Table 9 reveal that the equity portfolios exhibit a relatively moderate correlation with their respective index during the in-sample period, with beta values ranging from .56 to .59, which is further supported by the low R^2 values, which range from .43 to .57 for each of the investment strategies. In the second time period from '07–'09, the correlation strengthens, with beta reaching values between .96 and 1.08 and R^2 values ranging from .88 to .92.

The diminishing nature of the equity portfolios' alpha returns is most likely attributable to two factors. On the one hand, the effectiveness of our initial alpha screen might have deteriorated as the security mispricing gets corrected over time, while, on the other hand, it might indicate that the economic turmoil of the financial crisis simply had a widespread adverse effect on many stocks. Although the scope of this research paper does not include an attribution analysis, in general, the study's results clearly indicate that the alpha screening and Markowitz portfolio optimization procedure were effective at constructing equity portfolios for each investment strategy with superior performances compared to their respective index universe. Furthermore, in light of the increasing correlation between the underlying index universe and the corresponding equity portfolio during the second investment horizon, the argument for adapting an Islamic investment philosophy in anticipation of financial market turmoil becomes even more compelling, especially given the fact that the Islamic index was subject to the least losses from 2007 to 2009.

Conclusion

There is no doubt that the recent global financial crisis has spurred demand for safer investment strategies among today's risk-averse investors. The aim of this study was to determine whether an investment strategy for international equity funds based on Islamic finance principles would limit potential downside losses during financial crises. An Islamic investment model might have proven particularly beneficial due to its exclusion of highly leveraged companies, effectively reducing its exposure to credit market conditions.

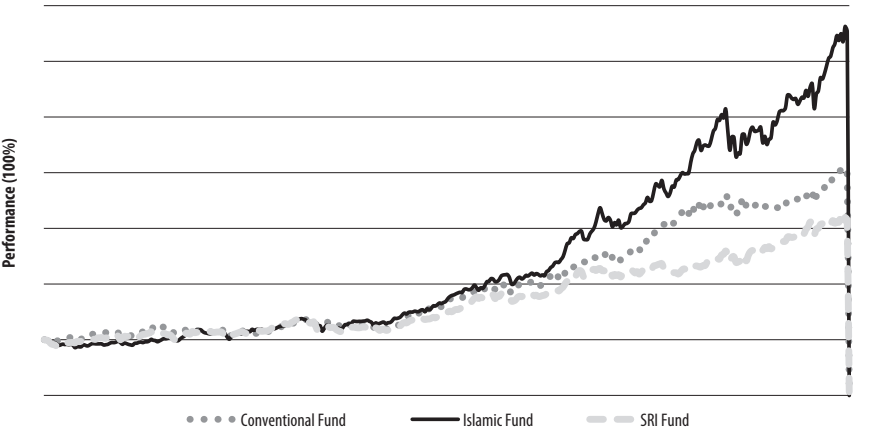
It is important to note that the onset of the recent financial crisis can be traced back to sub-prime lending practices and excessive leverage. Under *shari'a* law, which prohibits *riba, gharar* and *maisir*, Islamic funds are forbidden to trade on margin or short-sell by borrowing funds, invest in highly-leveraged firms, MBS, or risky derivatives. These investments collapsed in value during the credit crunch and the financial crisis, while the aforementioned risky investment techniques and vehicles further amplified losses suffered by the underlying assets and securities. Therefore, the study bases its hypothesis on the notion that the principles and rules inherent to Islamic finance would yield *shari'a*-compliant equity portfolios better economic results during times of distress.

For the purposes of our study, quantitative alpha screening and subsequent Markowitz minimum-variance optimization procedures were utilized to construct conventional, Islamic and SRI equity portfolios. In-sample (January 2000 to June 2007) optimized portfolio weights were used to forecast out-of-sample (July 2007 to April 2009) risk and return figures for each of the portfolios. In addition to annual return and standard deviation computations, the modified Sharpe ratio was chosen as the primary comprehensive performance measure, because it determines the risk-adjusted profitability of the various portfolios.

Within this context, the comparative performance analysis of the conventional, Islamic and SRI investment strategies based on comprehensive as well as size-based equity portfolios, confirms the study's hypothesis that the Islamic strategy is most effective at shielding investors assets from losses during economic and financial crises. In fact, with the sole exception of the large-cap portfolio group, the Islamic equity portfolios even outperform their conventional and SRI counterparts during the prior investment horizon marked by normal economic activity. As the results of this study show, an investment strategy based on Islamic principles may be successful not only amidst financial market turmoil, but also during regular, more tranquil periods.

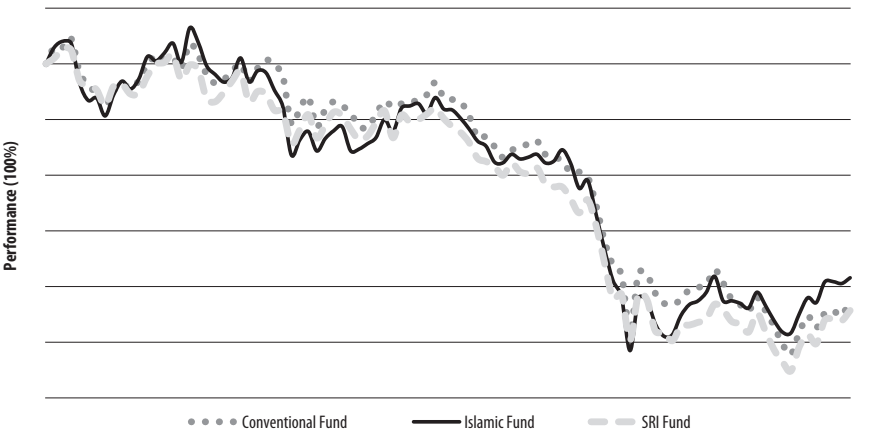
Appendix 1

Indexed Fund Performance (2000–2007 June)
Group: Comprehensive



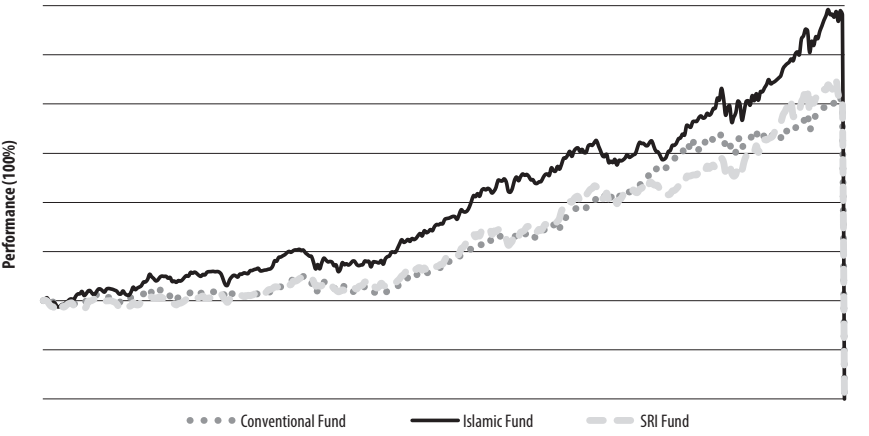
Appendix 2

Indexed Fund Performance (2007 July–2009 May)
Group: Comprehensive



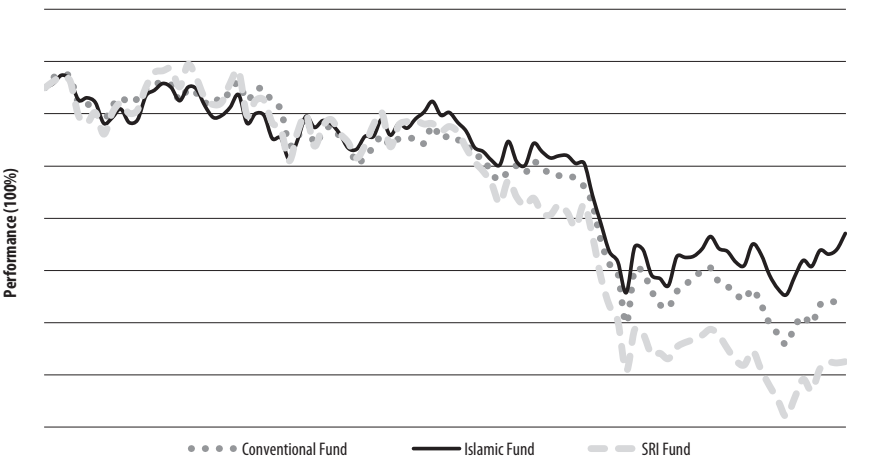
Appendix 3

Indexed Fund Performance (2000–2007 June)
Group: Small Cap



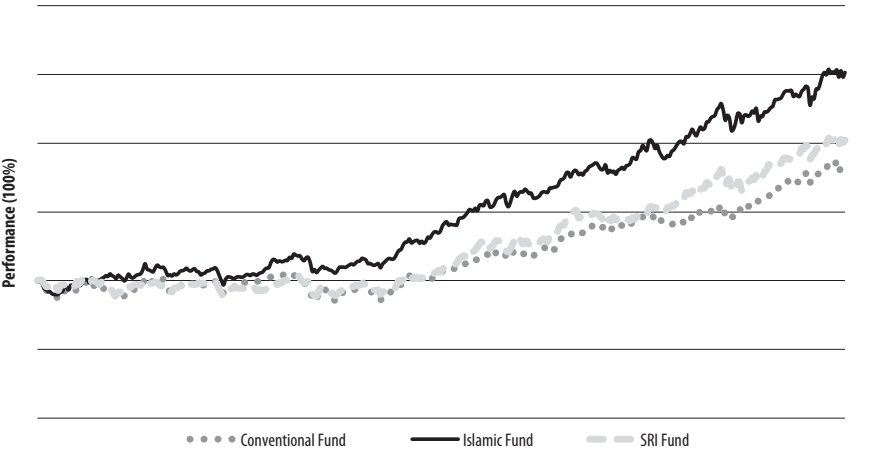
Appendix 4

Indexed Fund Performance (2007 July–2009 May)
Group: Small Cap



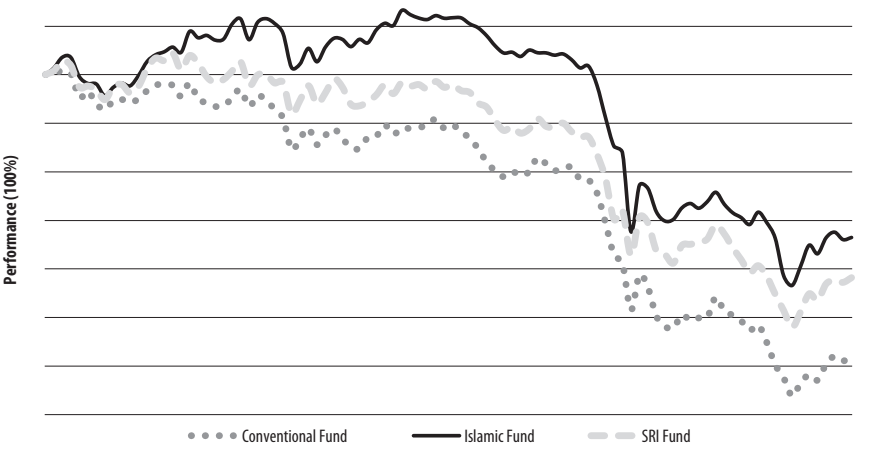
Appendix 5

Indexed Fund Performance (2000–2007 June)
Group: Medium Cap



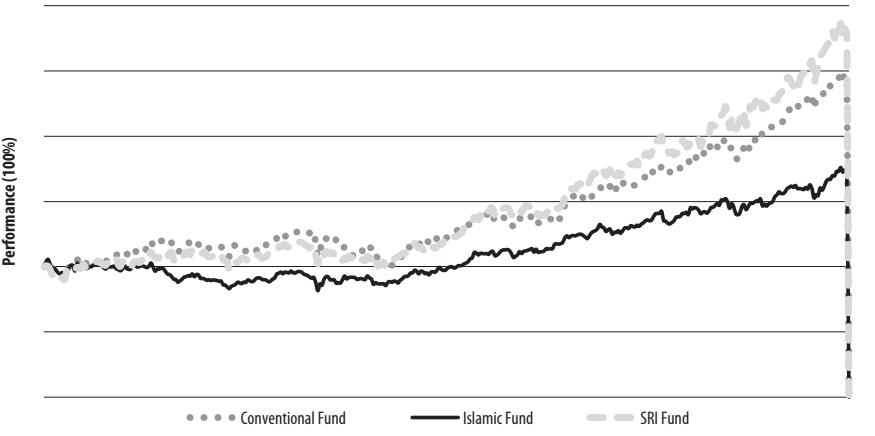
Appendix 6

Indexed Fund Performance (2007 July–2009 May)
Group: Medium Cap



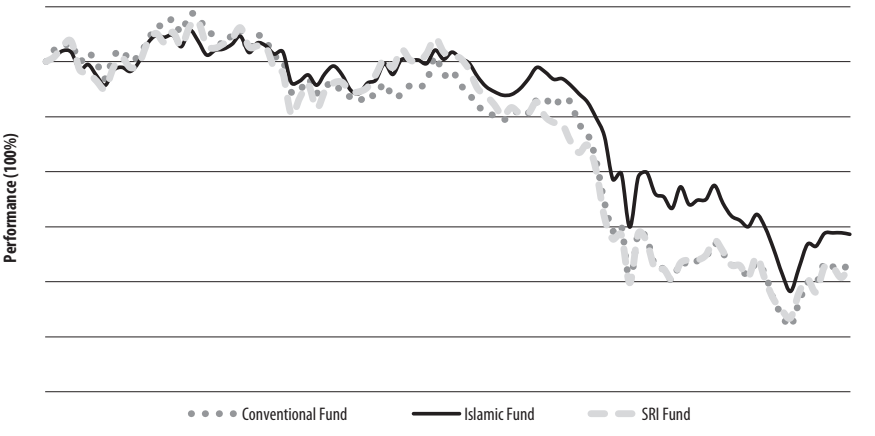
Appendix 7

Indexed Fund Performance (2000–2007 June)
Group: Large Cap



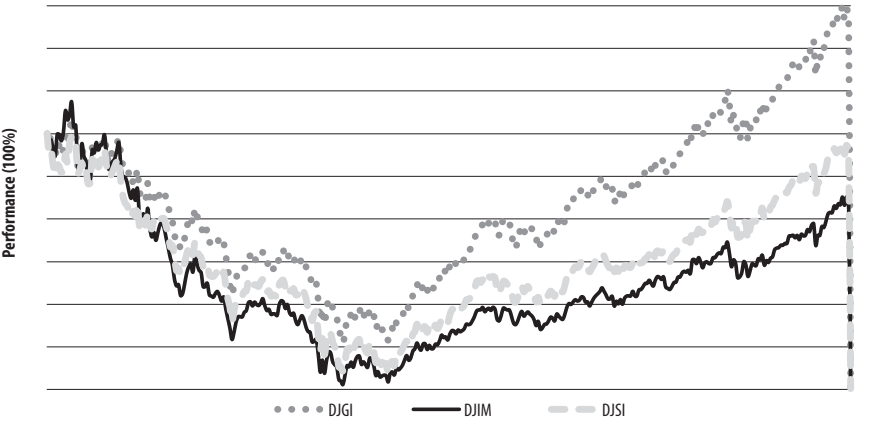
Appendix 8

Indexed Fund Performance (2007 July–2009 May)
Group: Large Cap



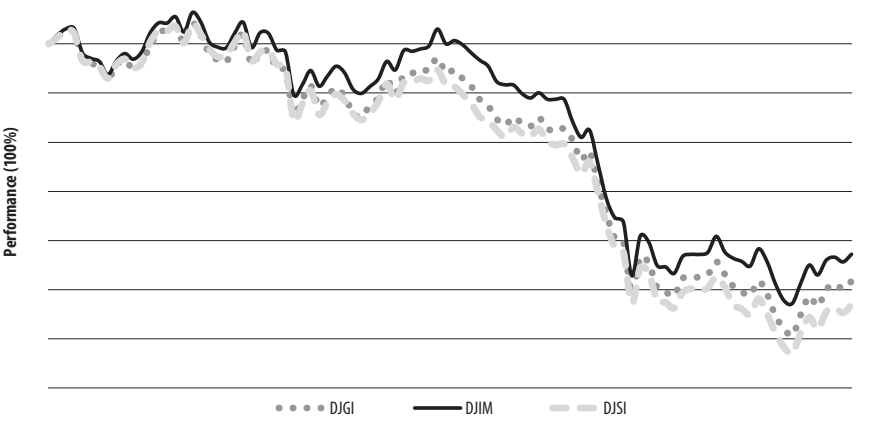
Appendix 9

Benchmark Index Performance (2000–2007 June)



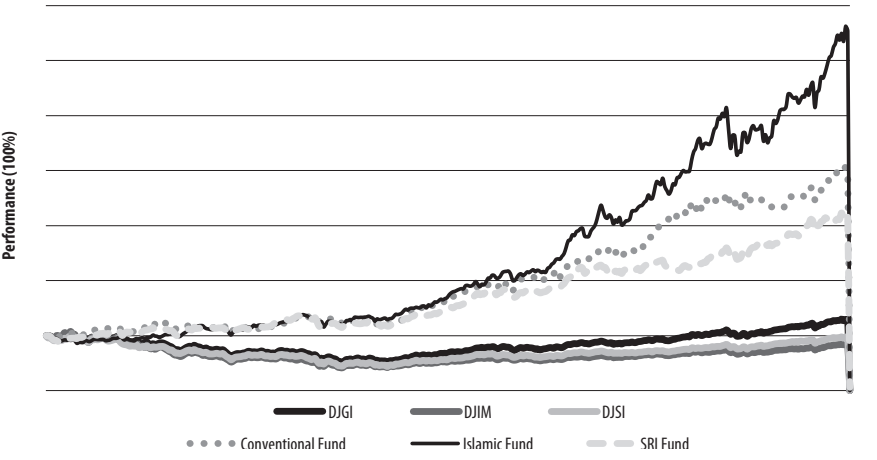
Appendix 10

Benchmark Index Performance (2007 July–2009 May)



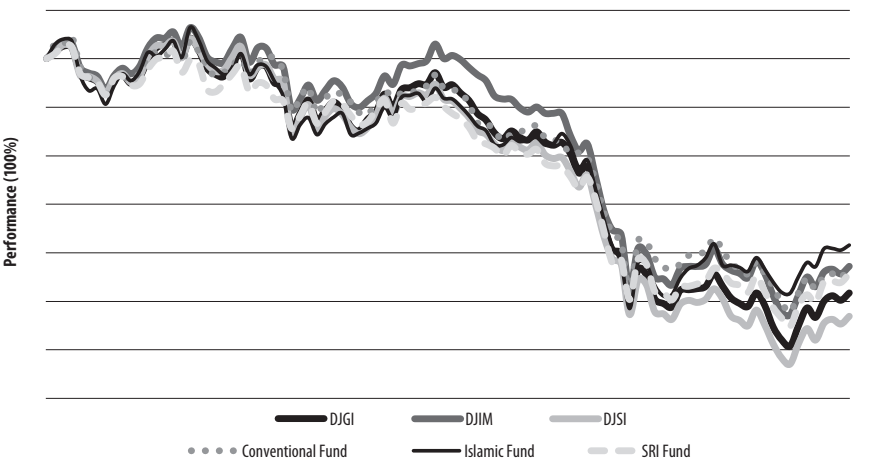
Appendix 11

Performance Overview (2000–2007 June)
Group: Comprehensive



Appendix 12

Performance Overview (2007 July–2009 May)
Group: Comprehensive



Endnotes

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5. As explained in later sections, stocks are screened on the basis of return on capital and earnings yield to determine if they are good investments and whether they are cheap. See Joel Greenblatt, *The Little Book that Beats the Market* (Hoboken: John Wiley & Sons, 2005).
6. Rushdi Siddiqui, *Issues & Suggestions for OIC Shari'ah Compliant Indexes.*
7. Emmanuel Volland and Mohamed Damak, *Islamic Finance Outlook 2008* (Standard & Poor's, 2007).
8. Faisal Hijazi and Dominique Gribot-Carroz, *2007 Review and 2008 Outlook: Islamic FInance: Sukuk Take Centre Stage, Other Shari'ah-Compliant Products Gain Popularity as Demand Increases* (London: Moody's Investors Service, 2008), 2.
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19. Siddiqui, *Issues & Suggestions for OIC Shari'ah Compliant Indexes.* This would be equivalent to 1/5th of the U.S. economy. http:// *www.oicexchanges.org/.../Rushdi%20Siddique%20Presentation.ppt.*
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    According to Moody's estimates, the Islamic finance industry could reach $5 trillion (no time table available). See also "Islamic Finance, The New Mainstream Alternative," *Investor Offshore*, August 2010, at http://www.investorsoffshore.com /html/specials/082010_islamic_finance.html.
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28. Quran 5:90.
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34. Ghoul, Karam, and Paul, "MRI and SRI Mutual Funds: A Comparison of Christian, Islamic (Morally Responsible Investing), and Socially Responsible Investing (SRI) Mutual Funds," *Journal of Investing* 16:2 (Summer 2007): 96–104.
35. Ibid., 96–104.

36. These filters screen stocks on the basis of certain profitability and liquidity ratios, firm size, industry classification, beta, leverage ratio, etc.
37. Dow Jones & Company, *Dow Jones Indexes*. Also see Abdulkader Thomas, Stella Cox, and Bryan Kraty, *Structuring Islamic Finance Transactions* (London: Euromoney Books, 2005), 145. "When it comes to the screening of debt, the question of what is incidental is derived from a specific *hadith* in which the Prophet Mohammed (pbuh) stated that 'one third is abundant' and this, combined with the rule of khulta or mixture, leads to the rule of mixing borrowed funds with non-borrowed funds in a company's capital structure. As a result, Islamic scholars conclude that: 'the majority deserves to be treated as the whole thing.'"
38. Dow Jones & Company, *Dow Jones Indexes*.
39. *Haram* means forbidden according to Islamic rules.
40. Maulana Taqi Osmani, *Principles of Shari'a Governing Islamic Investment Funds* from http://www.philadelphia.edu.jo/courses/Markets/Files/Markets/90022.pdf.
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43. This rule can be beneficial for non-Muslims because it gives them higher investment returns (dividends). If the Islamic mutual fund were to dispose of the haram income before paying returns (dividends) to its investors, non-Muslims would receive a lower return—the fund is basically enforcing this purification onto its investors without taking in consideration whether they are actually Muslim. With this regulation though, none of the income for the Islamic fund is purified and the non-Muslim investor thus receives a higher return.
44. Iqbal and Mirakhor, *An Introduction to Islamic* Finance, 80.
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56. Ibid.
57. Although this SRI universe is relatively small compared to the other two and skewed toward companies with large market capitalizations, it is used as there was no data access to a more comprehensive index that would be acceptable according to socially responsible investing standards and would more closely mimic the composition of the other two universes. Given this particular qualification, the later SRI portfolio performances should be placed in this context for appropriate evaluation.
58. See the appendix in Joel Greenblatt's *The Little Book That Beats the Market* (2006) for a detailed back-test performance analysis. In a recent test conducted by Morningstar (Coumarianos, 2010) the magic formula generated 10.4 percent annualized excess return over 9.4 percent annualized return from S&P500 over the period 1998–2009. Also see http://seekingalpha.com/article/237970-how-does-joel-greenblatts-magic-formula-investing-hold-up.
59. In order to prevent look-ahead bias, the relevant fundamental data, as reported at the end of year 2005 (or latest prior available) financial statements, is extracted from the FactSet.
60. In addition, it is vital to realize that the later performance results are contingent on the underlying assumption of the chosen quantitative Greenblatt stock selection screen, though alternative security selection strategies produced similar results.
61. Higher EY and ROC values are better so that the highest EY stock would receive an EY rank of 1 and the highest ROC stock would get a ROC rank of 1. The EY and ROC ranks are added together—the best stocks will have the "lowest" ranking. For example, if the stock with the highest EY also had the highest ROC, its overall rank would be $1 + 1 = 2$.
62. We conducted several experiments to see if the results are sensitive to such maximum weight restriction. A lack of this restriction would have resulted in portfolios with too few securities, which would not allow for sufficient diversification of firm-specific risk.
63. r_p = weekly portfolio return; r_i = weekly index return.
64. The negative Sharpe ratio gives misleading results when excess returns are negative. An investor would not be able to identify whether this is a result of excess returns being negative (which is undesirable) and the volatility is

lower (a desirable property). The modified Sharpe ratio accounts for both. See C.L. Israelson, "A Refinement to the Sharpe Ratio and Information Ratio," *Journal of Asset Management* 5:6 (April 2005).

65. It is difficult to attribute the success of *shari'a* compliant stocks to one particular factor. However, it is possible that the Greenblatt's magic formula ranking of good performing stocks, coupled with low leverage, and correlation within the portfolio, is largely responsible for the Islamic portfolio's stellar performance during up markets.
66. The Islamic, conventional and SRI universes are each divided into three size classes: the "small" group is composed of firms with market capitalization of more than $5.5 but less than $10 billion, the "medium" one includes firms that are larger than $10 billion but smaller than $21 billion, and the "large" group includes firms larger than $21 billion. Since there are no official guidelines on where to draw the line between the size classes, these market cap ranges are chosen to ensure that each universe will be composed of a sufficient number of stocks to allow for efficient diversification and optimization.
67. As indicated in Söhnke M. Bartram and Gordon M. Bodnar, "No Place to Hide: The Global Crisis in Equity Markets in 2008/09," *Journal of International Money and Finance* 28:8 (December 2009): 1246–1292, the global equity market lost about $29 trillion due to the recent financial crisis of 2007–2009. In light of such a huge loss in wealth, the fact that Islamic stocks lost less than their conventional and SRI counterparts is quite reassuring.
68. Financial institutions include banks, S&Ls, asset management firms, insurance companies, and consumer finance firms. Real estate firms include real estate development firms, apartment rental agencies, real estate financing, and other firms with substantial real estate involvement.
69. The base-indexing procedure is basically equivalent to the one employed to plot the performances of the equity portfolios on the same chart.