THE INVESTMENT COST OF FOLLOWING ISLAMIC LAWS

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Abstract

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This study examines the extent to which imposing constraints on a portfolio diminishes its return. I look at the cost of observance of Islamic laws (*Sharia*), which restrict the composition of portfolios according to the activities of companies and their financial ratios. Cross-sectional regressions of monthly risk-adjusted S&P 500 stock returns on a variety of company characteristics reveal that individual mean returns are significantly related to industry membership but not to the various Islamic compliance criteria. This is further supported by spanning tests which suggest that an Islamic index can be considered a substitute for the overall Secular index. However, randomly selected Islamic-compliant portfolios of various sizes tend under-perform their risk-matched Secular counterparts in-sample. And while out-of-sample performance turns against Secular portfolios, this is attributable largely to investment in Financials by the latter.

Acknowledgments and Dedications

I dedicate this master's thesis to my family and friends for their support and constant encouragement. A special dedication would go to my grandfather Mahmood Al-Asaad who always believed in me and pushed me to pursue my goals. I wish to thank the members of my committee for giving me this opportunity. Lastly, I want to express my gratitude to Professor Lypny for his great support during my studies.

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1. Introduction

Islam is a religion that teaches both the spiritual and temporal aspects of life. It provides guidance to people on their relationship with God and their behaviour in everyday social and economic settings. It is the only major religion that has a set of laws, *Sharia*, that deals with the private and public aspects of life, things ranging from sexuality, family, and hygiene, to business, banking, economics, and politics. These laws are based upon interpretations of the Quran and the Sunnah. [1]

The application of Sharia in business and finance is not a recent phenomenon. During the Islamic golden age (8^{th} to 12^{th} centuries), a number of innovative practices arose, including limited partnerships (*mudaraba*), early forms of capital and capital accumulation, promissory notes, cheques, and trusts. The principles of that early system were based mainly on the sharing of profit and loss and the prohibition of usury (*riba*).

As Muslim societies developed, with their financial needs becoming more complex, the Islamic financial system was gradually replaced by a conventional one based on interest. The post golden age can be viewed as a time of stagnation in Islamic financial thought. But the growing desire of Muslims today to reconcile modern finance with their religious beliefs has led to a new and rapid growth in Islamic investment practices [Elfakhani, Hassan, and Sidani (2005)]. At the heart of this reconciliation are voluntary restrictions on investment choice, and the issue addressed in this study is

[1] Sayings of the prophet Mohammad (*pbup*).

whether those restrictions disadvantage Muslim equity investors. Is there a cost of observance?

As a practical matter, portfolios are always formed from far fewer assets than are available in a given market. Portfolio theory [Markowitz (1952)] tells us that portfolios comprised of all available assets dominate those formed of any subset. But the relative performance of portfolios that are formed from *different* subsets of all available assets is necessarily an empirical question. Self-imposed restrictions on investment choice for religious or ethical reasons may or may not result in performance that is poorer than that which is unrestricted. This study provides evidence on this by measuring the cost of observance and examining which restrictions, if any, affects performance. I find that Islamic investment criteria bear no significant relation to the mean returns on individual S&P 500 stocks when industry sector is taken into account. Furthermore, spanning tests suggest that an index of Islamic-compliant stocks is effectively a substitute for an index of Secular stocks. However, randomly selected Islamic portfolios comprised of various numbers of stocks are dominated by their risk-matched Secular counterparts' in-sample. And a reversal of the performance difference that is observed out-of-sample is largely attributable to Secular investment in Financials and the period under study. It may be, therefore, that the effects of restrictions on choice are not discernable at the level of individual stocks or large indices, but are discernible in portfolios that contain the small number of stocks that is most typical. Given that there are currently multiple Islamic investment compliance standards, with no universal standard to be expected for some time, and that Islamic investors appear willing to re-examine their rules of investment, the evidence presented here contributes to that deliberation.

2. Historical Backgroud

The first Islamic bank, a project pioneered by the economist Ahmad El Najjar, began operating in the Egyptian town of Mit Ghamr in 1963. It downplayed its Islamic image to avoid possible public perception of associations with Islamic fundamentalism. It operated much like a credit union, engaging in trade and sharing profits with its depositors. Within four years, there were nine similar banks in the country but Mit Ghamr bank had since stopped operating [Siddiqi (1988)]. Nasser Social Bank was established in 1971 as a revival of the Mit Ghamr institution, headed again by Dr. El Najjar. It was affiliated with the Ministry of the Treasury and had the financial support of the government. The bank formed under the socialist regime of the time: "In a society of 'sufficiency and justice', believing that work is the main foundation of society... capital has, above all, a social function, and should be freed from any suspicion of exploitation or injustice. This it has been decided to replace the principle of interest with a principle of 'partnership' " [Atiyya, (1987:33-34)].

Following the decline of the "Nasser socialism" [2] and the oil boom in the Arab world, both in the early 1970's, Egypt started to promote the idea of Islamic banking internationally. The Nasser social bank would become the organizational model for Islamic banks that emerged in the Arab world. [3] The mid 1970s then marked the

[2] Arab nationalist political ideology based on the thinking of former Egyptian president Gamal Abdel Nasser. It had a strong influence on pan-Arab politics in the 1950s and 1960s.
[3] Nazih N.M. Ayubi, Political Islam (181-182).

beginning of a growth period for Islamic banks: the first private bank, Dubai Islamic Bank; the Saudi-based Faisal Islamic Bank with branches in Egypt, Sudan, and Jordan; and Kuwait Finance House and the Islamic Bank of Bahrain doing business outside the Muslim world.

Since the 1990s, Islamic financial assets have been averaging a ten to 15 percent growth rate [Tutton (2009)], and are expected to grow at this rate for several years to come [*The Daily Star Regional*, 2008]. There are some 300 Islamic financial institutions in more than 51 countries, accounting for more than $900 billion in shari'a-compliant investments [Lindsay (2010)]. Western financial centres have begun taking a closer look at Islamic finance in the aftermath of the subprime loan crisis, and the University of Reading's Heanley in Britain has even started a master's program in investment banking and Islamic finance [Gardiner (2009)].

3. The Fundamentals of Islamic Investment

Islam encourages labour, trade, and the sharing of profit and loss. It forbids *riba*, *maysir* (games of chance or gambling) and *gharar* (trading in highly speculative assets and short selling). Insurance and financial derivatives are *gharar*. Most Islamic scholars and jurists are opposed to them.

Islam condemns severely those three sins as put clearly in the Quran: "Those who eat riba will not stand (on the day of resurrection) except like the standing of a person beaten by Shaitan (Satan) leading him to insanity. That is because they say: Trading is only like riba, whereas Allah has permitted trading and forbidden riba" (2:275); "Allah

will destroy riba and will give increase for sadaqat (deeds of charity)" (2:276); "O people of faith: Wine, gambling, dedications of stones, and divination with arrows are abominable works of the devil. Thus, avoid such activities so you may prosper" (5:90).[4] Additionally, the prophet Mohammad was narrated for the following: "The Prophet (*pbuh*) has forbidden the purchase of the unborn animal in its mother's womb, the sale of the milk in the udder without measurement, the purchase of spoils of war prior to their distribution, the purchase of charities prior to their receipt, and the purchase of the catch of a diver." [5]

Islamic teachings draw a distinction between legitimate labour income and interest income. *Riba* is forbidden for these reasons:

1. A dollar equals a dollar. Money cannot grow without human effort.
2. Usury tempts people away from real labour. Earning interest instead of working makes people less productive.
3. Usury represents an unhealthy self-interest. Charging the poor interest destroys our sense of humanity and willingness to cooperate or help others.
4. Charging interest is usually a transfer of wealth from the poor to the rich that increases economic inequality.

Islam also sets limits on the investment in companies that contradict its values. No investment can be made in companies that engage in activities involving liquor, pork-related products, gambling, pornography, and conventional financial services.

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[4] English translation of the Quran.

[5] Narrated by Ahmad and Ibn Majah on the authority of Abu-Said Alkhudriy. Source: Academy for International Modern Studies (AIMS), www.learning Islamicfinance.com.

Like socially responsible investments (SRIs), Islamic portfolios must satisfy certain criteria. Although Muslims follow the same teachings, the Quran and the Sunnah (learnings of the prophet), there is no consensus on the criteria that constitutes Islamic compliance for modern investments. That is because the Quran dates back to the seventh century. Today, it is Islamic scholars who come up with investment rules based on *Ijtihad*, which is the process of making legal decisions by independent interpretation of the Quran and the Sunnah.

Those rules are drafted and agreed upon by committees of Muslim scholars called Sharia boards. They are generally scholars of high repute with extensive experience in law, economics, banking systems and finance as prescribed by Islamic Sharia. They work together, sometimes in consultation with other religious scholars, to ensure that each *fatwa* (a ruling on Islamic principle) is in accordance with Islamic principles. Once the *fatwa* or set of *fatwas* is made, it is communicated to financial institutions. Thereafter, the board supervises institutions to ensure compliance. The Sharia board is important for the image of any Islamic bank, since their Muslim clientele will refer to the *fatwas* of the board for their financial decisions. Any deviance from those rulings that are made public could severely damage a bank's reputation. The board also plays an informal marketing function by participating in conferences and publishing studies about compliant financial products offered by the institution.

The existence of so many Sharia boards makes it difficult to agree upon common fatwas. Differences in the interpretation of the Quran and the Sunnah can completely change the way Muslims invest their money. In fact, a few Islamic scholars have

opposed *any* investment in the capital markets. They believe that those markets are based on pure speculation and *gharar*. They instead prefer investments in the real asset markets through a set of Islamic investment contracts such as mark-up credit sales (*murabaha*), lease financing (*ijara*) and *mudaraba*. Another group of scholars sees no harm in stock market investment, however, subject to strict constraints to exclude companies whose activities are considered *haram* (forbidden). The latter can be problematic when only a minuscule part of a company's business is *haram* [Al-Kurdi. A. (1998)].

Nevertheless, the majority of Islamic scholars agree that investment in the stocks is acceptable if the company's activities are *hallal* (permissible). If an otherwise compliant company deals with *riba*, then its assets must be evaluated to ensure that its debt does not exceed one-third of its market capitalization[6]. This consensus of scholars is found to be the most accepted and followed by Islamic mutual funds. Muslims are advised that they can invest in businesses that satisfy the following conditions:

- The business must not violate *Shari'a*. No investment can be made in companies that engage in unlawful activities such as liquor, gambling and pornography.
- If the principal business activity is acceptable, but the company engages in interest-related activities, shareholders must express their disapproval for such dealings wherever possible.
- Income generated from dividends should be purified of *riba* activities. This is done through the allocation of a percentage of that dividend to charities in proportion to the income generated from interest-related activities.

[6] The reasoning behind this specific ratio is the prophetic saying: "The third is significant", concerning the restricting voluntary distribution of estate in a will to a maximum of one third of the estate.

- Shares of companies are only negotiable if the business has real assets. Shares of companies whose assets are financial can only be traded at par value.

A small number of Islamic academics believe that as long as the core business of the company is *hallal*, then the amount of debt shouldn't be of any importance as long as this burden doesn't harm stakeholders (such as employees being laid off due to financial distress from excessive borrowing or decreasing value of the firm). Unlike secular portfolios, Islamic portfolios cannot include debt instruments, and are therefore deprived of bonds or any sort of fixed-income security. Additionally, Islamic portfolios must pass through the screening criteria discussed previously. These will be stated more specifically in the Methods section.

4. Previous Research on Islamic and Ethical Investments

Girard and Hassan (2008) study the performance of FTSE Islamic indices and compare them to their secular counterparts. In order to evaluate any possible cost of faith-based investing, they use three methodologies: risk-reward performance via the CAPM alpha, Sharpe and Treynor ratios; performance under Carhart's four-factor pricing model; and lastly, multivariate co-integration analysis. No significant difference in performance of Islamic and secular indices other than that which can be attributed to differences in investment style was found. Islamic indices were found to be growth- and small-cap oriented while secular indices lean towards value and mid-cap stocks. Girard and Hassan believe this is because of exclusion of value sectors with high environmental risks.

Derigs and Marzban (2009) proposed a new paradigm for *Sharia* compliance whereby the criteria are applied to portfolios rather than the stocks contained in them. This necessarily increases choice as companies that have non-compliant debt levels taken individually can be included in a portfolio if the debt level of all of its stocks combined is acceptable. The approach has yet to be approved by a Sharia board or council of boards. Derigs and Marzban compare the performance of Islamic portfolios under the most widely used compliance criteria with that of secular portfolios and find that the most liberal screens tend to result in portfolios with comparatively better performance.

While there is considerable research on Islamic banking, very little has been done on Islamic portfolio management. However, the question raised by socially responsible investment (SRI, also called ethical investment), where compliance with chosen social interests or causes, such as gender equality, civil rights, the environment, labour rights, and support of local communities, is a condition of investment is exactly the same as that faced by Muslim investors: Does restriction on choice result in poorer (or different) portfolio performance? Drhymes (1998) found, through an analysis of variance, that the annual cross section of stock returns for 1991 through 1996 is generally significantly associated with IBES sector membership but either insignificant or inconsistent year to year for various SRI criteria. Statman (2000) found that the Domini Social Index outperformed the S&P 500 Index in raw returns but underperformed it (insignificantly) in risk-adjusted returns. SRI funds outperformed conventional funds when both were controlled for asset size but again the difference was insignificant. Sauer (1997) found much the same in comparing the performance of the Domini 400 Social Index to the S&P 500 and the CRSP value weighted market index. He found that the cost of social

constraints is negligible when measuring performance with respect to Jensen's alpha and Sharpe ratios.

The lack of any substantial difference between ethical and conventional mutual fund performance extends internationally. Bauer, Koedijk and Otten (2004) found no significant difference in the CAPM and Carhart four-factor model risk-adjusted returns for Germany, the United Kingdom and the United States. They found that ethical funds are less exposed to market risk and tend to be more growth-oriented; ethical funds in the United States invest more in large caps, while those of the United Kingdom and Germany are more exposed to small caps.

The evidence suggests that SRI and conventional indices may be substitutes for one another. Schroder (2006) focuses solely on the performance of SRI indices, eliminating therefore the need to take into consideration mutual fund management variables. He also employs a spanning test to determine if Jensen's alpha and the beta coefficient from a regression of SRI indices' returns versus benchmark returns are jointly equal to zero and one. SRI indices neither outperform nor underperform their benchmarks. He also finds that 28% of the SRI indices could be replicated by their conventional benchmarks.

5. Data and Methods

5.1 Data

The sample is current members of the S&P 500. Monthly price data for the ten-year period January, 1999 through December, 2008 were collected from Bloomberg. Companies were identified by their Industry Classification Benchmark (ICB) membership. Monthly market capitalization, total debt, cash and cash equivalents, and accounts receivables were also obtained from Bloomberg and used to compute averages for each year from January, 1998 to determine compliance with Islamic financial criteria as described below. This dataset was formed to allow compliance screen annually. A stock was deemed compliant in a given year if it passed all screens in the previous year.

5.2 Compliance Screening

Sharia compliance was determined according to the *Guide to the Islamic Dow Jones Islamic Market Indexes,* which is the rulebook developed by the Dow Jones Islamic Market Indexes supervisory board, a group of Muslim scholars from different countries, for the DJIM. Index members are reviewed quarterly for compliance. Compliant companies cannot be involved in business having to do with alcohol, tobacco, pork-related products, financial services, weapons and defence, and entertainment (movies, hotels, casinos, pornography, bars, music, etc.). Compliance is determined by ICB sector as presented in Table 1. Since it is difficult to screen for companies involved with pork-related products or alcohol, the guidebook suggest to refrain from investing in any food-related business. That includes producers, retailers, wholesalers, and restaurants.

Table 1
Islamic Non-compliant ICB Sectors

ICB Code	*ICB Sector*
2717	Defence
3533	Brewers
3535	Distillers & Vintners
3577	Food Products
3745	Recreational Products
3785	Tobacco
5337	Food Retailers & Wholesalers
5553	Broadcasting & Entertainment
5555	Media Agencies
5752	Gambling
5753	Hotels
5755	Recreational Services
5757	Restaurants & Bars
8355	Banks
8532	Full Line Insurance
8534	Insurance Brokers
8536	Property & Casualty Insurance
8538	Reinsurance
8575	Life Insurance
8733	Real Estate Holding & Development
8773	Consumer Finance
8775	Specialty Finance
8777	Investment Services
8779	Mortgage Finance

Companies must also pass a financial screen. The 12-month averages for total debt, cash and interest-bearing securities, and accounts receivable cannot exceed one-third of the 12-month average market capitalization in any a given year. These financial screens are an attempt to ensure that a company is mostly involved in real rather than financial activities, but they are nonetheless controversial as compliance is affected by market conditions. Table 2 reports that in the year 2000, 202 companies were identified as Islamic compliant and 425 as Secular (223 non-complaint plus 202 Islamic).

Table 2
Establishing the Islamic-Compliant and Secular Samples

Screen	*Number of companies*
S&P 500	500
Removed because of insufficient company or price information	75
Secular sample	425
Removed financials	61
Removed companies with other forbidden activities	41
Removed companies with financial ratios above 33%	121
Islamic-compliant sample	202

Tables 3 and 4 report the number of constraints violated by non-compliant companies and the frequency with which each constraint results in non-compliance. Most companies violate one, and being in the financial services sector or having a high debt ratio constitutes two-thirds of the violations.

Table 3
Number of Constraints Violated Per Company

Number of constraints Violated	*Number of Companies*
1	131
2	75
3	17

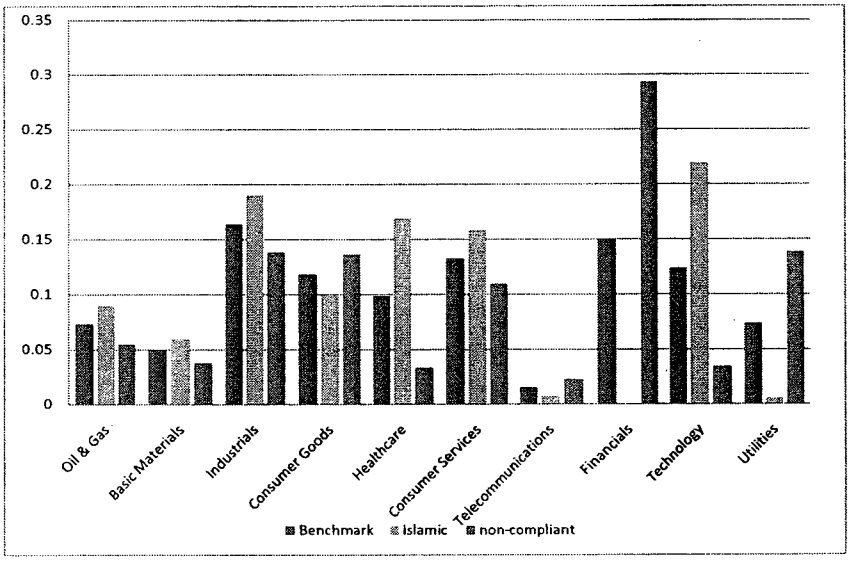
Table 4
Number of Times a Violation Occurred

Constraint	*Number of times occurred*
Financials	61
Alcohol	7
Tobacco	2
Pork	24
Weapons & Defence	6
Entertainment	7
Cash ratio > 33%	23
Debt ratio > 33%	164
Accounts receivables ratio > 33%	38

5.3 Profile of companies

Islamic companies are more highly represented in healthcare and technology, and of course, completely absent from the financial sector. Figure 1 shows histograms of sector membership for the Islamic and Secular companies and the subset of Secular companies that are non-compliant. Except for the complete exclusion from the financial sector, Islamic companies are present in all others, although telecommunications and utilities are distinctly under-represented.

Figure 1
Average Distribution of stocks per sector for each portfolio



The left scale is the weight of every industry. The bars show the average weights in each industry for 3 portfolios. Three portfolios are compared over the entire 10 years period as portfolios are rebalanced on an annual basis.

5.4 Cross-Sectional Regressions

I follow Dhrymes (1998) and regress the average monthly return for each company in a given year, y_i, on two sets of dummy variables. The first set, Xj, is comprised of the eight compliance criteria (tobacco, alcohol, pork, weapons and defence, entertainment, debt, cash, accounts receivable), where 1 denotes violation and 0 compliance, and a ninth indicator for overall Islamic-compliance (1 for true, 0 false). The second set of dummy variables, D, identifies membership in nine of the ten ICB sectors (Oil and Gas, Materials, Industrials, Consumer Goods, Healthcare, Consumer Services,

Telecommunications, Financials, Technology). The intercept represents the average return on Islamic-compliant companies in the Utilities sector.

$$y_i = \alpha_0 + \sum_{j=1} \beta_j X_j + \sum_{k=1} \gamma_k D_k + u_i$$

The estimated coefficients of X represent the incremental average monthly return associated with the violation of any one of the compliance criteria, while the estimated coefficients of D gauge the incremental return associated with sector membership. The regressions are run for our sample of S&P500 companies and each of the ten years.

5.5 Risk-matched Portfolios

No portfolio includes all stocks available in a given market. The relevant question is whether portfolios formed of fewer stocks than are available but otherwise chosen freely from the whole set perform differently from those with the same number of stocks but whose composition is restricted to the subset that is compliant with *Sharia*. To make this comparison so that it is not affected by the investment ability or timing of fund managers, I randomly selected 100 portfolios from the subset of 202 S&P Islamic stocks and compared the return of each to a risk-matched portfolio that is randomly selected from among all 425 Secular stocks. That exercise was repeated for portfolios of five, 10, 15, 20, and 25 stocks.

For each randomly selected pair of portfolios, a risk target was set equal to the standard deviation that the Islamic portfolio would have if its stocks were included with equal weights. Based on this risk target the efficient unconstrained and constrained (no short positions) mean-variance weights were computed [Markowitz (1952)], allowing

comparison of their expected returns for a seven-year estimation or in-sample period, 2000 through 2006 (84 monthly observations). The portfolios were then tracked for the two years immediately following.

5.6 Spanning Test[7]

In addition to the direct comparison of risk-matched portfolios, I performed a spanning test by regressing monthly returns of a value-weighted index formed from the subset of stocks that are Islamic-compliant in 1998 on a value-weighted index of the entire set of Secular stocks. This index was rebalanced every year to include newly compliant stocks or exclude stocks that had become non-compliant.

Performance was assessed by a simple linear regression and comparison of means. The spanning test is the test of the joint null hypothesis that the intercept of the regression is zero and the slope coefficient is one. A failure to reject the null hypothesis is evidence in support of the Islamic index being a substitute for the Secular index, and therefore allowing Islamic investors to effectively replicate portfolios that are enjoyed by Secular investors [Schroder (2007)]. As in Huberman and Kandel (1987), I test whether the minimum-variance frontier of the Islamic index coincides with that if its benchmark.

[7] Typically the indices used in spanning tests come from non-intersecting sets of assets. In my case, the Islamic index is a subset of the Secular index, and it might be thought that the slope coefficient in the regression is necessarily equal to one. This is not so. The coefficient is equal to the covariance of the two indices divided by the variance of the Secular index, which is the independent variable. It will equal one only if the covariance is equal to the variance; and while the covariance does converge to the variance if the number of assets in the subset portfolio is increased so that it approaches the total in the Secular set, for any fewer, it is an empirical question.

6. Results and Discussion

6.1 Cross-sectional Average Monthly Returns

There is no consistent or significant association between the average monthly returns of stocks and the compliance criteria. Table 4 summaries the ten cross-sectional regressions of average monthly returns on the Islamic compliance criteria and sector membership for each year, 1999 through 2008. The table reports the R-squared for each regression and identifies which variables were significant and their signs. Details of the estimates are in Appendix 1. These variables explain between seven and 37% of the cross-sectional variation in returns. It can be seen that in most years only sector membership matters, and this itself varies, as would be expected, from year to year depending on market conditions.

Table 5a
Summary of Cross-Sectional Regressions: 1999-2003

	1999 (37.8%)	*2000 (26.7%)*	*2001 (15.5%)*	*2002 (6.8%)*	*2003 (26.4%)*
	+/-	+/-	+/-	+/-	+/-
Intercept		+	-	-	+
1. Oil & Gas	+			+	
2. Basic Materials	+	-	+	+	+
3. Industrials		-	+	+	+
4. Consumer Goods		-	+	+	
5. Health Care			+		+
6. Consumer Services		-	+	+	+
7. Telecommunications		-		+	
8. Financials		-	+		
9. Technology	+	-	+		+
10. Alcohol					
11. Tobacco		+			
12. Pork					-
13. Weapons & Defense			+		-
14. Entertainment					
15. Cash > 33%					+
16. Debt > 33%					
17. Accounts Receivables > 33%			+	-	+
18. Compliant	+				-

Mean stock returns regressed on dummy variables for ICB sector membership (1-9), business criteria for Islamic non-compliance (10-14), financial criteria for Islamic non-compliance (15-17), and overall compliance (18). Pluses (+) and minuses (-) indicate the sign of estimated coefficients that are significantly different from zero. Details re reported in Appendix 1.

Table 5b
Summary of Cross-Sectional Regressions: 2004-2008

	2004 (12.8%)	*2005 (22.7%)*	*2006 (6.6%)*	*2007 (24.6%)*	*2008 (8.6%)*
	+/-	+/-	+/-	+/-	+/-
Intercept		+	+	+	
1. Oil & Gas	+	+		+	-
2. Basic Materials	+				-
3. Industrials					
4. Consumer Goods	+	+		-	
5. Health Care	+		-		
6. Consumer Services	+			-	
7. Telecommunications					
8. Financials				-	-
9. Technology				-	-
10. Alcohol	+				
11. Tobacco					
12. Pork					
13. Weapons & Defense					
14. Entertainment		-	+		
15. Cash > 33%				+	
16. Debt > 33%		-		-	-
17. Accounts Receivables > 33%				+	
18. Compliant		-			

Mean stock returns regressed on dummy variables for ICB sector membership (1-9), business criteria for Islamic non-compliance (10-14), financial criteria for Islamic non-compliance (15-17), and overall compliance (18). Pluses (+) and minuses (-) indicate the sign of estimated coefficients that are significantly different from zero. Details re reported in Appendix 1.

6.2 Comparison of Individual Stocks Based on Violation or Non-Violation

For six of the ten years, I cannot reject the null hypothesis that the mean return on Islamic stocks is different from that of Secular stocks. For the other four years the null is rejected, twice in favour of Secular stocks and twice in favour of Islamic. Table 6 summaries t-tests for differences in means based on different sample sizes across all ten years.

Table 6
Comparison Mean Returns of Compliant and Non-compliant Stocks

Year	*Number of observations for compliant stocks*	*Number of observations for non-compliant stocks*	*t-stat of the difference in means*
1999	179	162	**6.32**
2000	202	223	**-3.40**
2001	197	248	-0.45
2002	206	249	-1.67
2003	199	261	-0.79
2004	204	260	**-3.68**
2005	239	233	0.25
2006	239	231	1.66
2007	257	227	**4.56**
2008	260	233	1.40

This supports the cross-sectional regression, suggesting that individual Islamic-compliant stocks cannot be said to perform differently from non-compliant stocks.

6.3 Performance of Risk-Matched Portfolios

When randomly selected, constrained portfolios are risk matched, Secular portfolios are found to dominate Islamic portfolios across all size classes for the estimation period. The Secular portfolios outperform the Islamic portfolios by

approximately 20 to 30 basis points per month, and the null hypothesis of equal mean returns is rejected in all cases. Table 7 summaries the performance comparison for the in-sample. Both the mean and quartiles of the differences (Secular minus Islamic) in expected returns are stated in basis points. The column headed Secular shows the number of outperforming Secular portfolios that contain at least one non-compliant stock, no matter how small the investment, and the column headed Islamic shows the number of outperforming Islamic portfolios that were pitted against a Secular portfolio with at least one non-compliant stock in it. The differences between the two columns show that if a Secular portfolio has any non-complaint stocks in it, it is more likely to dominate than be dominated. Finally, the last column reports the correlation coefficient of between the difference in expected return and the fraction that the Secular portfolio is invested in non-compliant stocks.

Table 7
In-Sample Performance of Risk-Matched Portfolios

Portfolio size	*Matched*	*Difference*	*p-value*	*Quartiles*	*Secular*	*Islamic*	*Correlation*
5 stocks	84	23	0.004	-32,26,84	47	27	0.16
10 stocks	97	23	0.00014	-11,27,65	65	28	0.11
15 stocks	100	29	0	-9,28,64	67	32	0.08
20 stocks	100	31	0	-2,32,63	71	28	0.19
25 stocks	100	31	0	-2,32,63	72	28	-0.19

The column headed *Matched* is the number of successful risk matches out of 100 random draws of pairs of portfolios of the given number of stocks. *Difference* is the difference in mean return in basis points (Secular minus Islamic). A positive difference means that Secular portfolios have a higher expected return on average. P-values are reported for t-tests of the mean difference across all portfolios in the given size class. *Quartiles* shows the 25th, 50th and 75th percentiles of the difference in expected return. The column headed *Secular* shows the number of outperforming Secular portfolios that with an investment in at least one non-compliant stock. The column headed *Islamic* shows the number of outperforming Islamic portfolios that were pitted against a Secular portfolio with an investment in at least one non-compliant stock. The last column, Correlation, show the correlation coefficient between *Difference* and the total percentage invested in non-compliant stocks by the Secular portfolio.

In general, Secular portfolios are expected to do better when they include a higher proportion of non-compliant stocks. This is further supported when we look at the industries in which both Islamic and Secular portfolios invest. Islamic portfolios tend to invest in only seven out of the ten ICB sectors. Financials and utilities are two industries completely passed over by Islamic portfolios due to their non-compliance with Sharia', while telecommunications is a negligible investment in both Islamic and Secular portfolios. In all, the compositions of both sets of portfolios differ greatly (Appendix 2). Islamic portfolios would appear to be disadvantaged by this reduced diversity of choice. In fact, about 70% of the Islamic investments are locked in three sectors: health care, industrials, and consumer goods.

When the performance of the portfolios is tracked out of sample for two years, 2007 and 2008, the Secular advantage largely disappears. The average difference in mean returns (Secular minus Islamic) is now -25 basis points, although it is insignificant for all but the 20 stocks size class.

Table 8
Out-of-Sample Performance of Risk-Matched Portfolios

No. of stocks	*Difference*		*P-Value*		*Quartiles*		*Top Return*		*Less Risk*	
	Return	*S.d.*	*Return*	*S.d.*	*Return*	*S.d.*	*Secular*	*Islamic*	*Secular*	*Islamic*
5	-22	107	0.322	0.013	-102,3,102	237,51,-89	44	40	31	53
10	-29	79	0.111	0.004	-141,-23,51	195,24,-60	41	56	38	59
15	-9	85	0.612	0.010	-78,5,112	192,39,-98	51	49	37	63
20	-48	61	0.004	0.009	-136,-27,59	183,41,-74	37	63	42	58
25	-5	-24	0.783	0.415	-126,8,90	195,59,-146	51	49	41	59

The same portfolios constructed at the beginning of the in-sample period are kept for two years and their performance compared. The difference in returns and standard deviations (s.d.) between the averages of the Secular portfolios and the averages of the Islamic portfolios are calculated and presented in basis points. A negative difference in return indicates underperforming Secular portfolios on average. A positive difference in standard deviation indicates that Secular portfolios re riskier on average. The number of top performing portfolios in term of risk and return for each set in the last set of columns.

This situation is due to the difference in the composition of the two sets of portfolios. As the pie charts in Appendix 2 indicate, Islamic portfolios do not include any investments in financials, a sector that was severely hit during the two out-of-sample years (2007 and 2008). This is illustrated in Table 9. The bigger the investment in financials, the more that Secular portfolios suffer. This is consistent across size classes. However, we can see that if we look at every portfolio individually, we find that the probability of a secular portfolio to come on top is close to the one where an Islamic portfolio outperforms. When we pick an Islamic portfolio over a secular one, chances to outperform or to underperform are similar. This portfolio is nevertheless, more likely to be less risky than the secular portfolio.

Table 9
Investment in Financials by Secular Portfolios and Mean Difference in Return

Secular Weight in Financials	*Mean Difference in Mean Return By Number of Stocks in the Portfolio*				
	5 Stocks	*10 Stocks*	*15 Stocks*	*20 Stocks*	*25 Stocks*
0%	-1.08%	-0.98%	-1.31%	-0.88%	-0.89%
> 0%	-1.94%	-1.46%	-1.71%	-1.55%	-1.41%
> 20%	-1.82%	-1.61%	-1.81%	-1.80%	-1.97%
> 50%	-2.36%	-2.12%	-2.25%	-2.39%	-2.30%

Difference in mean return is Secular minus Islamic, 2000-2008, for 24 months.

6.4 Spanning Test

The spanning test provides evidence as to whether one index can be taken as a substitute for another. The mean return on a value-weighted index of all 202 Islamic stocks is 0.0217%, and that of all 425 Secular stocks, -0.0211%, for the period 1999-2008

(119 observations). The null hypothesis that they are equal cannot be rejected (t-stat = 0.367). This suggests that there is no difference in performance between the two indices.

A regression of the returns of the Islamic index on the Secular index produces an R-squared of 94%. Following Schroder (2007), the null hypothesis that the intercept is equal to zero and that the slope coefficient is equal to one cannot be rejected when conducted separately, and neither can the joint null hypothesis. This supports the substitutability of the Islamic index for the Secular index; however, as the results on risk-matched portfolios shows, this may not be realized in the performance of smaller portfolios.

Table 10
Results of the Spanning Test

Test	*T-Stat*	*F-Value*	*P-Value*
H_0: $\alpha=0$	0.372	0.139	0.7103
H0: $\beta=1$	0.903	0.816	0.368
H_0: $\beta=1$ & $\alpha=0$	-	0.476	0.623

A regression of the returns of a value-weighted index of all Islamic stocks on the value-weighted index of all Secular stocks, 1999-2008

7. Conclusion

In this paper, I examined the investment cost that Muslim investors bear when choosing to be observant with their religion. Cross sectional regression of mean returns and spanning tests do not reveal a cost at the level of individual stocks or for entire indices. However, Islamic portfolios, containing what would be considered a typical number of stocks do under-perform their risk-matched Secular counterparts in-sample, and out-performance in a forecast period is largely attributable to specific events affecting Secular portfolios with at least some investment in Financials.

Nevertheless, we should keep on mind that our study looked only at the cost of compliance from a purely equity perspective. We might be underestimating the cost by excluding debt-bearing securities. In that regard, it is noteworthy to look at *Sukuks* (Islamic bonds) and Islamic asset based contracts as possible ways of diversification.

Appendices

Appendix 1A

Cross-Sectional Regression Estimates for 1999

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	-1701.228	1024.840	-1.660	.098
2	Oil & Gas	4279.037	963.171	4.443	.000
3	Materials	2467.291	1106.524	2.230	.026
4	Industrials	1160.664	872.106	1.331	.184
5	Consumer Goods	-381.990	971.894	-.393	.695
6	Health Care	1832.221	962.482	1.904	.058
7	Consumer Services	331.158	974.166	.340	.734
8	Telecommunications	1985.372	1852.308	1.072	.285
9	Financials	1325.781	975.092	1.360	.175
10	Technology	6787.711	950.941	7.138	.000
11	Alcohol-Related	-1260.235	1840.521	-.685	.494
12	Tobacco-Related	-2802.347	3591.237	-.780	.436
13	Pork-Related	1030.871	1116.555	.923	.357
14	Weapons and Defence	-1393.099	1528.674	-.911	.363
15	Entertainment-Related	2936.307	1532.222	1.916	.056
16	Cash/market cap ratio > 33%	444.660	794.701	.560	.576
17	Debt/market cap ratio > 33%	2012.168	1503.403	1.338	.182
18	Accounts Receivables ratio > 33%	808.768	829.025	.976	.330
19	Company is Compliant	1993.806	924.285	2.157	.032

Ordinary least squares cross-sectional regression of mean monthly return for 1999 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 341 companies, R-square = 0.378, Adjusted R-squared = 0.344.

Appendix 1B

Cross-sectional Regression Estimates for 2000

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	-1701.228	1024.840	-1.660	.098
2	Oil & Gas	4279.037	963.171	4.443	.000
3	Materials	2467.291	1106.524	2.230	.026
4	Industrials	1160.664	872.106	1.331	.184
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16	Cash/market cap ratio > 33%	444.660	794.701	.560	.576
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19	Company is Compliant	1993.806	924.285	2.157	.032

Ordinary least squares cross-sectional regression of mean monthly return for 2000 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 425 companies, R-square = 0.267, Adjusted R-squared = 0.236.

Appendix 1C

Cross-Sectional Regression Estimates for 2001

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	-1604.032	622.435	-2.577	.010
2	Oil & Gas	436.752	646.045	.676	.499
3	Materials	2278.050	697.649	3.265	.001
4	Industrials	2101.245	558.057	3.765	.000
5	Consumer Goods	2502.768	601.761	4.159	.000
6	Health Care	2169.600	646.828	3.354	.001
7	Consumer Services	3589.902	622.791	5.764	.000
8	Telecommunications	-165.167	1052.486	-.157	.875
9	Financials	1185.624	569.937	2.080	.038
10	Technology	2178.568	626.992	3.475	.001
11	Alcohol-Related	-237.288	1020.994	-.232	.816
12	Tobacco-Related	-542.538	1840.388	-.295	.768
13	Pork-Related	-1069.545	661.318	-1.617	.107
14	Weapons and Defence	3011.101	1090.273	2.762	.006
15	Entertainment-Related	-1929.126	972.558	-1.984	.048
16	Cash/market cap ratio > 33%	-479.598	598.425	-.801	.423
17	Debt/market cap ratio > 33%	668.428	445.126	1.502	.134
18	Accounts Receivables ratio > 33%	846.821	402.771	2.102	.036
19	Company is Compliant	-65.137	538.618	-.121	.904

Ordinary least squares cross-sectional regression of mean monthly return for 2001 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 445 companies, R-square = 0.155, Adjusted R-squared = 0.119.

Appendix 1D

Cross-Sectional Regression Estimates for 2002

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	-1625.957	571.860	-2.843	.005
2	Oil & Gas	1435.515	571.267	2.513	.012
3	Materials	1301.261	627.102	2.075	.039
4	Industrials	1447.396	509.979	2.838	.005
5	Consumer Goods	1704.212	549.707	3.100	.002
6	Health Care	910.567	580.960	1.567	.118
7	Consumer Services	1401.390	570.106	2.458	.014
8	Telecommunications	1903.976	945.324	2.014	.045
9	Financials	898.425	499.704	1.798	.073
10	Technology	368.356	561.240	.656	.512
11	Alcohol-Related	277.570	925.040	.300	.764
12	Tobacco-Related	-858.918	1705.115	-.504	.615
13	Pork-Related	-329.869	570.400	-.578	.563
14	Weapons and Defence	1035.892	984.423	1.052	.293
15	Entertainment-Related	-1101.913	894.062	-1.232	.218
16	Cash/market cap ratio > 33%	-2.307	488.727	-.005	.996
17	Debt/market cap ratio > 33%	263.351	410.421	.642	.521
18	Accounts Receivables ratio > 33%	-795.653	403.134	-1.974	.049
19	Company is Compliant	-357.448	478.632	-.747	.456

Ordinary least squares cross-sectional regression of mean monthly return for 2002 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 455 companies, R-square = 0.068, Adjusted R-squared = 0.038.

Appendix 1E

Cross-Sectional Regression Estimates for 2003

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	1699.719	486.372	3.495	.001
2	Oil & Gas	788.282	495.841	1.590	.113
3	Materials	1646.512	543.759	3.028	.003
4	Industrials	1035.192	436.092	2.374	.018
5	Consumer Goods	609.367	478.804	1.273	.204
6	Health Care	1343.288	509.438	2.637	.009
7	Consumer Services	1455.366	494.827	2.941	.003
8	Telecommunications	-1061.589	822.800	-1.290	.198
9	Financials	-186.056	426.784	-.436	.663
10	Technology	3444.387	482.649	7.136	.000
11	Alcohol-Related	268.721	755.384	.356	.722
12	Tobacco-Related	-282.885	1451.895	-.195	.846
13	Pork-Related	-1201.973	509.064	-2.361	.019
14	Weapons and Defence	-1913.535	868.523	-2.203	.028
15	Entertainment-Related	-790.333	718.935	-1.099	.272
16	Cash/market cap ratio > 33%	1685.475	368.264	4.577	.000
17	Debt/market cap ratio > 33%	181.348	339.480	.534	.593
18	Accounts Receivables ratio > 33%	691.401	331.170	2.088	.037
19	Company is Compliant	-847.782	404.478	-2.096	.037

Ordinary least squares cross-sectional regression of mean monthly return for 2003 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 460 companies, R-square = 0.264, Adjusted R-squared = 0.234.

Appendix 1F

Cross-Sectional Regression Estimates for 2004

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	781.162	422.438	1.849	.065
2	Oil & Gas	2002.657	429.199	4.666	.000
3	Materials	1634.376	477.378	3.424	.001
4	Industrials	748.400	383.504	1.951	.052
5	Consumer Goods	760.551	415.766	1.829	.068
6	Health Care	909.161	430.937	2.110	.035
7	Consumer Services	876.696	426.422	2.056	.040
8	Telecommunications	482.368	717.076	.673	.501
9	Financials	44.149	367.557	.120	.904
10	Technology	780.366	417.298	1.870	.062
11	Alcohol-Related	1526.031	656.192	2.326	.020
12	Tobacco-Related	-90.265	1260.807	-.072	.943
13	Pork-Related	-328.499	436.033	-.753	.452
14	Weapons and Defence	320.345	758.503	.422	.673
15	Entertainment-Related	-985.793	612.870	-1.608	.108
16	Cash/market cap ratio > 33%	392.790	291.540	1.347	.179
17	Debt/market cap ratio > 33%	273.955	285.465	.960	.338
18	Accounts Receivables ratio > 33%	349.620	274.100	1.276	.203
19	Company is Compliant	-602.314	338.463	-1.780	.076

Ordinary least squares cross-sectional regression of mean monthly return for 2004 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 464 companies, R-square = 0.128, Adjusted R-squared = 0.093.

Appendix 1G

Cross-Sectional Regression Estimates for 2005

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	1806.655	436.099	4.143	.000
2	Oil & Gas	2803.155	466.908	6.004	.000
3	Materials	494.394	512.098	.965	.335
4	Industrials	-118.027	406.056	-.291	.771
5	Consumer Goods	-982.394	438.074	-2.243	.025
6	Health Care	378.834	453.367	.836	.404
7	Consumer Services	-199.540	451.857	-.442	.659
8	Telecommunications	-1268.555	751.518	-1.688	.092
9	Financials	-300.650	384.591	-.782	.435
10	Technology	285.636	439.685	.650	.516
11	Alcohol-Related	889.670	688.448	1.292	.197
12	Tobacco-Related	653.770	1337.096	.489	.625
13	Pork-Related	-847.673	473.847	-1.789	.074
14	Weapons and Defence	-1379.011	816.044	-1.690	.092
15	Entertainment-Related	-2458.383	656.394	-3.745	.000
16	Cash/market cap ratio > 33%	363.035	365.186	.994	.321
17	Debt/market cap ratio > 33%	-857.630	296.066	-2.897	.004
18	Accounts Receivables ratio > 33%	262.177	330.091	.794	.427
19	Company is Compliant	-1104.584	357.092	-3.093	.002

Ordinary least squares cross-sectional regression of mean monthly return for 2005 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 472 companies, R-square = 0.227, Adjusted R-squared = 0.196.

Appendix 1H

Cross-Sectional Regression Estimates for 2006

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	1103.934	358.035	3.083	.002
2	Oil & Gas	-408.732	394.058	-1.037	.300
3	Materials	538.689	423.414	1.272	.204
4	Industrials	-71.991	332.663	-.216	.829
5	Consumer Goods	-440.409	361.249	-1.219	.223
6	Health Care	-739.512	375.616	-1.969	.050
7	Consumer Services	-375.722	373.366	-1.006	.315
8	Telecommunications	420.846	584.059	.721	.472
9	Financials	89.370	317.237	.282	.778
10	Technology	-240.480	366.074	-.657	.512
11	Alcohol-Related	149.186	566.458	.263	.792
12	Tobacco-Related	1064.026	1100.857	.967	.334
13	Pork-Related	367.126	394.730	.930	.353
14	Weapons and Defence	855.097	670.061	1.276	.203
15	Entertainment-Related	1302.728	536.345	2.429	.016
16	Cash/market cap ratio > 33%	585.010	305.603	1.914	.056
17	Debt/market cap ratio > 33%	106.809	247.081	.432	.666
18	Accounts Receivables ratio > 33%	99.138	287.401	.345	.730
19	Company is Compliant	168.551	298.788	.564	.573

Ordinary least squares cross-sectional regression of mean monthly return for 2006 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 470 companies, R-square = 0.066, Adjusted R-squared = 0.029.

Appendix 1I

Cross-Sectional Regression Estimates for 2007

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	2278.216	550.218	4.141	.000
2	Oil & Gas	1191.845	600.544	1.985	.048
3	Materials	644.034	653.347	.986	.325
4	Industrials	-336.518	515.460	-.653	.514
5	Consumer Goods	-1972.346	554.289	-3.558	.000
6	Health Care	-575.870	567.945	-1.014	.311
7	Consumer Services	-2121.468	570.812	-3.717	.000
8	Telecommunications	-586.602	839.600	-.699	.485
9	Financials	-2579.603	486.007	-5.308	.000
10	Technology	-1374.147	565.475	-2.430	.015
11	Alcohol-Related	-25.815	818.544	-.032	.975
12	Tobacco-Related	378.404	1674.345	.226	.821
13	Pork-Related	-40.808	610.039	-.067	.947
14	Weapons and Defence	337.833	1027.979	.329	.743
15	Entertainment-Related	-435.118	783.465	-.555	.579
16	Cash/market cap ratio > 33%	1509.841	519.279	2.908	.004
17	Debt/market cap ratio > 33%	-1659.979	388.690	-4.271	.000
18	Accounts Receivables ratio > 33%	924.621	470.835	1.964	.050
19	Company is Compliant	-625.464	487.115	-1.284	.200

Ordinary least squares cross-sectional regression of mean monthly return for 2007 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 484 companies, R-square = 0.246, Adjusted R-squared = 0.216.

Appendix 1J

Cross-Sectional Regression Estimates for 2008

	Variable	*Coefficient*	*Standard Error*	*t-value*	*p-value*
1	Intercept	-1951.035	613.311	-3.181	.002
2	Oil & Gas	-1485.802	662.379	-2.243	.025
3	Materials	-1743.091	730.335	-2.387	.017
4	Industrials	-377.464	566.165	-.667	.505
5	Consumer Goods	-255.248	615.971	-.414	.679
6	Health Care	274.289	626.205	.438	.662
7	Consumer Services	-646.338	625.173	-1.034	.302
8	Telecommunications	-1051.532	961.137	-1.094	.274
9	Financials	-1284.481	555.288	-2.313	.021
10	Technology	-1337.564	612.855	-2.183	.030
11	Alcohol-Related	-292.170	941.122	-.310	.756
12	Tobacco-Related	-808.019	1907.369	-.424	.672
13	Pork-Related	464.216	662.460	.701	.484
14	Weapons and Defence	689.207	1164.190	.592	.554
15	Entertainment-Related	-1197.606	880.159	-1.361	.174
16	Cash/market cap ratio > 33%	-583.567	548.670	-1.064	.288
17	Debt/market cap ratio > 33%	-598.598	430.162	-1.392	.165
18	Accounts Receivables ratio > 33%	-1251.118	536.376	-2.333	.020
19	Company is Compliant	-299.523	520.717	-.575	.565

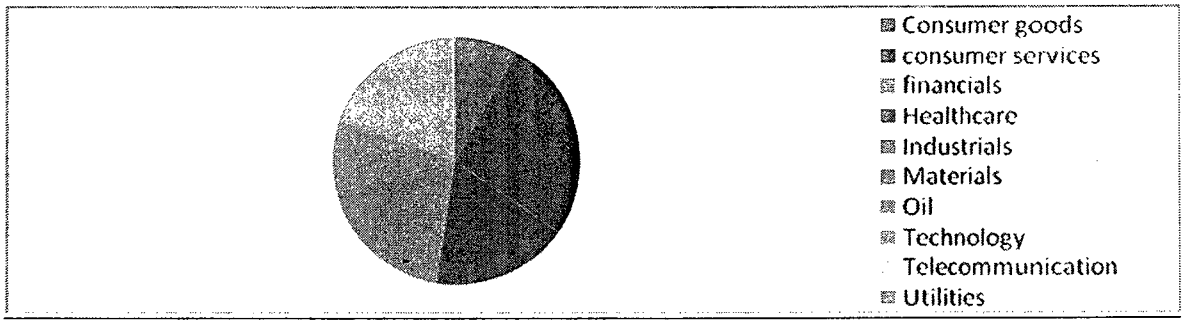
Ordinary least squares cross-sectional regression of mean monthly return for 2008 on dummy variables for Industry Classification Benchmark sector (variables 2-10), Islamic compliance criteria (variables 11-18) and whether the company is Islamic-compliant (19). The intercept represents non-compliant companies in the Utilities sector. N = 493 companies, R-square = 0.086, Adjusted R-squared = 0.051.

Appendix 2

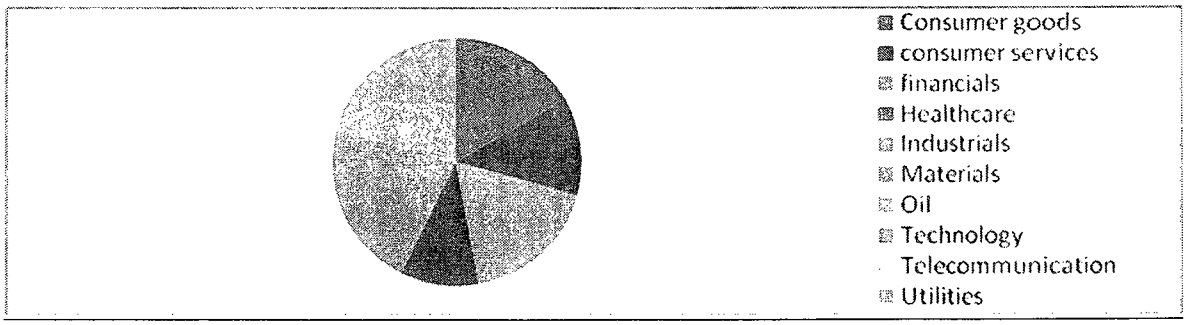
Average Industry Composition of Randomly Selected Portfolios

Five-stock portfolio

Islamic

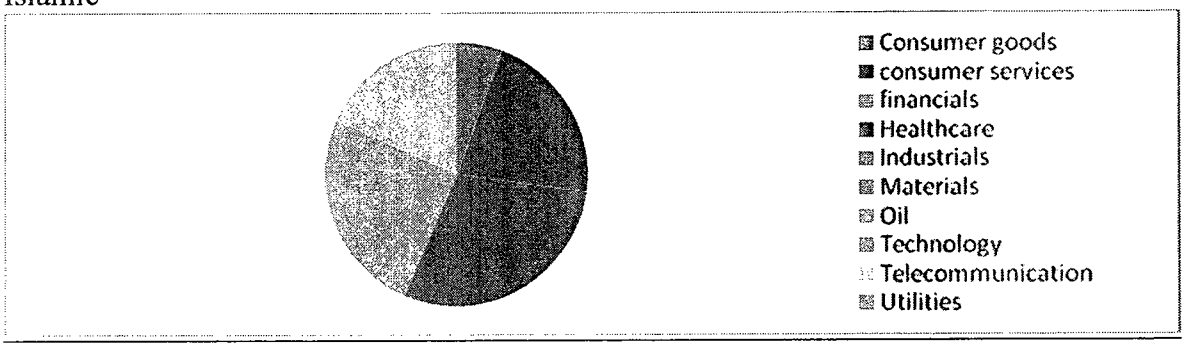


Secular

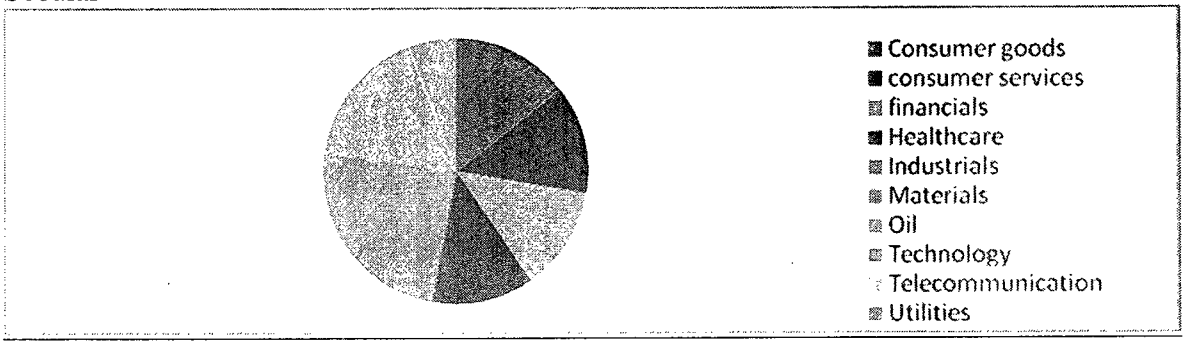


Ten-stocks portfolio

Islamic

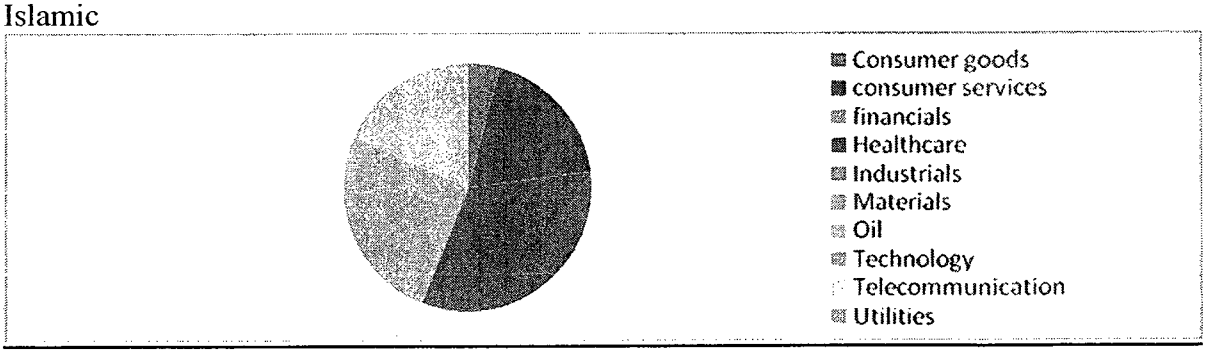


Secular

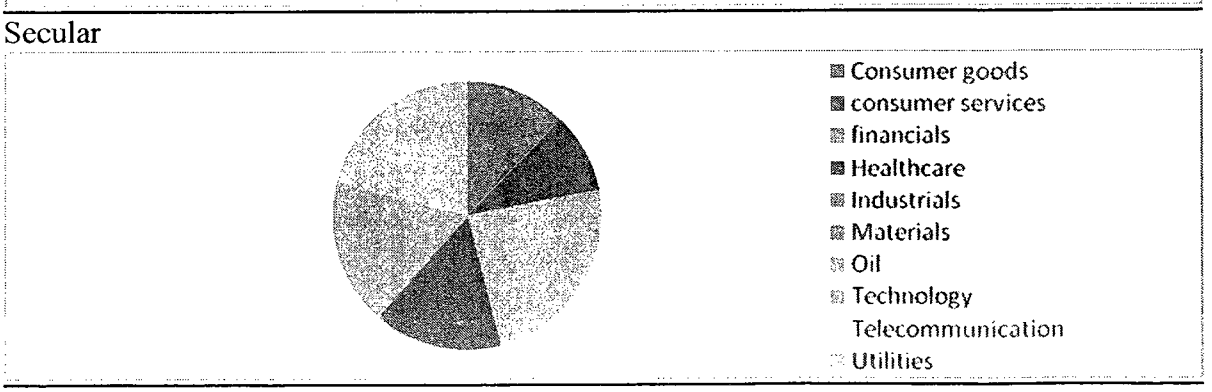


15-stock portfolio

Islamic

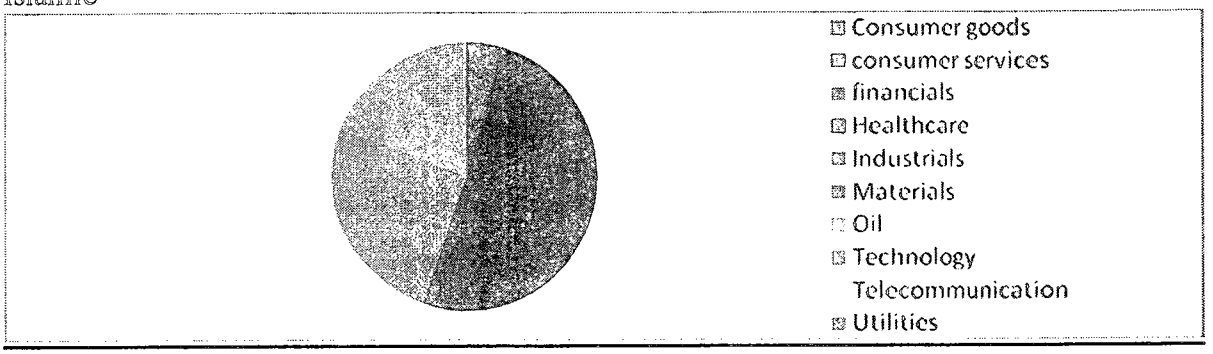


Secular



20-stock portfolios

Islamic



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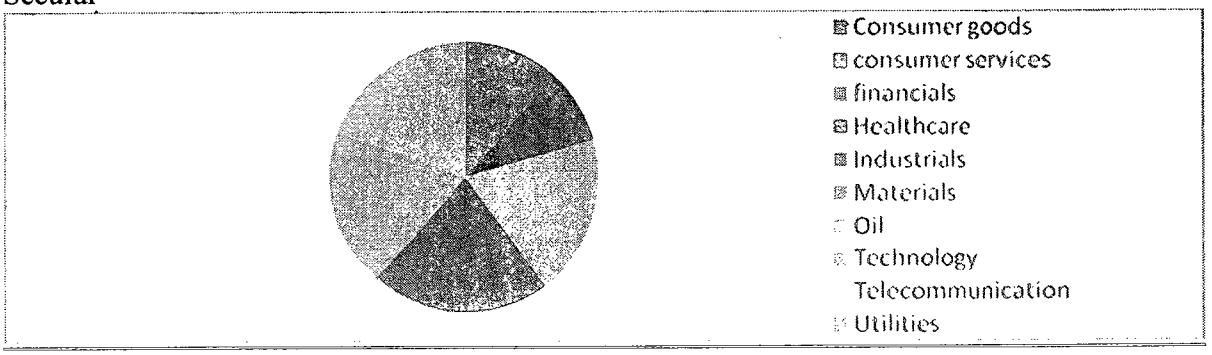
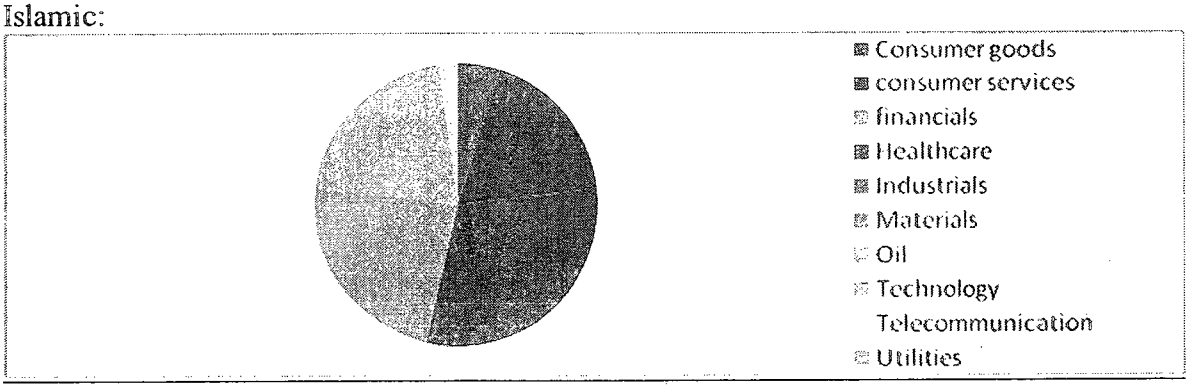


25-stock portfolios

Islamic:



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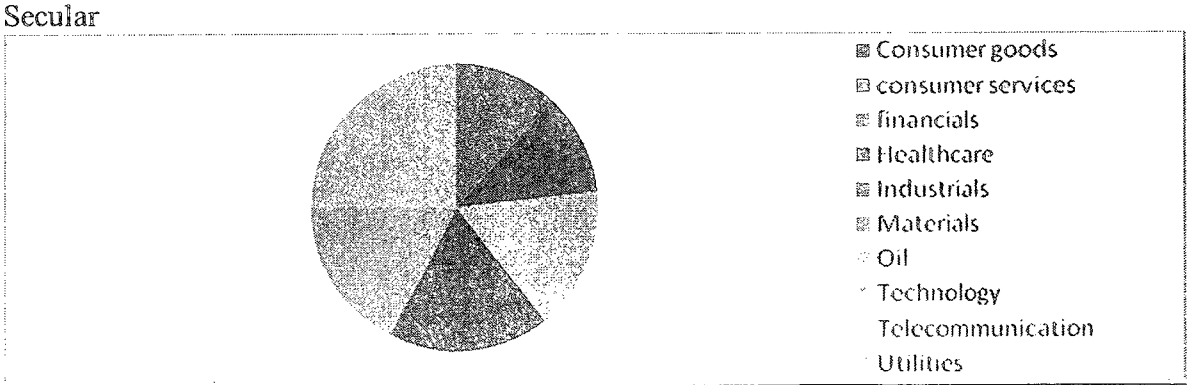

Appendix 4:

Comparison of Individual Stocks Based on Violation or non-Violation

1999	*no violation*	*at least one criteria violated*
Mean	0.033282963	0.002016609
Variance	0.002968604	0.001281338
Observations	179	162
Hypothesized Mean Difference	0	
df	310	
t Stat	**6.317547046**	
P(T<=t) one-tail	4.60951E-10	
t Critical one-tail	1.649783823	
P(T<=t) two-tail	9.21901E-10	
t Critical two-tail	1.967645863	

2000	*no violation*	*at least one criteria violated*
Mean	0.014147478	0.02785245
Variance	0.001923741	0.001489603
Observations	202	223
Hypothesized Mean Difference	0	
df	403	
t Stat	**-3.404680342**	
P(T<=t) one-tail	0.000364439	
t Critical one-tail	1.648643452	
P(T<=t) two-tail	0.000728877	
t Critical two-tail	1.965867856	

2001	*no violation*	*at least one criteria violated*
Mean	0.006089209	0.007433622
Variance	0.00122563	0.000748679
Observations	197	248
Hypothesized Mean Difference	0	
df	443	
t Stat	-0.454719735	
P(T<=t) one-tail	0.324766811	
t Critical one-tail	1.648300535	
P(T<=t) two-tail	0.649533622	
t Critical two-tail	1.965333331	

2002	*no violation*	*at least one criteria violated*
Mean	-0.010147706	-0.005962724
Variance	0.000705397	0.000704972
Observations	206	249
Hypothesized Mean Difference	0	
df	437	
t Stat	-1.673261043	
P(T<=t) one-tail	0.047495773	
t Critical one-tail	1.648347962	
P(T<=t) two-tail	0.094991546	
t Critical two-tail	1.965407254	

2003	*no violation*	*at least one criteria violated*
Mean	0.029003352	0.030875568
Variance	0.000501244	0.000823693
Observations	199	261
Hypothesized Mean Difference	0	
df	458	
t Stat	-0.785929324	
P(T<=t) one-tail	0.216157653	
t Critical one-tail	1.648187415	
P(T<=t) two-tail	0.432315306	
t Critical two-tail	1.965157018	

2004	*no violation*	*at least one criteria violated*
Mean	0.01300082	0.020050047
Variance	0.000394806	0.000451647
Observations	204	260
Hypothesized Mean Difference	0	
df	448	
t Stat	**-3.6784519**	
P(T<=t) one-tail	0.000131585	
t Critical one-tail	1.648261985	
P(T<=t) two-tail	0.000263171	
t Critical two-tail	1.965273244	

2005	*no violation*	*at least one criteria violated*
Mean	0.011598085	0.011057201
Variance	0.00061861	0.000462637
Observations	239	233
Hypothesized Mean Difference	0	
df	463	
t Stat	0.252906783	
P(T<=t) one-tail	0.400226247	
t Critical one-tail	1.64815134	
P(T<=t) two-tail	0.800452495	
t Critical two-tail	1.965100792	

2006	*no violation*	*at least one criteria violated*
Mean	0.012596258	0.0151542
Variance	0.000283488	0.000273714
Observations	239	231
Hypothesized Mean Difference	0	
df	468	
t Stat	-1.661194176	
P(T<=t) one-tail	0.048672082	
t Critical one-tail	1.648116038	
P(T<=t) two-tail	0.097344165	
t Critical two-tail	1.96504577	

2007	*no violation*	*at least one criteria violated*
Mean	0.010418623	-0.001453243
Variance	0.000879288	0.000759508
Observations	257	227
Hypothesized Mean Difference	0	
df	481	
t Stat	**4.56367106**	
P(T<=t) one-tail	3.19498E-06	
t Critical one-tail	1.648027694	
P(T<=t) two-tail	6.38996E-06	
t Critical two-tail	1.964908081	

2008	*no violation*	*at least one criteria violated*
Mean	-0.03455039	-0.038428285
Variance	0.000766087	0.00110324
Observations	260	233
Hypothesized Mean Difference	0	
df	453	
t Stat	1.399185154	
P(T<=t) one-tail	0.081220901	
t Critical one-tail	1.648224288	
P(T<=t) two-tail	0.162441803	
t Critical two-tail	1.965214488	

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