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Islamic Economics Rules and the Stock Market: Evidence from the United States

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ABSTRACT

In the Islamic framework of stock markets there is no predetermined interest rate, excess speculative activities and asymmetric information. In these markets there are good intentions in trades and stocks are obtained not in vanities. It has been shown that debt financing and economic waste through excess speculative activities cause a reduction in stock price and returns. A model of stock price for a large country was developed and tested for the S&P 500 Index. It was found interest rate, outstanding government debt and deficits result in a reduction of stock price for the sample period of 1973 Q1 – 2011 Q4. It was also found that the excessive speculative activities during the 1871 Q1 – 2011 Q4 period resulted in bubbly stock prices in the United States and the excess speculative activities added misleading information to stock prices so that stock returns fell.

JEL Classifications: G120, G140, G190

Keywords: Islamic rules, stock price, bubbles, excessive speculative activities

I. INTRODUCTION

There are at least four rules in Islam that make a transaction acceptable. A stock market or index that is established based on these rules is an Islamic market or index. These rules include not obtaining any property in vanities, a goodwill and intention in trade, the absence of usury and trading goods/stocks based on full symmetric information. Any violation of these rules results in a drastic reduction in stock prices. As Naughton and Naughton (2000) describe, common stocks are legitimate in Islam provided these rules are followed. Short selling and margin trading are severely restricted. The use of equity futures and options is questionable from an Islamic perspective and stock markets must be fully regulated to eliminate wasteful transactions that mean a Tag El-Din (1996)-Kia (2001) normative stock exchange is an optimum stock market.

The current literature concentrates on three aspects of Islamic stock markets: The first is on the outperformance of the Islamic stock markets over the traditional stock markets. For example, Wilson (1997) analyses Islamic equity indexes as ethical investment products and shows, in general, these indexes perform well relative to conventional indexes. Hussein and Omran (2005) find the Dow Jones Islamic Market Index (DJIMI) outperforms the traditional stock index. However, they found that, during the bear period, DJIMI underperforms the market and the reverse is true in the bull market. Tag El-Din and Hassan (2007) report studies that show DJIMI has done relatively well compared to the Dow Jones World (DJW) Index, but underperformed in relation to the Dow Jones Sustainability World (DJS) Index. They also report studies that show that the Islamic index performs as well as the Financial Times Stock Exchange (FTSE) All-World Index[1]. Al-Zoubi and Maghyereh (2007) examine the relative risk performance of the Dow Jones Islamic index (DJIS) with respect to the DJW index and find that the former outperforms the latter[2].

Abdul Rahim et al. (2008) examine the causality between the Islamic equity world — Malaysia, the US, the UK, Canada, Japan, Europe, Asia Pacific (with and without Japan), the World Emerging, the World Developed, and the World (excluding the US). They found that Malaysia is a potential investment center capable of offering enormous returns and Malaysia, Asia Pacific (without Japan) and the World Emerging offer the lowest risk per unit of returns. Guyot (2011) finds Islamic indexes are as efficient and globally liquid as traditional indexes, but bring additional portfolio diversification benefits to investors. Furthermore, he finds DJW index exhibits higher levels of informational efficiency than its conventional counterpart.

Finally, the study found the terrorist attacks of September 11 and the invasion of Iraq in 2003 as well as the subprime US crisis affect the price dynamics of Islamic indexes, compared to conventional indexes, by accentuating the divergence of price patterns. Consequently, it concludes that, due to their particular nature, Islamic indexes are associated with specific risk factors, which are of interest for the purpose of the diversification of international portfolios. Al-Khazali et al. (2013) find during the 2007-2012 period the global, European, and US Islamic stock indexes dominate their conventional counterparts. However, the reverse is true in the earlier period, i.e., 2001-2006. Since the 2007-2012 period includes the recent financial crisis, they concluded Islamic indexes outperform their conventional counterpart during that meltdown period.

The second aspect is on the correlation between Islamic and conventional stock indexes. Tag El-Din and Hassan (2007) conduct an extensive survey of the literature

and report studies that examined the volatility of the DJIM Index returns and those which found that the DJIMI is correlated with neither the Wilshire 5000 Index nor the three-month Treasury bill. Abdul Rahim et al. (2008) find the Malaysian Islamic equity market to be weakly correlated with all the other markets, especially with the advanced markets. They also find returns of Islamic stocks traded in the Malaysian market are caused only by the US, Asia Pacific, World Emerging as well as World Developed stock returns.

The third aspect is on excessive speculative activities. Tag El-Din (1996) discusses the traditional concept of market efficiency in light of the theories of Keynes-Hicks-Samuelson. He proposes three conditions and asserts that under these conditions both operational and informational efficiencies can be achieved. He stresses the fact that there is an excessive speculative activity in the conventional stock markets and introduces a highly regulatory normative stock exchange that is needed in a competitive market in order to achieve an efficient stock market. Kia (2001) finds that excessive speculative activities do create wasteful information from the efficiency point of view. His empirical finding confirms Tag El-Din's (1996) view that a highly regulatory normative stock exchange is needed in a competitive market. He also showed that the application of the Islamic law automatically guarantees stable and efficient stock markets.

Kia (2001) suggests the central bank and the government should ensure that the investors in stock markets have complete knowledge of the stock market mechanism that implies that the government facilitates the training of the existing as well as new investors in these markets. Such a policy leads participants in stock markets to have or acquire the knowledge of the market mechanism so that they conduct transparent transactions rather than over or under react to any information. Since he found, using Canadian data, the excessive speculative activities create inefficiency in the stock markets, Kia (2001) proposes a tax levy on short-horizon investment returns.

Since short-horizon (at least up to a month) investment returns could purely be due to windfall gains and not to real investment opportunities - and in most cases these returns are the result of excessive speculative activities – he suggests a 20% Quranic tax[3] may be appropriate. Tag El-Din and Hassan (2007) review speculation in the stock market from an Islamic point of view and raise the question of how much speculation is allowed in an Islamic stock exchange market.

The last aspect is on the impact of the Shariah (Islamic law) on liquidity and the performance of individual stocks. Sadeghi (2008), using an event study methodology, analyses the impact of the Shariah-compliant index by the Bursa Malaysia on the liquidity and performance of each stock in the index. He found there is a positive relationship between the introduction of the Shariah-compliant index and the performance of each individual stock in it. Furthermore, he found a positive reaction of the market to the introduction of the Shariah. However, the bid-ask spread, as a measure of liquidity, increased after the introduction of the Shariah, which Sadeghi (2008) interprets as the reaction of market participants to the generated asymmetric information rather than the reduction in liquidity.

The existing literature successfully compares and contrasts conventional and Islamic stock indexes from a correlation, performance and liquidity point of view. However, to the best of my knowledge, no study tests the impact of the violation of Islamic economic laws on stock price/market. For example, what is the impact of

outstanding government debt, which is financed by predetermined interest rates, rather than by profit-risk sharing agreements, on the stock price in conventional markets? Furthermore, what is the impact of expected future changes on such a debt, measured by deficit, on stock price? How can federal government debt management influence the stock price? Moreover, the existence of predetermined interest rates, according to Islamic laws, results in the reduction of the stock price. Is this rule true empirically in a conventional stock market? How can the excess speculation, which is a non-Islamic activity, influence the stock price? These are the factors that have not been studied so far in the literature. This study attempts to fill this gap. I have therefore developed a long-run model of the stock price which incorporates all these factors for a large country and estimated the model on the US data for the Standard and Poor's 500 Index for the 1970 Q1 - 2011 Q4 sample period. It was found that the existence of predetermined interest rates and the interest-financed government debts result in the reduction of stock prices in the United States.

Furthermore, using the last 141-year observations on the S&P 500 dividend payments and price, the fundamental stock price was estimated. It was found that, over that period, there were bubbles in the United States stock market. Namely, the market price on average has been a "bubbly" price and deviated from the fundamental price. Furthermore, the excessive speculative activities in the US stock markets resulted in misleading information in the stock price so that it caused reductions in the rate of returns in the stock market. All together the violation of the four Islamic rules in conventional stock markets causes a drastic reduction in stock prices. Namely, there will be inefficiency and lower stock returns.

Section II provides some explanations on the characteristics of the Islamic stock exchange. The models are introduced in Section III. Section IV is devoted to the description of the data and the empirical evidence. The final section provides a summary and conclusions.

II. CHARACTERISTICS OF STOCK EXCHANGE IN ISLAM

To describe equity transactions from the Islamic point of view we need to review the four rules that make a transaction acceptable. These rules are as follows: Rule 1: One must not obtain any property in vanities or unacceptable ways or illegally. Rule 2: The trade must be based on goodwill and intention among participants. We understand from rules 1 and 2 that any transaction based on cheating and aggression or on illegal or unjustified reasons, subject to asymmetric information, or resulting in corruption or in the production of tools which can be used illegally from the Islamic point of view, or any activity linked among others to prostitution, pornography, gambling, production of alcoholic beverages or weapons of mass destruction, is not acceptable[4]. The violation of these rules results in economic or individual destruction (see, e.g., Shirazi, 1995; Shahabi, 1994).

Rule 2 is purely internal as it is up to the trader, buyer or seller, to have a good intention in his trade. As Kia (2001) mentioned, because uncertainty is a fact of life there is not any kind of price except a speculative one. "A successful investor is a speculator while a speculator is merely an investor who has lost his money (Samuelson, 1972). To Keynes (1976), speculative markets are mere casinos where the wealth is transferred from unlucky to lucky and from slow to quick individuals" (Kia, 2001, p. 32).

Rule 3: Usury is prohibited[5]. According to this rule, usury, contrary to trade, results in the reduction of the stock price among other things. Rule 4: One cannot sell a commodity which is less than what the seller claims or the label indicates[6]. The violation of Rule 4 results in what is known as gharar. This violation creates uncertainty "about any one of the objects of exchange; either amount of *price* to be paid for a specific commodity, or nature of commodity to be bought at a given price" (Tag El-Din, 1996, p. 36). According to Rule 4, "transactions are accepted from an Islamic point of view if the qualities and flaws of the commodity (including stocks) transacted were known to the buyer(s) and seller(s). Furthermore, the true price of the commodity should be declared by transacting participants (see, e.g., al-Ghazzali, 1992, pp. 350-354). For example, if the purchaser, based on some information [unknown to the seller] believes the share is undervalued, then s/he should provide the information to the seller(s), otherwise, some kind of gambling or gharar has occurred" (Kia, 2001, p. 36).

From the above four rules we understand that the stock of a company that produces any product and is not accepted in Islam (explained above) cannot be traded. Stocks on conventional banks that pay/charge a predetermined interest rate are not Islamic. Furthermore, there should not be any asymmetric information in the market, i.e., equity issuing firms should clearly and accurately publish their balance sheet. Market participants must clearly know the market conditions and situations so that stocks are traded according to their true values. Such a condition is possible only under Tag El-Din (1996) and Kia's (2001) normative stock exchange. In such a market there is an optimum (maximum) level of speculative activity (Tag El-Din, 1996). He also suggests that a highly regulatory normative stock exchange is needed in a competitive market in order to achieve an efficient stock market.

Since transactions are accepted from an Islamic point of view if the qualities and flaws of the stocks transacted were known to the buyer(s) and seller(s) (rules 2 and 4), Kia (2001, p. 48) proposes "the following policy rules: (a) Under an Islamic framework the central bank and the government should ensure that the investors in stock markets have complete knowledge of the stock market mechanism. This also requires that the central bank and the government facilitate the training of the existing as well as new investors in these markets. Such a policy leads participants in stock markets to have or acquire the knowledge of the market mechanism so that they conduct transparent transactions rather than over or under react to any information. (b) According to this study government should levy a tax on short-horizon investment returns. Since short-horizon (at least up to a month) investment returns could purely be due to windfall gains and not to real investment opportunities - and in most cases these returns are the result of excessive speculative activities - a 20% Qur-anic tax (The Holy Qur-an, Ch. 8, V. 41) may be appropriate."

It should be mentioned that in an Islamic system, transactions in stock markets occur, not because of different opinions about the future prices of the shares being transacted (excessive-speculative activities), but because of the investors' utility maximization process. In this way, since markets are more often in equilibrium there is no room for excessive speculative activities. In sum, according to the above rules we expect over the long run the existence of a predetermined interest rate results in a lower stock price (Rule 3). Furthermore, government debt, financed by a predetermined rate should reduce the stock price. In the next section I will develop a model that describes the determination of stock price in a large country. I will estimate the model on the US

stock market that rules by the conventional economy. I will pick up the Standard and Poor's 500 index that reflects, for a given number of shares and outstanding corporate bonds, the value of 500 companies over the long run.

III. THE MODELS

A. Long-Run Conventional Stock Price Model

In an exchange-economy asset-pricing model, Lucas (1978) finds the equilibrium price of an asset is the expected, discounted present value of its real dividend stream, conditional on current information. Consequently, the price of a stock may be approximated as:

$$sp_t = E_t[(1+r_t)^{-1}(sp_{t+1} + D_{t+1})] \tag{1}$$

where sp_t is the real stock price (S&P 500 Index) at time t, D_{t+1} is the real dividend paid to the shareholders between t and t+1, $0<(1+r_t)^{-1}<1$ is the discount factor and E denotes the mathematical expectation operator for information at time t, see Lucas (1978) and Kia (2001).

If the transversality condition, i.e., $\lim_{n\to\infty} E_t[(1+r_{t-n})^{-n}(sp_{t+n})]=0$ holds, then the unique solution to Equation (1) is the following equation where $sp_t = fsp_t$, and fsp_t is the real fundamental value of the stock price at time t.

$$fsp_t = sp_t = E_t[\sum_{i=1}^{\infty}(1+r_{t+i-1})^{-i}(D_{t+i})] \tag{2}$$

Future dividends as well as discount rates are not observable. Consequently, I assume that in a large, open and financially integrated economy like the United States (where there is a conventional stock market), the discounted expected value of future payments has the following function:

$$E_t[\sum_{i=1}^{\infty}(1+r_{t+i-1})^{-i}(D_{t+i})] = F(rgdp_t, cpi_t, dy_t, cor_t, defgdp_t, debtgdp_t, dlforgdp_t, oil_t, q_t, z_t) \tag{3}$$

In Equation (3), rgdp is the real GDP, cpi is the price level, dy is the dividend yield rate, cor is the three-month corporate rate, defgdp is the percentage of the federal government deficits per GDP, debtgdp is the percentage of the federal government outstanding debt per GDP, dforgdp is the percentage of the federal government foreign-financed debt per GDP, oil is the oil price, q is the real effective exchange rate and z includes past values of sp and the above-mentioned macroeconomic variables as well as other valid conditioning variables[7]. Furthermore, market psychology and speculative activities could also lead stock markets in the US. The variable z can also reflect market psychology and speculative activities. Note that there is no generally accepted theory for linking stock price to the economy. Consequently, general

economic theory and intuition have been the main input in the selection of macroeconomic variables.

A higher level of real GDP is associated with higher corporate profits and cash flows. Consequently, it is expected theoretically for the real GDP to have a positive relationship with the stock price. Moreover, while a higher price level increases expectations of a future hike in interest rates, it may also lead to higher offsetting cash flows. However, cash flows may not rise at the same rate as the price level, see Mukherjee and Naka (1995) and references therein. Consequently, one would expect a negative relationship between the price level and the stock price. Furthermore, if stocks hedge against inflation, at least in the long run, as it was shown by Kaul (1986), Ely and Robinson (1997), and Kia (1997a, 1997b), then a positive relationship between the stock price and the level of domestic price may be expected. The overall impact of the price level on the stock price, therefore, depends on the prevailing forces.

According to one version of the efficient markets hypothesis, a higher dividend yield means a lower stock price relative to dividends indicating a lower future expected dividends and earnings/returns. Consequently, one would expect the relationship between dividend yield and stock price to be negative. A higher domestic interest rate is expected to have a positive impact on the investors' subjective discount rate and is also associated with expected lower corporate profits. Both a higher subjective discount rate and expectations of lower corporate profits result in a fall of the stock price.

A higher deficit per GDP implies a higher government debt or monetization of debt as well as a higher tax rate in the future and results in an increase in the subjective discount rate, indicating a lower stock price. This is also true for the impact of outstanding debt per GDP on the stock price that can be influenced by the government debt management. Namely, a higher externally-financed government debt would be associated with a lower expected value of domestic currency in the future. This is because there is always a higher possibility of dumping the government issued bonds that are held by foreign investors. A lower value of domestic currency results in an appreciation of the balance of trade[8]. This leads to higher corporate profits and cash flows, indicating a higher stock price. This is also true for a higher exchange rate (lower value of domestic currency). Consequently, a higher exchange rate is expected to lead to a higher stock price.

For a net oil-importing country like the US, a rise in the oil price results in a higher cost schedule that can reduce corporate profits and lower expectations of future cash flows. Consequently, one would expect a negative relationship between the oil and the stock prices. However, as the oil price increases, the value of the stock of oil producing companies will also go up. Depending on their weight in the stock index, it is possible for the stock price (S&P 500) to go up. Consequently, over the long run, the impact of the oil price on the index is an empirical issue. Substitute (3) in (2) to get:

$$sp_t = F(rgdp_t, inf_t, dy_t, cor_t, defgdp_t, debtgdp_t, dforgdp_t, oil, q, z_t) \qquad (4)$$

Following Kia (2003) and references therein let us assume a long-run relationship of Equation (4) has the following log-linear form:

$$lsp_t = \beta_0 + \beta_1 lrgdp_t + \beta_2 lcpi_t + \beta_3 dy_t + \beta_4 cor_t + \beta_5 defgdp_t + \beta_6 debtgdp_t + \beta_7 dforgdp_t + \beta_8 loil_t + \beta_9 lq_t + u_t \quad (5)$$

In Equation (5) an l before a variable means log of the variable, β's are constant coefficients, u_t is the error term and is assumed to be white noise, normally, identically and independently distributed[9]. Considering the above economic intuitions, we would expect β's to have the following signs, i.e., $\beta_1>0$, $\beta_2=?$, $\beta_3<0$, $\beta_4<0$, $\beta_5<0$, $\beta_6<0$, $\beta_7>0$, $\beta_8=?$ and $\beta_9>0$. Note that since Equation (5) is a long-run relationship, vector z will affect only the short-run dynamics of the system.

In an Islamic stock market, according to Rule 3, a predetermined interest rate is prohibited as God says in the The Holy Qur-an that those who charge or pay a predetermined interest rate "…are companions of the Fire: They will abide therein (forever)." (2:275), "God will deprive usury of all blessing,…" (2:276), "O ye who believe! Fear God, and give up what remains of your demand for usury..." (2:278), "… Take notice of war from God and His Messenger. But if ye turn back, ye shall have your capital sums: Deal not unjustly…" (2:279), and finally God says "… Devour not usury, doubled and multiplied; but fear God that ye may (really) prosper." (3:130).

Consequently, according to the above verses, we would expect in a conventional economy the interest rate and government debt, which is financed, directly and indirectly, by predetermined interest rates, to negatively affect stock prices. In an Islamic economy, a debt is financed by a profit-risk sharing agreement. But dividend payments (dividend yield), which is a return based on an Islamic system, affect positively stock returns (prices). The theoretical signs of the coefficients in Equation (5), in fact, confirm these Islamic predictions. In Section IV we will investigate, using US data, if such predictions are relevant over the long run.

B. Bubble Model

No one knows what will happen in the future[10]. This implies any speculative activity based on forecast of future prices is a waste of resources. Furthermore, if transactions in stock markets are based on anything other than investors' utility maximization there will be a stock price bubble, i.e., waste of resources. This bubble will eventually burst[11].

Accordingly, in non-Islamic stock markets, there exist excessive speculative activities that result in bubbly prices and inefficient stock markets. To analyze this issue let us follow Kia (2001) and express the fundamental price in terms of observable dividends. Specifically, assume the stochastic process for dividends is in such a way that the dividends are a random walk with constant drift so that $fspt = \mu D_t$. Under this hypothesis μ is equal to the mathematical expectation of price dividends ratio.

However, as Kia (2001) mentioned, if the transversality condition does not hold, then $sp_t = fsp_t$ is not the unique solution to Equation (1). One solution, from potentially infinite solutions, is given by $sp_t = fsp_t + B_t$, where B_t is the bubble term which must satisfy $B_t = (1+r)^{-1}E_t(B_{t+1})$, see references in Kia (2001).

"If market and fundamental values diverge, but beyond some range the differences are eliminated by speculative forces, then stock prices will revert to their mean. This implies that the stock returns must be negatively serially correlated at some frequencies if erroneous market moves are eventually corrected. This kind of negative

serial correlation is not a cogent refutation of a random walk process in price levels. However, it indicates that the price level will perform a Brownian-like vibration around the fundamental value and there will be an ergodic probability" (Kia, 2001, p. 39).

Note that if speculative activities are taken place because of real investment opportunities then bubbles could not exist and speculative activities are not destabilizing. "Then, one would expect the bubbles on average to be zero. However, if there are noise traders among speculators who dominate the market, then bubbles exist in the price. Then we can say that (a) prices are dominated by irrational destabilizing noise traders (De Bondt and Thaler, 1985), and (b) excessive speculative activities by irrational noise traders deviate stock markets from fundamental values" (Kia, 2001, p. 40).

Following Kia (2001) we will test this hypothesis:

$$E(sp_t) = E(fsp_t) \tag{6}$$

The above hypothesis means that the unconditional mean of real speculative or "bubbly" prices is equal to the unconditional mean of real fundamental values. This hypothesis cannot be rejected indicating that the speculative price, on average, reverts to its expected fundamental component. In other words, speculative activities are not excessive and, consequently, do not create instability in the stock markets and there will not be any waste of resources due to noise traders.

The second hypothesis is that the excess speculative activities add no information to stock markets or result in a lower rate of return in the stock market. To test this hypothesis we test the $\beta_1 \leq 0$ in the following regression.

$$NR_t = \beta_0 + \beta_1(S_{t-1} - S_{t-2}) + DUM'_t\,\delta + u_t \tag{7}$$

In Equation (7), $NR=100*[(SP_t/SP_{t-1}- 1) + (Div_t/SP_{t-1})]$ is the nominal quarterly rate of return. SP and Div are nominal S&P 500 Index and dividends per share, respectively. S_t $[=100*(B_t/sp_t)]$ reflects the percentage of the deviation of the actual price from its fundamental value per actual price created by speculative activities. β's are constant coefficients and vector DUM incorporates all policy regime changes and exogenous shocks which could affect the nominal rate of return and the parameter-vector δ contains constant coefficients. The rejection of the hypothesis $\beta_1 \leq 0$ indicates that the changes in proportion deviation between actual prices and fundamental values (i.e., the changes in S_t) have a positive forecasting power for stock returns. In other words, according to this hypothesis, we will test if the excessive speculative activities add any value to the stock price. Rejecting the null hypothesis (6) and accepting $\beta_1 \leq 0$ together means what is going on in the conventional stock market (i.e., "Eat not up your property among yourselves in vanities: But let there be amongst you traffic and trade by mutual good-will" (The Holy Qur-an, Ch. 4, V. 9) which may mean the existence of asymmetric information and unnecessary speculative activities leads to stock price bubbles. We will test these hypotheses in the next section.

IV. DATA, EMPIRICAL METHODOLOGY AND RESULTS

A. Data

The model is estimated by using quarterly US data for the sample period 1871 Q1 – 2011 Q4. The choice of the period is based on the availability of the data. However, some variables are not available before 1973 or after 2011. Therefore, the long-run model is estimated for the 1973 Q1 – 2011 Q4 period and the bubble model is estimated over the 1871 Q1 – 2011 Q4 period. The Standard and Poor's 500 Index is a representative of the price of stock markets. Unless otherwise specified, all data are taken from the St. Louis Federal Reserve Database (FRED). Dividend yield (dividend payments and Standard and Poor's 500 price) is taken from the web site of Yale University Professor Robert J. Shiller.

To investigate the stationarity property of the variables, I used Augmented Dickey-Fuller and non-parametric Phillips-Perron tests. Furthermore, to allow for the possibility of a break in intercept and slope, I also used tests developed by Lee and Strazicich (2003) (which was adjusted for four structural breaks), Perron (1997) and Zivot and Andrews (1992). According to the test results, all variables are integrated of degree one (non-stationary). They are first-difference stationary. It should, however, be noted that the price level according to Phillips-Perron test results is stationary while based on all other test results has a unit root. Furthermore, changes of variable debt per GDP are stationary at only 90% level of significance according to Zivot and Andrews' (1992) test result. For the sake of brevity, these results are not reported, but are available upon request. All data, when appropriate, are seasonally adjusted, otherwise, I made them seasonally adjusted. The interest rate is adjusted to a 365-day basis. All variables, when appropriate, are in billions of dollars.

B. Long-Run Methodology and Results

Since all variables in Equation (5) have a unit root, we will first verify if a long-run cointegrating relationship exists between the level of the stock price and its determinants, as specified by this equation. Table 1 reports the cointegration test results on the model. During the sample period, there have been some policy regime changes and/or exogenous changes which could influence the short-run dynamics of the system. As evidenced by Kia (2006), constant models can have time-varying coefficients if a deeper set of constant parameters characterizes the data generation process. Specifically, the existence of constancy may depend on whether raw coefficients or underlying parameters are evaluated. Kia (2006) also shows that the estimated long-run relationship can be biased when the appropriate policy regime changes and/or other exogenous shocks are not incorporated in the short-run dynamics of the system. Consequently, I will let the short-run dynamics of the system incorporate these policy regime changes and other exogenous changes during the sample period. Actually these variables reflect the conditional variables included in vector z in Equation (4).

Table 1
Long-run test results

Tests of the Cointegration Rank (ρ)												
H_0=ρ	0	1	2	3	4	5	6	7	8	9	Diagnostic tests**	*p*-value
Trace(1)	283	204[a]	147	114	89	62	34	16	5	1	Autocorrelation	
											LM(1)	0.37
Trace 95(2)	267	225	184	148	117	97	63	42	26	13	LM(2)	0.21
											ARCH	
											LM(1)	0.06
p-value	0.00	0.29[a]	0.75	0.76	0.69	0.76	0.95	0.99	1.00	0.99	LM(2)	0.02
											Normality	0.00
											Lag length = 4	

Johansen-Juselius Maximum Likelihood Procedure Result												
Normalized	lsp	lrgdp	lcpi	dy	cor	defgdp	debtgdp	dforgdp	loil	lq	Trend	C
lsp (*t*-stat)	-	-8.4	-0.6	-0.3	-0.2	-0.5	-0.0	-0.0	-0.2	0.3	0.1	-
		(-10.1)	(-3.1)	(-12.1)	(-0.3)	(-10.2)	(-0.4)	(-5.7)	(-5.0)	(2.2)	(12.1)	
Fully Modified Least Squares Results												
lsp (*t*-stat)	-	-1.4	0.0	-0.3	-0.9	-0.2	-0.0	0.0	-0.0	-0.2	0.02	7.8
		(-3.2)	(0.0)	(-18.6)	(-2-2)	(-9.9)	(-2.5)	(2.9)	(-0.2)	(-1.9)	(4.3)	(3.2)

a = means we cannot reject the null of ρ=1. (1) Using the Bartlett correction factor, the Trace test has been corrected for the small sample error; see Johansen (2000 and 2002). (2) The critical values of the Trace rank test were simulated. The critical values of the test statistics are calculated based on the length of the random walk of 400 with 2500 replications. * The sample period is 1970Q1-2012Q1. lsp is the log of the real S&P 500, lrgdp is the log of the real GDP, lcpi is the log of cpi, dy is the dividend yield rate, cor is the three-month corporate rate, defgdp is the percentage of federal government deficits per GDP, debtgdp is the percentage of the federal government outstanding debt per GDP, dforgdp is the percentage of the federal government foreign-financed debt per GDP, loil is the log of the oil price, lq is the real exchange rate, Trend is the time trend and C is the constant. ** LM(1) and LM(2) are one and two-order Lagrangian Multiplier test, respectively (Godfrey, 1978 and 1988).

These policy regime changes and other exogenous shocks include the following: (1) The October 87 stock market crisis. (2) The Persian Gulf War, which began on August 2, 1990, and ended on February 28, 1991. (3) The North American Free Trade Act (NAFTA), which went into effect on January 1, 1994. This act provided unprecedented freedom in trade among the United States, Canada, and Mexico. (4) The Asian market crisis in 1997. (5) On October 7, 2001, the U.S. declared war on Afghanistan. (6) The credit crunch and financial crisis that started on August 2007 and ended the third quarter of 2009.

Accordingly, the following dummy variables used to represent these potential policy regime shifts and exogenous shocks: the Oct87 dummy is used to capture the impact of the October 87 stock market crisis. It is equal to one in the last quarter of 87 and zero, otherwise, pwar = 1 from 1990 Q3 to 1991 Q1, and = 0, otherwise, reflecting the Persian war, nafta = 1 since 1994 Q1 and = 0, otherwise, to capture the North American Free Trade Act, awar = 1 since 2001 Q4 and = 0, otherwise, reflecting the declaration of war in Afghanistan, and uscrisis = 1 from 2007 Q3 to 2009 Q3, and = 0,

otherwise, reflecting the current US financial crisis. AS97 is a dummy variable, which is equal to one for the last quarter of 1997, and is zero, otherwise.

We analyze a p-dimensional Gaussian vector X= [lsp_t, $lrgdp_t$, inf_t, dy_t, cor_t, $defgdp_t$, $debtgdp_t$, $dforgdp_t$, $loil_t$, lq_t] which is modeled conditionally on the short-run set of z which includes the above dummy variables. In determining the lag length we should verify if it is sufficient to get white noise residuals. As it was recommended by Hansen and Juselius (1995, p. 26), set p=ρ (the order of cointegration) in Equation (5) and test for autocorrelation. LM(1) and LM(2) will be employed to confirm the choice of lag length. The order of cointegration will be determined by using the Trace test by Johansen and Juselius (1991). Note that the set of dummy variables that constitutes the set of z affects only the short-run dynamics of the system. They account for institutional and policy regime changes, which could affect stock prices in the country.

Since we allow the short-run dynamics of the system to be affected by these dummy variables (explained above) we need to simulate the critical values as well as their associated ρ values for the rank test. The number of replications is 2500 and the length of random walk is 400. Using the Bartlett correction factor, the Trace test has been corrected for the small sample error; see Johansen (2000 and 2002). Table 1 reports the Trace test result as well as the long-run relationship. For the sake of robustness I also used Phillips and Hansen's (1990) Fully Modified Least Squares (FMOLS) test. The result of this test is reported in the bottom panels of Table 1.

According to the diagnostic tests reported in this table, the lag length 4 was sufficient to ensure that errors are not autocorrelated. According to the normality test result, the error is not normally distributed. However, as it was mentioned by Johansen (1995), a departure from normality is not very serious in cointegration tests, see also, e.g., Hendry and Mizon (1998). According to the Trace test results, reported in Table 1, we cannot reject ρ≤1, implying that ρ=1.

I also calculated values of the recursive test statistics for the long-run relationship. These statistics are recursive likelihood-ratios, Eigenvalues and β's normalized by the 5% critical value. Thus, calculated statistics that exceed unity imply the rejection of the null hypothesis and suggest unstable cointegrating tests and vectors. It was found that all these tests and the long-run equation were stable over the long run when the models are corrected for short-run effects. For the sake of brevity the graphs associated with the values of the recursive test statistics are not reported, but are available upon request. Having established that the long-run equation is stable, we will analyze the relationship.

The second row of the bottom panel in Table 1 reports the long-run stock price determination, using Johansen-Juselius Maximum Likelihood Procedure (JJMLP). Except for the coefficient of the real GDP and the percentage of government debt financed externally per GDP, all other estimated coefficients justify the theoretical model [Equation (5)]. The estimated coefficient of both the interest rate and the percentage of debt per GDP is negative, but not statistically significant. The coefficient of the expected future government debt (percentage of deficit per GDP) is also negative and statistically significant which indicates that the violation of Rule 3 results in a reduction of stock price, the market value of companies, for a given number of shares in circulation and outstanding debt.

Note that the JJMLP test result should be analyzed with caution. As mentioned above the price level according to Phillips-Perron test results is stationary while based

on all other test results it has a unit root. Furthermore, changes of variable debt per GDP are stationary at only 90% level of significance according to Zivot and Andrews' (1992) test result. Furthermore, we needed to restrict the constant in JJMLP in order to estimate the equation with trend. As in this test we can use either trend or constant. For the robustness test we used FMOLS test that can be used when there are stationary and non-stationary variables in the system. The estimated result is reported in the last row of the table.

According to this estimated result, except for the coefficient of the price level and the foreign-financed debt, all other estimated coefficients confirm the JJMLP test result. However, the estimated coefficient of the price level is not statistically significant. Now the coefficient of the interest rate and the percentage debt per GDP is statistically significant indicating that the violation of Islamic stock markets results in the value of these stocks (firms) to fall[12].

C. Short-run Dynamic Model

Table 2 reports the parsimonious estimation of the final error correction model (ECM) that is implied by the cointegrating vector on the basis of Hendry's General-to-Specific approach[13]. To obtain the optimum lag length of variables a lag profile of eight quarters at the original ECM was chosen. Following Granger (1986), we should note that if small equilibrium errors can be ignored, while reacting substantially to large ones, the error correcting equation is non linear. Consequently, all possible kinds of non linear specifications, i.e., squared, cubed and fourth powered of the equilibrium errors (with statistically significant coefficients) as well as the products of those significant equilibrium errors were incorporated.

Table 2

Error correction model, dependent variable = Δlsp

Variable	Coefficient	Standard Error	*p*-value for Hansen's (1992) stability L_i test
Constant	0.98	0.91	0.32
Δlsp_{t-2}	0.19	0.06	0.17
Δcor_{t-1}	-0.96	0.42	0.61
$\Delta dforgdp_{t-1}$	0.02	0.01	0.91
$\Delta loil_{t-4}$	-0.06	0.02	0.33
EC_{t-1}	-0.11	0.06	0.32
EC_{t-2}	0.08	0.04	0.32
D751	0.25	0.08	0.00
D874	-0.33	0.07	0.02
D023	-0.24	0.07	0.19
D084	-0.39	0.07	0.65
Hansen's (1992) stability L_i test on the variance = 1.10			*p*-value = 0.50
Joint (coefficients and the error variance) Hansen's (1992) stability L_c test = 3.62			*p*-value = 0.05
Normality, Jarque-Bera = 4.20			*p*-value = 0.12

* The sample period is 1970Q1-2012Q1. Mean of dependent variable=0.005. Δ means the first difference, Δcor is the change in the three-month corporate rate, Δdforgdp is the change in the log of foreign financed debt per GDP and Δloil is the change in the log of oil price. EC is the error correction term generated from the long-run price determination of Johansen-Juselius Maximum Likelihood Procedure (See Table 1.). Dummy

variables D751, D874, D023 and D084 are equal to one for 1975:01, 1987:04, 2002:03 and 2008:04, respectively and zero otherwise. These dummy variables are included in order to eliminate the outliers in the residuals. The estimation method is Ordinary Least Squared. $\overline{R}^2$=0.39, σ=0.06, DW=2.09, Godfrey (5)=0.75 (significance level=0.60), White=47 (significance level=0.99), ARCH(5)= 4.9 (significance level=0.42) and RESET=0.47 (significance level=0.71). Note that $\overline{R}^2$, σ and DW, respectively, denote the adjusted squared multiple correlation coefficient, the residual standard deviation and the Durbin-Watson statistic. White is White's (1980) general test for heteroskedasticity, ARCH is five-order Engle's (1982) test, Godfrey is five-order Godfrey's (1978) test, REST is Ramsey's (1969) misspecification test, Normality is Jarque and Bera's (1987) normality statistics, L_i is Hansen's (1992) stability test for the null hypothesis that the estimated coefficient or variance of the error term is constant and L_c is Hansen's (1992) stability test for the null hypothesis that the estimated coefficients as well as the error variance are jointly constant.

Assuming government deficit, debt and foreign-financed debt as a percentage of GDP are exogenous over the short run, we will have seven endogenous variables in the system. But for the sake of brevity, the ECM of the growth of the stock price was only reported**.** However, the full estimation results of all these ECMs will be used to analyze the unanticipated shocks in endogenous variables using impulse response functions. In Table 2, Δ denotes a first difference operator and EC, $\overline{R}^2$, σ and DW, respectively, denote the error correction term from the long-run equation for the stock price level, the adjusted squared multiple correlation coefficient, the residual standard deviation and the Durbin-Watson statistics, respectively. White is White's (1980) general test for heteroskedasticity, ARCH is the five-order Engle's (1982) test, Godfrey is the five-order Godfrey's (1978) test, REST is Ramsey's (1969) misspecification test, Normality is Jarque-Bera's (1987) normality statistics, L_i is Hansen's (1992) stability test for the null hypothesis that the estimated i^{th} coefficient or variance of the error term is constant and L_c is Hansen's stability test for the null hypothesis that the estimated coefficients as well as the error variance are jointly constant.

Dummy variables D751, D874, D023 and D084 are equal to one for 1975:01, 1987:04, 2002:03, and 2008:04, respectively and zero otherwise. These dummy variables are included in order to eliminate the outliers in the residuals. According to the diagnostic tests the error term is white noise. None of the diagnostic checks is significant. Therefore, the estimation method is the Ordinary Least Squared. Based on Hansen's stability test results, all of the coefficients individually and jointly are stable.

I also included the dummy variable uscrisis as well as a linear time trend in the EC model. But none of these variables was statistically significant and so they were dropped in the parsimonious estimation result reported in Table 2. According to this estimation result, the estimated coefficient of the error-correction term is negative and statistically significant. However, after two quarters, the impact of the equilibrium error is positive, but the summation of the coefficients of the error term in two periods is negative, implying that the disequilibrium will be eliminated.

Apparently, except for the interest rate, the foreign-financed debt management and the growth of oil price variables, none of the other variables has any impact, over the short run, on the stock price in the United States. As it is expected the change in the interest rate reduces the stock price over the short run, which justifies Rule 3. The estimated coefficient of foreign-financed debt management is positive and the estimated coefficient of the growth of oil price is negative. All these three estimated coefficients

justify our theoretical model (Equation 5) even though the impact of the oil price on the stock price is an empirical issue.

D. Impulse Responses and Stock Price

To analyze the impact of shocks in the variables to the stock price, the estimated coefficients of all ECMs are used and their associated impulse responses were estimated. In order for each variable to be independently shocked the Choleski factor was used to normalize the system so that the transformed innovation covariance matrix is diagonal. The conclusions are potentially sensitive to the ordering (or normalization) of the variables. As one would expect, part of a shock in the real GDP is contemporaneously correlated to a shock in the price index, interest rate, oil price and real exchange rate which by themselves are correlated to a shock in deficit per GDP, debt per GDP, foreign-financed debt per GDP as well as dividend yield and stock price. Consequently, let us propose the ordering of lrgdp, lcpi, cor, loil, lq, defgdp, debtgdp, fdgdp, dy, and lsp.

By ordering the stock price at the end, the identifying restriction is that the other variables do not respond contemporaneously to a shock to the stock price. This ordering is not critical in our analysis as, to the best of my knowledge, no particular theory or empirical evidence conflicts with the logic of the proposed ordering. The VAR was run in the error-correction form with four lags (the lag length of the cointegration equations, see Table 1). The impulse response functions reflect the implied response of the levels, i.e., real GDP, the price index, interest rate, oil price, real exchange rate, deficit per GDP, debt per GDP, foreign-financed debt per GDP, dividend yield, and stock price. Following Lütkepohl and Reimers (1992) we assume a one-time impulse on a variable is transitory if the variable returns to its previous equilibrium value after some periods. If it settles at a different equilibrium value, the effect is called permanent.

Since, in computing confidence bands, neither the coefficients of VAR nor their responses to shocks are known with certainty, the Monte Carlo simulation is used. The number of Monte Carlo draws is 1000. Dummy variables that account for policy regime changes or other exogenous shocks are included as exogenous variable shocks. It was found all responses are within the confidence band. For the sake of brevity graphs of the impulse responses are not reported but are available upon request.

According to the results, not reported but available upon request, all impulse responses, except real exchange rate and foreign-financed debt per GDP, are permanent. Specifically, a one standard deviation shock to the real exchange rate (equal to 0.02 units) induces a contemporaneous fall of 0.01 units in real stock price and continues to 0.006 at the 10^{th} quarter before falling in magnitude and reaches, e.g., to 0.0031 units at the 24^{th} quarter; therefore, the impulse is temporary [14].

Furthermore, a one standard deviation shock to foreign-financed debt per GDP induces a contemporaneous fall in the real stock price by 0.005 units but the decline will be eliminated at the 8^{th} quarter and remains at 0.00 in the 24^{th} quarter. Interestingly, a one standard deviation shock to debt per GDP results in a contemporaneous fall in the real stock price by 0.01 units but the decline will change to an increase of 0.002 at the 4^{th} quarter and increases to 0.02 at the 14^{th} quarter and remains the same at the 24^{th} quarter. Another interesting observation is that a one standard deviation shock to real GDP results in a contemporaneous increase in the real stock price by 0.018, but the rise

will be eliminated at the 4th quarter and continues to fall to, e.g., -0.01 at the 24th quarter. Consequently, shock in the real GDP increases the real stock price only temporarily.

E. Bubble Model: Test Results

To construct the fundamental stock price (S&P 500 composite index) we need a very long period. For this purpose I use a 141-year sample period (1871 Q1 – 2011 Q4) of dividends (D) and dividend-price ratio of S&P 500 (Div/SP). The mathematical expectation of Div/SP is 27.12382294. Consequently, FSP (nominal fundamental value of stock price) for the sample period is FSP_t= 27.12382294(Div_t/SP_t). The means of the nominal value of the fundamental and market stock price as well as the bubble are 112.3443539, 183.07195299 and 70.7275991, respectively. The *t*-statistics of the bubble is 8.14 which rejects the null hypothesis of $E(sp_t) - E(fsp_t) = E(SP_t) - FSP_t = 0$.

The stationary test results (the absolute value of *t*-statistics) for the bubble are Augmented Dickey-Fuller =1.50<2.87 at 5%, Phillips-Perron =1.69< 2.86 at 5%, Zivot-Andrews = 5.33 (at 1990:04) > 4.80 at 5%. Since two of these tests (a parametric and non-parametric) cannot reject the null of unit root, we assume the bubble has a unit root. Consequently, we will use Mann-Whitney (-Wilcoxon) non-parametric test to verify if the mean of the bubble is zero. Namely, we will test if the mean of the fundamental stock price (112.34) and the mean of the actual market price (183.07) are statistically identical[15]. The Mann-Whitney U and Wilcoxon W tests are calculated to be 477,426 and 333,856, respectively. The Z-Score is 2.83 with the *p*-value of 0.005 implying that these variables are not identical and, therefore, the bubble has not been on average zero during the last 141 years. In other words, the market price on average has been a "bubbly" price and deviated from the fundamental price[16].

Now we need to test whether the excess speculative activities (measured by the bubbles in prices) add any information to stock prices, i.e., we need to test the hypothesis indicated by Equation (7). The stationary test results (the absolute value of the *t*-statistics) for NR are Augmented Dickey-Fuller =29.31>3.43 at 1%, Phillips-Perron =29.03>3.44 at 1%, Zivot-Andrews = 11.07 (at 1918 Q1) > 5.34 at 1%. All of these tests indicate NR is stationary. This is also true for the excess speculative activities. Namely, the stationarity test results (the absolute value of *t*-statistics) for $(S_{t-1}–S_{t-2})$ are Augmented Dickey-Fuller =28.80>3.43 at 1%, Phillips-Perron =28.60>3.44 at 1%, Zivot-Andrews = 12.38 (at 1932 Q3) > 5.34 at 1%. All of these tests indicate $(S_{t-1}–S_{t-2})$ is stationary.

I used the multiple structural change test by Bai and Perron (2003) and allowed up to 10 breaks to find the optimal number of breaks. According to the test result for a trimming factor of 0.15, there are structural changes in 1926 Q2 and 1932 Q3. The vector of DUM includes trend, the dummy variable GD (equal to one for the period 1921 Q4 – 1939 Q1, zero otherwise, to capture the Great Depression) dummy variables uscrisis and nafta (both defined before).

The impact of excess speculative activities for the whole sample, and for the first and second periods is -0.1633 (*t*-statistics= -6.26), -0.112 (*t*-statistics= -2.55) and -0.594 (*t*-statistics= -8.34), respectively. As we can see the excess speculative activities reduce the return. Namely, it adds misleading information in the market and creates inefficiency. Furthermore, in the sample period associated with the long-run model (i.e.,

1970 Q1 – 2011 Q4) the impact is also negative and statistically significant, i.e., -0.166, (*t*-statistics=-2.04)[17]. According to these results the excessive speculative activities, like in any casino, cause market participants to lose and causes inefficiency by adding misleading information to the stock price.

V. CONCLUDING REMARKS

From an Islamic point of view there is economic (stock market) destruction if properties are obtained in vanities, if there is no goodwill and intention in trade, if there is usury and if trading of goods/stocks is based on asymmetric information. It was found in this paper the existence of predetermined interest rate results in a lower stock price (therefore, return) in a large country like the United States. Federal government deficits as an expected change in future debt also result in a reduction in the value of stock price. These findings indicate that the existence of predetermined interest rate results in a reduction of stock price, the market value of companies, for a given number of shares in circulation and outstanding corporate debt.

It was also found the excessive speculative activities resulted in a bubbly stock price in the stock market during the last 141 years in the United States. Furthermore, the excess speculative activities (measured by the bubbles in prices) add misleading information to the stock price so that stock returns will fall. Namely, the excessive speculative activities, like in any casino, cause market participants to lose. Moreover, the impulse responses of the real stock price to all shocks, except real exchange rate and foreign financed debt, are permanent. The real stock price increases for a shock to deficit and debt per GDP. Furthermore, none of the variables contributes to the real stock price forecast error variance at any time horizon.

Finally, we can conclude that if we create a normative stock market in the sense of Tag El-Din (1996)-Kia (2001) we can avoid the stock-market destruction. In such a market, there is no asymmetric information; trades are based on good intentions and not in vanities. Both the central bank and the government ensure that market participants are aware of the correct values of equities. Furthermore, there should be at least a 20% tax on positive short-term (say, one-month) returns on stock transactions and no tax exemption on a negative return.

ENDNOTES

1. See the paper for more details.
2. Dow Jones indexes initiated their DJIS index in 1999. This index represents the first worldwide Islamic equity index that is compatible with Islamic investment guidelines. The DJIS is a "low-debt, non-financial, social-ethical index" in the broad sense (for a complete explanation of this index, see Al-Zoubi and Maghyereh, 2007, pp. 241-242).
3. See The Holy Qur-an, Ch. 8, V. 41.
4. See V. 9 of Ch. 4 of the Qur-an: "O ye who believe! Eat not up your property among yourselves in vanities: But let there be amongst you traffic and trade by mutual good-will: Nor kill (or destroy) yourselves: for verily God hath been to you Most Merciful!"

5. See V. 2 of Ch. 275 of the Qur-an: “Those who devour usury will not stand except as stand one whom the evil one by his touch hath driven to madness. That is because they say: “Trade is like usury," but God hath permitted trade and forbidden usury. Those who after receiving direction from their Lord, desist, shall be pardoned for the past; their case is for God (to judge); but those who repeat (the offence) are companions of the fire: They will abide therein (forever).”
6. See V. 1, 2 and 3 of Ch. 83 of the Qur-an: “Woe to those that deal in fraud, those who, when they have to receive by measure from men, exact full measure, but when they have to give by measure or weight to men, give less than due.” See also V. 181 of Ch. 26, where He says: “Give just measure, and cause no loss (to others by fraud).”
7. Other conditioning variables are a series of dummy variables that reflect policy regime changes and other exogenous factors like the financial crisis, the October 1987 crisis, etc.
8. This is true if Marshall-Lerner condition, a long-run condition, is satisfied.
9. Note that the error term in Equation (5) does not suffer from errors-in-variables problems as well as forward autocorrelation since it does not have any relation with the variables on the right hand side of the equation. Furthermore, we do not include in the equation actual values of price and dividend at time t+1.
10. See V. 65 of Ch. 27 of the The Holy Qur-an: “Say: None in the heavens or on earth, except God, knows what is hidden …”
11. See V. 29 of Ch. 4 of The Holy Qur-an: “O ye who believe! Eat not up your property among yourselves in vanities: But let there be amongst you traffic and trade by mutual good-will: Nor kill (or destroy) yourselves: for verily God hath been to you Most Merciful!”
12. It should be noted that the value of a firm and its stock price are not the same. A company’s value for many investors is its ability to generate a satisfactory return over a long holding period. However, for a given value of outstanding firm-issued bonds and the number of its shares in circulation, a change in the value of the outstanding equity of a firm can lead to a change in the market value of a company. This is because market value of a company stocks is equal to the value of the company debt and market value of shares, see Mossin (1969). The current value of all the company stocks is called the company's market capitalization or just market cap that is a part of the value of the firm. The day-to-day price fluctuation of the stock is usually more about volatility than value.
13. Using the estimated coefficients of JJMLP the error correction term (EC) was calculated.
14. Note that here we only analyze the impulse responses of the real stock price to a shock in real GDP, the price index, interest rate, oil price, real exchange rate, deficit per GDP, debt per GDP, foreign-financed debt per GDP and dividend yield.
15. Note that both of these variables are non-stationary based on the above three unit-root tests (the test results are available upon request).
16. I also used the Mann-Whitney U and Wilcoxon W tests to investigate if the bubble has been on average zero for the sample period 1970Q1-2011Q4. The Mann-Whitney U and Wilcoxon W tests are calculated to be 42420 and 25808, respectively. The Z-Score is -2.808 with the p-value of 0.005 implying that these

variables are not identical and, therefore, the bubble has not been on average zero during this sample period.

17. The full estimation result for all these periods is available upon request.

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