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Abstract: This study examines empirically the factor analysis model of stock returns using Iranian data over the period 1991-2010. Specifically, it examines whether the behavior of stock prices, in relation to eight accounting ratio reflects the behavior of earnings. Iran is a country that defer in it economy as compare to the rest of the world. Iran adopted a Sharia based economy and presently under financial and economical sanctions by the world. Therefore, this study also examines whether stock prices are affected by financial and economical sanctions. The major objective of this study is to provide evidence that would contribute to the effort of explaining the risk factors in a country that differs substantially from the other countries not only with regards to its full *Sharia* financial system but also as it relates to its economical and financial sanctions. Our findings reveal a significant relationship between book to market ratio, financial leverage and size factors and expected stock returns in the Iranian market. Moreover, consistent with rational pricing we find that BE/ME is a strong indicator of profitability when measured by for all stocks. Finally, consistent with the other studies we find evidence that stock prices reacted negatively to the financial and economical sanctions. This has increased the volatility effects on the stock returns and can be a risk for investors.

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Key Words: Sanctioned economy, accounting ratio, Sharia law, Canonical correlation Analysis, and arbitrage pricing theory.

1.0 Introduction

The asset- Pricing Model of Sharp(1964), Lintner(1965), and Black(1972) has long shaped the way academics and practitioners think about average returns and risk. Sharp (1964), Lintner (1965), Mossin (1966) and Black (1972) extended Capital Asset Pricing Model (CAPM) as the first theory. The central prediction of the model is that the market portfolio of investing is mean-variance efficient in the sense of Markowitz(1952). The CAPM, points out that merely one category of non-diversifiable risk affect security returns, and that particular category of risk is "Market risk". The second theory-Arbitrage pricing Theory (APT) was suggested by Ross (1976). The APT is more general than CAPM in admitting a range of various factors. In addition, APT theory expects that there could be different amount of factors in different financial markets, and that even in one part of the market that influenced expected security returns. Nevertheless, both the capital Asset Pricing Model (CAPM) and the Arbitrage Pricing theory (APT) treat the systematic risk of securities as invariant in the end, also, they expose theoretical and empirical evidence that the rate of return of a security changes over time. Furthermore, theoretical investigations relate variability in expected rate of

return to intertemporal varieties in firm specific variables. Among the benefits of employing the APT while contrasted to other similar methods such as the Capital Asset Pricing Model, the Gordon Valuation model etc., it gives a better entire account of return. Elton and Gruber (1999) stated that the APT gives a better justification for return than any other market proxies model. Good amount of literatures examine across several stock markets and over a variety of various time horizons between rate of return of portfolio in stock exchange markets and a variety of accounting variables. Existing financial economic theory supplies a number of models that provide a framework for the study of this relationship. One process is to synthetically generate the factors from the sample data itself employing factor analysis and employing the factor loading, or by principle components analysis. This process is helpful for concluding the number of applicable risk factors for determining the numerical stock return. Nevertheless, the method by employing factor analysis or principle components have a disagreeable condition which makes them complicate to construe. We refer to this as the Principle Components Analysis or PCA. Another method along the lines of Fama and French (1992) also uses specified factors as variables.

However, they use firm variables such as size (market value of equity), book-to-market equity, price earning ratio and leverage. It's known as

Financial Variable Model (FVM). One of benefit for using FVM is the firm factors are used directly in explaining expected returns. We refer to this as the Accounting variable model or FVM.

Since Iran inception in 1979, the world has imposed economic and financial sanctions on Iran. According to Alikhani, (2000), the sanctions have some economic success by causing damage to the Iranian economy and make it economy very volatile. The literatures have typically found that the company stock reacts negatively to the announcement of sanctions (Griffin et.al, 2004) and (Sabetfar et.al, 2011) with effects that persist for several months. Given established theories in finance and economic, the suggestion of firm-specific distinctiveness and to handle their perceived prospect firm valuation, a variety of strategic policies (e.g. capital structure and dividend policy) can be developed by policymakers. Therefore, stock prices are affected by firm specific variables. To the best of our knowledge, this is the first research that tests the APT in Tehran stock market with accounting ratios concurrently in full *sharia* economy under sanctions. This study tried to find the relevant factors that priced stock market returns. This study provides a test of the APT for Iranian stock market with respect to several accounting variables that could affect stocks risk in Tehran stock market as the Iranian largest capital market. The findings will contribute on the verification of the theory in different economic settings. The researchers tried to find whether the sanction affects accounting information of companies in TSE and how the securities react to of sanctions. The paper is organized as follows: Section two summarizes the evidence on APT; Section three explains the data and methodology; Section four presents the findings; and Section five concludes the paper.

2.0 Literature review

There are volumous tests done on the APT using US stock data. For example, Chen (1983), Dhrymes, Friend, and Gultekin (1984, 1985), Gehr (1975), and Roll and Ross (1980). They find that there are three to four factors priced in the US stock market. Hughes (1982) and Lam (1988) test the Canadian stock market and find that three to four factors significantly explain stock returns. Antoniou, Garrett, and Priestley (1998) investigate the UK stock market and find that three factors are priced. Similar to other tests, the empirical evidences from the APT tests suggest that there is more than one factor explaining returns in stock market. All the above studies use macroeconomic variable models

Anecdotal evidence from the financial press indicates that investors generally believe that monetary policy and changes in firm variables have also a large influence on returns and the volatility of the market's portfolio returns. Changes in the variables can influence investors' investment decision and motivates many researchers to investigate the risk and portfolio return. It is often argued that portfolio returns are affected by some fundamental firm-specific variables (FVM) such as size (market value of equity), book-to-market equity, price-to-earning ratio and leverage and the change in each, could affect the demand of stock which later translate to the return and risk of securities.

Chan et al. (1991) and Daniel, Titman, and Wei (1997) find that book-to-market equity can explain the cross-sectional variation of stock returns in the Japanese market. Chui and Wei (1998) examine the relationship between expected stock returns and, book-to-market equity, and size in five Pacific Basin emerging markets. They find that the relationship between average stock return and β is weak for all five markets. But the book-to-market equity can explain the cross-sectional variation of expected returns in Hong Kong, Korea, and Malaysia, while the size effect is significant in all five markets except Taiwan. Barry et al. (2002) investigate the robustness of size and B/M effects across 35 emerging equity markets over the 1985–2000 periods. They document a strong positive relationship between B/M and average stock returns and a negative relationship between firm size and average stock returns. Charitou and Constantinidis (2004), employing Japanese data over the period 1992–2001, performed empirically the Fama and French three factor model of stock returns. In particular, it investigates whether the behavior of stock prices, reflects the behavior of earnings, with regard to size (market equity, ME) and book-to-market equity (BE/ME), employing earnings to book-to-market equity (EI/BE) as a productivity measure. In addition, it investigates whether stock prices predict the decline of earnings growth experienced after firms are ranked on size and BE/ME, employing earnings to market equity (EI/ME) as growth measure. The main aim of the research is to offer facts that would supply to the attempt of describing the three factor model (3FM) in a country that varies considerably from the US not only in connection with its financial reporting system but also as it concerns to its economic characteristics. Their results expose a significant relationship between market, size and book-to-market equity factors and expected stock returns in the Japanese market. Furthermore, in agreement with rational pricing they note that BE/ME is a strong indicator of profitability when estimated

by EI/BE for all stocks excluding in the case of small low-BE/ME stocks. Big low-BE/ME stocks indicate strong earnings and high-BE/ME stocks indicate constant poor earnings, while small low-BE/ME stocks indicate the lowest earnings of all. Moreover, profitability (EI/BE) is demonstrated to concern size. To control for BE/ME, small stocks are inclined to have lower earnings on book equity than do big stocks. In addition, there is facts for all the portfolios of stocks that there is a size factor in fundamentals (EI/BE) that causes a size related risk factor in returns. In conclusion, in agreement with Lakonishok, Shleifer and Vishny (1994) they note facts that stock prices do not predict the reversion of earnings growth observed after firms are ranked on size and BE/ME.

Wang and Lorio (2007) by employing an expansion of the Fama and MacBeth(1973) cross-sectional regression model, studies the association between stock returns and (i) a local beta, (ii) two global betas, and (iii) some firm-specific features in the Chinese A-share market. The conclusions of the analysis propose that neither the conditional local beta nor the global betas has a significant connection with stock returns in A-shares. Their results designate that firm factors, like the book-to-market ratio and firm size, are significant in describing stock returns. Nevertheless, the size effect is responsive to the condition of the model. In conclusion, the consequences of sub-period tests designate that the A-share market did not become progressively more combined with either the world stock markets or the Hong Kong stock market over the period 1995–2002. Rutledge, Zhang and Karim (2008) study the connection between firm size and excess stock returns in the Chinese stock markets, and to scrutinize this outcome in both a bull and bear market. They contrast the stock returns of small and large companies during both bull and bear markets. The sample contains adjusted closing prices, daily opening prices, total market value, closing prices, trading volume, market value of tradable shares and rate of return with cash separated reinvested on all Shanghai and Shenzhen A-shares from January 1998 through December 2003. Comparable to previous study, the whole sample is separated into two sub periods, 1998–2000 (724 trading days) and 2001–2003 (718 trading days). The division of the two sub periods corroborates the change in the general main market trends for Chinese stocks. They employ Fama and French (1992) methodology for measuring. The consequences of the research designate that a size effect exists in the Chinese stock markets over the 6-year period from 1998 to 2003. They conclude small companies have significantly greater surplus returns than large companies. In addition, small companies

are found to have a stronger response to the direction of the market than large companies. During the bull market small companies have significantly greater positive excess returns than large companies. Nevertheless, small companies have significantly greater negative returns (using total market value), or no significant distinction in returns (using float market value) during the bear market period.

In Iran, Rahmani, (2006) designed at examining the connection between accounting variables and market variables and the stock return on the source of pooled cross-sectional data of a seven year period of 1997-2003 affecting the multi-variable model in Tehran stock exchange market. The model established statistically significant with respect to (β), S/P and the Size (Market Value). Single variable model was concerned to test hypotheses. In no year was there a significant relationship between D/E and the Stock Return, whereas the relationship between the Size, E/P, S/P and the Stock Return established steadier contrasted to other variables. Similar results were examined during four years between the above variables and the Stock Return. The relationship between (β), BV/MV and the Stock Return was significant in three years, even if the results were discrete. The expectedness of single variable models, which registered 16.3% under the best situation regarding the relationship between E/P and the Stock Return in 1997, estimated less than that of multi-variable model. The effectiveness of the yearly multi-variable models estimated greater than that of multi-yearly cross-sectional models: one possible reason for this being the changes in macro situation affecting Iranian economy. In addition, because of the volatility in the relationship between each one of the variables and the debt, one should not put great stress on some variables. The items placed on the financial statements containing Sale, Book Value, Equity and Earning may partially forecast the Stock Return. Such results may be vindicated on the source of Behavioral Finance Theories. Beginner investors may influence the prices in the emerging markets and consequently variations in the Stock Return may partially be attributed to the behavior of such investors.

3.0 Methodology and Data Analysis

The Iranian Calendar based on Hegri Shamsi that the beginning of the year is in the 20th March and ended on 19th March of the year which firms should have activities based on this calendar in TSE. The analysis period in this study, covers 21 years from 20th March 1991 to 19th March in 2010. This is so far the most comprehensive test of APT in this market. As a result of the availability of smaller stocks on the main board of the TSE in the earlier years, the

number of stocks in the sample was consequently limited. The stocks chosen in this research are taken randomly from main Board of TSE. Nevertheless, there are 80 stocks chosen, 20 stocks were removed because of the incomplete information. A total of 60 stocks were selected in the period.

In the above section, it was shown that different methodologies and research designs have been used to test APT in different markets. This study tests the APT using factor analysis with principal component analysis and Canonical Correlation Analysis (CCA). The stock price data for this study are the yearly returns on stocks on the main board of the TSE. The returns are calculated using month-end prices, i.e., $R_t = (P_t - P_{t-1}) / P_{t-1}$, where R_t is the return per period t for the period being computed, P_t is the price of the stock at the end of the period t , and P_{t-1} is the price of the stock at the end of the period $t-1$. The returns are adjusted for dividends, bonus issues, rights issues and stock splits.

One of the main aims of this study is to examine the effectiveness of financial (accounting) variables in assessment of returns and risk of Iranian firms in TSE. Data on all accounting figures are collected from the database of financial statements and balance sheets of the TSE firms published on the official web site of the TSE. Data on yearly accounting variables are obtained from databases in the TSE. Several firm specific accounting figures are required for the analysis to complete in this study.

The financial figures contain data from individual firms' balance sheets [Size, Price-to-Earning ratio, Book-to-Market ratio, financial leverage, Operating leverage, sale-to-price ratio, Return on equity (ROE) and Return on Asset (ROA)] as will be obtained in the annual financial statements reported to the TSE. For the measurement period that begins at March 20th of year $t+1$, data listed above are achieved from the annual financial statements of year t . Market value of equity is estimated as the number of shares outstanding times the stock price as of the commencement of the return measurement period, i.e. March 20th. Necessary accounting data span a period from 20th March 1998 to 19th March 2011. Three criteria are practical in stock selection. First, a stock should not have negative book equity at the fiscal year-end that falls in year $t-1$ (Fama and French, 1995). Second, to render activity in trading of the stocks, any stock without a trading record for more than four consecutive months during the twelve-month period preceding March of year t is disregarded (Chui and Wei, 1998). The procedure to test the APT is as follows: First, factor analysis with Principal Component Analysis (PCA) was applied to determine the individual securities and portfolios factor loadings estimates to explain the cross-

sectional variation of individual securities estimated returns. Second, cross-sectional regressions were run to determine the number of priced factors to measure the size and statistical significant of risk premium associated with the estimated factors from the common factors extracted in the first stage. This procedure repeated for individual securities for full period and two sub-periods separately. In the first stage, the principal component factor analysis procedure will describe the return in the following way:

Table1. Descriptive statistics of firm variables and returns

	Mean	Standard deviation	Max	Min
Size	24.86	.93147	25.97	23.49
Price-to-Earning ratio	6.84	6.7	34.20	3.09
Book-to-Market ratio	3.25	2.3	23.49	7.95
Financial leverage	3.09	0.96	5.13	2.17
Operating leverage	43761.91	39658.145	156116.51	3532.3
Sale-to-price ratio	37584591395.77	44228898845.08	129674000000	1.75
Return on equity (ROE)	152.75	72.78	353.57	31.79
Return on Asset (ROA)	14.61	8.61	23.64	-0.94
Stock returns	38.36	46.85	166.65	-11.8

$$R_{it} = b_{i1}PC_1 + b_{i2}PC_2 + b_{i3}PC_3 + \dots + b_{ik}PC_k \quad (1)$$

Where, R_{it} = is individual securities return; b_{ik} = is known as factor loadings, which can be used to represent the sensitivity of the security again the asset i 's returns to the movements in the common factors; PC_k = is the principal component scores of asset i . To test general hypothesis in this study is to identify b 's are priced in the arbitrage pricing relationship. Thus, in this study, the b 's will be used to test the pricing of risky factors. This traditional test using the APT is usually undertaken by implementing a cross-sectional regression procedure used in Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) methodology in the following way:

$$E(R_{it}) = \lambda_0 + \sum_{k=1}^k \lambda_k b_{ik} \quad (2)$$

If APT is valid, at least one number of priced factors must be statistically significant. This study utilized the *p*- values to determine the significance of the individual risk premia and vector of risk premia respectively.

4.0 Results and Discussions

This section discusses the findings.

4.1 Descriptive statistics

The descriptive statistics of the [Size, Price-to- Earning ratio, Book- to- Market ratio, financial leverage, Operating leverage, sale-to-price ratio, Return on equity (ROE) and Return on Asset (ROA)] are presented at Table1. According to this table sale to price ratio has highest mean and standard deviation and financial leverage has lowest mean and standard deviation between accounting variables. Also the mean of 17 years returns is 38.36 and standard deviation is 46.85 that seem high. Maximum digit related to returns is 166.65 and the lowest is negative 11.85.

4.2 Results of Factor analysis of accounting information

In the step the principal component factor analysis (PCA) is used to identify Iranian individual securities accounting variables that represent the Iranian stocks that can explain equity returns on the TSE. Eight accounting ratios that covered a wide spread of the process of firms were analyzed. The overall results from the principal component analysis shows the eight accounting ratios were grouped into three factors for the period respectively. The three factors explained 96% of variance of accounting information. In the period the first factor explained highest variance of stocks. The most important factors are operating leverage, sale to price ratio, and size in the 21-year full period. It means that operating leverage of stocks ratio can explain most of the variation of accounting information in balance sheets. This finding supported by various studies like chen et.al,(1991) and Chui and Wei (1998). SeeTable2.

Table2. Identification of the Accounting ratios Grouped by the Factor Loadings

FACTORS	VARIABLES
Factor1	Sale to Price ratio (0.90) Operating leverage(0.89)
Factor2	Size(0.96) Financial leverage(0.85) Book to Market ratio(0.63) Price to earnings ratio(0.89)
Factor3	ROA(0.60) ROE (0.59)
Factor Scores in parentheses.	

The result of sample of 60 firms for the 1991-2010 is presented in Table 3. The Kaiser-Meyer-Olkin test (KMO) value is 0.60 and the Bartlett's test of sphericity was significant at above the 0.00 percent acceptance level. The analysis identified 12 factors based on the identification criterion that the eigenvalue for factor selection must exceed 1 for the period. The sixty individual securities explained more than 96 percent of variance in the returns in the all periods.

4.2 Results of Factor analysis and Cross-Sectional Regression

Since some of accounting ratios like size, P/E, leverage and BE/ME are measured precisely for individual stocks, there is no reason to smear the information in these variables by using portfolios in the different methods. Most previous tests are used portfolios because estimates of market Beta (*bs*) are more precise for portfolios. Our approach is not to estimate *bs* for portfolios and then assign a portfolio's *b* to each stock in the portfolio. Then allow us to use individual securities in this study. The result of sample of 60 firms for the 1991-2010 is presented in Table 3. The Kaiser-Meyer-Olkin test (KMO) value was 0.60 and the Bartlett's test of sphericity was significant at above the 98 percent acceptance level. The analysis identified 12 factors based on the identification criterion that the eigenvalue for factor selection must exceed 1 for the period. The sixty individual securities explained more than 96 percent of variance in the returns in the all periods. These findings are consistent with findings in other markets: e.g. a UK study, Garrett and Priestley (1997), Rahmani and Sheri (2006) and Sabetfar et.al, (2011).

In the next step, the cross sectional regression with generalized linear model (GLM) of the mean stock returns indicated that the factors are jointly significant as evidenced by an *F*-value, which is well above the acceptance level of 1 percent. On an individual factor basis, 12 were found to significantly affect the prices: the *t*-values ranged from 1.38 to 57.73, all above the critical value for one percent level of significance for the sample. The financial sanction variable is significant at one percent level but economical sanction not significant in the sample. Both type of sanctions had a negative impact on stocks listed on the TSE. The opposing signs of market reactions in Iran suggest that Iranian investors were acting as close substitutes. The adjusted *R*-squared value was high from 0.99 percent.

Table3. Factor analysis and Cross-Sectional Regression of Average Returns against Factor Scores Coefficients

Total Variance Explained	96%
No. of Common Factors	12
No. of the Priced Factors	12
λ_1	28.6*** (58.3)
λ_2	27.2*** (62.2)
λ_3	16.9*** (40.2)
λ_4	8.5*** (18.8)
λ_5	7.08*** (15.5)
λ_6	6.6*** (11.5)
λ_7	2.5*** (6.2)
λ_8	5.1*** (10.9)
λ_9	2.6*** (6.4)
λ_{10}	4.1*** (8.6)
λ_{11}	3.5*** (9.4)
λ_{12}	1.4*** (3.6)
d_{Financial}	-5.9*** (-3.4)
d_{Economical}	-0.6 (-0.5)
LR SATATISTIC	14782.7
Sig. LR	0.00***
KMO	0.60

Note: N=No. of Factors from factor analysis;
Z - Values in bracket.

Only priced factors at 1% , 5% and 10% significant level are shown.

*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

4.3 Results of Canonical correlation to determine the risk factors in the Periods

The Canonical Correlation Analysis showed the relationship between Iranian stock market returns and accounting variables. Interpretation of the two significant canonical variates from loading are based on 0.3000 and above of canonical variates. Both the direction of correlation in the loadings matrices and the direction of scales of measurements are considered when interpreting the canonical variates (Tabachnik and Fidell, 1996). The tenth canonical variate formed the stock market returns are the most successful linear combination of the security to predict the first canonical variate formed from the accounting variables. Findings summarized in Table

3 demonstrate that, the factor structure of the accounting ratios in the full period is the second and first factor composed Book to market ratio, financial leverage, size, operating leverage and sale to price ratio. It means that there are two risk factors related to stock returns. This finding is supported by the other findings like Antoniou, Garrett, and Priestley (1998). They investigated the UK stock market and find that three factors are priced. Similar to other tests, the empirical evidences from the APT tests suggest that there is more than one factor explaining returns in stock market. Like the other studies, this paper also found that book to market ratio, financial leverage and size are the most important risk factors in TSE for firms. The results illustrates that the value of standardized variance of the principal component scores of stock market returns explained by their own canonical variate and the opposite of canonical variate (redundancy) are increased by reducing the number of samples in most of the cases in the period. However, these results are not supported in the standardized variance of the principal component scores of accounting ratios (Table 4).

Table4. Canonical Correlation Analysis in the Period

	Stock Market Returns		
	FSMR	Shared Variance	Redundancy
Full Period (1991-2010)	FSMR10	12%	3.6
	FSMR10	1	5.2
			5.2
Accounting variables			
FACCOUNT	Shared variance	Redundancy	
FACCOUNT2	66%	4.9%	
FACCOUNT1	33%	7%	

5.0 CONCLUSIONS

The time period chosen for this study aims to test the empirical applicability over as wide as possible time frame. Sixty stocks are available for the testing period 1991-2010. The factor model makes the unrealistic assumption of factor sensitivity and risk premia stationary over the long test period. On first step, by employing the Principal Component Analysis (PCA), we are able consider to identifying eight accounting ratio as well as the number of common factors in the asset rate of returns. These tests may have imperfections if the estimation of the factor sensitivities in the first part regression is done with error. On second step, cross- sectional

generalized least square regression analysis test is performed to determine the number of priced factors to measure the size and statistical significant of risk premia associated with the estimated factors from the common factors extracted in the first stage. CCA was employed to identify the risk factors. The results show that strong validity applicability of APT in Iran over the study period. This can be seen in the results of the factor analysis which generally found one to two factors being priced over the period. The results suggest that maximum 96% of variance was explained by the factors. The 4% of variance is remained without any explanation. This research found out that the eight variables were used did explaining the excess returns of the samples and all of them were not affected stock market returns. Due to the financial and economical sanctions the investment decision in Iran is complicated because the risks are difficult to evaluate and often non-quantifiable. The country risk is large; transactions are subject to considerable financial scrutiny. Notwithstanding, the above limitations, it is felt the data, research design and methodology employs are appropriate and sufficient to investigation the empirical applicability of the APT for the Tehran Stock Exchange Market. The slopes and intercept for the PCA for three groups of variables are measured and tested for significance from zero using t and F -test. The R-square and adjusted R-square values are obtained. The significance macroeconomic, accounting and combine variables which explain the expected returns are also identified.

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Appendix

Following the 1979 Islamic revolution, Iranian economy has implemented full *sharia* rule that all of financial institution must use Sharia law and they practiced non Riba (interest based) activity. Iran is an Islamic state with an economic system that, like exact Islamic economy (CIA Fact book, 2002). Exact Islamic economics can refer to the application of Islamic law (*Sharia*) to economic activity either where Islamic rule is in force (Chapra, 1993). In Islamic economy, all the sector in economy must active based on Islamic low. In Iran economy where interest bearing loans are prohibited and risks and profit sharing is encouraged. In this economy that all of financial institution should works based on Sharia law and the uses of interest rate activity are forbidden, the existence of a well functioning Stock Exchange is very important. It would allow for the mobilization of savings for investment and provide means for liquidity to individual shareholders. To achieve Islamic functions of Tehran Stock Exchange, it is necessary that companies issue only one type of share, i.e. a share which carries profit as a compensation for investment and risk taking. No interest-bearing bonds are to be transacted on the Stock Exchange of the Iranian Islamic economy. This study investigates the behavior of security prices on Tehran Stock Exchange (TSE), which is work under Full *sharia* economy.