

TESTING THE WEAK-FORM MARKET EFFICIENCY: THE CASE OF AMMAN STOCK EXCHANGE

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Abstract— The study aims to empirically investigate the weak-form market efficiency of Amman Stock Exchange (ASE) as an emerging financial market in the Middle East region. The time series methodology is thoroughly employed to test whether past indices returns can predict future returns. Annual data over the 1980-2015 of the seven indices of ASE were used. The Augmented Dickey-Fuller test (ADF), serial correlation, and Phillip-Perron (P-P) as parametric tests were applied. The results suggest that the ASE is inefficient at the weak-form level as the indices exhibited autocorrelation and stationary behaviour. Besides, result of the regression model of stock indices doesn't support the random walk model.

Keywords— Efficient market hypothesis, weak-form market efficiency, random walk model, serial correlation, runs test, Augmented Ducky Fuller (ADF) test, Amman Stock Exchange (ASE).

I. INTRODUCTION

The implication of the efficient market theory (EMT) is that prices have no memory, and yesterday has nothing to do with tomorrow. It follows that an accurate study of the history of a given stock price is, for a profit-seeking investor, useless (Maital et al., 1986). The MET was born when two types of research, theoretical and empirical, highlighted the same idea. Empirically, Granger and Morgenstern (1963), and Fama (1965) have explained that the stock movements are random. Simultaneously, Samuelson (1965) and Mandelbrot (1966) suggested that if information-gathering is cheap, buying and selling are costless, and everyone interprets information in the same way, then changes in prices of stocks behave as random walks.

In the financial market, the substantial value of a share is equivalently measured by the discounted value of future cash flow that investors will earn. In weak form efficient market, prices of the shares instantly and fully reflect all information of the past prices. This means future price movements cannot be predicted by using past prices. It is simply to say that past data on stock prices are of no use in predicting future stock price changes. In this kind of market, investors should simply use (a buy-and-hold) strategy, and there is no way to make extra profit. The random walk theory is the best-tested and verified theory to evaluate the efficiency of the weak-form financial market. Random walk emphasizes that there is no pattern to stock price changes. Particularly, past stock price changes don't enable one to predict future price changes. If the financial market is efficient, stock prices must reflect all available information which is relevant for the evaluation of a company's future performance, and therefore the market price of stocks must be equal to its inveterate value.

When stock markets are efficient, the prices of stocks at any time should fully reflect all available

information such as, inflation, money supply, and interest rate. MET was introduced by the pioneer Malkiel and Fama, (1970). Besides, Fama (1990) introduced three hypotheses to classify the world's market efficiency:

1. The weak form of stock efficiency: According to this form, stock market value is determined depending on historical information, so the stock prices were assumed to reflect all market information in the past. This hypothesis confirms that changes in stock price in the future are independent of the changes that happened in the past (random walk of prices). Therefore, the investor cannot earn an abnormal income on his trading based on past price movements. Evidence of inefficiencies was found based on the findings of Dicle and Levendis (2010) and weak-form efficiency in the stock markets of the Gulf Cooperation Council examined by Bley (2011); Segot and Lucey (2008); and Abdmoula (2010).

2. The semi-strong form hypothesis: According to this form, stock market value is determined depending not only on historical information, but also on all information investors can get or predictions derived from these information. The stock prices under this hypothesis could reflect all public information such as, announcement information by firms, economic and political news and events. Initial responses may be true or false. That is why investors should wait to make sure it is true, and then they could earn abnormal returns by utilizing the relevant information.

3. The strong form hypothesis: Strong form suggests that stock price fully reflects all the information. The investor should obtain it quickly with no cost. This applies to all investors at the same time. Some information may be historical or it can be available of a certain category. The main feature of this hypothesis, that abnormal return cannot be realized unless the insiders are performing the buying process of stocks that targets priors to others. They are discouraged from utilizing this information because it

is illegal, not because the market is strong-form efficiency.

The Equation (1) can be used to represent the efficient markets (Shiller, 2003).

$$P_t = f_t P^*_{t-1} \quad (1)$$

Where, P_t is information at time t ; f_t is a mathematical conditional expectation of public information available at time t . This model emphasizes that any unexpected trend in the stock market must have at its origin some new information about the original value of P^*_{t-1} (see Equation (2)).

$$P^*_{t-1} = P_{t-1} + e_t \quad (2)$$

Where, e_t is a forecast error and it must be uncorrelated with any information variable available at time t . Otherwise the forecast would not be optimal and it would not be taking into account all information.

And then, the question that arises now what is the significance of the market efficiency hypothesis? The answer implies that the fundamental paradigm of economics, as a discipline, is rational economic behavior. Therefore, if the market is efficient, stock prices behave in a purely rational manner. In an inefficient market, important pricing behaviors may be the result of emotional or psychological behavior (Madura, 2009). If the market shows a sign of being inefficient, economic theories of stock pricing such as, CAPM may become weak in interpreting what is observed in the financial markets. In case of efficient markets, it would have already incorporated all the current and expected changes in macroeconomic variables. So, there is no causal relationship between change in macroeconomic variables and SPI. Furthermore, stocks are priced on the basis of an analysis of all available information; each one has an expected rate

of return consistent with its risk level and the CAPM. Viewed from the perspective of the total information set, the risk and return relationship is perfectly clean. According to the CAPM structure of stock prices, the market is pricing efficiently (Haugen, 2001).

In contrast, the situation is different in inefficient markets where relevant information is publicly available. Therefore, non clean relationship between the estimated risk and the expected return exists. Jordan's financial market is an example of an inefficient market, which is considered as a weak form efficiency type (e.g., Abdmoulah, 2010; Smith, 2007; Maghayreh and Omet, 2002; Hassan et al., 2003).

This study is important for different parties like policy makers, domestic and foreign investors, corporations and government. However, the importance of this study stems from the reason that efficient market reflects all information made available for traders (investors) at any given time. Also, the efficient market hypothesis support that

market is able to pricing the financial assets based on the updated information available thus; there are no undervalued or overvalued assets.

The rest of the paper is organized as follows: The next section sheds light on Jordanian financial market (ASE). Section 3 reviews the related literature. Section 4 explores the methodology and research design. Section 5 illustrates the data analysis and results; the study conclusion is presented in section 6. The study's ended with policy implications in section 7.

II. AN OVERVIEW OF AMMAN STOCK EXCHANGE

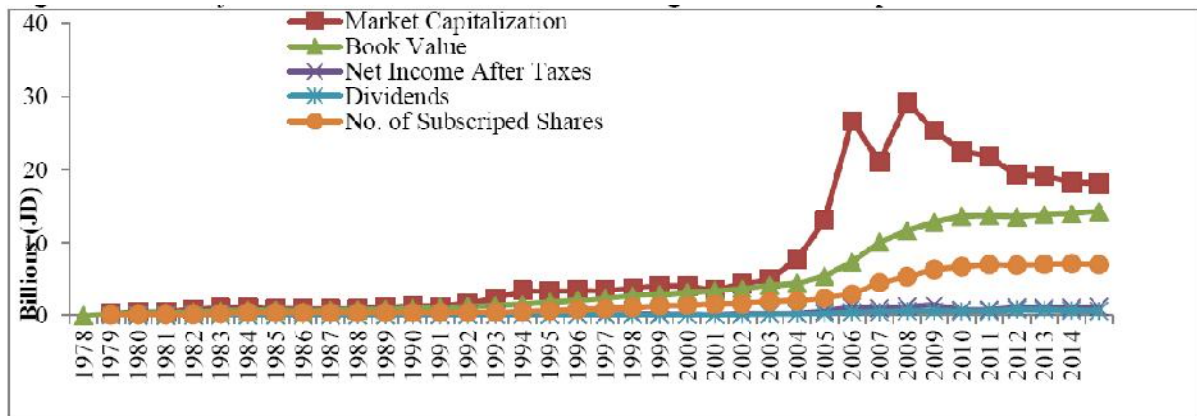
Long before the establishment of the Jordanian capital market in the late 1970's, shares of some publicly held companies were traded over-the-counter in an irregular market. Corporate bond were also begin traded as early as 1960's. It was in the mid of 70's when the main development in the Jordanian capital market occurred. In 1976, the increase in economic importance of stock markets and in order to collect national saving, ensure quick and easy trading, and protect small investors, the government in association with the International Finance Corporation of the World Bank, Amman Financial Market (AFM) was established in 1978. During the 1980's and early 1990's the market grew in an unbalanced way, and by the mid of 1990's it was necessary that a further restructure of the market was required to increase its size and liquidity.

The ASE was established in March 1999 as a non-profit, private institution with administrative and financial autonomy. It is authorized to function as an exchange for the trading of securities. The exchange is governed by a seven-member board of directors. A chief executive officer oversees day-to-day responsibilities and reports to the board. The ASE membership is comprised of Jordan's 65 brokerage firms. The ASE is committed to the principles of fairness, transparency, efficiency, and liquidity. The exchange seeks to provide a strong and secure environment for its listed securities while protecting and guaranteeing the rights of its investors. To provide this transparent and efficient market, the ASE has implemented internationally recognized directives regarding market divisions and listing criteria. To comply with international standards and best practices, the ASE works closely with the JSC on surveillance matters and maintains strong relationships with other exchanges, associations, and international organizations. The exchange is an active member of the Union of Arab Stock Exchanges, Federation of Euro-Asian Stock

Exchanges (FEAS), a full member of the World Federation of Exchanges (WFE), and an affiliate member of the International Organization for Securities Commissions (IOSCO).

236 companies traded on ASE until the end of 2014. The performance of ASE in the years 2009 and 2010 was exceptional. The trading value of ASE that ended the trading transactions for 2010 was JD6.7 billion compared to JD9.7 billion for 2009. The ASE price index weighted by free float shares closed at 2374 points in 2010 with a decrease of 6.3% when compared with the closing of shares that stood at 2534 points and 2758 points at the end of 2009 and 2008 respectively. However, non-Jordanian ownership as a percentage of market capitalization of the ASE rose to 49.6% at the end of the 2010, compared with 48.9% at the end of the 2009, and 49.2% at the end of 2008.

The number of traded shares witnessed an increase during 2010 reaching 7 billion shares, traded through 1.9 million transactions, compared with 6 billion shares traded during 2009 through 3 million transactions. The share turnover ratio also increased to reach 102.2% during the period 2010, compared with 91.3% during the period 2009. Figure (1) shows the major financial indicators of the ASE since its inception in 1978 until 2014 including the market capitalization, book value, net income, dividends, and number of subscribed shares (Bekhet and Matar, 2012).

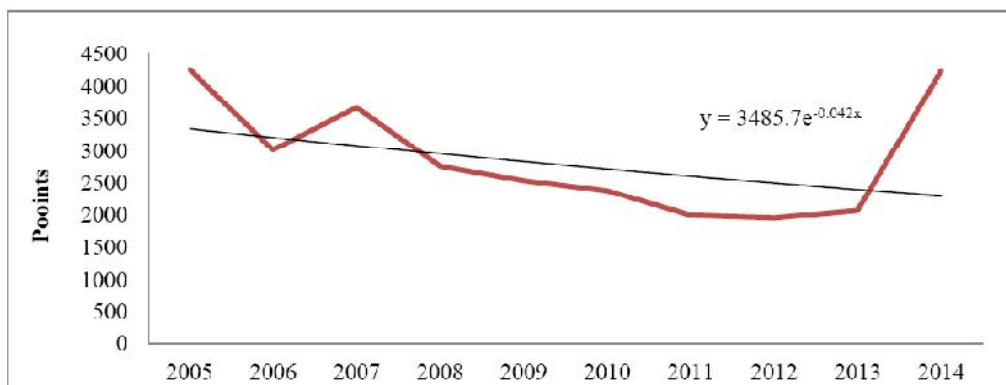


Source: ASE (2015), Major financial indicators for the ASE for the 1978-2014 period.

Figure 1: The major financial indicators of ASE during the 1978-2014 period.

Figure 2 reveals that the growth rate of ASE price index weighted by free float is 4.2 percent during the 2005-2014 period, it shows also a decrease from 2758 points to 2534 points at the end of 2008, with the number of traded shares increasing during the period in 2009. One of the features of Free Float Index is to

give better reflection for the changes of stocks prices in the market by not being biased to the companies that have large market capitalization. This provides diversification in the index sample by giving better chances to small and medium companies to reflect the index (<http://www.ase.com.jo/>).



Source: ASE (2015), Key Statistics of the ASE available on <http://www.ase.com.jo/>

Figure 2: ASE general free float weighted price index.

III. RELATED LITERATURE

Several studies have examined the weak form of market efficiency hypothesis (see, Dezelan, 2000, Cheung and Coutts 2001, Hajek, 2002; Buguk and Brorsen, 2003; Appiah-kusi and Menyah, 2003).

Most of these studies are based on the testing the random walk hypothesis.

Al-Ashikh, (2012) examined the weak form market efficiency of the Kingdom Saudi Arabia stock exchange. The linear serial dependence result indicated that Saudi stock market found to be

inefficient at the weak level. Mahmoud and Hussein Ali, (2011) tested the random walk theory in Jordan by using the runs test and serial correlation. The results indicated that past returns behavior are inconsistent with the random walk and the ASE is inefficient market.

Urrutia, (1995) investigated the hypothesis if the Latin American emerging market prices follow a random walk by employing monthly data during the December 1975- March 1991 period for Brazil, Argentina, Mexico, and Chili. The results suggested that domestic investors might not be able to develop trading strategies that would allow them to earn excess returns.

Alkhatib and Kharasheh, (2014) investigated the weak-form market efficiency of Palestine Exchange (PEX) by using the serial correlation, run, and the ADF tests. as parametric tests. Their results suggested that the PEX market is inefficient at the weak-form level as the indices exhibited autocorrelation and stationary behavior.

Guermezi and Boussaada, (2016) investigated the weak form of market efficiency hypothesis. They applied GARCH (1, 1) and EGARCH (1,1) on the Tunisian Stock Exchange during the July 2012 to June 2013 priod. The results suggested that the Tunisian stock market, in particular the banking sector would not show characteristics of market efficiency.

Ṭiṭan, A. G. (2015) examined the empirical research on efficient market hypothesis. The result indicates that testing for market efficiency is difficult and there is a high possibility that, because of changes in economic and market conditions. As a reasons, it is important to continue the empirical studies to determine if equity markets are informational efficient or not.

Suleman et al., (2010) tested the weak-form market efficiency of the stock market returns of Japan, Hong Kong, Singapore, Malaysia, Pakistan, India, China, Korea, Sri Lanka, China, Indonesia, Taiwan, Philippine, Australia and Thailand. They employed Ljung-Box Q-statistic Test, Unit Root and Autocorrelation tests on monthly observations for the January 2004-December 2009 period. The results concluded that the monthly prices do not follow random walks in all the countries of the Asian-Pacific region. The investors can take the stream of benefits through arbitrage process from profitable opportunities across these markets.

Kashif, Syed, Muhammad, and Rana, (2010) investigated the stock market efficiency of 14 Asian countries. They analysed the random walk theory by employing the unit root, variance ratio, and autocorrelation tests. The results suggested a non-stationary and non-randomness returns. Furthermore, the monthly prices don't follow a random walk and thus the stock market in each country is inefficient at the weak-form and investors can get benefit from arbitrage opportunities.

By using the ADF and P-P tests Hazim and Min, (2008) examined the weak efficient form market UAE. Their result concluded that the UAE capital market meets the criterion of weak form efficiency as the market data includes a unit root. Besides, Abdmoulaḥ, (2010) found the same result of exhibiting a weak-efficient form of 11 Arabic financial markets by applying the GARCH-M model.

Using data from 56 markets, Griffin et.al, (2009) examined the market efficiency theory across both developing and developed countries through a comprehensive analysis. The results suggested efficiency tests can yield misleading inferences because they do not control for the information environment. Moreover, short- term reversal, post-earnings drift, and momentum strategies earn similar profits in developing and developed markets. Portfolio-level variance ratios and market delay measures show greater deviations from efficiency in developed markets and firm-level variance ratios are similar across developed and developing markets.

The question here is whether ASE resembles weak-efficient market or not? This question was not clearly answered by previous studies since its emerging market. The study is trying to answer this question using different methodologies and tool. Thus, we add value to the existing literature by investing a new market that had not thoroughly been investigated much before; the study also use similar and different tools and methodologies that past research did not use.

The main objective of this study is to examine whether the ASE follows a random walk or investors can use technical analysis to gain abnormal returns.

H₀: market returns exhibit random walk feature over the time period of the study.

H₁: market returns don't exhibit random walk over the time period of the study.

IV. METHODOLOGY & RESEARCH DESIGN

Data used in this study are annual closing prices of market index during the 1980-2015, and then we included all companies that are traded during this period. The index is then transformed to natural logarithm to avoid hetroscedasticity problem and to get a continuous time series of compounded returns as: (Al-Qudah et al., 2004)

$$R_{i,t+1} = \log \frac{P_{i,t+1} + P_{i,t}}{P_{i,t}} \quad (3)$$

Where $R_{i,t+1}$ is the return on stock i in the month $t+1$; $P_{i,t+1}$ is the closing price of stock i of the month $t+1$; $P_{i,t}$ is the closing price of stock i in the month t ; n is the number of holding months of stock i .

The second test of serial which is a parametric test that measures the correlation coefficient between a series of returns and lagged returns in the same series. A significant positive serial correlation indicates that a trend exists in the series, while, a negative serial

correlation implies the existence of a reversal in price movements. A return series that is truly random will have a zero serial correlation coefficients.

Third: the Unit Root Tests: there are different types of unit root tests includes the following tests:

1. The Augmented Dickey–Fuller (ADF): the ADF test is derived from the Dicky–fuller test (DF). The actual procedure of implementing the DF test involves several decisions. In discussing the nature of the unit root process it is noted that a random walk process may have no drift, or it may have drift or it may have both deterministic trends. The DF test is estimated in three different forms under three different null hypotheses.

$$y_t \text{ is a random walk: } y_t = px_{t-1} + \varepsilon \quad (4)$$

$$y_t \text{ is a random walk with drift: } y_t = \beta_1 + px_{t-1} + \varepsilon_t \quad (5)$$

$$y_t \text{ is a random walk with drift and trend: } y_t = \beta_1 + \beta_2 t + px_{t-1} + \varepsilon_t \quad (6)$$

Where t is the time or trend variable. In each case, the H_0 is that $\rho = 0$; that is, there is a unit root and the time series is non-stationary. The H_1 is that $\rho < 0$; that is, the time series is stationary. If the null hypothesis is rejected, it means that y_t is a stationary time series with zero mean. The Augmented Dickey–Fuller (ADF) test, it was assumed in DF test that the error term was uncorrelated. But in case ε_t are correlated, the ADF test is preceding three equations by adding the lagged values of the dependent variable Δy_t estimating as in equation (7).

$$\Delta y_t = \beta_1 + \beta_2 t + \rho x_{t-1} + \sum_{i=1}^n \delta_i \Delta x_{t-i} + \varepsilon_t \quad (7)$$

In ADF we still test whether $\rho = 0$ and it is also tests the same asymptotic distribution as in the DF test, so the same critical values can be used.

2. P-P test: as previously noted that the assumption of the DF test states that the error terms ε_t are independently distributed. The ADF test adjusts the DF test to show possibility of serial correlation in the error terms by adding the lagged difference. Phillips and Perron (1988) used non-parametric methods to take care of the serial correlation in the error terms without adding lagged difference terms. P-P test estimates the y dependent variable as in equations (8) and (9).

$$\Delta y_t = \beta_1 + \lambda y_{t-1} + \varepsilon_{1t} \quad (8)$$

$$\Delta y_t = \beta_2 + \mu_t + \gamma y_{t-1} + \varepsilon_{2t} \quad (9)$$

Where β_1 and β_2 are constant terms; Δy_t denotes the first difference of y_t , t is the deterministic time trend; both ε_{1t} and ε_{2t} are residuals. In equation (8) the H_0 of unit root against the H_1 as follows: $H_0: \lambda=0$, and $\beta_1=0$ while $H_1: \lambda < 0$, and $\beta_1 \neq 0$. In equation (9) the H_0 of unit root against the H_1 as follows: $H_0: \gamma=0$, $\mu=0$, and $\beta_2 = 0$ while $H_1: \gamma < 0$, $\mu \neq 0$, and $\beta_2 \neq 0$. The

weakness of the ADF and P-P tests is their prospect confusion of structural breaks in the series as evidence of non-stationary. Thus, they may fail to reject the unit root hypothesis if underlying series have a structural break. Subsequently, for integrated of order one [I(1)] series, there may be a possibility that they are originally stationary around the structural break integrated of order zero [I(0)], but are wrong considered as I(1). Structural breaks occur in several time series for many reasons like wars, economic crisis, oil prices, and policy changes. Perron (1989) extends the Dickey–Fuller which shows that inability to allow structural break, results in a bias of non-rejection of a unit root null hypothesis (Chowdhury, 2012).

V. DATA ANALYSIS AND RESULTS

Table 1 shows the descriptive statistics of ASE market returns, namely general index (GI), Industry (I), Banks (B), Insurance (IN), and services (S). The results have shown that the industry index has the highest mean (7.940). By contrast, the banks index has the lowest mean of (7.110). The annual returns are positively skewed in all 5 indices for the period of 1980 to 2015 which implies that large positive returns (maximum extreme value) are larger than the higher negative returns (maximum extreme value). The kurtosis is positive for all indices. The general index is providing 7.59 return with 76.6% standard deviation. The insurance index is providing 7.21 with a standard deviation of 76.8%. The services index is providing 7.36 return with a risk level of 54.1%. Furthermore, results indicate that we can accept the H_0 of normality whereby the distributions for general index, banks, and services while we can reject it for the indices of industry and insurance due to the Jarque–Bera P-values.

Table 1: Descriptive statistics of the ASE market returns.

	General Index	Industry	Banks	Insurance	Services
Mean	7.590781	7.940189	7.110723	7.216758	7.362334
Median	7.397616	7.672660	7.080425	7.054749	7.187901
Maximum	9.010852	9.734595	8.114478	8.485021	8.906854
Minimum	6.584101	6.669752	6.438551	6.159518	6.554645
Std. Dev.	0.766284	0.960363	0.366485	0.768466	0.541280
Skewness	0.386739	0.380935	0.595781	0.357614	1.213566
Kurtosis	1.750435	1.661494	3.611739	1.800837	3.808993
Jarque-Bera Probability	3.239519 0.035926	3.558066 0.168801	2.691069 0.011568	2.924318 0.231735	9.818162 0.007379
Sum	273.2681	285.8468	255.9860	259.8033	265.0440
Sum Sq. Dev.	20.55169	32.28040	4.700902	20.66890	10.25442
Observations	36	36	36	36	36

Source: Output of E-Views package.

Moreover, the autocorrelation test is used to analyse the randomness of the returns and test the relationship between the times series and its own values at different time lags by employing Ljung-Box Q-statistics. If P-value < 0.05 of the Q-Statistics, and the null of the entire autocorrelation coefficients together = 0 may be rejected at 0.05 level of significance.

Thus, it is indicated that the historical returns can predict the future returns and this element implies that the weak-form of market efficiency does not hold.

Table 2: Q-statistic Autocorrelation Test.

Lags		1	2	3	4	5
<i>Indices</i>						
<i>General</i>	<i>AC</i>	0.874	0.811	0.685	0.563	0.452
	<i>Q-Stat</i>	29.833	56.305	75.761	89.299	98.328
	<i>Prob.</i>	0.000	0.000	0.000	0.000	0.000
<i>Industry</i>	<i>AC</i>	0.924	0.848	0.748	0.596	0.447
	<i>Q-Stat</i>	33.344	62.270	85.482	100.66	109.47
	<i>Prob.</i>	0.000	0.000	0.000	0.000	0.000
<i>Banks</i>	<i>AC</i>	0.846	0.771	0.631	0.516	0.422
	<i>Q-Stat</i>	27.977	51.863	68.356	79.748	87.601
	<i>Prob.</i>	0.000	0.000	0.000	0.000	0.000
<i>Insurance</i>	<i>AC</i>	0.743	0.611	0.382	0.240	0.024
	<i>Q-Stat</i>	21.600	36.638	42.695	45.167	45.191
	<i>Prob.</i>	0.000	0.000	0.000	0.000	0.000
<i>Services</i>	<i>AC</i>	0.726	0.562	0.309	0.120	-0.029
	<i>Q-Stat</i>	20.581	33.296	37.263	37.882	37.920
	<i>Prob.</i>	0.000	0.000	0.000	0.000	0.000

Source: Output of E.Views package.

Table 2 reveals the results of Q-statistic, the P-values indicates that the null hypothesis is rejected for all indices for all lags. Since all P-values are < 0.05 even when the series are lagged up to 5 lags, the market returns are not independently distributed and historical returns can predict the future return. As a

result, we conclude that ASE market is a weak form efficient. The further analysis requires that whether the time series is non-stationary or stationary. Table 3 shows the Augmented Dicky-Fuller and Phillip Perron tests of stationary for all variables, both in levels and in first-differences.

Table 3: ADF and PP Tests of Stationary.

<i>Variables</i>	<i>ADF-Level</i>	<i>P-value</i>	<i>Variables</i>	<i>ADF-1st Difference</i>	<i>P-value</i>	<i>Order of Integration</i>
<i>General</i>	-1.4208	0.5609	<i>General</i>	-7.6006***	0.0000	<i>I (1)</i>
<i>Industry</i>	1.3113	0.9980	<i>Industry</i>	-4.0569***	0.0041	<i>I (1)</i>
<i>Banks</i>	-1.5008	0.5215	<i>Banks</i>	-7.7106***	0.0000	<i>I (1)</i>
<i>Insurance</i>	-2.2337	0.1985	<i>Insurance</i>	-7.1908***	0.0000	<i>I (1)</i>
<i>Services</i>	-2.3033	0.1766	<i>Services</i>	-6.8867***	0.0000	<i>I (1)</i>
<i>Variables</i>	<i>PP-Level</i>	<i>P-value</i>	<i>Variables</i>	<i>PP-1st Difference</i>	<i>P-value</i>	<i>Order of Integration</i>
<i>General</i>	-1.3767	0.5823	<i>General</i>	-7.4217***	0.0000	<i>I (1)</i>
<i>Industry</i>	-1.2896	0.6234	<i>Industry</i>	-5.6958***	0.0000	<i>I (1)</i>
<i>Banks</i>	-1.4313	0.5558	<i>Banks</i>	-7.6565***	0.0000	<i>I (1)</i>
<i>Insurance</i>	-2.1680	0.2210	<i>Insurance</i>	-7.1908***	0.0000	<i>I (1)</i>
<i>Services</i>	-2.2699	0.1869	<i>Services</i>	-6.8867***	0.0000	<i>I (1)</i>

Note: ***, **, * denotes significant level of 1%, 5%, 10% respectively.

Source: output of E.Views

The results in Table 3 exist that we cannot reject the null hypothesis of unit roots for all variables in level forms. However, the null hypothesis is rejected when the ADF test applied to the first differences of each variable. This means that the all indices are stationary of order one $I(1)$. Thus, indices is non-stationary at order $I(0)$ and it becomes stationary for order $I(1)$ at 1% and 5 % level of significance. When the analysis is run by using P-P stationary test we got the same results approving the ADF results. The result of unit root test implies that the results of the indices do not follow the random walk hypothesis therefore the ASE is inefficient at the weak efficient form level.

CONCLUSION

This study has employed the ADF, P-P, and serial correlation approaches using annual time series data in ASE covering the 1980–2015 period. This paper is able to identify the weak form of market efficiency in the ASE. Jarque-Bera test is performed to verify the normal distribution of the data and visualized the skewness and kurtosis. The results reveal that the Jarque-Bera test rejects the hypothesis of a normal distribution for general, banks, and services indices. The J-B test accept the hypothesis of normal distribution only for industry and insurance indices.

Ljung-Box Q-Statistic for autocorrelation implies that the ASE is inefficient at the weak form efficient and strongly rejects the null hypothesis. Hence it is concluded that the investors may get the stream of arbitrage benefits due to the ASE market. The empirical results reveal strong evidence to reject the H_0 of unit roots in all series under investigation. Moreover the study found that the ASE market is inefficient at weak-form as supported by the results of time series previous tests. In addition, the findings of autocorrelation test revealed that return series are serially correlated as the p-value of the test is less than 5% which implies that future returns can be predicted from previous returns. These findings are in coincidence with the earlier results (e.g., Hajek, 2002; Suleman et al., 2010; Mahmoud and Hussein Ali 2011; Al-Ashikh, 2012; Alkhatib and Kharasheh, 2014; Guermezi and Boussaada, 2016).

VII. POLICY IMPLICATIONS

The equity market is the basis of a strong economy in any country. When the equity markets operate inefficiently it gives signals to investors to take essential actions. Jointly, when the equity market behaves efficiently when gives investors equally information, the economic growth is enhanced. The results of this paper have some implications to different groups, for government, policy makers, investors, and researchers. It is suggested that the ASE commission should develop techniques to disseminate official information to market traders. This policy may make stock price index reflect the situation of the economy at the right time. Furthermore, Investors and participants might get assistance from developed technological programs and high speed communication in the stock market quickly responds to economic activities and changing conditions therefore minimizing the impact of the herd behavior. The reduction of interest rates is needed to reduce the cost of funds to investors. That would contribute to the revival of the stock market, leading to higher demand for shares in the ASE, and finally increasing the GSI.

There is an inarguable need for the ASE to work on follow-up efforts for deepening of the market, increasing the efficiency and liquidity, and increasing cultural awareness among the citizens and the investment market. This should raise the level of consciousness on savings and investment, especially for the foreigners who have those particular interests. The study suggests to the policy makers in the Jordanian government to pay more attention to the selected macroeconomic variables that are playing a strong role in leading the economy and affecting the ASE. In addition, it advises to try to get benefit from the non-economic variables like Arab spring since the study results revealed its negative impact on the stock price index. The government can invest to get benefit from the troubled situation by creating a fertile

investment environment with tax free opportunities, giving more facilities to encourage FDI in Jordan.

REFERENCES

- [1] Abdmoulah. W 2010, 'Testing the evolving efficiency of Arab stock markets', *International review of Financial Analysis*, 17, 25-34.
- [2] Al-Ashikh. A 2012, 'Testing the weak form of efficient market hypothesis and the day- of- the- week effect in Saudi stock exchange', *International review of Business research papers*, 8, 27-54.
- [3] Alkhatib, Akram, and Murad Harasheh. "Market Efficiency: The Case of Palestine Exchange (PEX)." *World Journal of Social Sciences* 4, no. 1 (2014): 196-206.
- [4] Al-Qudah, K., Al-Khoury, R. & Ahmad, S. (2004). How Many Securities from a Well Diversified Portfolio in an Emerging Market (Developing Countries)? A Case Study of Amman Stock Exchange. *Dirasat, Administrative Sciences*, 31(1), 157-168.
- [5] Amman stock exchange, <http://www.ase.com.jo>. Accessed in August 2016. Appiah-Kusi, J., & Menyah, K. (2003). Return predictability in African stock markets. *Review of financial economics*, 12(3), 247-270.
- [6] Bekhet, H.A. & Matar, A.A., (2012). Risk-adjusted performance: a two-model approach application in Amman Stock Exchange. *International Journal of Business and Social Science*, 3(7), 34-45.
- [7] Bley, J. (2011). Are GCC Stock Markets Predictable?. *Emerging Markets Review*, 12, 217-237. Buguk, C., & Brorsen, B. W. (2003). Testing weak-form market efficiency: Evidence from the Istanbul Stock Exchange. *International Review of Financial Analysis*, 12(5), 579-590. Cheung, K. C., & Andrew Coutts, J. (2001). A note on weak form market efficiency in security prices: Evidence from the Hong Kong stock exchange. *Applied Economics Letters*, 8(6), 407-410.
- [8] Chowdhury, K. (2012). Modelling the dynamics, structural breaks and the determinants of the real exchange rate of Australia. *Journal of International Financial Markets, Institutions and Money*, 22, 343-358. Dezelan, S. (2000). Efficiency of the Slovenian equity market. *Economic and Business Review (for Central and South-Eastern Europe)*, 2(1), 61-83.
- [9] Dicle, M. & Levendis, J. (2011). Greek market efficiency and its international integration. *Journal of International Financial Markets, Institutions and Money*, 21(2), 229-246.
- [10] Fama, F. (1965), The Behavior of Stock Market Prices, *Journal of Business*, 38, 34-105. Granger, C. W., & Morgenstern, O. (1963). SPECTRAL ANALYSIS OF NEW YORK STOCK MARKET PRICES. *Kyklos*, 16(1), 1-27.
- [11] Griffin, J, Kelly, J and Nardaric, F 2009, 'Are Emerging Markets More Profitable? Implications for Comparing Weak and Semi-Strong Form Efficiency', available on the following link, www.ssrn.com, SSRN-id1489646, pp 1-12, Accessed on 20 June, 2016.
- [12] GUERMEZI, F. S., & BOUSSAADA, A. (2016). THE WEAK FORM OF INFORMATIONAL EFFICIENCY: CASE OF TUNISIAN BANKING SECTOR. *Ecoforum Journal*, 5(1). Hájek, Jan. "Weak-form efficiency test in the czech equity market." *Politická ekonomie* 2002, no. 3 (2002).
- [13] Hassan, K.M., Al-Sultan, W.S. & Al-Saleem, J.A. (2003). Stock market efficiency in the gulf cooperation council countries (GCC): The case of Kuwait stock exchange. *Scientific Journal of Administrative Development*, 1(1), 1-21.
- [14] Haugen, R. (2001). *Modern Investment Theory* (5th ed.). New Jersey: Prentice- Hall, Inc.
- [15] Hazim. M, and Min B 2008, 'Efficiency in emerging markets- Evidence from the Emirates securities markets',

- European Journal of Economics, Finance and Administrative Sciences. 12, 143-149.
- [16] Madura, J. (2009). *Financial Markets and institutions* (9th ed.) USA: south western college publishing.
- [17] Maghyereh, A. & Omet, G. (2002). Financial liberalization and stock market efficiency: empirical evidence from an emerging market. *African Finance Journal*, 4(2), 24-35.
- [18] Mahmoud, J and Hussien, Z 2011, 'Testing the weak form efficiency of Amman stock exchange', *International research journal of Finance and Economics*, 65, 93-97.
- [19] Maital, S., Filer, R. & Simon, J., 1986. What do people bring to the stock market (besides money)?, *Handbook of Behavioral Economics*, 273-307. Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, 25(2), 383-417. Mandelbrot, B. (1966). Forecasts of future prices, unbiased markets, and "martingale" models. *The Journal of Business*, 39(1), 242-255.
- [20] Perron, P. (1989). The Great Crash, the Oil Price Shock, and the Unit Root hypothesis. *Econometrica: Journal of the Econometric Society*, 1361-1401. Samuelson, P. A. (1965). Proof that properly anticipated prices fluctuate randomly.
- [21] Segot, T.L. & Lucey, B.M. (2008). Efficiency in emerging markets—Evidence from the MENA region. *International Financial Markets, Institutions and Money*, 18, 94–105.
- [22] Shiller, R. (2003). From Efficient Markets Theory to Behavioral Finance. *Journal of Economic Perspectives*, 17(1), 83-104.
- [23] Smith, G. (2007). Random walks in Middle Eastern stock markets. *Applied Financial Economics*, 17(7), 587-596.
- [24] Suleman, M. T., Hamid, K., Ali Shah, S. Z., Akkash, I., & Shahid, R. (2010). Testing the weak form of efficient market hypothesis: Empirical evidence from Asia-Pacific Markets. *International Research Journal of Finance and Economics*, (58), 121.
- [25] Tıtan, A. G. (2015). The Efficient Market Hypothesis: Review of Specialized Literature and Empirical Research. *Procedia Economics and Finance*, 32, 442-449. Urrutia, J. L. (1995). Tests of random walk and market efficiency for Latin American emerging equity markets. *Journal of financial research*, 18(3), 299-309.

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