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Article · March 2014

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World Journal of Social Sciences
Vol. 4. No. 1. March 2014 Issue. Pp. 196 – 206

Market Efficiency: The Case of Palestine Exchange (PEX)

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The study aims to empirically examine the weak-form market efficiency of Palestine Exchange (PEX) as a developing financial market in the Middle East region. The random walk theory is thoroughly investigated to test whether past indices returns can predict future returns. Observations of past returns of the seven indices of the Palestinian stock market are the key input for the empirical data analysis. The study employs the serial correlation and the Augmented Dickey-Fuller test (ADF) as parametric tests. The runs test is also used as a non-parametric test. Results of the parametric tests are consistent with the alternative hypothesis that the stock market is inefficient at the weak-form level as the indices exhibited autocorrelation and stationary behavior. Meanwhile, results of the runs test also supports the inefficiency of the market as the major index found to be following a pattern rather than a random walk. Finally, result of the regression analysis of stock indices doesn't support the random walk model.

Field of Research: Financial market efficiency

Keywords: Efficient market hypothesis, weak-form market efficiency, random walk model, serial correlation, runs test, Augmented Ducky Fuller (ADF) test, and PEX

1. Introduction

The efficient markets hypothesis (EMH), popularly known as the Random Walk Theory, states that current stock prices fully reflect all available information about the value of the firm, and there is no way to earn excess profits by using this information. It deals with one of the most fundamental and exciting issues in finance – why prices change in securities markets and how these changes take place. It has very important implications for investors as well as for financial managers. The concept of "efficient market" was first investigated in 1965 in a paper by Fama who said that in an efficient market, *on the average, competition will cause the full effects of new information on intrinsic values to be reflected "instantaneously" in actual prices.*

Investors require compensation for the postponement of current consumption as they put their money into a stock market. A market in which prices always fully reflect available information is called "efficient" (Fama, 1970). In an efficient market an investor gets what he pays for and there are no profit opportunities available to professional money managers or experienced investors. The market genuinely "knows best," and the prices of securities traded are equal to the values of the dividends which these securities pay, also known as fundamental values. (Fama, 1970a, 1972b, 1991c), and (Fama & French, 1992d).

In the stock market, the intrinsic value of a share is equivalently measured by the discounted value of future cash flow that investors will earn. If the stock market is

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efficient, equity prices must reflect all available information which is relevant for the evaluation of a company's future performance, and therefore the market price of share must be equal to its inherent value. 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 excess profit. The random walk theory is the best-tested and best-verified theory to assess the efficiency of a stock market at the weak-form. Random walk asserts that there is no pattern to stock price changes. In particular, past stock price changes don't enable one to predict future price changes.

The result of this research is quite consistent with the previous research conducted on similar developing and emerging markets like Palestine that ended up with the inefficiency of such markets. The result is also consistent with a similar study conducted on 14 Asian countries including Palestine that rejected the random walk properties of those markets. However, the studies were different in the employed methodologies and statistical tools. *Conversely it contradicts some studies showing that there is no difference between emerging and developed markets in terms of efficiency measures.*

In Palestine, the Palestine Exchange (PEX) was founded in 1995. Empirical studies relied on trading data of the PEX market are very rare. As a result, this study serves to bridge a gap in literature and provides a reliable background for further future investigations regarding the Palestinian Economy in general and its financial sector in particular.

Therefore our statement of problem is to examine the PEX as developed stock market that operates in the Middle East region. This market has been in action for roughly fifteen years as the market conducted its first trading in 1997. The PEX pertains several characteristics that make it worth exploring, such as a market cap of 2.7 billion dollars and a trading volume of 184 million shares in 2011. Throughout this empirical study, we try to answer the following relevant question: Does the Palestine Stock Exchange resemble the weak-form efficient market?

The paper is organized as follows; related literature about weak form market efficiency is presented in section 2. Relevant studies regarding emerging and Arab stock markets are also summarized in section 2. Section 3 is about the methodology, research design, and statistical tests accompanied with the results are presented in section 4. They study ended with concluded remarks in section 5, and implications in section 6.

2. Related Literature

Stock market efficiency implies that stock prices respond instantly and accurately to relevant information. As information arrives randomly, stock prices must also behave or fluctuate unpredictably. The efficient market hypothesis follows three levels:

1- Weak form market efficiency: at this level, all historical data pertaining past stock returns are reflected in the price of stock. Thus, one can’t use time series analysis to predict future stock performance. This is the scope of this empirical study.

2- Semi-strong market efficiency: asserts that all public information such as accounting data found in a company's annual report is reflected in the current stock price.
3- Strong market efficiency: implies that all public and inside private information are reflected in the current stock price.

Most of the studies on EMH are conducted on the world's largest stock markets. In recent years, efficiency in emerging markets has been investigated widely. Few studies target countries from the Middle East region, most of them concentrated on return predictability and markets integration and linkages. In addition, most of these studies are usually focused on their individual or a small set of countries for a short horizon.

Emerging markets are typically characterized by low liquidity, thin trading, and possibly less well informed investors with access to unreliable information and considerable volatility. Therefore, in the context of Middle East region, one would expect the inefficiency and illiquidity of the local capital markets to raise a firm's marginal cost of capital, when it forced to raise capital locally. Little is known about stock price behavior in these economies. It is well known that infrequent trading can affect the results of empirical studies on efficiency by introducing serious bias into the results of empirical work. (Bashar, 2006).

One study undertaken by (Kashif, Syed, Muhammad, and Rana 2010) examined the stock market efficiency of 14 Asian stock markets including China and Japan. The authors used the autocorrelation, Runs test, Unit root test and the Variance ratio test to analyze the random walk model. Serial correlation was detected in their analysis and results of runs test support the non-randomness of the series. Further, the unit root test revealed that return series are non-stationary. Their study concluded that monthly prices don't follow a random walk and therefore the stock market in each country is inefficient at the weak-level and investors can benefit from arbitrage opportunities.

Another research regarding the Arab stock market efficiency was conducted as a PhD thesis by *(Abu Zaror* 2006), in his paper titled "the efficiency of Arab stock markets", the author concluded that random walk properties were rejected for nine Arab stock markets including PEX. Results obtained from regression analysis, variance ratio, runs tests, and serial correlation tests rejected the randomness and independence of returns. Moreover, the author indicated that prices responded non-linearly to the arrival of new information. This was the first study to give insight into the PEX inefficiency using different models. The Palestinian economy and the stock market have must have been improved since 2006. And hence comes the significance to conduct an up-to-date study to test whether the PEX still inefficient and to propose recommendations to better address the PEX market efficiency.

(Hazim and Min 2008) investigated the weak form market efficiency of United Arab Emirates. The authors applied the Augmented Dickey Fuller test and the Phillips-Perron unit root test. They found that the Emirates equity market meets the criterion of weak form efficiency as the market data contains a unit root. (Abdmoulah 2010) focused on the efficiency of 11 Arabic equity markets. In the analysis, the author tried to answer the question whether the Arab equity markets become more efficient during the last decade thanks to organizational improvements. Using the GARCH-M model, the author concluded that all markets showed high sensitivity and exhibited weak-form inefficient.

Moreover, (Al-Ashikh 2012) studied the weak form market efficiency of the Saudi stock exchange as one of the largest stock market in the Middle East. The author employed the autocorrelation along with the runs test and found that returns exhibit linear serial dependence. Thus, Saudi stock market found to be inefficient at the weak level. (Mahmoud and Hussein Ali 2011) analyzed the random walk theory in Amman stock exchange using the serial correlation and the runs test. Their results implied that past returns behavior are inconsistent with the random walk and the Amman stock market is inefficient.

On the other hand the conventional wisdom is that emerging markets are less efficient than developed markets. Highly profitable trading strategies and prices which deviate from a random walk are often what people have in mind when describing the evidence. For example, in a recent speech that describes the Chinese stock market as inefficient; Burton Malkiel states that "there is considerable serial correlation. The markets are nowhere near a random walk." A considerable paper done by (Griffin et.al 2009) in which they investigated this common perception across both developed and emerging markets through a comprehensive analysis of profits from trading strategies, efficiency measures, and impediments to efficient pricing, such as transaction costs. The paper provides new insight into differences in stock, portfolio, and country-level efficiency measures around the world but also points to the limitations of standard notions and measures of stock market efficiency. Using data from 56 markets, they find that short-term reversal, post-earnings drift, and momentum strategies earn similar profits in emerging 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 emerging and developed markets. Conceptually, they show that efficiency tests can yield misleading inferences because they do not control for the information environment. Their evidence corrects misperceptions that emerging markets feature larger trading profits and higher return autocorrelation, highlights crucial limitations of weak and semi-strong form efficiency measures, and points to the importance of measuring informational aspects of efficiency.

Our question here is whether Palestine Stock Exchange resembles weak-efficient market or not? This question was not clearly answered by previous studies since it's a newly established market, and almost no studies were conducted on the Palestinian market. Our objective here is trying to answer this question using different methodologies and tool. Therefore we add value to current body of literature by investing a new market that had not thoroughly been investigated before; we also use similar and different tools and methodologies that past research did not use.

As aforesaid, most studies about weak market efficiency in emerging and Arab stock markets supported the inefficiency of these markets. This study comes to add a relevant analysis of EMH in PEX to the exciting inquiries.

2.1 Palestine Exchange (PEX) at a Glance

The Palestine Exchange (PEX), in Nablus, was incorporated as a private shareholding company in early 1995. By August 1996 the Exchange was fully operational, and on November 7th of that year the PEX signed an operating agreement with the Palestine National Authority, allowing for the licensing and qualification of brokerage firms to take place. On February 18, 1997, the PEX conducted its first trading session. In 2010, PEX was converted into a public shareholding company. This transformation was

accompanied by the launch of its new corporate Identity, bearing the trade name "Palestine exchange" and the slogan "Palestine for opportunities".

Since its inception, PEX has sought to utilize the latest financial market technology as well as to keep up with the latest laws and regulations to ensure a market with utmost transparency, integrity and investor protection. By July 30, 2012, 48 companies with a total market value of US$ 2.8 billion were listed on the Palestine exchange. These encompassed five economic sectors: banking and financial services, Insurance, Investment, Industry and Services. Half of the listed companies trade in Jordanian dinars, while the other half trade in US dollars. At present only ordinary shares are traded but there remains the possibility and readiness for trading other securities in the future.

Alquds Index is the main index in PEX that includes 15 companies out of 46 companies. Those 15 companies alone represent 83 percent of total market capitalization. Also, PEX has five sub-sectors indices which are: banking and financial services, Insurance, Investment, Industry and Services index.

Table 1: Palestine stock market key statistical figues

Period	No. of Trading sessions	Market Cap (US$)	Volume (Shares)	Value (US$)	Revenue (US$)
2010	249	2.4 billion	230 million	451 million	2.8 million
2011	248	2.7 billion	184 million	365 million	2.9 million
Change	-0.40%	13.57%	-19%	-18.9%	2.6%

** Source: Palestine exchange annual report, 2011*

The above table shows the shallow trading at PEX that contributes to the lack of liquidity, and almost 50% of listed companies are illiquid.

2.2 Hypothesis

Our goal in this study is to check whether the stock market follows a random pattern or investors can rely on technical analysis to beat the market and achieve abnormal returns.

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

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

3. Methodology and Research Design

3.1 Data Sample

Data used in this study are daily closing values of market indices from the time period each index was established (as shown in table 1 below) till 31/10/2012, we start from the Al-Quds index that began in 1998, then we included the industry indices that started in 2006, we were not able to use prior data because the year 1998 is the starting point of the index, and also to track the largest number of observations that gives more rigor to the study, we also wanted to start from the beginning of the index to show a comparability between Al-Quds index and the other indices that started later in terms of size and number of companies that may affect efficiency.

Daily closing values are retrieved from the Palestine exchange website. Each index return is then transformed to natural logarithm to get a continuous time series of compounded returns as:

$$R_t = \text{Log}\ (P_t/P_{t-t})*100$$

Where R_t is the return of the index at time t, P_t is the current index value, and P_{t-1} is the previous day index value. This model is the common model used to test the behavioral of market returns to test the efficiency of the stock market.

3.2 Random Walk Model Tests

We intended to use the tests described below because they were used by previous research to test the weak-form efficiency, so they statistically valid. Moreover we added the ADF test because many past research on developing market lack this test.

First: Serial correlation (or autocorrelation) test 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 implies that a trend exists in the series, whereas, a negative serial correlation indicates the existence of a reversal in price movements. A return series that is truly random will have a zero serial correlation coefficients.

Second: Runs test is a non-parametric test in which the number of sequences of consecutive positive and negative returns, or runs, is tabulated and compared against its sampling distribution under the random walk hypothesis. Further, the runs test determines whether successive price changes are independent. Unlike its parametric equivalent the serial correlation test, the runs test does not require returns to be normally distributed.

Third: Augmented Dickey-Fuller unit root is a parametric test applied to check the presence of unit root in the time series of past returns. Particularly, the test is used to look for non-stationary in the return time series. Random walk model requires stock returns to be non-stationary; i.e. unit root feature must exist in the series to supports the efficiency of the weak form. When indices returns are stationary, they are inconsistent with the efficient market hypothesis which shows the presence of profitable arbitrage opportunities. (Chien and Jun 2010).

Fourth: Regression analysis is a statistical process used to estimate the relationship between a dependent variable and independent variable(s). For testing the random walk model, the dependent variable is today's index value and the independent variable is previous index value giving a constant term α as follows:

$$R_t = \alpha + \alpha_1 R_{t-1} + \varepsilon_t$$

For the random walk to hold true under the above regression model, the null hypothesis states that the constant term α and the predicted value α_1 must be insignificantly different from zero.

4. Data Analysis and Results

Table 2: Summary statistics of Palestine security exchange daily index returns

Index	Al-Quds	General	Banking	Industry	Service	Investment	Insurance
Period	Jan.1998 -Oct.2012	Jan.2003- Oct.2012	Jan.2006- Oct.2012	Jan.2006 - Oct.2012	Jan.2006- Oct.2012	Jan.2006 - Oct.2012	Jan.2006- Oct.2012
Mean	2.000	1.999	2.000	1.999	1.999	1.999	1.999
Max	2.079	1.997	2.020	2.028	2.093	2.021	2.021
Min	1.950	1.86	1.980	1.909	1.909	1.977	1.978
Std.Dev	0.006	0.007	0.004	0.004	0.007	0.007	0.005
Observations	3086	2316	1671	1671	1671	1671	1671

4.1 Testing the Random Walk Hypothesis Using the Serial Correlation Test

Table 3: Serial correlation test results for daily returns for each index

Variable (Index)		1 lag	2 lags	3 lags	4 lags
Alquds	Coefficient P-value	0.255 0.000	0.051 0.000	0.050 0.000	-0.020 0.000
General	Coefficient P-value	0.162 0.000	-0.093 0.000	-0.062 0.000	-0.033 0.000
Banking	Coefficient P-value	0.231 0.000	0.061 0.000	-0.037 0.000	-0.029 0.000
Industry	Coefficient P-value	0.095 0.000	-0.030 0.000	-0.022 0.000	-0.044 0.000
Service	Coefficient P-value	0.138 0.000	-0.019 0.000	-0.033 0.000	-0.039 0.000
Investment	Coefficient P-value	0.190 0.000	-0.016 0.000	-0.024 0.000	-0.043 0.000
Insurance	Coefficient P-value	0.048 0.000	-0.017 ***0.114***	-0.015 ***0.118***	-0.010 ***0.123***

The autocorrelation is used to test the relationship between the times series and its own values at different time lags. In running the test using SPSS 17, we look for the absence of statistical significance in autocorrelation which implies the randomness of the return series. According to table 2 above, we find that all indices have P-values of less than 5%. Even when the series are lagged, the returns still exhibit a non-random behavior except for the Insurance sector. As the coefficients in lag 2 are less than their lag 1 counterparts, this means that the market needs more time to absorb and reflect the information on the index value. As a result, we conclude that historical returns can be analyzed to predict future returns as long as the p-value still significant; the evidence is consistent with (Al-Ashikh 2012) used the same method on Saudi Stock Market to reject the null hypothesis stating that PEX is efficient at the weak form and the PEX resembles the behavior of an inefficient market.

4.2 Testing the Random Walk Hypothesis Using the Runs Test

Table 4: Runs test results for daily index returns of each index

Variable (Index)	T-value	Cases< TV	Cases >= TV	Total cases	# of runs	Z-stat	Sig
Alquds	2.0001	1703	1384	3087	1364	-5.9	0.000
General	1.9997	313	2003	2316	375	-14.8	0.000
Banking	2.0000	816	855	1671	803	-1.6	0.16
Industry	1.9998	834	837	1671	818	-1.9	0. 35
Service	1.9998	837	834	1671	830	-1.3	0.75
Investment	1.9999	852	819	1671	815	-1.03	0.33
Insurance	1.9999	722	949	1671	831	-1.46	0.62

When performing the run test using SPSS 17, we search whether succeeding price returns are autonomous to each other as it appears under the random walk null hypothesis. If there is no effect of preceding returns on following returns, then the observations are independent and follow a random walk. Consulting table 3 above, we find that the P-value of only two indices (Alquds and General index) is less than 0.05. And the five other indices follow a random walk. Nonetheless, as the main index which represents 83% of the market cap (Alquds index) found to be non-random, we conclude that the results of the runs test support the alternative hypothesis that the stock market is inefficient at the weak form. The indices of sectors that show a proof of the random walk may have correlation among of return of the stock in each index that may have affected the result. The results of the run test are also consistent with (Ali 2011) on Amman Stock Market.

4.3 Testing the Random Walk Using Augmented Dickey-Fuller Unit Root (ADF)

Table 5: Results of ADF test for Palestine Exchange indices

Variable (Index name)	ADF t-stat	Prob	Test Critical Values		
			1%	5%	10%
AlQuds	-42.17	0.00000	-3.43	-2.86	-2.56
General	-35.21	0.00000	-3.44	-2.86	-2.55
Banking	-32.09	0.00000	-3.34	-2.76	-2.52
Industry	-37.94	0.00000	-3.43	-2.86	-2.56
Service	-26.14	0.00000	-3.43	-2.86	-2.56
Investment	-33.77	0.00000	-3.43	-2.86	-2.56
Insurance	-38.33	0.00000	-3.43	-2.86	-2.56

In conducting the ADF test using E-views, our main goal is to find whether a unit root and a non-stationary process exist in the past return series. Non-stationary in the return series is a necessary condition for the random walk to hold true. Table 4 shows that the null hypothesis that return series have unit roots is clearly rejected as the ADF t-stats are more negative than the corresponding critical values. The ADF findings are inconsistent with the random walk theory and thus the stock market is inefficient at the weak form.

4.4 Testing the Random Walk Using Regression Analysis

Table 6: Results of regression analysis for Palestine Exchange indices

$R_t = \alpha + \alpha_1 R_{t-1} + \varepsilon_t$

Variable (Index name)	Terms	Coefficient	Std.error	t-value	P-value
AlQuds	α α_1	0.0807 0.9923	0.367 0.000	2.193 1304.3	0.0283 0.0000
General	α α_1	57.918 0.4206	1.3734 0.0137	42.16 30.61	0.0000 0.0000
Banking	α α_1	51.821 0.4812	1.3742 0.0137	37.61 34.95	0.0000 0.0000
Industry	α α_1	90.345 0.0966	2.436 0.024	37.08 3.955	0.0000 0.0000
Service	α α_1	86.158 0.1383	2.424 0.024	35.53 5.693	0.0000 0.0000
Investment	α α_1	80.904 0.1902	2.397 0.023	33.74 7.933	0.0000 0.0000
Insurance	α α_1	101.213 0.0125	1.055 0.010	95.88 1.192	0.0000 0.0000

The least square regression used in the above model provides estimate for the constant α, and the independent variable coefficient α1. The dependent variable is the current index value while the independent variable is the previous index value return. For the random walk to be justified under the regression model, the null hypothesis states that the constant and the coefficient term α1 must be insignificantly different from zero. Nevertheless, the P-values of all the indices in the table above suggest that both the constant and the coefficient terms are significantly different from zero, meaning that today's value return can be predicted using regression analysis.

5. Conclusions

To recap, this empirical study examined the efficiency of the Palestinian equity market and found that the market is inefficient at weak-form as supported by the results of parametric and non-parametric tests. The three tests used in this paper are the serial correlation test (a parametric test), the Runs test (a non-parametric test) and the Augmented Dickey-Fuller unit root (parametric test). The sample of the study consists of daily time series closing value returns of the seven indices in PEX. Autocorrelation test revealed that return series are serially correlated as the p-value of the test is less than 5%. Results of the runs test also showed that future returns can be predicted from previous returns for the main index and the general index only. The other five sub-sector indices showed randomness. Augmented Dickey fuller test (ADF) assumed that there exists a unit root in the returns series. On the contrary, Results of the ADF test implied that unit root doesn't not hold in the time series, which means that the indices are stationary and doesn't exhibit randomness. The final test of the random walk is the regression analysis that requires the constant α and the coefficient α1 to be insignificantly different from zero in order for the random walk to exist. The regression results of all indices revealed that both the constant α and the coefficient α1 are significantly different from zero, indicating non-randomness of the indices. At the end, our findings support the previous research conducted on similar regional markets like

Jordan and Saudi Arabia concluding that these markets are inefficient, but contradicts the study of (Griffin et.al 2009) that there is no difference between developed and emerging markets in terms of efficiency measures, this contradiction can be due the fact that the Palestine market is a developing one rather than emerging.

This study is like any other empirical studies, not free of limitations, first it would have been better if we had larger time period to gather more observations, our main index was tracked since 1998 (since its initiation), and the other sub indices were traced since 2006. In addition our study used only three tests, results might have been different if we have used more or different tests, finally, there are 4 companies that comprise more than 80 of the market leading to some bias since also about 50% of companies are almost illiquid, furthermore we future studies should pay more attention to control the information environment.

6. Implications

The financial market in any country is the backbone of a strong economy. When the financial markets operates efficiently and treats investors equally, the economic prosperity is enhanced. At the same time, when the stock market behaves inefficiently, it gives signals to policymakers and investors to take necessary actions. The results of this research have some implications to different groups, for policy makers and investors. First, for policy makers in order to have a sound financial market, the market should resembles one of the forms of efficiency, which is the weak form efficiency this can be achieved by many things, first, Palestine is characterized by having high percentage of businesses formed as SME's that tend to have adequate invested capital. Such small and medium enterprises should be given facilities and encouraged to go public to increase the number of companies traded, this leads to more available choices for investors. Second, the regulators of the financial markets with collaboration with academic institutions have the duty to spread the financial and investing knowledge to the public. Third, attracting institutional investments, (especially foreign ones) help to improve diversity of investors' preferences, therefore minimizing the impact of the herd behavior. But we have to be aware of the concentration of ownership at the same time.

Some investors seek to make abnormal returns, since these markets are less efficient, they are considered a good opportunity for this kind of investors. On the other hand it is important for long term investor not to follow the herd in their investing behavior, and they should base their decisions on corporate and economic fundamentals.

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