

Testing for correlation and causality relationships between stock prices and macroeconomic variables

The case of Palestine Securities Exchange

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This study aims at investigating the correlation and causality relationships between stock prices in Palestine and some macroeconomic variables. Two methodologies were used in order to determine the relationships, first we used a regression analysis for ten years' worth of quarterly data (40 observations in total) for the studied variables, five macroeconomic variables were used as independent variables (GDP, inflation, exchange rate, Libor rate and balance of trade), and the quarterly stock market index returns were used as the dependant variable. Second, a unit root test was conducted on the studied variables in order to perform a Granger causality test to assess the causality relationship. The results of the regression analysis as a whole indicate a significant relationship between the macroeconomic variables used and stock prices. Nevertheless, some macroeconomic variables' coefficients (although having a significant relationship with stock prices) weren't consistent with the results of other researches. Moreover, the causality analysis negated any kind of causal relationships between each particular macroeconomic variable and stock prices.

Field: financial economics

1. Introduction

The relationship between the stock market and the economy has been studied extensively all over the world, some studies showed that there is in fact a relationship between stock returns and certain macroeconomic indicators, those studies were mostly conducted in developed economies, Fama and Schwert (1977), among many others, found a negative relationship between stock returns and inflation in the US market, But what about less developed economies? Some studies showed no relationship between the economies and the financial markets of less developed countries, like Asian markets, Fung and Lie (1990) explained this by saying that "macroeconomic factors can't be reliable indicators for stock market price movements in the Asian markets because of the inability of stock markets to fully capture information about the change in macroeconomic fundamentals".

Economists, researchers, policy makers and financial investors find the relationship between macroeconomic variables and stock prices very important to study for many

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reasons. First, it helps policy makers understand the full effect of prevailing and upcoming policies and regulations. Second, if investors were aware of this relationship and fully understood it then they will make more informed investment decisions thus reducing their exposure to risk. And third, knowing which force leads the other can help in reducing the shock factor because the public will be somewhat aware of what might happen in the economy or the financial market and thus will be able to take protective measures.

Most of these and other studies focused on two main points when investigating the relationship, first they focused on finding a relationship between the movements of the two variables, and secondly they focused on finding out which variable was leading the other, and results varied in this area, and the differences in the results depended on the level of development in the country studied but most importantly it depended on the economic variables being studied. Results showed that some macroeconomic variables lead stock returns, while others are lead by them.

Researchers were successful in finding a relationship between the different macroeconomic indicators and the financial market in countries like Lithuania (Pilinkus, 2009) , Brazil (Chatrath, 2002) , and Jordan (Maghayreh, 2003).The outcome of most studies suggests that – with minor degrees of variation- there is a relationship between fundamental macroeconomic variables and stock market returns. For example, there exists a positive relationship between stock returns and economic output (Foresti, 2006), as well as a negative relationship between inflation and stock returns (Hoguet, 2008). When it comes to the relationship between stock returns and exchange rate a lot of varying results appeared, for example (Smith, 1992) found a positive relationship between stock returns and exchange rates, while other studies found a negative relationship (Hennigar, 1998) .

Problem statement: This study looks into the relationship between five macroeconomic variables (inflation, GDP, exchange rate, balance of trade, and LIBOR) and stock prices in PEX.

Research objectives: First: it helps policy makers understand the full effect of prevailing and upcoming policies and regulations.

Second: if investors were aware and fully understood this relationship then they will make more informed investment decisions thus reducing their exposure to risk.

Third: knowing which force leads the other can help in reducing the shock factor because the public will be somewhat aware of what might happen in the economy or the financial market and thus will be able to take protective measures.

The structure of the study goes as follows, the first section provides an introduction on the subject, the second section discusses the findings of previous literature conducted on different markets over the world, the third section gives an overview of the Palestine securities exchange market (PEX), the fourth section defines the independent and dependent variables used in this study, then the fifth section discusses the methodology

of the study, the sixth section shows the results of the data analysis (correlation, Granger causality), the seventh section compares the findings of this study with those of previous studies, then finally the conclusions and recommendations are provided in the eighth and ninth sections.

2. Review of Literature

Numbers of studies have been conducted to examine the effects of macroeconomic variables on the stock markets of industrialized as well as developing economies. Regarding the relationship between economic output and stock prices all studies had unified results; stock returns lead economic output in a positive relationship. (Campbell , 1989) used the standard discounted cash flow model in his argument, this model states that
$$\text{Stock prices} = \sum_{j=1}^{\infty} \frac{\text{expected dividends } (t+j)}{(1+k)^j}$$
 where k is the discount rate ,when investors believe that expected dividends will grow then stock prices will increase. Expectations about future dividends reflect expectations about the economic condition in the future, so if the economy is expected to grow then future dividends are expected to grow as well, which means that there will be an increase in current stock prices, however investors don't always have right expectations so the stock market will sometimes mislead the economy.

On the other hand, inflation and stock prices are negatively correlated with causality running from inflation to stock prices. The proxy hypothesis by (Fama, 1981) explains that the negative relationship is indirect; this is because a direct positive relationship exists between stock prices and expected level of economic activity while a negative relation exists between the level of economic activity and inflation, and the result is a negative relationship between inflation and stock prices.

As for exchange rates and stock returns, economic theory suggests that foreign exchange changes can have an impact on stock prices by affecting cash flows and investment and profitability of firms , exchange rates can affect a firm's competitiveness through affecting input and output prices , so if a country's currency appreciates then exporters in this country will lose their competitive advantage in international markets , their sales and profits will decrease and therefore the stock price of the exporting firm will decrease as well. Importers, on the other hand, will benefit from a currency appreciation; their profits will increase as will their firm's stock price. so the movement of a currency's exchange rate has 2 simultaneous opposing effects on stock prices of domestic firms , it also affects stock prices of multinational firms by affecting the value of foreign operations and firm's profitability, (Kandir 2008).

Balance of trade has also been taken by many researchers to analyze its effects on stock exchange prices; however it is observed that it has no significant effects on stock exchange prices, for instance (Bhattacharya, 2002) found negative relationship between trade balance and stock exchange prices in India. (Ali et al, 2009). Additionally, (Uddin et al, 2009) found a negative relationship between interest rates and stock prices, this relationship is more significant in developed countries than in developing countries . (Nissim et al, 2003) also investigated the relationship between changes in interest rate

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and stock returns, the results support other researchers' in that a negative relationship exists between the two variables.

The global economic movements and local stock markets have become interdependent due to several factors such as increasing international diversification, cross-market return correlation and the gradual abolishment of capital inflow barriers and foreign exchange restrictions. These changes have increased the variety of investment opportunities as well as the volatility of exchange rates and the risk of investment decisions, (Frimpong, 2009).

At the same time, the more a market is unrelated to the global scene the less it is affected by global risk factors, this was evident in the latest financial crisis of 2008 where some markets were more affected than others, research implied that emerging stock markets are more segmented from the global financial market, this leads to the fact that local risk factors are the primary source of equity variations in these markets rather than global risk factors, Kutty (2010).

The economic theory, in explaining this interrelationship, suggests that stock prices should reflect expectations about futures corporate performance. Corporate profits on the other hand generally may reflect the level of country's economic activities. Thus, if stock prices accurately reflect the underlying fundamentals, then the stock prices should be employed as leading indicators of future economic activity. However, if economic activities reflect the movement of stock prices, the results then should be the opposite, i.e economic activities should lead stock price. Therefore, the causal relations and dynamics interactions among economics factors and stock prices are important in the formulation of nation's macroeconomic policy, (Mahmood & Dinniah, 2009).

3. Overview of the Palestinian Stock Market

The Palestine exchange (PEX) – formerly known as PSE- holds the securities of 41 listed public companies divided into 5 sectors (industrial, insurance, banking, services and investment). The services sector in general (insurance, banking, telecommunications and other services) contributes for more than 80% of the total market capitalization in Palestine (around \$2.5 billion). 20 out of the 41 listed public companies in PEX are actively traded with an average daily trading volume of \$1.2 million. The above information constitutes for the low liquidity and the market inefficiency in Palestine exchange PEX.

4. Variable Definition

Al-Quds Index (QI) : is a market value weighted index composed of the shares of 12 listed companies from different sectors in the Palestine exchange , it gives the investor a general idea about the direction and performance of the market. It is computed by dividing the total market value of all listed companies in the market for the current period over the total market value of companies included in the index for the previous period. This index has been used in PEX since the trading session in 7/7/1997 where the

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closing prices in that session were used as a reference point. The 12 companies included in Al-Quds Index are:

- 1- Industrial sector: Golden Wheat Mills (GMC) and Birzeit Pharmaceutical Company (BPC).
- 2- Insurance sector: Ahleia Insurance Group (AIG).
- 3- Banking sector: Al Rafah Microfinance Bank (AMB), Bank of Palestine (BOP) and Arab Islamic Bank (AIB).
- 4- Service sector: Palestine electric (PEC), Palestine telecommunications (PALTEL) and The Palestinian Company for Distribution & Logistics Services_ (WASSEL).
- 5- Investment sector: Palestine development and investment (PADICO), Palestine industrial investment (PIIC) and Union construction and investment (UCI).

Al-Quds Index will be representing stock returns in this study

The macroeconomic variables studied are economic output (**GDP**), inflation rate (**INF**), balance of trade (**BOT**), Libor rate (**LIBOR**) and USD exchange rate in terms of Israeli shekels (**Ex**).

Economic output will be represented by gross domestic product (GDP) and inflation will be represented by the consumer price index (CPI).

The London inter-bank offer rate was used as a proxy for the interest rate due to the non-existence of a national Palestinian currency, in addition to the lack of available information on applied interest rates in Palestine. Moreover, the lending rates in Palestine depend on Libor rates (Lending rate = Libor + Margin+ Risk Premium), the margin (2.5%) and risk premium (2.5%) rates were constant over the period of the study, therefore the only variable in determining the interest rate is the Libor rate.

The use of the five independent variables in this study depended on three main factors, one, previous studies, after reviewing the literature we found that these variables seem to be more influencing than others, two, the availability of data for these variables in the Palestinian market and the nature of the Palestinian economy as a less developed economy, three, other variables were tested and omitted due to the multi-collinearity effect.

5. Methodology

As used in almost all previous researches, the following methodology was used in our paper, a quarterly representation of the studied variables is examined, this adds up to 42 observations ranging from the first quarter of 2000 (March 2000) to the second quarter of 2010 (June 2010). Monthly and quarterly data representations can be found in the appendix, the rationale behind using this time frame is that the PEX is a newly issued one (in 1997), and we wanted to have more reliable and more mature data for the market, quarterly data was used depends on the availability of the data and in order to have reliable number of observations for the regression analysis.

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The following tests will be conducted on the used time series:

- 1- Causation Test: In order to find out which variable causes the other and can be used in forecasting it a Granger Causality Test will be run.
 Granger Causality Test: in 1969, Clive Granger proposed a technique that helps in determining causality between two time series and whether one time series is useful in forecasting another.
 A unit root test was performed on the sets of data to examine their stationarity, after the data sets were proved to be non-stationary a bi-directional Granger causality test was performed on the sets of data to determine the direction of causality if existing.

- 2- The following multivariate regression model will be developed:

$$QI = \alpha + \beta_1 GDP + \beta_2 INF + \beta_3 Ex + \beta_4 LIBOR + \beta_5 BOT + e$$
 Where α is the vertical intercept, β is the regression coefficients and e is the error term.

All tests will be conducted using E-Views software in addition to Microsoft Excel.

6. Data Analysis and Results

6.1 Correlation

The correlation coefficients for the studied variables in expressed in the matrix below

	BOT	EX	GDP	INF	LIBOR	QI
BOT	1.000000	-	0.34832	-	-	0.19449
EX	-	1.00000	-	-	-	-
GDP	0.105841	0	1.00000	-	-	0.66631
INF	0.096323	0.035460	0.152934	1.00000	-	-
LIBOR	0.069443	0.033896	0.035179	0.201158	1.00000	0.27576
QI	0.19449	0.254814	0.66631	0.176034	0.27576	1.00000

Table 1: Correlation Matrix

As illustrated in the correlation matrix stock prices are positively correlated with each of the trade balance, GDP, and Libor rate. Meanwhile, stock prices are negatively correlated with exchange rates and inflation rates.

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6.2 Regression Analysis

Quarterly data for the studied variables were entered into the regression system, the following results surfaced

Sample: 2000Q3 to 2010Q1

Included observations: 39

	Coefficient	Std. Error	t-Statistic	Prob.
(constant)	-2563.489	562.3701	-4.558366	0.0001
(GDP)	1.542048	0.213735	7.214780	0.0000
(Inflation _{t-2})	9907.574	4667.512	2.122667	0.0414
(Exchange rate ₋₁)	257.5173	87.56933	2.940725	0.0059
(LIBOR)	61.85260	15.43733	4.006690	0.0003
(BOT ₊₁)	-623.3225	586.0708	-1.063562	0.2952
R-squared	0.701096	Mean dependent var		421.9633
Adjusted R-squared	0.655807	S.D. dependent var		249.5966
S.E. of regression	146.4332	Sum squared resid		707608.4
Durbin-Watson stat	1.153419			

Table 2: Results of the regression analysis

The table above shows the significance of each particular macroeconomic variable in influencing the stock index in the Palestine Securities Exchange, the table indicates that almost all variables are significant in influencing the stock index except the BOT “balance of trade” which has a probability more than 5%, and it’s not uncommon to see this result in the Palestine Securities Exchange because the majority of public companies listed at the PEX are service companies, telecommunication services and financial services, they contribute for more than 80% of the total market capitalization, so these large companies are not engaged in international trade activities, since they are the dominants of the index, the index will not be influenced by the economy’s trade activities.

In addition its worth to mention here that the signs of all coefficients do not comply with what mentioned in the literature and other studies that’s due to many reasons, first, the Palestinian economy is not an industrial oriented economy, it depends on imports rather than exports, second the lack of knowledge among the trends and investment behaviors of individual investors in analyzing the fundamentals of the economy, industry, and the company contributes to this distortion of results. Third, however the existence of

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institutional investors and the interoperate investment contribute to these results, and few holding companies owns many listed companies. Fourth, ten years may not be enough for such a developing market to build some conclusive results. Fifth, expectation is the key driver for investing in the Palestine Securities Exchange especially for institutional investors, but the degree of error in expectations is very high in such market due to the instability in political and economic conditions. Sixth, the inefficiency of the PEX also contributes to the inconsistency of results, so the behavior of this inefficient market may not be the same as the behavior of other stronger and more efficient markets.

The table above also shows the summary of the whole regression analysis, it indicates a strong explanatory power of the regression model, R^2 has a value of about 70% meaning that the macroeconomic valuables explains 70% of changes in the stock market index for Palestine Securities Exchange

The equation goes as follows

$$QI = -2563.489 + 1.542048 GDP + 9907.574 INF (t-2) + 257.5173 Ex (t-1) + 61.85260 LIBOR -623.3225 BOT (e) + 146.4332$$

6.3 Causality analysis

The results for the unit root test for the variables is summarized in the following table

Variable	ADF	Critical Value
Level		
QI	1.4788	-3.60099
GDP	-0.65907	-3.60099
INF	-7.49596	-3.60099
Ex	-1.37031	-3.60099
LIBOR	-1.67676	-3.60099
BOT	-2.03599	-3.60099
1st Difference		
QI	-5.06225	-3.60559
GDP	-6.35482	-3.61045
Ex	-4.9223	-3.60559
LIBOR	-4.92741	-3.60559
BOT	-6.1651	-3.60559

Table 3: Summary of Unit root test results (1% level)

As illustrated in the table above, all variables except for inflation (INF) are stationary at their level. Moreover, all variables (including inflation) are non-stationary at their 1st difference. The data were converted from stationary to non-stationary in order to be entered into the Granger causality test illustrated below.

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Pairwise Granger Causality Tests

Sample: 2000Q1 2010Q2

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
DQI1 does not Granger Cause DBOT	39	0.43724	0.64940
DBOT does not Granger Cause DQI1		0.36986	0.69358
DQI1 does not Granger Cause DEX	39	0.30791	0.73701
DEX does not Granger Cause DQI1		0.12899	0.87941
DQI1 does not Granger Cause DGDP	39	1.46843	0.24453
DGDP does not Granger Cause DQI1		0.12604	0.88199
DQI1 does not Granger Cause DLIBOR	39	2.00666	0.15005
DLIBOR does not Granger Cause DQI1		0.18019	0.83590
INF does not Granger Cause DQI1	39	0.40488	0.67023
DQI1 does not Granger Cause INF		0.24406	0.78481

Table 4: Granger Causality test results

The Granger causality test results indicate that there is no kind of causality between stock market index and each particular macroeconomic variable studied.

7. Comparison of Findings

In this section, results will be compared with findings from previous literature. The main findings in the literature review were the three following points:

- A positive relationship between stock prices and GDP exists, with causation running from stock prices to GDP.
- A negative relationship between stock prices and inflation exists, with causation running from inflation to stock prices.

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- A sometimes positive, sometimes negative relationship between stock prices and exchange rates exists, but causation runs from stock prices to exchange rates.
- A negative relationship between stock prices and trade balance
- A negative relationship between stock prices and interest rates

After comparing this paper's findings with previous literature , it was found that this paper's findings agree with previous literature in three points:

- There's a positive relationship between stock prices and GDP.
- There's a negative relationship between stock prices and exchange rates.
- There's a negative relationship between stock prices and balance of trade.

At the same time the paper's findings disagreed with previous literature in three points as well:

- There's no causality relationship between stock prices and GDP.
- There's no causality relationship between stock prices and inflation, additionally a positive instead of a negative relationship exists between the 2 variables.
- There's no causality relationship between stock prices and exchange rates.
- There's no causality relationship between stock prices and trade balance.
- There's no causality relationship between stock prices and interest rates (represented by the Libor rate), additionally a positive instead of a negative relationship exists between the 2 variables.

8. Conclusion

The Palestinian stock market is linked with macroeconomic indicators, thus the macroeconomic variables can explain the behavior the stock index, but not in the same direction indicated in the researches reviewed due to the inefficiency of the PEX. The Palestinian stock market, although linked with macroeconomic variables, doesn't have causal relationships with macroeconomic variables.

The reason behind the non-existence of any causality between stock returns and macroeconomic variables might be lack of data, or most probably lack of liquidity and depth in the Palestinian market as well as political and economic circumstances. It is important to keep in mind that the Palestinian stock market is still at its early stages and is highly inefficient; there's isn't enough liquidity in this market in order to allow it to respond to macroeconomic forces. Another reason behind the non-existence of causation might be the lack of availability and the overall difficulty in attaining information about both the stock market and the economy as a whole.

This paper is a newly one and adds to the literature conducted on the same topic, this is the only paper conducted on the Palestinian market, therefore it provides the basis for doing further research to verify the results.

9. Recommendations

- The Palestinian investor must understand the relationship between stock prices and macroeconomic indicators in order to make sound investment decisions.
- The Palestinian investor must follow news about the stock market and the economy as a whole in order to minimize risk and avoid losses.
- The government must be aware of the relationship between macroeconomic indicators and stock prices when setting rules and regulations that affect either one of them.
- Further research must be conducted on the relationship between stock prices and the economy.

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Appendix

This appendix shows the set of data used in the study beginning from 2000 to 2010 on quarterly basis.

Period	QI	INFLATION	LIBOR	EX	GDP	BOT
2000Q1	282.56	-0.0023	6.97	4.026	1013.5	-495488
2000Q2	273.07	0.0002	7.214	4.084	1089	-495488
2000Q3	260.98	0.0075	6.811	4.024	1122.4	-495488
2000Q4	207.62	0.0086	5.997	4.041	893.6	-495488
2001Q1	166.74	0.0051	4.67	4.192	865.1	-435825
2001Q2	172.31	0.0008	4.055	4.165	967.6	-435825
2001Q3	163.42	0.0111	2.65	4.356	984.9	-435825
2001Q4	195	0.0039	2.445	4.385	947.6	-435825
2002Q1	182.12	0.0065	3.006	4.668	839.7	-318685
2002Q2	170.29	0.0077	2.251	4.769	776	-318685
2002Q3	149.34	0.0083	1.813	4.862	795.4	-318685
2002Q4	151.16	0.0061	1.447	4.737	853	-318685
2003Q1	159.39	0.0174	1.34	4.658	870.1	-380147
2003Q2	197.82	0.002	1.2014	4.314	929.1	-380147
2003Q3	169.53	0.0166	1.2857	4.441	986.8	-380147
2003Q4	179.81	0.0027	1.4582	4.379	963.6	-380147
2004Q1	183.41	-0.0041	1.3401	4.528	988.9	-515140
2004Q2	174.5	-0.001	2.4682	4.497	1003.8	-515140
2004Q3	249.41	0.003	2.4445	4.482	1120.9	-515140
2004Q4	277.56	0.0142	3.1004	4.308	1084.8	-515140
2005Q1	603.74	-0.0014	3.842	4.361	1034.9	-605821
2005Q2	669.69	0.0004	3.8632	4.574	1077.3	-605821
2005Q3	885.42	0.0086	4.4067	4.598	1180.8	-605821
2005Q4	1128.59	-0.0038	4.8226	4.603	1266.5	-605821
2006Q1	871.54	0.0027	5.2476	4.673	1126	-575221
2006Q2	536.66	-0.0025	5.766	4.44	1132.9	-575221
2006Q3	603.67	0.0075	5.2985	4.302	1070.4	-575221
2006Q4	605	0.0024	5.3139	4.225	993	-575221
2007Q1	622.87	-0.0031	5.2009	4.155	1113.2	-692764
2007Q2	509.69	0.0105	5.4048	4.249	1177.1	-692764
2007Q3	517.18	0.0054	5.0618	4.002	1149.3	-692764
2007Q4	527.26	0.0035	4.4227	3.857	1114.5	-692764
2008Q1	655.22	0.0164	2.5133	3.544	1167.3	-726931
2008Q2	688.58	0.0059	3.4176	3.338	1207.5	-726931
2008Q3	644.84	0.0128	3.3709	3.421	1242.5	-726931
2008Q4	441.66	-0.0052	2.3845	3.802	1203.6	-726931
2009Q1	514.61	0.0105	2.1173	4.188	1213.9	-759939
2009Q2	524.85	0.0035	1.6776	3.919	1298.8	-759939
2009Q3	498.92	0.0054	1.2691	3.758	1307.1	-759939
2009Q4	493	0.0058	0.9993	3.775	1327.4	-759939

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2010Q1	503.17	-0.0003	0.8733	3.697	1344.3	-794039
2010Q2	515.84	0.0024	1.188	3.875	1417.8	-794039

QI: ALquds index

EX: Exchange rate between USD and Israeli shekel

GDP: Gross Domestic Product

BOT: Balance of trade