Investigating the Relationship between Macroeconomic Variables and the Stock Price Index

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Abstract
The Stock Price Index in every country is the most important means for investigating the stock market conditions. The purpose of this study is to investigate the relationship between the Stock Price Index and macroeconomic variables including the GDP, the oil price, the cash and the foreign exchange rate. The relationship is examined using seasonal data from 2001 to 2014, the VAR method and the Granger causality test. Finally the analysis of prediction error variance showed that the unofficial foreign exchange rate has the most long term effect on the Stock Price Index and the effect of the other variables decrease with time.

Keywords: VAR, Stock Price Index, Granger causality

Introduction
Nowadays the stock market has a special role in economic development and with pricing, decreasing risks, mobilizing sources and optimized capital allocating make a better field for economic development (Pakdin, 2008). Stock market is an official capital market in which companies shares and governmental or nongovernmental debenture bonds are bought and sold. stock market is either a center for gathering private capitals and cashes to fund long term investment projects and an official safe market in which the stagnant asset owners can invest their capital in companies and firms or buy governmental or nongovernmental debenture bonds and have a certain and guaranteed profit (Khodabakhsh, 2004). Index is a means to measure and compare phenomena which have certain specifications. Though according to the index, we can investigate some specified variables and their changes in a period (Ghaffari, 2004). Stock Price Index is very useful for investors for their investments also as an economic index from macroeconomic view point. The word “index” means apparent, indicator and illustrator. Practically, index is a quantity which indicates multiple homogeneous variables (Pakdin et al, 2008). According to Iran’s twenty years perspective, rule no. 44, government’s general policies make it easy for nongovernmental forces to enter the field and take the control and one of its results is giving governmental firm’s shares to public via stock market. So acquaintance with financial factors affect Stock Price Index is necessary in order to make stock market a profitable market for public and effective in national economic development.

Theoretical base of the relationship between macroeconomic variables and the Stock Price Index
In this study we use Portfolio theory and Fisher theory to investigate the relationship between Stock Price Index and macroeconomic variables with due attention to economic factors.

Portfolio Theory
Portfolio is a set of assets which investors keep that with various sets of assets. The theory is about choosing useful portfolio with due attention to effective factors. Some financial assets like bank deposits with certain, constant and risk-free interest and some other like stocks, foreign exchange, etc. with uncertain and risky benefit. because there is various combinations of assets in a portfolio like cash, stocks, deposits, debenture bonds, gold and foreign exchange, changes in cash amount, foreign exchange rate, bank interest rate and inflation rate affect the people’s demand for keeping each of these assets such as stocks which affects stock price (Karimzadeh, 2006).
Fisher Theory
Fisher equation indicates that the real interest rate is obtained from deference of nominal interest rate and inflation rate.
\[ R^*_f = R^n_i - \text{INF}_t \]  \hspace{1cm} (1)
In which \( R^*_f \) is the real interest rate and \( R^n_i \) is the nominal interest rate and \( \text{INF}_t \) is the inflation rate. Fisher indicates such equation for stock efficiency:
\[ RS^*_f = RS^n_i - \text{INF}_t \]  \hspace{1cm} (2)
In which \( RS^*_f \) is real stock efficiency and \( RS^n_i \) is nominal stock efficiency. Also nominal efficiency is stock price change rate:
\[ RS^n_i = \text{dlnPS}_t \]  \hspace{1cm} (3)
In which [...] is stock price. According to this equation, Fisher introduces econometrics equation and says that inflation rate affect stock efficiency.
\[ RS^*_f = y_0 + y_1\text{INF}_t + U_t \]  \hspace{1cm} (4)
In 1981 Fama said that in Fisher’s equation some macro financial variables including cash and interest rate is missed. Fama with a due attention to the relationship between cash market and stock market, uses the cash market balance to prove his claim. Cash market balance is:
\[ M_t/P_t = M(Y_t,R_t) \]  \hspace{1cm} (5)
In which \( M_t \) is cash within economics, \( P_t \) is prices general level, \( Y_t \) is national income and \( R_t \) is interest rate. So Fama introduces cash demand:
\[ \ln(M_t/P_t) = \alpha_0\ln Y_t - \alpha_1\ln R_t \]
\[ \ln P_t = -\alpha_2\ln Y_t + a_2 R_t + \ln M_t + a_2 > 0 \]  \hspace{1cm} (6)
So the result of differentiation of the equation is:
\[ \text{dlnP}_t = -\alpha_2\ln Y_t + a_2 R_t + \text{dlnM}_t \]  \hspace{1cm} (7)
And \( \text{dlnP}_t = \text{INF}_t \) so:
\[ \text{INF}_t = -\alpha_2\ln Y_t + a_2 R_t + \text{dlnM}_t \]  \hspace{1cm} (8)
With replacing this equation in equation (4) we have:
\[ RS^*_f = \beta_0 + \beta_1\text{dlnY}_t + \beta_2 dR_t + \beta_3 \text{dlnM}_t + U_t \]  \hspace{1cm} (9)
Where
\[ \beta_3 = Y_t, \beta_2 = Y_t, \beta_1 = -Y_t, \beta_0 = Y_0 \]  \hspace{1cm} (10)
Using the relationship between stock nominal efficiency and real efficiency:
\[ RS^n_i = RS^*_f + \text{INF}_t \]  \hspace{1cm} (11)
Equation (9) can be written like:
\[ RS^n_i = \beta_0 + \beta_1\text{dlnY}_t + \beta_2 dR_t + \beta_3 \text{dlnM}_t + \beta_4 \text{INF}_t + U_t \]  \hspace{1cm} (12)
Finally the equation for stock price would be like:
\[ \text{lnRS}_t = \beta_0 + \beta_1 \text{dlnY}_t + \beta_2 dR_t + \beta_3 \text{dlnM}_t + \beta_4 R_t + U_t \]  \hspace{1cm} (13)
As you see, Fisher theory and Fama adjustments indicate the relationship between some variables like inflation, interest rate and stock price (Ebrahimi and Shokri, 2011).

International Stock Price Index
The word “index” generally means apparent, indicator or illustrator. Practically, index is a quantity which indicates multiple homogeneous variables and it’s a means to measure and compare phenomena which have certain specifications and according to it, some specified variables and their changes in a period of time can be investigated. The first attribute of an index is that it’s used as representative of multiple homogeneous variables. The second attribute is that its examined based on its value for one base year. The value of index for base year is considered as 100. Computation of index for every company, corporation, team or group is possible. To do that, we consider a specific year as base year then we divide current value by the base year value and multiply the result by 100. The final result is that team/group’s index. In the stock market many indices can be defined and computed to respond various needs. Actually in the stock markets in the world many indices for groups and companies is computed. for example in the America’s stock market, Dow & Jones index indicates changes of 30 industrial companies, 20 transportation companies and 15 services companies or NASDAQ index indicates the stock changes out of the stock market (Saeedi et al, 2010, 114).
Teheran Price Index and its computation
At the Teheran stock market that started at 1968, computation of Stock Price Index was in the priorities of Teheran stock market organization and it’s known as TEPIX from 1990. TEPIX is the abbreviated form of TEHRAN PRICE INDEX. According to this priority, computation of TEPIX started from the beginning of 1990 based on average transacted stock price in the 1989’s second half. From the beginning of 1992 the base value of the computation formula change from number of the transacted shares to number of the published shares by the authenticated companies in the stock market. The general formula for computation of the index with the weighted average method in the Teheran stock market like the other stock markets is the Laspeyres formula:

\[ \text{TEPIX} = \frac{\text{accepted companies published stock current value}}{\text{accepted companies published stock base value}} \times 100 \]

Generally the stock market index indicates the general market condition and in developed economies it’s increase means economic flourish and its decrease means stagnancy. To compute the Stock Price Index we should have the last data about stocks price changes and their transaction amount.

The base year is 1998. This index indicates that how much times is the total value of the market as many as base year value. For example a value of index equal to 12700 indicates that the market value is 127 times as much as the base year (1998). The total price index in Teheran market is computed for 3 groups:
1. Total market price index: in which all of the transacted stocks price is participated.
2. Main hall price index: in which just the main board transacted stocks price is participated.
3. Secondary hall price index: in which just the secondary board transacted stocks price is participated.

Effective factors of Stock Price Index
GDP is a metric to measure the economic activities. GDP is the total value of goods production and end services which is produced by an economic system in a period of time like one year (Tabibian, 2001). GDP is formed of nongovernmental consumption expenses, nongovernmental investment expenses, governmental expenses, net exports and etc. investor with looking at the GDP’s parts would be aware of that if the economy has the acceptable development and firmness or not. Also he/she would know that which part cause the intense instability. The investor knowing the nongovernmental consumption amount, tries to invest in companies which produce goods/service which it’s consumption has acceptable growth but specifies current and future governmental goods and services consumption. If the public consumption of some goods/services decreases, economic development will decrease except investment in those goods/services decrease proportionally. Generally a look at the parts of GDP and its growth rate is important for investment decisions.

Oil income
Increase in oil price cause increase in GDP for oil exporters but it should be regarded that end consumers of the oil productions mainly are the developing countries. Most of the oil exporters are importers of oil productions because they don’t have required technology to process the pure oil so the oil price increases cause an increase in the oil productions which is produced in developed countries and it cause an increase in imports value of developing countries like Iran. Though it’s expected that the relationship between increasing of oil income and increasing of stock market indices is a negative relationship.

Cash growth rate
There are different theories about the relationship between cash and the stock price. Cash amount as a macroeconomic variable can make great effects on interest rate and general prices level in the money market but since practically there is no interest rate in Iran and benefit rate is determined by central bank, so we can focus on the prices level. For example an increase in cash amount cause an increase in general prices level in the market. Furthermore if the increase in the cash amount is the result of government budget missing it may have a negative effect on the stock price. So the cash amount as a variable can affect price index in the positive or negative way. Many of economists think that in Iran cash amount increase at least in the psychic way has negative effect on stock market (Eslamlouiy and Zare, 2006). According to inflation money theory cash continuous growth with a rate more than the result of multiplication of real income growth rate and income tension of demand for money, is the necessary and sufficient condition for continuous inflation. On the other hand some think that cash increase can cause an increase in request for investment including investment in stocks. Though the relationship between cash and indices must be positive. This hypothesis is considerable when cash growth cause investment activities development. In Iran
economic foundation for absorbing investments in productions isn’t enough and most of the cash used in business activities instead of production activities so mostly the cash increase cause request and current expense increase. studies about inflation money theory in Iran indicate that cash increase doesn’t cause GDP increase but cause inflation increase so it seems relationship between cash growth and stock market indices is negative(Sajjadi et al, 2010: 49).

Foreign exchange rate
Till 1950 risk was thought as a qualitative factor until Markowitz works made it a quantity and standard deviation of investment cash transactions in various conditions introduced as risk measurement quantity and Markowitz theory cause the birth of portfolio theory. he assumed that investors isn’t looking for maximization of expected efficiency because if they was looking for it, they would choose the asset with maximum efficiency but they have a portfolio of stocks and we can say that they compare various investments and choose between them base on expected efficiency and standard deviation. If the investors avoid from risk and there is two portfolio which is same except the standard deviation, the investment with lower standard deviation will be chosen. Now with due attention to that foreign exchange rate is a risky part of portfolio, based on Markowitz model this asset risk changes can affect its request though can cause stock price change because the companies are export/import based and they are dependent to foreign exchange rate so increase and decrease of foreign exchange rate may have great effects on the sources accepted in the stock exchange and companies.
With decreasing foreign exchange rate, the end price of productions will decrease so the benefit and benefit margin for each share will increase and following that the stock price will increase. Increasing companies’ stock prices will cause a change in total stock price (Taheri et al, 2011: 69).

Study purposes

Main purpose
Investigating the relationship between macroeconomic variables and Stock Price Index.

Secondary purposes
- Investigating the relationship between the economic development and Stock Price Index.
- Investigating the relationship between the oil price and Stock Price Index.
- Investigating the relationship between the cash growth and Stock Price Index.
- Investigating the relationship between the foreign exchange rate and Stock Price Index.

Study Questions
- How is the relationship between the economic development and Stock Price Index and what sign is it?
- How is the relationship between the oil price and Stock Price Index and what sign is it?
- How is the relationship between the cash growth and Stock Price Index and what sign is it?
- How is the relationship between the foreign exchange rate and Stock Price Index and what sign does it have?

Background
Papapetrou (2001) investigated the relationship between the oil price, the interest rate, the economic activities and the real stock price in Greece. He used the industrial production monthly data (as economic activities), the interest rate, the real oil price (the oil price which adjusted with consumer price index), the industrial employment and the real stock price. In his study, the VAR method was used but he used the hit reaction function and extended variance analysis instead of hit reaction function and variance analysis. he estimated two VAR models: specifying industrial productions with following variables: the real oil price, the real stock efficiency, the interest rate and industrial productions and specifying employment with following variables: the real oil price, the real stock efficiency, the interest rate and employment. He concluded that oil price shocks had a negative impact on stock market, industrial productions and employment. AL-Rjoub (2005) using the VAR model investigated the impact of the oil price shocks on US Stock Price Index. In this study he used monthly data of the oil price and US Stock Price Index from 1985 to 2005. The results indicate that the oil price shocks have a negative impact on US stock market and the interaction is bidirectional. Christopher Fregan et al (2006) tested the interactions between New Zealand stock index and a set of 7 macroeconomic variables for monthly data from January 1990 to January 2003 using the con-integrating test. The results were indicating a long term relationship between the macroeconomic variables and New Zealand stock market index. Salifu et al(2007) investigating the impact of the foreign exchange rate changes
on Ghana stock market showed that 55% of investigated companies was affected by US dollar rate changes and this relationship was statistically meaningful. Also this study showed that the efficiency of the most of the companies have a straight relationship with the US dollar rate. Fayyad and Dally (2011) compared the impact of the oil price shocks in stock efficiency in GCC, US and UK. In this study they used daily data of stock indices in Kuwait, Oman, Emirate, Bahrain, Qatar, UK and US and the North Sea Brent pure oil price. They used VAR method and concluded that oil price predictability in the stock market has been improved after an increase during the international economic crisis.

Khosro Piraei et al (2008) investigated the impact of macroeconomic variables on Iran stock market. He used seasonal data of various economic variables like the GDP, inflation cash amount and foreign exchange rate from 1991 to 2006. According to pricing theory and one root tests and co-integrated specifying he used the self-explanation model with the distributed interrupts. The results indicate that Stock Price Index has a straight relationship with the GDP and the general price level and an inverse relationship with the cash amount and the foreign exchange rate. Ezzatollah Abbasian (2008) investigated the effects of macroeconomic variables in Tehran stock market. Using the seasonal data he examined the effects of the foreign exchange rate, commercial balance, inflation, cash and the interest rate on the total stock market index during the 1998-2005. The methods used were the co-integrating, error correction models, implicit reaction functions and variance analysis. Findings indicate the long term positive impact of foreign exchange rate and commercial balance and the negative impact of inflation, cash and interest rate on the stock market. Karimzadeh et al (2013) investigated the effects of foreign exchange rate, bank interest rate, cash amount, GDP and inflation rate on the banks stock index using the seasonal data from 2003 to 2011 with the Johansen Josilious co-integrating method and they specified the long term relationship between those variables. Then using the vector error correction they specified the velocity of adjustment of short term to long term. Finally using the immediate reaction function they checked the impact of the variables shocks and using the variance analysis specified the variables with the most impacts on the banks stock index. According to the results inflation and foreign exchange rate has a negative effect and the bank benefit rate and GDP has a positive effect on the banks stock index.

Research Method

In this study the VAR method is used for investigating the relationship between the financial development indices and economic development. The data used in the study is extracted from the seasonal data from IR central bank time series and IR statistics center during 1990-2012 and for the Eviews 7 Software is used for statistical analysis.

Vector Automatic Regression

A vector automatic regression with degree p(VAR(p)) for a system with M variables

\[ y_t = (y_{1t}, ..., y_{Mt}) \] is defined as:

\[ y_t = v + \theta_1 y_{t-1} + \theta_p y_{t-p} + v_t \]

Where in the system \( V = (v1, ..., vM) \) is a M-dimension vector.

\[ \theta_t = \left[ \begin{array}{ccc} \theta_{11} & & \\ & \ddots & \\ & & \theta_{MM} \end{array} \right] \]

Multiplication matrix is \( M \times M \), \( V \) has \( E[V] = 0 \), covariance matrix is not unique, for any \( t \) \( \sum V = E[V_t V_t^T] \) and for \( t \neq s \) \( V_t \) and \( V_s \) is uncorrelated.

VAR systems because of their automatic regression need vast data. The best form of data is the seasonal data which is inaccessible so we have to use annual data.

Stationary

The time series \( y_t \) is weak stationary that it’s average, variance and covariance don’t change with time. If the \( \mu \) is the average, \( \sigma^2 \) is the variance and we show the covariance of \( y_t, y_{t-s} \) and we have:

\[ E(y_t) = E(y_{t+s}) = \mu \]

\[ \text{Var}(y_t) = \text{Var}(y_{t+s}) = \sigma^2 \]

\[ \text{Cov}(y_t, y_{t-s}) = E(y_t - E(y_t))E(y_{t-s} - E(y_{t-s})) = \text{Cov}(y_{t+s}, y_{t+s}) = \gamma_s \]

It means average, variance and covariance don’t change with time. If \( E, \text{Var} \) and \( \text{Cov} \) change with time the time series is non stationary (Green, 2003).
Results

In this paper we used GDP as an index for economic development. The other variables are Stock Price Index with the symbol (i), oil price with the symbol (oil), cash with the symbol (m), and unofficial foreign exchange rate with the symbol (r). Also for removing trend from the relationship we used the logarithm of time. To be confident of regression estimations it’s necessary to review series stationary. To do that we used ADF test. The results of this test is presented in the table below.

<table>
<thead>
<tr>
<th>interrupt</th>
<th>Mackinnon critical value 1%</th>
<th>Mackinnon critical value 5%</th>
<th>Mackinnon critical value 10%</th>
<th>ADF</th>
<th>series</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-2.615093</td>
<td>-1.947975</td>
<td>-1.612408</td>
<td>3.99039</td>
<td>Li</td>
</tr>
<tr>
<td>4</td>
<td>-5.186481</td>
<td>-3.518090</td>
<td>-3.189732</td>
<td>-2.187347</td>
<td>LGDP</td>
</tr>
<tr>
<td>1</td>
<td>-2.615093</td>
<td>-1.947975</td>
<td>-1.612408</td>
<td>3.99039</td>
<td>Loil</td>
</tr>
<tr>
<td>4</td>
<td>-5.186481</td>
<td>-3.518090</td>
<td>-3.189732</td>
<td>-2.187347</td>
<td>Lm</td>
</tr>
<tr>
<td>3</td>
<td>-3.588509</td>
<td>-2.929734</td>
<td>-2.603064</td>
<td>2.245867</td>
<td>Lr</td>
</tr>
<tr>
<td>0</td>
<td>-3.58152</td>
<td>-2.926622</td>
<td>-2.601424</td>
<td>-5.366049</td>
<td>D(Li)</td>
</tr>
<tr>
<td>3</td>
<td>-3.592462</td>
<td>-2.931404</td>
<td>-2.603944</td>
<td>-3.63098</td>
<td>D(LGDP)</td>
</tr>
<tr>
<td>0</td>
<td>-3.58152</td>
<td>-2.926622</td>
<td>-2.601424</td>
<td>-5.366049</td>
<td>D(Loil)</td>
</tr>
<tr>
<td>2</td>
<td>-2.619851</td>
<td>-1.948686</td>
<td>-1.612036</td>
<td>-8.208656</td>
<td>D(Lm)</td>
</tr>
<tr>
<td>1</td>
<td>-2.618579</td>
<td>-1.948495</td>
<td>-1.612135</td>
<td>-14.41383</td>
<td>D²(Lr)</td>
</tr>
</tbody>
</table>

As it’s obvious the logarithm of the GDP, the logarithm of the Stock Price Index and the logarithm of the oil price have an 1 root and so they are I(1) and after one time differentiation they will be stationary. The logarithm of unofficial foreign exchange rate and cash have two 1 root though they are I(2) that after two times differentiation they will be stationary.

Optimize interrupt

To specify the optimize interrupt we use Akaike and Schwarz measure.

<table>
<thead>
<tr>
<th>interrupt</th>
<th>AIC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.85</td>
<td>11.12</td>
</tr>
<tr>
<td>2</td>
<td>7.43</td>
<td>9.75</td>
</tr>
<tr>
<td>3</td>
<td>6.19</td>
<td>9.57</td>
</tr>
<tr>
<td>4</td>
<td>5.42</td>
<td>9.85</td>
</tr>
<tr>
<td>5</td>
<td>5.68</td>
<td>10.56</td>
</tr>
<tr>
<td>6</td>
<td>2.54*</td>
<td>9.09*</td>
</tr>
</tbody>
</table>

We can see that the Akaike and Schwarz both recommend the sixth interrupt.

Investigating the causality relationship between the variables

With due attention to VAR model structure the value of a variable is a function of the old and current value of all existed variable. Though for investigating the causality relationship there is some assumption tests. Now we can do the Granger causality test analysis:

1. Investigating the Granger causality test relationship between the logarithm of the Stock Price Index and the logarithm of the GDP:
   - Assumption Ho: logarithm of Stock Price Index isn’t the Granger causality of the logarithm of GDP.
   - With a look at the Chi-sq. values and the projected probabilities we can’t reject the Ho.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>7.54</td>
<td>0.27</td>
</tr>
</tbody>
</table>
Now if we assume the reverse of the Ho:
- The assumption Ho: the logarithm of the GDP isn't the Granger causality of the logarithm of the Stock Price Index.
- With a look at the Chi-sq. values and the projected probability the Ho is rejected.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGDP</td>
<td>23.46</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

So the relationship between Stock Price Index and the GDP is one direction from GDP to Stock Price Index.

2. Investigating the Granger causality test relationship between the logarithm of the Stock Price Index and the logarithm of the oil price:
- Assumption Ho: logarithm of Stock Price Index isn't the Granger causality of the logarithm of oil price.
- With a look at the Chi-sq. values and the projected probabilities we can't reject the Ho.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>11.7</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Now if we assume the reverse of the Ho:
- The assumption Ho: the logarithm of the oil price isn't the Granger causality of the logarithm of the Stock Price Index.
- With a look at the Chi-sq. values and the projected probability the Ho is rejected.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loil</td>
<td>12.93</td>
<td>0.0441</td>
</tr>
</tbody>
</table>

So the relationship between Stock Price Index and the oil price is one direction from oil price to Stock Price Index.

3. Investigating the Granger causality test relationship between the logarithm of the Stock Price Index and the logarithm of the cash:
- Assumption Ho: logarithm of Stock Price Index isn't the Granger causality of the logarithm of cash.
- With a look at the Chi-sq. values and the projected probabilities the Ho is rejected.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>25.66</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

Now if we assume the reverse of the Ho:
- The assumption Ho: the logarithm of the cash isn't the Granger causality of the logarithm of the Stock Price Index.
- With a look at the Chi-sq. values and the projected probability the Ho is rejected.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lm</td>
<td>21.74</td>
<td>0.0014</td>
</tr>
</tbody>
</table>

So the relationship between Stock Price Index and the cash is bidirectional.

4. Investigating the Granger causality test relationship between the logarithm of the Stock Price Index and the logarithm of the unofficial foreign exchange rate:
• Assumption H0: logarithm of Stock Price Index isn't the Granger causality of the logarithm of the unofficial foreign exchange rate.
• With a look at the Chi-sq. values and the projected probabilities we can't reject the Ho.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>10.17</td>
<td>0.1117</td>
</tr>
</tbody>
</table>

Now if we assume the reverse of the H0:
• The assumption H0: the logarithm of the unofficial foreign exchange rate isn't the Granger causality of the logarithm of the Stock Price Index.
• With a look at the Chi-sq. values and the projected probability the Ho is rejected.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Chi-sq.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lr</td>
<td>37.05</td>
<td>0</td>
</tr>
</tbody>
</table>

So the relationship between Stock Price Index and the unofficial foreign exchange rate is one direction from unofficial foreign exchange rate to Stock Price Index.

**Prediction error variance analysis**
Prediction error variance analysis is a manner for inspecting interactions between series which specifies the impact of each variable on the others during the time. in the investigating the results of Prediction error variance analysis all of the Li changes during the first period caused by LGDP shocks is explained by the Li itself but it changes with time. for example during the second period 12.97% of the changes is explained by the variable itself, 28.99% by the LGDP, 23.23% by the Loil, 30.45% by the Lm and 4.35% by the Lr. In the ninth period it’s 10.48% by the variable itself, 9.18% by the LGDP, 12.67% by the Loil, 15.10% by the Lm and 54.58% by the Lr. In the chart below the Stock Price Index variance analysis is shown. As you can see Lr have the most long term impact on the Li between the other variables and the impact of the others is vast at the outlet and it disappear with time.
Conclusion

In this study we asked that if there is any relationship between the Stock Price Index and macroeconomic variables (GDP, cash, unofficial foreign exchange rate and foreign exchange rate) or not? Using the VAR method and Granger causality test we concluded that:

1. The relationship between Stock Price Index and the GDP is one direction from GDP to Stock Price Index.
2. The relationship between Stock Price Index and the oil price is one direction from oil price to Stock Price Index.
3. The relationship between Stock Price Index and the cash is bidirectional.
4. The relationship between Stock Price Index and the unofficial foreign exchange rate is one direction from unofficial foreign exchange rate to Stock Price Index.

Also using the variance analysis it specified that the unofficial foreign exchange rate has the most impact on the Stock Price Index and the impact of the other variables is vast at the outlet and will decrease and disappear with time.

References