# The Effect of Foreign ownership on stock Return Volatility In Egyptian Stock Market "An Empirical Investigation"

Amira Sayed Muhammad Gad El-Rab

**الملخص :**

يختبر البحث العلاقة بين الملكيات الأجنبية و كيف تؤثر على تذبذبات العائد على الأسهم في البورصة المصرية تعتمد الدراسة على مجموعة من البيانات عن الملكيات الأجنبية و العائد السوقي بين الفترة ٢٠٠٥ إلى ٢٠١٤.

لقد أصبح الاستثمار من أهم التخصصات التي يرغب في دراستها و معرفة كل جديد عنها أصحاب الأعمال أو الراغبين في المتاجرة عن طريق البورصة و أصبحت البورصة المصرية من أهم الأسواق الناشئة في الشرق الأوسط حيث أنها رتبت من اوائل هذه الأسواق في العديد من المواقع والمجلات العلمية ،حيث بلغ الرأس مال السوقي حوالى ٥٢٣,٢٧٠,٦٣٩,١٠٥ جنيه مصري حيث يمثل ٢٤ % من الناتج المحلي الإجمالي في ٢٠١٤.

يمثل الاستثمار الأجنبي في البورصة المصرية ٨,١ % كعرب و ٢,٨ % كغير عرب.

لذا أصبح من المهم دراسة تأثير هذه الملكيات على السوق و معرفة ما إذا كان تأثيرات إيجابية أو سلبية و كيفية ربطها بالواقع و الظروف الاقتصادية و المالية للدولة.

**Abstract**:

This research empirically investigates the relationship between foreign ownership and how it affects volatility at the Egyptian stock market based on data collected by researcher on foreign ownership in EGX and Market return for the period from 2005 to 2014. The study contributes to the current discussion on volatility, how it affects stock market efficiency and factors increasing volatility through modeling volatility.

Recently, investment has become one of the desirable specifications for business people, especially for the area of stock market. As a result, stock market has become a main source for investing money and a purpose for those who want to make fortunes.

Egyptian stock market is an important emerging stock market in the Middle East where Bloomberg has ranked it as one of the best emerging markets. In 2014, its market capitalization reached about 523,270,639,105 L.E according to EGX. In addition, it accounted for 24% of Egyptian GDP according to Oxford Business Group Report on Egypt in 2013.

Foreign investing at EGX accounted for 8.1% for Arabs and 12.8% for Non-Arabs based on trading volume in 2014 (EGX.COM). Furthermore, it is necessary to investigate how foreign ownership affects the market positively or negatively, especially after various unstable conditions, which faced Egypt during the last five years from 2010 until now.

Volatility is one of the most efficient indicators of variation and risk. So, the researcher studied how volatility has

been affected by entry of foreigners during the last 10 years in order to explore how the overall market has been affected.

The research examines the relationship between foreign ownership and stock return volatility through hypothesizing that there is a positive relationship between the independent variable "foreign ownership"(which is divided into eight sub-independent variables) and the dependent variable" stock return volatility". Autoregressive Distributed Lagged Model is used to measure data accuracy through applying Unit Root Analysis.

The main findings are as following: first, the study found that the eight sub-hypotheses of foreign ownership have positive influence on stock return volatility at EGX during the period from 2005 to 2014. Second, results show that the main hypotheses of foreign ownership have positive influence on stock return volatility.

The researcher formulates **research problem** as follows: Foreign ownership is one of the main indicators for market success as it reflects how political, financial and economical movements affect the market. Therefore, the researcher carries out this study in order to examine the relationship between Foreign Ownership and Stock Return volatility within the Egyptian stock market and accordingly interpret this integrated influence.

Two types of hypotheses are examined, a main hypotheses and sub-hypotheses, as foreign ownership at EGX is classified into eight types as following: Arab –Institutions- Buy (AIB) , Arab –Institutions-Sell (AIS) , Arab –Individuals- Buy (APB) ,

Arab –Individuals- Sell (APS), Non-Arab –Institutions- Buy (FIB), Non-Arab –Institutions- Sell (FIS), Non-Arab – Individuals – Buy (FPB), and Non-Arab – Individuals – Sell (FPS).

Research analysis is based on daily bases in EGX, which is rarely studied through using Autoregressive Distributed Lagged Model introduced by Adkins, 2011.

Research findings in the Egyptian stock exchange provide evidence using research model that there is a positive relationship between stock return volatility and foreign ownership sub-variables.

According to the Model, there are eight relationships using eight models; first model measures the relationship between AIB and stock return volatility; second model measures the relationship between AIS and SRV; third model measures the relationship between APB and SR; forth model measures the relationship between APS and SRV; fifth model measures the relationship between FIB and SRV; sixth model measures the relationship between FIS and SRV; seventh model measures the relationship between FPB and SRV and, finally, eighth model measures the relationship between FPS and SRV.

Research concluded that all models have coefficient of determination $r^2$, which is more than 50% as following. For first model, $r^2$is 69.6% and random error 30.4%. For second model; $r^2$ is 64.74% and random error 35.26%. For third model; $r^2$ is 57.47% and random error is 42.53%. For forth model; $r^2$ is 62.01% and random error 37.99%. For fifth model; $r^2$ 64.49%

and random error 35.51%. For sixth model; $r^2$ is 60.95% and random error 39.05%. Finally, for seventh model; $r^2$ is 55.04% and random error is 40.85%.

The p-value for f-test to test the goodness of the whole model (f-statistics) is less than significance level ($\alpha$ =. 05), so that the whole model can be acceptable and the empirical results can be applied.

The research has two main contributions; first, it proves that there are positive and significant relationships between foreign ownership sub-variables and stock return volatility and this proves that there is a positive and significant relationship between the main variable "foreign ownership" and stock return volatility at EGX.

## Introduction:

This research empirically investigates the relationship between foreign ownership and how it affects volatility at the Egyptian stock market based on data collected by researcher on foreign ownership in EGX and Market return for the period from 2005 to 2014. The study contributes to the current discussion on volatility, how it affects stock market efficiency and factors increasing volatility through modeling volatility.

Foreign investing at EGX accounted for 8.1% for Arabs and 12.8% for Non-Arabs based on trading volume in 2014 (EGX.COM). Furthermore, it is necessary to investigate how foreign ownership affects the market positively or negatively, especially after various unstable conditions, which faced Egypt during the last five years from 2010 until now. Volatility is one of the most efficient indicators of variation and risk. So, the researcher studied how volatility has been affected by entry of foreigners during the last 10 years in order to explore how the overall market has been affected.

The research examines the relationship between foreign ownership and stock return volatility through hypothesizing that there is a positive relationship between the independent variable "foreign ownership"(which is divided into eight sub-independent variables) and the dependent variable" stock return volatility".

Autoregressive Distributed Lagged Model is used to measure data accuracy through applying Unit Root Analysis. The main findings are as following: first, the study found that

the eight sub-hypotheses of foreign ownership have positive influence on stock return volatility at EGX during the period from 2005 to 2014. Second, results show that the main hypotheses of foreign ownership have positive influence on stock return volatility.

## The paper consist of the following points:

## 1-Research Objectives:

The research aims to explore the extent which foreign ownership plays a role in affecting stock return volatility and how this effect takes place at the Egyptian Stock Exchange. The research seeks to fulfill the following objectives:

1. Identifying the existence of components of foreign trade at Egyptian Stock Market.
2. Identifying how the stock volatility is affected by foreign trade at EGX.
3. Identifying how stock volatility is affected by the size of Arab –Institutions- Buy (AIB)
4. Identifying how stock volatility is affected by the size of Arab –Institutions-Sell (AIS) at EGX.
5. Identifying how stock volatility is affected by the size of Arab –Individuals- Buy (APB) at EGX.
6. Identifying how stock volatility is affected by the size of Arab –Individuals- Buy (APS) at EGX.
7. Identifying how stock volatility is affected by the size of Non-Arab –Institutions- Buy (FIB) at EGX.
8. Identifying how stock volatility is affected by the size of Non-Arab –Institutions- Sell (FIS) at EGX.

9. Identifying how stock volatility is affected by the size of Non-Arab – Individuals – Buy (FPB) at EGX.
10. Identifying how stock volatility is affected by the size of Non-Arab – Individuals – Sell (FPS) at EGX.

## 2-Research Problem:

The researcher formulates **research problem** as follows: Foreign ownership is one of the main indicators for market success as it reflects how political, financial and economical movements affect the market. Therefore, the researcher carries out this study in order to examine the relationship between Foreign Ownership and Stock Return volatility within the Egyptian stock market and accordingly interpret this integrated influence.

## 3-Research Hypotheses:

Two types of hypotheses are examined, a main hypotheses and sub-hypotheses, as foreign ownership at EGX is classified into eight types as following: Arab –Institutions- Buy (AIB), Arab –Institutions-Sell (AIS), Arab –Individuals- Buy (APB), Arab –Individuals- Sell (APS), Non-Arab –Institutions- Buy (FIB), Non-Arab –Institutions- Sell (FIS), Non-Arab – Individuals – Buy (FPB), and Non-Arab – Individuals – Sell (FPS).

## 4-Main Hypothesis:

There is a positive relationship between foreign ownership and stock return volatility at the Egyptian stock market.

**Sub-Hypotheses:**

1. There is a positive relationship between size of Arab – Institutions- Buy (AIB) and stock return volatility at EGX.
2. There is a positive relationship between size of Arab – Institutions-Sell (AIS) and stock return volatility at EGX.
3. There is a positive relationship between size of Arab – Individuals- Buy (APB) and stock return volatility at EGX.
4. There is a positive relationship between size of Arab – Individuals- Buy (APS) and stock return volatility at EGX
5. There is a positive relationship between size of Non-Arab –Institutions- Buy (FIB) and stock return volatility at EGX.
6. There is a positive relationship size of Non-Arab – Institutions- Sell (FIS) and stock return volatility at EGX.
7. There is a positive relationship between size of Non-Arab – Individuals – Buy (FPB) and stock return volatility at EGX.
8. There is a positive relationship between size of Non-Arab – Individuals – Sell (FPS) and stock return volatility at EGX.

**Literature Review**

Based on the previous studies, the researcher reviewed, most of them was mainly about stock return volatility that have been published between 2013 and 2014.

- The existing literature between 2013 and 2014 was empirically targeted toward emerging stock market like

Korean, Turkey, Hong Kong, China, Taiwan and Thailand.

- Three studies were about Middle East stock market; Abu Dhabi, Egypt and Amman stock markets.
- The studies have been varied between conditional volatility, unconditional volatility and volatility.
- GARCH model, ARCH model, Regression analysis and standard deviation have been used to investigate the interaction between many variables and stock return volatility.
- The independent variables varied from crisis, equity ownership, volatility, foreign ownership, cross section of stock returns, investor sentiment, Terrorism, Time varying correlation, Business Intelligence, insider trading, liberalization, financial ratio to political risk.
- Five studies examined the relationship between foreign ownership and stock return volatility. They varied between US stock market, Turkey, Thailand, Asia, Europe, Pakistan and Swedish stock market. Their measures varied between regression analysis, causality tests and variance. For example, Li, Ngyen Phamg & Wei, 2010 and Aimpidaimongkol & Pandungsaksawasdi, 2013 measured the relationship using regression analysis and panel data model, whereas Sellin, 1996 measured the relationship using the Granger causality tests. On the other hand, Uppal, 2006, measured the relationship using Variance and Umutluakdeniz & Salih, 2013, measured it

using adjusted model of Campell (2001). Li, Ngyen Phamg & Wei, 2010 and Aimpidaimongkol & Pandungsaksawasdi, 2013, found a negative relationship between the two variables, whereas Uppal, 2006, and Umutluakdeniz & Salih, 2013, found a positive relationship and Sellin, 2014, found a temporary effect on price volatility as foreign investors look like nosier traders.

- There is still a need for more studies to examine the relationship within Middle East especially after Revolutions in 2010, especially in Egyptian Stock Market.
- Emerging market, US and Swedish stock markets are the pioneers markets to examine volatility.
- The result varies between negative and positive relationship and varies according to the variables and the empirical data set.

## Research Methodology

Secondary data has been used to test hypotheses. Data has been collected from Egypt for Information Dissemination (EGID) which is a sole aggregator and authorized distributor of the Egyptian Exchange' Listed Companies' information. The Data intervals are daily for 10 years starting from 2005 to Oct. 2014. Data has been collected for both daily market turnover and daily foreign trade volume. The Research is designed to examine volatility on daily basis for 2480 days as a study population.

**The dependent variable** is the Stock return volatility itis defined as the movement in stock return varied during normal and abnormal times. Investors use volatility as a statistical measure of risk when making their investment decisions.

**The independent variables** Foreign ownership is defined as the number of shares owned by foreign institutions or investors. The researcher divides foreign ownership into the following types:

1. Arab- Institutions-Buy (AIB)
2. Arab-Institutions-Sell (AIS)
3. Arab-Person-Buy (APB)
4. Arab-Person-Sell (APS)
5. NonArab-Institution-Buy (FIB)
6. Non Arab – Institution-Sell (FIS)
7. Non Arab – Person –Buy (FPB)
8. Non Arab – Person –Sell (FPS)

In this research, the relationship between foreign ownership and stock return volatility is estimated using Autoregressive Distributed Lagged ARDL model.

**Descriptive data:** is used by the researcher to acquire understanding data accuracy by checking the central tendency and the dispersion by having the minimum, maximum, mean and standard deviation values as following:

| | Minimum | Maximum | Mean | | Std. Deviation |
|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Std. Error | Statistic |
| AIB | 49040.00 | 4.34E8 | 3.5332E6 | 2.06375E5 | 1.00193E7 |
| AIS | 38460.00 | 9.61E7 | 3.3846E6 | 1.05449E5 | 5.11945E6 |
| APB | 19082.00 | 8.75E7 | 4.3735E6 | 1.18864E5 | 5.77072E6 |
| APS | 9892.00 | 7.50E7 | 4.1506E6 | 1.07921E5 | 5.23945E6 |
| FIB | 300.00 | 8.90E8 | 3.6941E6 | 4.19359E5 | 2.03594E7 |
| FIS | 275.00 | 3.83E8 | 3.8656E6 | 2.80422E5 | 1.36142E7 |
| FPB | 3700.00 | 1.69E8 | 4.6698E6 | 1.85743E5 | 9.01763E6 |
| FPS | 1251.00 | 3.01E8 | 4.0741E6 | 1.90044E5 | 9.22450E6 |
| TURNOVER | 7.22E7 | 7.28E10 | 8.5807E8 | 3.49884E7 | 1.69865E9 |

Table (4): Descriptive statistics for data from 2005 to 2014

| | Minimum | Maximum | Mean | | Std. Deviation |
|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Std. Error | Statistic |
| LOG_AIB | 4.69 | 8.64 | 6.3214 | .00856 | .41573 |
| LOG_AIS | 4.59 | 7.98 | 6.3105 | .00884 | .42910 |
| LOG_APB | 4.28 | 7.94 | 6.4023 | .00994 | .48276 |
| LOG_APS | 4.00 | 7.88 | 6.3715 | .01038 | .50396 |

| | | | | | |
|---|---|---|---|---|---|
| **LOG_FIB** | **2.48** | **8.95** | **5.9330** | **.01630** | **.79129** |
| **LOG_FIS** | **2.44** | **8.58** | **5.9706** | **.01658** | **.80492** |
| **LOG_FPB** | **3.57** | **8.23** | **6.0693** | **.01672** | **.81164** |
| **LOG_FPS** | **3.10** | **8.48** | **6.0384** | **.01624** | **.78843** |
| **LOG_Y** | **7.86** | **10.86** | **8.8196** | **.00593** | **.28799** |

Table (5): Descriptive statistics for the transformed data 2005 to 2014

Note: This table reports the descriptive statistics of variables used in panel estimations for 2000 observations for the years 2005–2014. The variables include; stock return volatility and foreign ownership variables at EGX as following; Arab – Institutions- Buy (AIB), Arab –Institutions-Sell (AIS), Arab – Persons- Buy (APB), Arab –Persons- Buy (APS), Non-Arab – Institutions- Buy (FIB), Non-Arab –Institutions- Sell: (FIS), Non-Arab – Persons –Buy (FPB) and Non-Arab – Persons – Sell (FPS).

**Model (1)**

Ha: There is a positive relationship between size of Arab – Institutions- Buy (AIB) and stock return volatility at EGX

ARDL model is used to investigate if there is a positive relationship between

AIB (X) and Stock return volatility (Y). The results are listed below:

Table (15) summarizes the estimates of the model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_AIB | 0.084540 | 0.007979 | 10.59531 | 0.0000 |
| LOG_Y(-1) | 0.480931 | 0.018736 | 25.66839 | 0.0000 |
| LOG_Y(-2) | 0.369405 | 0.018663 | 19.79329 | 0.0000 |
| C | 0.785675 | 0.111085 | 7.072754 | 0.0000 |
| R-squared | 0.696210 | Mean dependent var | | 8.819870 |
| Adjusted R-squared | 0.695822 | S.D. dependent var | | 0.287846 |
| S.E. of regression | 0.158754 | Akaike info criterion | | -0.841228 |
| Sum squared resid | 59.25168 | Schwarz criterion | | -0.831437 |
| Log likelihood | 994.5458 | Hannan-Quinn criter. | | -0.837663 |
| F-statistic | 1795.964 | Durbin-Watson stat | | 2.109622 |
| Prob(F-statistic) | 0.000000 | | | |

Table (15): model (1) estimation

From table (15), the following results can be reported:

1. The final model is
   LOG_Y =0.785+0.0845 LOG_AIB+0.481 LOG_Y (-1) + 0.369 LOG_Y (-2) Where Y (-1) is Stock return volatility with lag (1)
   Y (-2) is Stock return volatility with lag (2)
2. The P-value for LOG_AIB suggests that AIB has a positive and significant effect on the Stock return volatility.

3. The P-value for the constant is 0.0. The value is less than the significance level (α =0.05) which means that the constant has a meaning and we cannot eliminate it.

**Checking assumptions and model 1 (evaluation):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 2.109 and the two tabulated values [dl =1.648 and du =1.708 at k = 3], the calculated value is between du and (4 – du) and it's close to 2. So, there is no evidence for the auto correlationship problem in the model.

**1- Normality assumption for model 1**

The following figure shows the distribution of the residuals of model 1

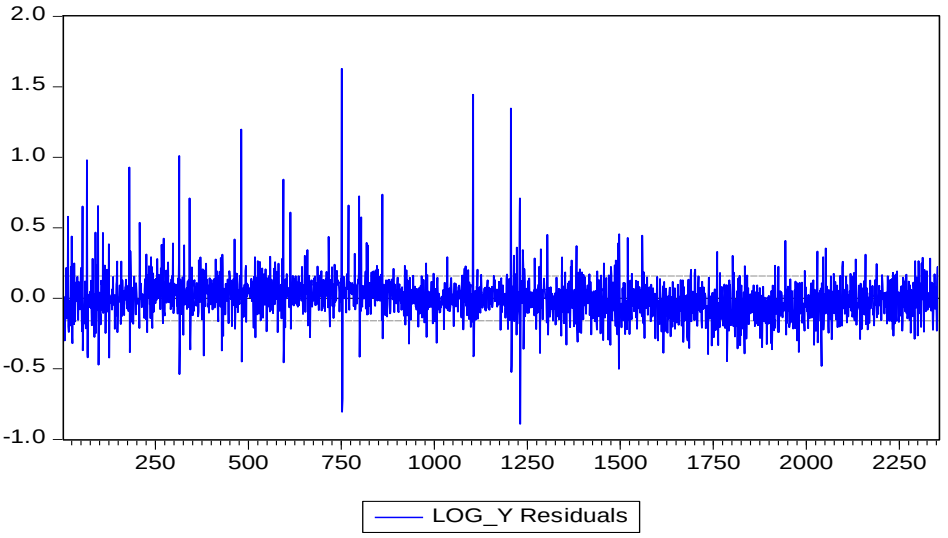


Figure 9: Distribution of residuals of model 1

Moreover, normality test is used to check the normality assumption about the residuals and table (16) shows the results.

| | |
|---|---|
| Mean | 5.77e-15 |
| Median | 0.000373 |
| Std Dev | 0.8158 |
| Jarque-Bera | 22362.96 |
| Probability | 0.049 |

Table (16): Jarque-Bera test of normality for model 1

Since the probability is almost the significance level, we can say that the residuals have a normal distribution.

**Multi colinearity assumption for model 1**

The result are reported as following:

Variance inflation factor VIF was measured in table (17)

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_AIB** | **6.37E-05** | **1.026244** |
| **LOG_Y(-1)** | **0.000351** | **2.717019** |
| **LOG_Y(-2)** | **0.000348** | **2.700493** |

Table (17): VIF for model (1)

Table (17) shows that all values of Variance inflation factor VIF do not exceed value (10) which means that there is no evidence for multicolinearity problem.

**2- Evaluation of Goodness of Fit for Model (1):**

a. The coefficient of determination $r^2$ =69.6% which means that AIB and the lagged Stock return volatility are responsible to explain 69.6% of changes in Stock return volatility over time and 30.4% is due to random error.
b. Adj- $r^2$ = 69.5%; this value is close to or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 69.5%. in turn, this appears to be a good explanatory power.
c. The p-value for f-test to test the goodness of the whole model is less than the significance level ($\alpha$ =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (2)**

Hb: There is a positive relationship between size of Arab – Institutions-Sell (AIS) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between AIS (X) and SRV (Y). The results are listed below:

Table (18) summarizes the estimated model using Stock return volatility as the dependent variable

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_AIS | 0.092168 | 0.008431 | 10.93175 | 0.0000 |
| LOG_Y(-1) | 0.761808 | 0.012554 | 60.68320 | 0.0000 |
| C | 1.519307 | 0.111557 | 13.61910 | 0.0000 |
| R-squared | 0.647437 | Mean dependent var | | 8.819797 |
| AdjustedR-squared | 0.647138 | S.D. dependent var | | 0.287806 |
| S.E. of regression | 0.170963 | Akaike info criterion | | -0.693462 |
| Sum squared resid | 68.77461 | Schwarz criterion | | -0.686122 |
| Log likelihood | 819.8985 | Hannan-Quinn criter. | | -0.690789 |
| F-statistic | 2160.496 | Durbin-Watson stat | | 2.428396 |
| Prob(F-statistic) | 0.000000 | | | |

Table (18) model (2) estimation

From table (18), the following results can be reported:

1. The final model is
   LOG_Y =1.519 +0.0921 LOG_AIS+0.7618 LOG_Y (-1)
   Where:Y (-1) is Stock return volatility with lag (1)
2. The P-value for LOG_AIS suggests that AIS has a positive significant effect on the Stock return volatility.
3. The P-value for the constant is 0.0 and the value is less than the significance level ($\alpha$ =0.05) which means that the constant has a meaning and we cannot eliminate it.

**Checking assumptions and model 2 (evaluation):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 2.428 and the two tabulated values [ dl =1.552 and du =1.803 at k = 2 ], the calculated value is between (4-du) and (4 – dl) and we cannot determine whether the auto correlationship problem exists in the model or not because it is inconclusive region.

**1- Normality assumption for model 2**

The following figure shows the distribution of the residuals of model 2

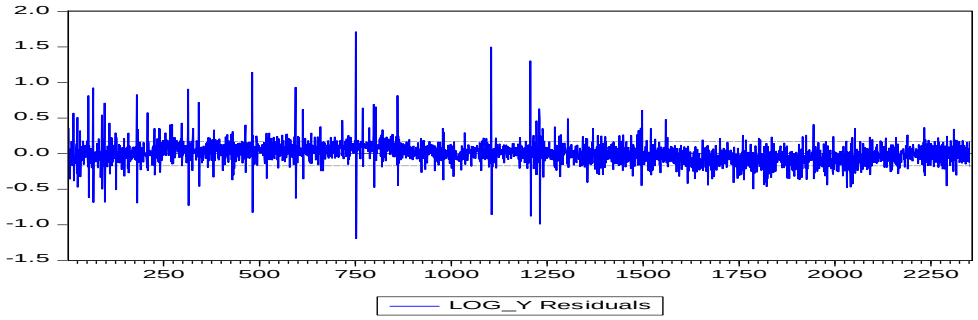


Figure 10: Distribution of residuals of model 2

Moreover, normality test is used to check the normality assumption about the residuals and table (20) shows the results.

| | |
|---|---|
| **Mean** | **-2.22e-14** |
| **Median** | **0.0016** |
| **StdDev** | **0.7128** |
| **Jarque-Bera** | **17764.58** |
| **Probability** | **0.047** |

Table (19): Jarque-Bera test of normality for model (2)

Since the probability almost the significance level, we can say that the residuals have a normal distribution.

**2- Multicolinearity assumption for model 2:**

The results are reported on Variance Inflation Factor (VIF) was measured in table (20).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_AIS** | **7.11E-05** | **1.053595** |
| **LOG_Y(-1)** | **0.000158** | **1.053595** |

Table (20): VIF for model (2)

Table (20) shows that all values of Variance Inflation Factor (VIF) do not exceed value (10), so it appears that there is no evidence for multi colinearity problem.

**3- Evaluation of Goodness of Fit for Model(2):**

a. The coefficient of determination $r^2$ =64.74% . It means that AIS and the lagged Stock return volatility are responsible for explaining 64.74% of changes in Stock return volatility over time and 35.26% is due to random error.
b. Adj- $r^2$ = 64.71 %, this value is close or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 64.71% and this appears to be a good explanatory power.

c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level (α =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (3)**

Hc: There is a positive relationship between size of Arab – Individuals- Buy (APB) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between APB and SRV. The results are listed below:

Table (21) summarizes the estimates of model 3 using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_APB | 0.121303 | 0.008295 | 14.62434 | 0.0000 |
| LOG_Y(-2) | 0.911742 | 0.006036 | 151.0493 | 0.0000 |
| R-squared | 0.574757 | Mean dependent var | | 8.819870 |
| AdjustedR-squared | 0.574576 | S.D. dependent var | | 0.287846 |
| S.E. of regression | 0.187746 | Akaike info criterion | | -0.506603 |
| Sum squared resid | 82.93996 | Schwarz criterion | | -0.501708 |
| Log likelihood | 598.5255 | Hannan-Quinn criter. | | -0.504821 |
| Durbin-Watson sta | 1.720523 | | | |

Table (21): model (3) estimation

From table (21), the following results can be reported:

1. The final model is:
   LOG_Y =0.1213 LOG_APB+0.911 LOG_Y (-2)
   Where Y (-2) denotes Stock return volatility with lag (2).
2. The P-value for LOG_APB suggests that APB has a positive and significant effect on the Stock return volatility.
3. The P-value for the constant is greater than the significance level ($\alpha$ =0.05) which means that the constant has a meaningless and we can eliminate it.

**Checking assumptions and model (3) (evaluation):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 1.72 and the two tabulated values [dl =1.552 and du =1.803 at k = 2], the calculated value is between du and dl. So, we cannot determine whether the auto correlation ship problem exists in the model or not because it is the inconclusive region.

**1- Normality assumption for model 3**

The following figure shows the distribution of the residuals of model 3

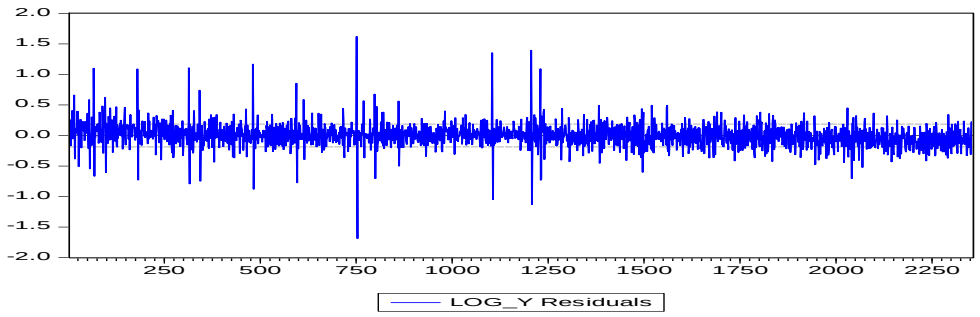


Figure 11: Distribution of residuals of model 3

Moreover, normality test is used to check the normality assumption about the residuals and table (22) shows the results.

| | |
|---|---|
| **Mean** | **0.001** |
| **Median** | **-.0016** |
| **StdDev** | **0.8769** |
| **Jarque-Bera** | **13238.85** |
| **Probability** | **0.039** |

Table (22): Jarque-Bera test of normality for model 3

Since the probability is almost the significance level, we can say that the residuals have a normal distribution.

**2- Multicolinearity assumption for model 3:**

The results are reported on the Variance Inflation Factor (VIF) which is measured in table (23).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_APB** | **6.35E-05** | **1.089310** |
| **LOG_Y(-2)** | **0.000177** | **1.089310** |

Table (23) VIF for model (3)

Table (23) shows that all values of Variance Inflation Factor (VIF) do not exceed value (10). So, it appears that that there is no evidence for the multicolinearity problem.

**4- Evaluation Goodness of Fit for Model (3):**

a. The coefficient of determination $r^2$ =57.47% . It means that APB and the lagged Stock return volatility are responsible for explaining 57.47% of the variability in Stock return volatility over time and 42.53% is due to random error.
b. The value of Adj- $r^2$ is 57.45% and this value is close to or equivalent to the value of $r^2$ which means the power of explanation after isolating the number of explanatory variables equals 57.45%. This appear to be a good explanatory power.
c. The p-value for f-test to test the goodness of the whole model (f- statistic) is less than the significance level ($\alpha$ =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (4)**

Hd: There is a positive relationship between size of Arab – Individuals- Sell (APS) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between APS and SRV. The results are listed below:

Table (24) summarizes the estimates of the model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_APS | 0.103891 | 0.007633 | 13.61064 | 0.0000 |
| LOG_Y(-2) | 0.711911 | 0.013339 | 53.37136 | 0.0000 |
| C | 1.879067 | 0.112749 | 16.66586 | 0.0000 |
| R-squared | 0.620118 | Mean dependent var | | 8.819870 |
| AdjustedR-squared | 0.619795 | S.D. dependent var | | 0.287846 |
| S.E.of regression | 0.177488 | Akaike info criterion | | -0.618555 |
| Sum squared resid | 74.09263 | Schwarz criterion | | -0.611212 |
| Log likelihood | 731.3486 | Hannan-Quinn criter. | | -0.615881 |
| F-statistic | 1919.701 | Durbin-Watson stat | | 1.572357 |
| Prob(F-statistic) | 0.000000 | | | |

Table (24): model (4) estimation

From table (24) the following results can be represented:

1. The final model is
   LOG_Y =1.87+0.103 LOG_APS+0.711 LOG_Y (-2)
   Where Y (-2) denotes Stock return volatility with lag (2).
2. The P-value for LOG_APS suggests that APS has a positive significant effect on the Stock return volatility.

3. The P-value for the constant is 0.0 and the value is less than the significance level (α =0.05) which means that the constant has a meaning and we cannot eliminate it.

**Checking assumptions and model 4 (evaluation):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 1.572 and the two tabulated values [ dl =1.552 and du =1.803 at k = 2 ], the calculated value is between (4-du) and (4 – dl). So, we cannot determine whether the auto correlationship problem exist in the model or not because it is the inconclusive region.

1- **Normality assumption for model 4**

The following figure shows the distribution of the residuals of model 4.

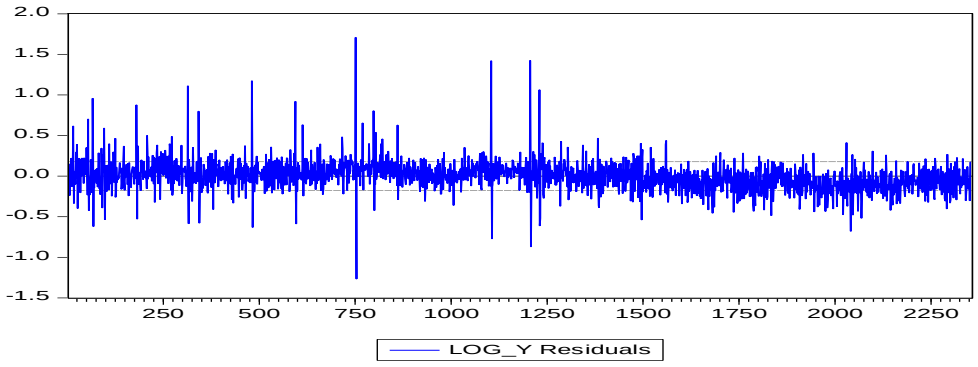


Figure 12: Distribution of residuals of model 4

Moreover, normality test is used to check the normality assumption about the residuals and table (25) shows the results.

| | |
|---|---|
| **Mean** | **-2.22e-14** |
| **Median** | **0.002** |
| **StdDev** | **0.774** |
| **Jarque-Bera** | **13604.78** |
| **Probability** | **0.045** |

Table (25): Jarque-Bera test of normality for model (4).
Since the probability almost the significance level, so we can say that the residuals have a normal distribution

2- **Multicolinearity assumptionfor model 4:**

The results are reported on Variance Inflation Factor( VIF) which was measured in table (26).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_APS** | **5.83E-05** | **1.103618** |
| **LOG_Y(-2)** | **0.000178** | **1.103618** |

Table (26): VIF for model (4)

Table (26) shows that all values of Variance Inflation Factor (VIF) do not exceed value (10). So, it appears that that there is no evidence for the multicolinearity problem.

3- **Evaluation of Goodness of Fit for Model (4):**

a. The coefficient of determination $r^2$ =62.01% which means that APS and the lagged Stock return volatility are responsible for explaining 62.01% of changes in Stock return volatility over time and 37.99% is due to random error.
b. The value of Adj- $r^2$ is 69.5% and this value is close to or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 61.97%. win turn, this appears to be a good explanatory power.

c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level (α =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (5)**

He: There is a positive relationship between size of Non-Arab – Institutions- Buy (FIB) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between FIB and SRV. The results are listed below:

Table (27) summarizes the estimated model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_FIB | 0.047283 | 0.004684 | 10.09528 | 0.0000 |
| LOG_Y(-1) | 0.753770 | 0.012867 | 58.57959 | 0.0000 |
| C | 1.891319 | 0.108492 | 17.43279 | 0.0000 |
| R-squared | 0.644911 | Mean dependent var | | 8.819797 |
| AdjustedR-squared | 0.644610 | S.D. dependent var | | 0.287806 |
| S.E. of regression | 0.171575 | Akaike info criterion | | -0.686323 |
| Sum squared resid | 69.26735 | Schwarz criterion | | -0.678983 |
| Log likelihood | 811.4887 | Hannan-Quinn criter. | | -0.683650 |
| F-statistic | 2136.758 | Durbin-Watson stat | | 2.426909 |
| Prob(F-statistic) | 0.000000 | | | |

Table (27): model (5) estimation

From table (27), the following results can be reported:

1. The final model is:
   LOG_Y =1.89+0.047 LOG_FIB+0.753 LOG_Y (-1)
   Where Y (-1) is Stock return volatility with lag (1)
2. The P-value for LOG_FIB suggests that FIB has a positive significant effect on the Stock return volatility.
3. The P-value for the constant is 0.0 and the value is less than the significance level ($\alpha$ =0.05) which means that the constant has a meaning and we cannot eliminate it.

**Checking assumptions and model 5 (evaluations):**

1. To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 2.426 and the two tabulated values [ dl =1.552 and du =1.803 at k = 2 ], the calculated value is between (4-du) and (4 – dl). So, we cannot determine whether the auto correlationship problem exists in the model or not because it is the inconclusive regio
2. **Normality assumption for model 5**
   The following figure shows the distribution of the residuals of model 5

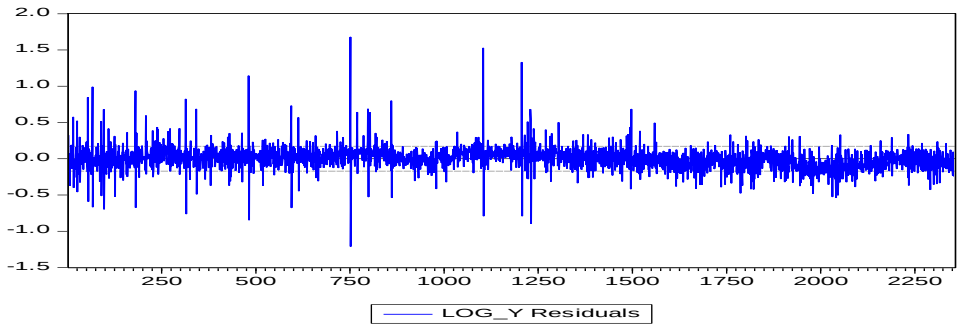


Figure 13: Distribution of residuals of model 5

Moreover, normality test is used to check the normality assumption about the residuals and table (28) shows the results.

| | |
|---|---|
| Mean | -2.207e-14 |
| Median | 0.0023 |
| StdDev | 0.717 |
| Jarque-Bera | 16712.76 |
| Probability | 0.0425 |

Table (28): Jarque-Bera test of normality for model (5)

Since the probability almost the significance level, we can say that the residuals have a normal distribution.

1- **Multicolinearity assumption for model 5:**

The results are reported on Variance Inflation Factor (VIF) which was measured in table (29).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| LOG_FIB | 2.19E-05 | 1.099015 |
| LOG_Y(-1) | 0.000166 | 1.099015 |

Table (29): VIF for model (5)

Table (29) shows that all values of Variance Inflation Factor (VIF) do not exceed value (10). So, it appears that that there is no evidence for the multicolinearity problem.

2- **Evaluation of Goodness of Fit for Model (5):**

a. The coefficient of determination $r^2$ =64.49% which means that FIB and the lagged Stock return volatility are responsible for explaining 64.49% of changes in Stock return volatility over time and 35.51% is due to random error.
b. The value of Adj- $r^2$ is 64.46% and this value is close to or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 64.46. In turn, this appears to be a good explanatory power.
c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level ($\alpha$ =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (6)**

Hf: There is a positive relationship between size of Non-Arab – Institutions- Sell (FIS) and stock return volatility at EGX.

ARDL model is used to if there is a positive relationship between FIS and SRV. The results are listed below:

Table (30) summarizes the estimated model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_FIS | 0.052151 | 0.004825 | 10.80881 | 0.0000 |
| LOG_Y(-2) | 0.724957 | 0.013461 | 53.85474 | 0.0000 |
| C | 2.114586 | 0.113741 | 18.59127 | 0.0000 |
| R-squared | 0.609591 | Mean dependent var | | 8.819870 |
| AdjustedR-squared | 0.609259 | S.D. dependent var | | 0.287846 |
| S.E. of regression | 0.179931 | Akaike info criterion | | -0.591219 |
| Sum squared resid | 76.14598 | Schwarz criterion | | -0.583876 |
| Log likelihood | 699.1603 | Hannan-Quinn criter. | | -0.588545 |
| F-statistic | 1836.223 | Durbin-Watson stat | | 1.575666 |
| Prob(F-statistic) | 0.000000 | | | |

Table (30) model (6) estimation

From table (30) the following results can be reported:

1. The final model is
   LOG_Y =2.11+0.052 LOG_FIS+0.724 LOG_Y (-2)
   Where Y (-2) is Stock return volatility with lag (2)
2. The P-value for LOG_FIS suggests that FIS has a positive significant effect on the Stock return volatility.

3. The P-value for the constant is 0.0 a3nd the value is less than the significance level (α =0.05) which means that the constant has a meaning and we cannot eliminate it.

**Checking assumptions and model 6 (evaluation):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 1.575 and the two tabulated values [dl =1.552 and du =1.803 at k = 2], the calculated value is between du and dl. So, we cannot determine whether the auto correlationship problem exist in the model or not because it is the inconclusive region.

1- **Normality assumption for model 6**

The following figure shows the distribution of the residuals of model 6

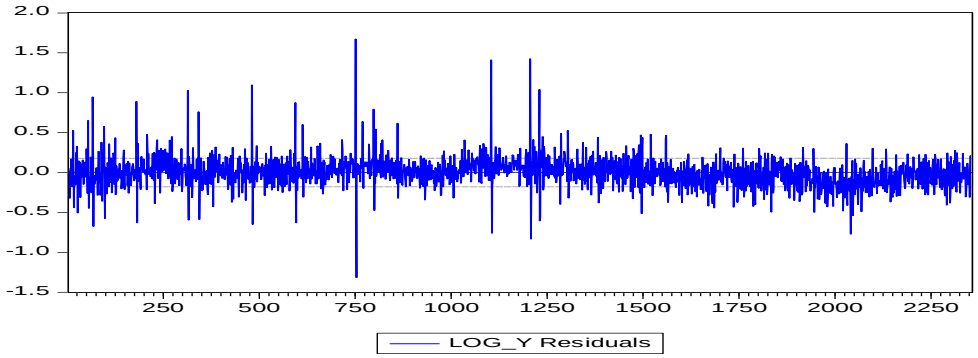


Figure 14: Distribution of residuals of model 6

Moreover normality test si used to check the normality assumption about the residuals and table (31) shows the results.

| | |
|---|---|
| Mean | -2.30e-14 |
| Median | 0.0014 |
| StdDev | 0.798 |
| Jarque-Bera | 11017.53 |
| Probability | 0.048 |

Table (31): Jarque-Bera test of normality for model (6)

Since the probability almost the significance level, we can say that the residuals have a normal distribution.

2- **Multicolinearity assumption for model 6 :**

The results are reported on Variance Inflation Factor (VIF) which was measured in table (32).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_FIS** | **2.33E-05** | **1.093677** |
| **LOG_Y(-2)** | **0.000181** | **1.093677** |

Table (32) VIF for model (5)

Table (32) shows that all values of Variance Inflation Factor (VIF) do not exceed value (10). So,it appears that there is no evidence for the multicolinearity problem.

3- **Evaluation of Goodness of Fit for Model (6):**

a. The coefficient of determination $r^2$ =60.95% which means that FIS and the lagged Stock return volatility are responsible for explaining 60.95% of changes in Stock return volatility over time and 39.05% is due to random error.
b. The value of Adj- $r^2$ is 60.92% and this value is close to or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 60.92%. This appears to be a good explanatory power.

c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level (α =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (7)**

Hg: There is a positive relationship between size of Non-Arab – Individuals – Buy (FPB) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between FPB and SRV.

The results are listed below:

Table (33) summarizes the estimated model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_FPB | 0.040149 | 0.004600 | 8.727236 | 0.0000 |
| LOG_Y(-2) | 0.972200 | 0.003192 | 304.5352 | 0.0000 |
| R-squared | 0.550650 | Mean dependent var | | 8.819870 |
| AdjustedR-squared | 0.550460 | S.D. dependent var | | 0.287846 |
| S.E.of regression | 0.192994 | Akaike info criterion | | -0.451463 |
| Sum squared resid | 87.64174 | Schwarz criterion | | -0.446568 |
| Log likelihood | 533.5978 | Hannan-Quinn criter. | | -0.449680 |
| Durbin-Watson sta | 1.768687 | | | |

Table (33): model (7) estimation

From table (33), the following results can be reported:

1. The final model is:
   LOG_Y =0.0401 LOG_FPB+0.972 LOG_Y (-2)
   Where Y (-2) is Stock return volatility with lag (2).
2. The P-value for LOG_FPB suggests that FPB hax a positive significant effect on the Stock return volatility.
3. The P-value for the constant is greater than the significance level ($\alpha$ =0.05) which means that the constant is meaningless and we can eliminate it.

1- **Checking assumptions and model 7 (evaluations):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 1.768 and the two tabulated values [dl =1.552 and du =1.803 at k = 2], the calculated value is between du and dl. So, we cannot determine whether auto correlationship problem exist in the model or not because it is the inconclusive region.

1- **Normality assumption for model 7**

The following figure shows the distribution of the residuals of model 7

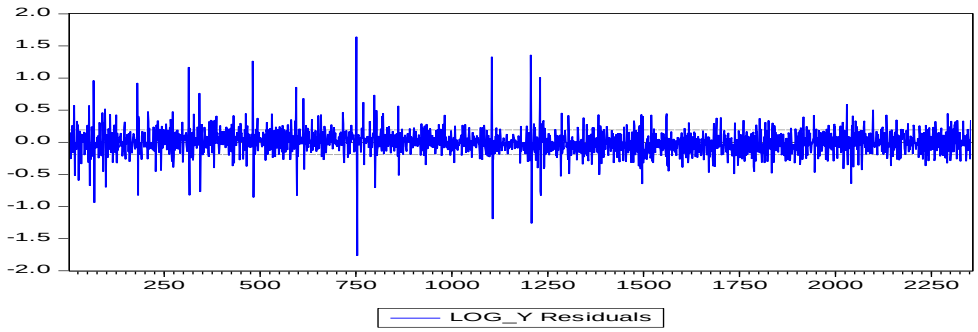


Figure 15: Distribution of residuals of model 7

Moreover normality test is used to check the normality assumption about the residuals and table (34) shows the results.

| | |
|---|---|
| **Mean** | **0.0017** |
| **Median** | **-0.0027** |
| **StdDev** | **0.912** |
| **Jarque-Bera** | **12759.39** |
| **Probability** | **0.049** |

Table (34): Jarque-Bera test of normality for model (7)

Since the probability almost the significance level, we can say that the residuals have a normal distribution.

2- **Multicolinearity assumption for model 7:**

The results are reported on Variance Inflation Factor (VIF) which was measured in table (35).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_FPB** | **2.24E-05** | **1.024453** |
| **LOG_Y(-2)** | **0.000178** | **1.024453** |

Table (35) VIF for model (5)

Table (35) shows that all values of Variance Inflation Factor (VIF) does not exceed value (10). So, it appears that there is no evidence for the multicolinearity problem.

3- **Evaluation Goodness of Fit for Model (7):**

a. The coefficient of determination $r^2$ =55.06% which means that FPB and the lagged Stock return volatility are responsible for explaining 55.06% of changes in Stock return volatility over time and 44.94% is due to random error.
b. The value of Adj- $r^2$ is 55.04% and this value is close to or equivalent to the value of $r^2$ which means that the power of explanation after isolating the number of explanatory variables equals 55.04%. In turn, this appears to be a good explanatory power.
c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level ($\alpha$ =0.05) , so that the whole model can be acceptable and the empirical results can be applied.

**Model (8)**

Hh: There is a positive relationship between size of Non-Arab – Individuals – Sell (FPS) and stock return volatility at EGX.

ARDL model is used to investigate if there is a positive relationship between FPS and SRV. The results are listed below:

Table (36) summarizes the estimated model using Stock return volatility as the dependent variable.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOG_FPS | 0.016101 | 0.004864 | 3.309969 | 0.0009 |
| LOG_Y(-2) | 0.773492 | 0.013314 | 58.09609 | 0.0000 |
| C | 1.900866 | 0.125325 | 15.16749 | 0.0000 |
| R-squared | 0.591595 | Mean dependent var | | 8.820147 |
| AdjustedR-squared | 0.591247 | S.D. dependent var | | 0.287593 |
| S.E.of regression | 0.183869 | Akaike info criterion | | -0.547913 |
| Sum squared resid | 79.48210 | Schwarz criterion | | -0.540568 |
| Log likelihood | 647.8942 | Hannan-Quinn criter. | | -0.545239 |
| F-statistic | 1702.767 | Durbin-Watson stat | | 1.622825 |
| Prob(F-statistic) | 0.000000 | | | |

Table (36): model (8) estimation

From table (36), the following results can reported:

1. The final model is:
   LOG_Y =1.9+0.016 LOG_FPS+0.773 LOG_Y (-2)
   Where Y (-2) is Stock return volatility with lag (2)
2. The P-value for LOG_FPS suggests that FPS has a positive significant effect on the Stock return volatility.
3. The P-value for the constant is greater than the significance level ($\alpha$ =0.05) which means that the constant is meaningless and we can eliminate it.

**Checking assumptions and model 8 (evaluations):**

To check the assumption of auto correlationship regarding the calculated value of Durbin Watson statistic is 1.622 and the two tabulated values [dl =1.552 and du =1.803 at k = 2], the calculated value is between du and dl. So, we cannot determine whether the auto correlationship problem exist in the model or not because it is the inconclusive region.

1- **Normality assumption for model 8**

The following figure shows the distribution of the residuals of model 8

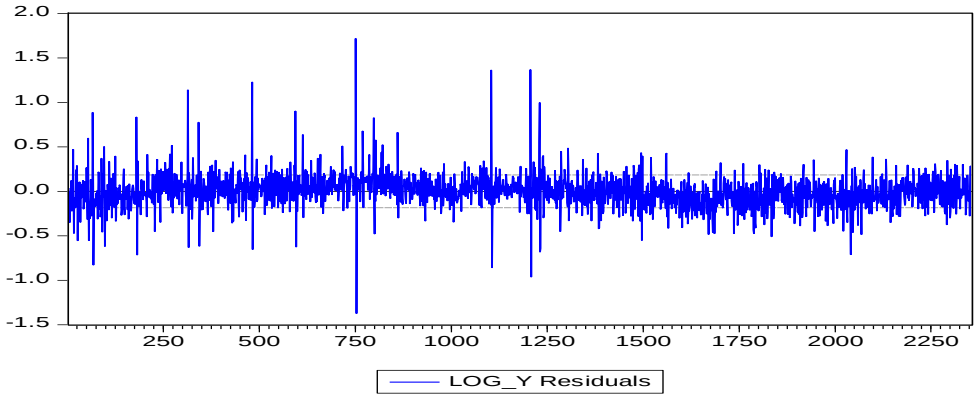


Figure 16: Distribution of residuals of model 8

Moreover, normality test is used to check the normality assumption about the residuals and table (37) shows the results.

| | |
|---|---|
| **Mean** | **-2.32e-14** |
| **Median** | **-0.0016** |
| **StdDev** | **0.813** |
| **Jarque-Bera** | **10785.73** |
| **Probability** | **0.046** |

Table (37): Jarque-Bera test of normality for model (8)
Since the probability is almost the significance level, we can say that the residuals have a normal distribution.

2- **Multicolinearity assumption for model 8 :**

The results are reported on Variance Inflation Factor (VIF) which was measured in table (38).

| Variable | Coefficient Variance | Centered VIF |
|---|---|---|
| **LOG_FPS** | **2.37E-05** | **1.023258** |
| **LOG_Y(-2)** | **0.000177** | **1.023258** |

Table (38) VIF for model (8)

Table (38) shows that all values of Variance inflation factor VIF do not exceed value (10). Accordingly, it appears that there is no evidence for the multicolinearity problem.

3- **Evaluation of Goodness of Fit for Model (8):**

a. The coefficient of determination $r^2$ =59.15% which means that FPS and the lagged Stock return volatility are responsible for explaining 59.15% of variability in Stock return volatility over time and 40.85% is due to random error.
b. The value of Adj- $r^2$ is 59.12% and this value is close to or equivalent to the value of $r^2$ which means the power of explanation after isolating the number of explanatory variables equals 59.12% and this appears to be a good explanatory power.
c. The p-value for f-test to test the goodness of the whole model (f-statistic) is less than the significance level (α

=0.05), so that the whole model can be acceptable and the empirical results can be applied.

## Research Findings:

Research analysis is based on daily bases in EGX, which is rarely studied through using Autoregressive Distributed Lagged Model introduced by Adkins, 2011.

Research findings in the Egyptian stock exchange provide evidence using research model that there is a positive relationship between stock return volatility and foreign ownership sub-variables.

According to the Model, there are eight relationships using eight models; first model measures the relationship between AIB and stock return volatility; second model measures the relationship between AIS and SRV; third model measures the relationship between APB and SR; forth model measures the relationship between APS and SRV; fifth model measures the relationship between FIB and SRV; sixth model measures the relationship between FIS and SRV; seventh model measures the relationship between FPB and SRV and, finally, eighth model measures the relationship between FPS and SRV.

Research concluded that all models have coefficient of determination $r^2$, which is more than 50% as following. For first model, $r^2$is 69.6% and random error 30.4%. For second model; $r^2$ is 64.74% and random error 35.26%. For third model; $r^2$ is 57.47% and random error is 42.53%. For forth model; $r^2$ is 62.01% and random error 37.99%. For fifth model; $r^2$ 64.49%

and random error 35.51%. For sixth model; $r^2$ is 60.95% and random error 39.05%. Finally, for seventh model; $r^2$ is 55.04% and random error is 40.85%.

The p-value for f-test to test the goodness of the whole model (f-statistics) is less than significance level ($\alpha$ =. 05) , so that the whole model can be acceptable and the empirical results can be applied.

The research has two main contributions; first, it proves that there are positive and significant relationships between foreign ownership sub-variables and stock return volatility and this proves that there is a positive and significant relationship between the main variable "foreign ownership" and stock return volatility at EGX.

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