Forecasting Foreign Direct Investment in Jordan for the Years (2011 -2030)

Salah T. Al-rawashdeh (Assistant professor)
Head of Economics & Finance Dpt
Faculty of Planning and Management, Al-Balqa Applied University
Assalt 19117, Jordan
E-mail: alrawashdeh32@hotmail.com

Jaafar H. Nsour (Part time Lecturer)
Economics & Finance Dpt.
Faculty of Planning and Management, Al-Balqa Applied University
Assalt 19117, Jordan
E-mail: jaafarnsour@yahoo.com

Rafat S. Salameh (Assistant professor)
Head of Accounting Dpt
Faculty of Planning and Management, Al-Balqa Applied University
Assalt 19117, Jordan
E-mail: dr_rafats@yahoo.com

Received: April 18, 2011 Accepted: May 26, 2011 Published: October 1, 2011
doi:10.5539/ijbm.v6n10p138 URL: http://dx.doi.org/10.5539/ijbm.v6n10p138

Abstract

This study is aimed at forecasting foreign direct investment (FDI) inflow in Jordan for the years (2011-2030), using (ARIMA), models based on data covering the period (1981-2010), it was found that the time series for the variable (FDI) was not stationary in its levels during the time, and it suffers from a unit root, we have been working to make it stationary after identifying first order of difference which was used in (ARIMA) models .in this research ,We used the computer program (Minitab, 14 and Eviews, 3.1) for data analysis and forecasting.

The study reached a set of results and found out that the expected total volume of (FDI) inflows will reached (29207.06) million Jordanian dinar (JD) by the year 2030, while the average (FDI) is equal to (1479.096) million (JD) with an average annual growth of 3.22%.

The study recommends that there is a need to provide appropriate investment environment through providing necessary incentives and facilities to investors away from bureaucracy, the need to work on a comprehensive economic plan, especially in the aftermath of the global financial crisis that affect the world m the region including Jordan, to make a comprehensive review of all legislations governing (FDI).

Keywords: FDI, Forecasting, Time series, ARIMA, Dicky-fuller, Box-Jenkins

1. Introduction

Foreign direct investment FDI is the most important factor of economic growth, which contributes to increase productivity of the national economy, reducing unemployment, creating job opportunities, increase the use of technology and other positive output that distinguish this kind of investment from other funding sources.

Due to shortages in local funding sources to finance development projects in most developing countries, those

countries realized the need for alternative resources of local funding and reliance on developed countries to provide necessary funding for these projects, including FDI to increase rates of economic growth. despite the race among Arab States to improve its investment environment to attract foreign capital through modern legislations to attract this kind of investment and enhance the competitiveness of their national economy, most of these countries are still suffering from a low volume of FDI inflow compared to other world countries, due to the lack of effective legislations that should facilitate the process of attracting FDI, impose higher taxes, the lack of political and economic stability in some countries, and the existence of administrative and financial corruption.

The world financial crisis from 2007 to present is considered by many economists to be the worst financial crisis since the great depression of the 1930s.It was triggered by a liquidity shortfall in the United States banking system, and has resulted in the collapse of large financial institutions, the bailout of banks by national governments, and downturns in stock markets around the world. In many areas, the housing market has also suffered, resulting in numerous evictions, foreclosures and prolonged vacancies. It contributed to the failure of key businesses, declines in consumer wealth estimated in the trillions of U.S. dollars, substantial financial commitments incurred by governments, and a significant decline in economic activity.

Many causes for the financial crisis have been suggested, with varying weight assigned by experts. Both market-based and regulatory solutions have been implemented or are under consideration, while significant risks remain for the world economy for the next years.

According to the annual report on the flows of FDI in the ESCWA region of the Economic and Social Commission for Western Asia - ESCWA - which includes 14 Arab countries, showed that the financial crisis has negatively affected the flows of FDI received by the countries of the region, which reached about $ 60 billion in 2008, compared with $ 64 billion in 2007, a decline of about 6.3 per cent. The report refers to the increase of foreign investment in five countries in the region, namely Bahrain, Jordan, Sudan, Syria and Lebanon (ESCWA, 2009). Since the emergence of globalization, particularly the economic ones, which leads to free movement of goods and services, labor, capital and information across national and regional boundaries, Jordan witnessed turning point in the economic system and relations with the countries of the world, through maximizing the role of the private sector, reducing the role of public sector and expanding Trade activity with the outside world, all of that has led to economic openness and competition in the markets, expansion and achieve acceptable rates of growth in recent years.

Jordan's economy is suffering from problems of poverty and unemployment for many years and a lack of funding for major economic projects which help to create the appropriate conditions to promote industrial linkages. There are barriers attracting FDI in Jordan such as Infrastructure That include weak of transportation out side major cities, the high cost of electricity and the shortfall of water supply. In the other hand political stability in the kingdom plays a major role in attracting FDI in Jordan and the advantage of the country's membership to the World Trade Organization (WTO) in the year 2000 (Al-Nuemat, 2009).

The establishment of Jordan investment board under the Investment Promotion Law in the past decade was the most prominent indicator of the economic openness and investment promotion in general and FDI in particular. The foreign investment plays an important role in the economy of any country, which leads to increase investment capital and economic growth.

1.1 Study Problem and questions

Economic forecasting is the process of attempting to predict the future condition of the economy. This involves the use of statistical models utilizing variables sometimes called indicators. Some of the most well-known economic indicators include inflation and interest rates, GDP growth decline, retail sales and unemployment rates.

The research problem is that Jordan economy suffers from a shortage of local resources, which is an obstacle from pushing economic development forward towards economic development programs.

In spite of the adoption of successive governments economic policies to increase FDI inflows, the volume of this investment is still below the level of aspirations and expectations, as there are risks and obstacles facing this investment, in this paper we will answer the following questions: -

- What is the optimal ARIMA (Autoregressive Integrated Moving Average) model to forecast FDI?

- What is the expected volume of foreign investment for the period 2011 to 2030?

1.2 Study Objectives

The main objectives of this study is to: - Forecast the volume of foreign direct investment for the next twenty

years (2011-2030) using ARIMA models based on the analysis of time series (1981-2010)

- Submit the study to economic decision-makers that hopefully is useful for the national Macro economy.

1.3 Study Importance

The importance of the study based on FDI inflow to Jordan. FDI plays an important role in compensating the shortfall of domestic savings and investment, The use of technology which has an impact on macroeconomic variables related to economic growth rates, unemployment money supply and Trade balance, therefore, forecasting FDI in Jordan for the years (2011-2030) gives economic decision-makers a clear picture of this investment in the future in a scientific manner, which helps them in making appropriate decisions for the development of economic policies that will help them attract FDI.

1.4 Study Methodology

We have used the data for the years 1981- 2010 to forecast the volume of FDI for the next twenty years. The data has been obtained from both Central Bank of Jordan and the Department of Statistics (Central Bank of Jordan, 2010; Department of Statistics, 2011). Also we adopted the methodology of Box – Jenkins using ARIMA models and Augmented Dickey Fuller (ADF) for a unit root test. We will use Minitab, 14 and Eviews, 3.1 programs for data analysis and forecasting.

2. Theoretical Background

2.1 The concept of FDI

2.1.1 FDI Definitions

There are several definitions of FDI, including:

According to the Balance of Payments Manual: Fifth Edition (BPM5), FDI refers to an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor. Further, in cases of FDI, the investor's purpose is to gain an effective voice in the management of the enterprise. The foreign entity or group of associated entities that makes the investment is termed the direct investor. The unincorporated or incorporated enterprise-a branch or subsidiary, respectively, in which direct investment is made-is referred to as a direct investment enterprise. Some degree of equity ownership is almost always considered to be associated with an effective voice in the management of an enterprise; the BPM5 suggests a threshold of 10 per cent of equity ownership to qualify an investor as a foreign direct investor (UNCTAD, 2011; Hassan, 2004).

Once a direct investment enterprise has been identified, it is necessary to define which capital flows between the enterprise and entities in other economies should be classified as FDI. Since the main feature of FDI is taken to be the lasting interest of a direct investor in an enterprise, only capital that is provided by the direct investor either directly or through other enterprises related to the investor should be classified as FDI. The forms of investment by the direct investor which are classified as FDI are equity capital, the reinvestment of earnings and the provision of long-term and short-term intra-company loans between parent and affiliate enterprises (Kawaz and Abbadi, 2007; UNCTAD, 2011).

According to Benchmark Definition of FDI, third edition, 1996 (BD3) of the Organization for Economic Co-operation and Development (OECD), a direct investment enterprise is an incorporated or unincorporated enterprise in which a single foreign investor either owns 10 per cent or more of the ordinary shares or voting power of an enterprise (unless it can be proven that the 10 per cent ownership does not allow the investor an effective voice in the management) or owns less than 10 per cent of the ordinary shares or voting power of an enterprise, yet still maintains an effective voice in management. An effective voice in management only implies that direct investors are able to influence the management of an enterprise and does not imply that they have absolute control. The most important characteristic of FDI, which distinguishes it from foreign portfolio investment, is that it is undertaken with the intention of exercising control over an enterprise (OECD, 2010).

As defined by the World Trade Organization (WTO), FDI is the investment that arises when the investor in the mother country holds and owns assets in the host country with the willing to control management and operations of that asset (Abdul hasan and Alsamarrai, 1998).

Emanate from above definitions we can conclude that FDI, in general concept, could be defined as the investment of multinational companies in foreign countries.

2.1.2 Forms of FDI

FDI takes two forms:

- Greed-field investment: establishing a wholly new operation in a foreign country.

It is a preferred form by multinational companies, because direct investors exercise wide control over an enterprise by controlling management and operations so they can achieve and maximize profits.

- Acquiring or merging with an existing firm in the foreign country: is a business agreement in which parties agrees to develop, for a finite time, a new entity and new assets by contributing equity. They both exercise control over the enterprise and consequently share revenues, expenses and assets (Abuqahf, 1991).

Other types of investment such as investing in foreign financial instruments, Portfolio investment- is not FDI.

2.1.3 Motives of FDI

There are several FDI motives that makes multi-national firms invest abroad, including:

- Investment aim to search for natural resources: it is the most common types of foreign investment in developing countries, such as excavating companies for mineral resources such as oil, sulfur, iron, gas and other resources.

- Foreign investment aimed at finding cheap and skilled labor: most multinational companies are looking for skilled manpower to enter a particular economy, such as direct investment flows to Southeast Asia, which is characterized by the skilled and cheap labor.

- investment in the service sector: After the privatization of several public firms in the developing countries including Arab countries in recent years, many foreign companies have invested in this vital sector, such as water , electricity, energy and transportation.

- Foreign investment aimed at finding market: The aim of this type of investment targeted developing countries with large markets, it considers as an alternative to the home countries of export (Dunning, 1993).

3. Literature review

There are quite a few but noteworthy empirical attempts made by the researchers to examine the growth of FDI inflows using ARIMA models. Here are some of these studies.

Abdel-Rahman (2002) investigates the Determinants of the flow of FDI to the economy of the Kingdom of Saudi Arabia (KSA) .The paper discusses FDI with respect to overall trends, sources, and their regional, sectoral and sub-sectoral distributions. It also focuses on the determinants of FDI: the roles of market size, openness and international trade, wage rates, and country risk in attracting FDI to the (KSA). Empirical methods used to gauge the issues include causality tests and conventional regression models where results generally show that activity GDP levels affect FDI in a positive and significant way. Exports had a significant negative impact on the KSA's FDI, while the socio-political risk variables were mostly significant, and negative in their impacts on FDI inflows.

Karmar and Badkardzhieva (2002) illustrate the reforms needed to attract more FDI investment in Egypt. The paper aims to draw some lessons for Egypt from the experience of Poland, Hungary and the Czech Republic during the 1990s. The paper illustrates that strengthening a country's attractiveness toward (FDI) has become a new imperative of economic policy. The achievements of the central and eastern European countries in this field appear to be very instructive. The study highlights the importance of multi-regional cooperation as the main determinant of the Egyptian FDI attractiveness.

Shoter and Abdulrazzag (2003) examine the impact of FDI on economic growth in Jordan. The paper illustrates whether or not FDI inflows enhance economic growth in Jordan. It utilizes the augmented production function that includes FDI inflows as the independent variable along with other variables that are expected to have an impact on the growth process. The results show that there is a long-run relationship between economic growth and FDI among other variables.

Alasrag (2005) analyzes development policies of FDI in Arab countries and aims to review and stimulate the mechanisms of FDI flows in the Arab States during 1992-2003. He found out that although many of the reforms that have been taken to attract more FDI in Arab countries, the flow of this investment is still weak compared with other developing countries, such as Mexico, Brazil, Hong Kong and Singapore. The FDI flows in Arab countries were smaller than the flows of FDI in China and the United States (53.5 billion dollars) in the year 2003. On the other hand the investments between the Arab countries in the same period are very low $ 20.7 billion or 44 per cent of the total flows of FDI in Arab countries.

Al-Abdulrazag and Bataineh (2007) forecast FDI inflows into Jordan for the period 2004-2025 using Box-Jenkins methodology and building ARIMA model based on time series data for the period 1976-2003.

Findings of the study show that ARIMA (0, 1, 1) is the optimal model for forecasting FDI in Jordan and there is an expected increase of FDI volumes over r the period (2004-2025).

Judi (2007) uses Autoregressive Integrated Moving Average (ARIMA) models to forecast the non-oil Gross Domestic Product (GDP) in the United Arab Emirates (UAE). The paper analysis the non-oil industry representing the GDP cost prices during the period (1970-2006), which will form a basis to predict future performance of the economy by finding the GDP estimations up to year 2020. That includes the contributions of the different economic sectors other than the oil industry. The main objective of this study is to define the most important sectors in the (UAE) non-oil economy. The outcomes of this study will help in better planning of future strategies, and give an insight of the expected performance of the economy in the next upcoming fifteen years.

Kawaz and Abbadi (2007) identify the risks of FDI on Arab countries. The research aims at knowing the importance and advantages of FDI to the host countries in addition to the risks and determinatives that face FDI in the developing countries , including Arab states , explaning the way each one of these riskis influences on FDI. In order to obtain emperical results, data was obtained for arab countries sample and linear regression had been used for the sake of testing the hypothesis of the research. The most important results of the reasearch is that to pay more attention to attracting FDI as it is one of external financial resources also determining the factors effects FDI inorder to be increased.

Meshaal and Abu Laila (2007) measure and analyze the impact of FDI and imports on economic growth of Jordan, depending on the time series for the period 1976-2003. The study is based on autoregressive (VAR) to achieve this goal, by showing the existence of a causal relationship mutually between FDI, imports and GDP. It found that the same causal relationship between FDI and imports, the existence of indirect effect of foreign investment on human capital, and there is human capital indirect effect on foreign investment through domestic capital and imports.

Sabri (2008) uses the Bayesian models to analyze the impact of FDI on macro-economy in the Republic of Yemen. A forecasting model has been constructed. The importance of the thesis is to design effective and optimal models to develop economic policies which can help attract FDI and also studying the efficiency of predictive models that could assist decision-makers. The findings were that independent variables (budget deficit, the cost of FDI, volume of employment in the investment sector, investment expenses allocated in the state's budget and agricultural production) have significant impact on (GDP) and have a high explanation capacity. Also FDI has significant impact on exports, imports, agriculture production, extraction industry, manufacturing industry and employment in the investment sector.

Al-Nuemat (2009) explores obstacles and solutions facing FDI in Jordan. He highlights the obstacles facing trans-national corporations (TNC) considering FDI. The paper uses Dunning's theory which indicates that the third world countries' ability to attract and make advantage of the potential economic avail from FDI, cultures and infrastructure, differs in accordance with its national, political, economical and legal interests and the government's policies of the hosting countries together the economical targets. It found that that some of the obstacles encountering FDI in Jordan could probably be attributed to its national infrastructural factors and government policies, as Dunning's model suggests. The paper recommends improving commercial infrastructure, reinforcing the national competitive capability and the economical policies, raising the economic openness, increasing the government's investment share in the basic infrastructures, encouraging private sector to join this field and lifting up the level of human resources.

Bakir and Alfawwaz (2009) identify the determinants of FDI in Jordan during the past decade. The sample focuses on Arab countries during the years 1996-2007 to verify whether the Greater Arab Free Trade Area Agreement (GAFTA) has an effect on FDI or not. The standard gravity model used to determine the factors that affect FDI and the effect of GAFTA. The model assumes that FDI depends on variables such as GDP, per capita GDP, distance, integration agreements, border countries and immigration (Jordanians working abroad). The paper concludes that country size in terms of GDP and per capita are the major determinants of FDI. Distance, common borders and the presence of Jordanian workers in the respective countries plays no significant role in determining FDI. Also it shows that the GAFTA factor was insignificant in influencing FDI.

4. Data analysis and discussions

Please insert table (1) here

Based on the data obtained from table (1), we have to test the stationary of time series whether it has a unit root or not.

4.1 Unit Root Test

In one of the most widespread unit root test is the Augmented Dickey Fuller (ADF) test by using (EVIEWS, 3.1) program It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The testing procedure for the (ADF) test is the same as for the Dickey–Fuller test but it is applied to the model

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

Where α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. Imposing the constraints α = 0 and β = 0 corresponds to modelling a random walk and using the constraint β = 0 corresponds to modelling a random walk with a drift. By including lags of the order p (Greek for 'rho') the ADF formulation allows for higher-order autoregressive processes. This means that the lag length p has to be determined when applying the test. One possible approach is to test down from high orders and examine the t-values on coefficients. An alternative approach is to examine information criteria such as the Akaike information criterion, Bayesian information criterion or the Hannan-Quinn information criterion (Dickey and Fuller,1979).

The unit root test is then carried out under the null hypothesis γ = 0 against the alternative hypothesis of γ < 0. Once a value for the test statistic

$$DF_\tau = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

is computed it can be compared to the relevant critical value for the Dickey–Fuller Test. If the test statistic is less (this test is non symmetrical so we do not consider an absolute value) than (a larger negative) the critical value, then the null hypothesis of γ = 0 is rejected and no unit root is present (Dickey and Fuller, 1981).

The intuition behind the test is that if the series is integrated then the lagged level of the series ($yt - 1$) will provide no relevant information in predicting the change in *yt* besides the one obtained in the lagged changes ($\Delta yt - k$). In that case the $\gamma = 0$ null hypothesis is not rejected model that includes a constant and a time trend is estimated (Elliott, Rothenberg and Stock (1996).

The Phillips–Perron (PP) test is also a unit root test. That is, it is used in time series analysis to test the null hypothesis that a time series is integrated1. It builds on the Dickey- Fuller test of the null hypothesis $\delta = 0$ in, where is the first difference operator. Like the the augmented Dickey- Fuller test , the (PP) test addresses the issue that the process generating data for *yt* might have a higher order of autocorrelation than is admitted in the test equation - making $yt - 1$ endogenous and thus invalidating the Dickey–Fullert- test. Whilst the augmented Dickey–Fullert addresses this issue by introducing lags of as regressors in the test equation, the (PP) test makes anon-parametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation (Phillips and Perron, 1988).

Decision rule:

If t* > ADF, PP critical value, the decision: not reject null hypothesis, unit root exists, the value series is non-stationary.

If t* < ADF, PP critical value, the decision: reject null hypothesis, unit root does not exist, the value series is stationary.

If ADF, PP value (in obsolute terms) < t* critical value (in obsolute terms), the decision: not reject null hypothesis, unit root exists, the value series is non-stationary

If ADF, PP value > t* critical value (in absolute terms), the decision: reject null hypothesis, unit root does not exist, the value series is stationary

Please insert table (2) here

Since the computed ADF test -statistics (-3.135505) is greater than the critical values – "tau"(-4.3082, -3.5731 and -3.2203 at 1%, 5% and 10% significant level, respectively), we can not conclude to reject Ho. That means the FDI series has a unit root problem and the FDI series is a non-stationary series.

Please insert table (3) here

Again, the computed Phillips - Perron test -statistic (-3.052529) is greater than the obsolute critical values - "tau" (-4.3082, -3.5731, -3.2203 at 1%, 5% and 10% significant level, respectively), thus we cannot conclude to reject

the Ho. That means the FDI series is a non-stationary series.

Please insert table (4) here

Now the absolute value of ADF test -statistic (-4.494762) is greater (in absolute terms) than the critical "tau" (in absolute terms) -3.6852, -2.9705, -2.9705 at 1%, 5%, 10%, respectively, thus we can conclude that it is the first differences of the value series that are stationary . Therefore, the first differenced time series can be used for forecasting. The Durbin-Watson statistics is significant at (1.687274)

Please insert table (5) here

Again, the absolute computed Phillips - Perron test -statistic (-4.164880) is also grater than the critical "tau" (in absolute terms). This means the 1st-difference of FDI series is stationary and can be used for forecasting.

4.2 Box – Jenkins Models (ARIMA)

The Box-Jenkins approach to modelling Auto Regressive, Integrated, and Moving Average (ARIMA) processes is a mathematical model used for forecasting. Box-Jenkins modelling involves identifying an appropriate ARIMA process, fitting it to the data, and then using the fitted model for forecasting. One of the attractive features of the Box-Jenkins approach to forecasting is that ARIMA processes are a very rich class of possible models and it is usually possible to find a process which provides an adequate description to the data. The original modelling procedure involved an iterative three-stage process of model selection, parameter estimation and model checking ((Box and Jenkins, 1970; Vandaele, 1983).

Recent explanations of the process often add a preliminary stage of data reparation and a final stage of model application or forecasting. Each ARIMA process has three parts: the autoregressive (or AR) part; the integrated (or I) part; and the moving average (or MA) part. The models are often written in shorthand as ARIMA (p, d, and q) where p describes the AR part, d describes the integrated part and q describes the MA part.

AR: This part of the model describes how each observation is a function of the previous p observations. For example, if p = 1, then each observation is a function of only one previous observation. That is,

$$Yt = c + \varphi 1 Yt-1 + et$$

Where Yt represents the observed value at time t, Yt−1 represents the previous observed value at time t − 1, et represents some random error and c and φ1are both constants. Other observed values of the series can be included in the right-hand side of the equation if p > 1:

$$Yt = c + \varphi 1 Yt-1 + \varphi 2 Yt-2 + \cdots + \varphi p Yt-p + et.$$

(I): This part of the model determines whether the observed values are modeled directly, or whether the differences between consecutive observations are modelled instead. If d = 0, the observations are modelled directly. If d = 1, the differences between consecutive observations are modelled. If d = 2, the

differences of the differences are modelled. In practice, d is rarely more than 2.

MA: This part of the model describes how each observation is a function of the previous q errors. For example, if q = 1, then each observation is a function (Makridakis, Wheelwright and Hyndman, 1998).

Although we have made a unit root test, and prove that FDI series was not stationary, and determined the first difference for ARIMA models, but it is better to emphasize it again before we go a head with forecasting.

4.2.1 Data preparation

Please insert figure (1) here

From the line graph in Figure (1). we can see that the time series is likely to have upward trend and seasonal cycles, which implies to non-stationary level. It is clear that variance in the FDI series is not stable where the variation changes with the level, an indication that it is not stationary. This means that the short term mean level is not constant but varies over the time of series.

Please insert figure (2) here

Autocorrelation Function (ACF) is used as shown in Figure (2). It illustrate that there is a significant spike at ACF at lag (1, and after the first lag, the ACFs are slowly declined. We can conclude again that time series is non- stationary.

Please insert figure (3) here

From Figure (3) Partial Autocorrelation Function PACF of the difference series in the estimation period, we see that it has a significant spike at lag (1). The mean and variance do not remain constant throughout the time

periods indicating the non-stationary of the time series.

Since the ACF and PACF have spikes at lag (1), so the differences can be used for ARIMA model.

Please insert figure (4) here

Graph in figure (4) shows that after taking differences the time series became stationary, noting that the variance is stable where the variation changes with the level.

Please insert figure (5) here

From figure 5, it is clearly that the ACF first difference series has no significant spikes at any lags. We can conclude that time series is stationary.

Please insert figure (6) here

Figure 6 show that the PACF first difference series has no significant spikes at any lags. We conclude that ARIMA models with first difference are recommended for the time series.

4.2.2 Estimating ARIMA models

Since the time series become stationary after the first difference, it is possible to estimate the following models and choose the most appropriate model for forecasting. The autoregressive (or AR) part; the integrated (or I) part; and the moving average (or MA) part. The models are often written in shorthand as ARIMA (p, d, and q)

Where p describes the AR part, d describes the integrated part and q describes the MA part.

4.2.3 Parameter estimation

In order to find the values of the model coefficients which provide the best fit to the data? And testing the assumptions of the model to identify any areas where the model is inadequate. We used (Minitab, 14) program. We suggest using the first difference included in the following models:-

- The autoregressive model AR (1, 1, 0) - the moving average model MA (0, 1.1)

- The integrated (AR) part; and (MA) part. Written as ARIMA (1, 1, 1)

Autoregressive model AR (1, 1, 0)

Please insert table (6) here

From table (6) the coefficient of AR (1) with the first difference is not statistically significant at (0.05) level as significant "P" (0.678 is greater than (0.05), thus we ignore this model.

Moving average model MA (0, 1, 1)

Please insert table (7) here

Results from table (7) shows that the coefficient of MA (1) with the first difference is statistically significant at a level significantly (0.05) as significant "P" (0.001 is less than (0.05). thus we can conclude that this model is inadequate for forecasting the data.

Please insert figure (7) here

In Figure (7), ACF of residuals shows that FDI series has no problem with residuals and there are no spikes which indicate a good sign for using this model for forecasting.

Please insert figure (8) here

We also have no problem with the PACF of residuals. So it's likely to use (0.1.1) model for forecasting.

Autoregressive model AR and moving average model MA with first difference ARIMA (1, 1, 1).

Please insert table (8) here

Results obtained from table (8).The coefficient of AR (1) with the first difference is not statistically significant at (0.05) level as "P" value (0.142) is greater than (0.05), thus we ignore this model.

4.2.4 Model checking

Please insert table (9) here

Results from table (9) show that the values of Mean Absolute Percentage Error (MAPE) 1.229, Mean Absolue Deviation (MAD) 12.060, Mean Squre Deviation (MSD) 151.688, Akaie Info. Criterion (AIC) 14.47447 and Schwarz Criterion (SC) 14.61591 have achieved the smallest values for model (0.1.1) compared with other models, this would prove that (0.1.1) is the optimal model for forecasting.

Durbon Watson Criterion (DW) for this model is 1.84 very close to 2.0 and the highest. Adjusted R2 0.524810 is also the highest.

5. Conclusions and Recommendations

5.1 Conclusions

Please insert Table (10) here

Table (10) represents the conclusion of the study which is the forecasting FDI over the coming twenty years and we found out the following findings:-

- The total volume of direct investment is expected for the years (2010-2029) is (29207.06) million Jordanian dinar (JD). - Average foreign direct investment is expected for the next twenty years is (1479.096) million (JD) with an average growth rate of 3.22% per year.

- There is an expected smooth increase of FDI inflows in to Jordan over the years (2010-2029)

5.2 Recommendations

1 - To provide a suitable investment environment in Jordan through more incentives and facilities to investors away from the bureaucracy and the removal of the obstacles faced by these investors.

2- To work on creating investment opportunities to attract more FDI in the country.

– To work on a comprehensive economic plan, in light of the global financial crisis that has been affected Jordan and the region aimed at. Inspiring economic growth, creating more job opportunities, reducing poverty.

4 - Conduct a comprehensive review of all legislation governing FDI in general and the Investment Promotion Law in particular.

5 - To pay more efforts by the government on fighting all forms of corruption.

6- It's very essential for decision –makers to take a look at the results of this research.

7- This study is subject to a limitation and might be explored in future research. It adopted box Jenkins methodology for forecasting. While ARIMA models limiting the choice of methodology, which is only employing time series data collection for forecasting. Thus could be varied from one study to another one that depends on the number of years used in the time series and any added data could change the results accordingly. Despite this limitation, this study has provided several important insights into issues relating to forecasting. Hopefully, this study will encourage researchers to conduct further studies about forecasting FDI in Jordan.

References

Abdel-Rahman, A. (2002). The Determinants of Foreign Direct Investment in the Kingdom of Saudi Arabia. Economic Research Forum, working paper, 200238. [Online] Available: http://www.erf.org.eg/cms.php?id=publication_details&publication_id=313

Abdul Hasan, S., & Al-Samarrai, H. (1998). *A seminar on foreign investment justification and notification*. Baghdad: Bayt al-Hikma.

Abuqahf, A. (1991). *Economics of international investment.* (1st ed.). Alexandria: Modern Arab Bureau.

Al-Abdulrazag, B., and Bataineh, T. (2007). Forecasting Foreign Direct Investment Inflow in Jordan: Univariate ARIMA Model. *Journal of Social Sciences*, 3 (1), 1-6. http://dx.doi.org/10.3844/jssp.2007.1.6

Alasrag, H. (2005). Foreign Direct Investment Development Policies in the Arab Countries. MPRA Paper, (83). [Online] Available: http://mpra.ub.uni-muenchen.de/2230/ (Mar, 2007).

Al-Nuemat, A. (2009). Obstacles and Solutions Facing Foreign Direct Investment in Jordan. *European Journal of Social Sciences,* 9 (2), 323.

Bakir, A., & Alfawwaz, T. (2009). Determinants of Foreign Direct Investment in Jordan. *International Management Review*, 5 (2), 66-73.

Box, G., & Jenkins, G. (1970). *Time Series Analysis, Forecasting and Control.* San Francisco: Holden-Day.

Central Bank of Jordan. (2010). Annual reports. [Online] Available: http://www.cbj.gov.jo/arabic/pages.php?menu_id=134&local_type=0&local_id=0&local_details=0&local_details1=0&localsite_branchname=CBJ. (Apr, 2010).

Department of Statistics. (2011). Information System of Trade and Investment. [Online] Available: www.jotiis.dos.gov.jo:7001/JoTIIS/InvFDI.jsp. (Jan, 2011)

Dickey, D., & Fuller, W. (1979). Distribution of the Estimators for Autoregressive Time Series with A unit root. *Journal of the American Statistical Association*, 84, 427-431. http://dx.doi.org/10.2307/2286348

Dickey, D., & Fuller, W. (1981). Likelihood Ratio Stastics for Autoregressive Time Series with A unit root. *Econometrica*, 49, 1057-1072. http://dx.doi.org/10.2307/1912517

Dunning, J. (1993). *Multinational Enterprise and the Global Economy*. Workingham: Addison-Wesley.

Elliott, G., Rothenberg, T., & Stock, J. (1996). Efficient Tests for an Autoregressive unit root. *Econometrica*, 64, 4, 813–836.

ESCWA. (2009). Foreign Direct Investmet report. UN, NY. [Online] Available: http://www.escwa.un.org/information/publications/edit/upload/edgd-09-TP2.pdf. (Sep, 2009).

Hassan, K. (2004). Foreign investment, Definitions and issues, Arab Planning Institute. (32).1 - 29. [Online] Available: http://www.arab-api.org/devbrdg/delivery/develop_bridge33.pdf. (Nov, 2004).

Judi, Y. (2007). Forecasting the None-Oil GDP in the United Arab Emirates Using ARIMA Models. International Review of Business Research Papers, 3(2), 162-183.

Karmar, B., & Badkardzhieva, D. (2002). The Reforms Needed to Attract More FDI in Egypt: Lessons from the CEEC Experience. Economic Research forum, Working Paper, No 200240R [Online] Available: www.erf.org.eg/CMS/getFile.php%3Fid%3. (Dec, 2002).

Kawaz, M., & Abbadi, O. (2007). Risks of foreign direct investment study of a sample of Arab States. *Encyclopedia of Islamic economics and finance,* (1), 1-16. [Online] Available: www. iefpedia.com/arab/wp-content/uploads, (Aug, 2007).

Makridakis, S., Wheelwright, S., & Hyndman, R. (1998). *Forecasting: methods and applications.* (3rd ed), New York: John Wiley and sons.

Meshaal, Z., & Abu Laila, Z. (2007). The impact of FDI on Economic Growth: An Empirical Study on Jordan. *Journal of Economic and Administrative Sciences*, 23 (1), 1-31.

OECD. (2010). *Benchmark Definition of Foreign Direct Investment.* (3rd Ed). [Online] Available: http://www.oecd.org/dataoecd/10/16/2090148.pdf (Aug, 2009).

Phillips, P.C, B, & Perron, p. (1988). Testing For A Unit Root In Time Series Regressions. *Biometrika,* 75, 335-346. http://dx.doi.org/10.1093/biomet/75.2.335

Sabri, I. (2008). The use of Bayesian models to analyze the impact of FDI on the overall economy of Yemen. PhD thesis, University of Niles, Sudan.

Shoter, M., & Abdulrazzag, B. (2003). The Impact of Foreign Direct Investment on Economic Growth in Jordan. *J. for International Business and Entrepreneurship Development,* 1(1), 14 - 21. (June 6, 2002).

UNCTAD. (2011). Foreign Direct Investment. [Online] Available: http://www.unctad.org/templates/Page.asp?intItemID=3146&lang=1. (Jan, 2011).

Vandaele, W. (1983). Time Series and Box-Jenkins Models. In A. H. Haroon & A. Azzam (Eds). Applied methods for Time series and Box –Jenkins Models (pp.52-112). Riyadh: Dar Almariekh publications.

Table 1. Volume of FDI for the years (1981-2010)

year	Value in million Jordanian dinar (JD)	year	Value in million Jordanian dinar (JD)
1981	46.90	1996	79.20
1982	33.00	1997	176.00
1983	13.70	1998	217.60
1984	29.90	1999	109.00
1985	9.60	2000	576.40
1986	10.50	2001	936.00
1987	13.50	2002	528.00
1988	9.60	2003	309.30
1989	1.00	2004	461.60
1990	45.80	2005	108.60
1991	0.20	2006	241.46
1992	47.10	2007	1348.80
1993	40.50	2008	1385.60
1994	21.40	2009	1666.60
1995	37.60	2010	643.30

Table 2. ADF test for FDI in its level

ADF Test Statistic	-3.135505	1% Critical Value*		-4.3082
		5% Critical Value		-3.5731
		10% Critical Value		-3.2203
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.540879	0.172501	-3.135505	0.0042
C	-146.2239	122.9334	-1.189457	0.2450
@TREND(1981)	21.69374	9.376513	2.313626	0.0289
R-squared	0.274547	Mean dependent var		20.56552
Adjusted R-squared	0.218743	S.D. dependent var		332.8363
S.E. of regression	294.1899	Akaike info criterion		14.30403
Sum squared resid	2250241.	Schwarz criterion		14.44547
Log likelihood	-204.4084	F-statistic		4.919829
Durbin-Watson stat	1.653068	Prob(F-statistic)		0.015414

Table 3. Phillips - Perron test for FDI in its level

PP Test Statistic	-3.052529	1% Critical Value*		-4.3082
		5% Critical Value		-3.5731
		10% Critical Value		-3.2203
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Residual variance with no correction				77594.51
Residual variance with correction				69549.92
Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.540879	0.172501	-3.135505	0.0042
C	-146.2239	122.9334	-1.189457	0.2450
@TREND(1981)	21.69374	9.376513	2.313626	0.0289
R-squared	0.274547	Mean dependent var		20.56552
Adjusted R-squared	0.218743	S.D. dependent var		332.8363
S.E. of regression	294.1899	Akaike info criterion		14.30403
Sum squared resid	2250241.	Schwarz criterion		14.44547
Log likelihood	-204.4084	F-statistic		4.919829
Durbin-Watson stat	1.653068	Prob(F-statistic)		0.015414

 ISSN 1833-3850 E-ISSN 1833-8119

Table 4. ADF test for FDI in its level with first difference

ADF Test Statistic	-4.494762	1% Critical Value*		-3.6852
		5% Critical Value		-2.9705
		10% Critical Value		-2.9705
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.101352	0.245030	-4.494762	0.0001
C	27.65928	66.57434	0.415465	0.6812
R-squared	0.437265	Mean dependent var		-36.05000
Adjusted R-squared	0.415621	S.D. dependent var		450.2620
S.E. of regression	344.2014	Akaike info criterion		14.58908
Sum squared resid	3080341.	Schwarz criterion		14.68424
Log likelihood	-202.2471	F-statistic		20.20288
Durbin-Watson stat	1.687274	Prob(F-statistic)		0.000128

Table 5. Phillips-perron Unit Root test for (FDI) with first difference

PP Test Statistic	-4.164880	1% Critical Value*		-3.6852
		5% Critical Value		-2.9705
		10% Critical Value		-2.6242
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Residual variance with no correction				110012.2
Residual variance with correction				74453.10
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.101352	0.245030	-4.494762	0.0001
C	27.65928	66.57434	0.415465	0.6812
R-squared	0.437265	Mean dependent var		-36.05000
Adjusted R-squared	0.415621	S.D. dependent var		450.2620
S.E. of regression	344.2014	Akaike info criterion		14.58908
Sum squared resid	3080341.	Schwarz criterion		14.68424
Log likelihood	-202.2471	F-statistic		20.20288
Durbin-Watson stat	1.687274	Prob(F-statistic)		0.000128

Table 6. AR (1, 1, 0) statistics

Type	**Coef**	**SE Coef**	**T**	**P**
AR 1	0.1008	0.2405	-0.42	0.678
Constant	26.41	63.23	0.42	0.679
Differencing: 1 regular difference				
Number of observations: Original series 30, after differencing 29				
Residuals: SS = 3081789 (backforecasts excluded) MS = 114140 DF = 27				
Modified Box-Pierce (Ljung-Box) Chi-Square statistic				
Lag	12	24	36	48
Chi-Square	9.2	9.5	*	*
DF	10	22	*	*

Table 7. MA (0, 1, 1) statistics

Type	**Coef**	**SE Coef**	**T**	**P**
MA 1	0.6019	0.1557	3.87	0.001
Constant	37.49	25.10	1.49	0.147
Differencing: 1 regular difference				
Number of observations: Original series 30, after differencing 29				
Residuals: SS = 3002946 (backforecasts excluded) MS = 111220 DF = 27				
Modified Box-Pierce (Ljung-Box) Chi-Square statistic				
Lag	12	24	36	48
Chi-Square	13.5	14.5	*	*
DF	10	22	*	*

Table 8. ARIMA (1, 1, 1) statistics

Type	**Coef**	**SE Coef**	**T**	**P**
AR 1	0.4491	0.2963	1.52	0.142
MA 1	0.9065	0.2224	4.08	0.000
Constant	19.157	9.425	2.03	0.052
Differencing: 1 regular difference				
Number of observations: Original series 30, after differencing 29				
Residuals: SS = 2500746 (backforecasts excluded) MS = 96183 DF = 26				
Modified Box-Pierce (Ljung-Box) Chi-Square statistic				
Lag	**12**	**24**	**36**	**48**
Chi-Square	8.4	9.3	*	*
DF	**9**	**21**	*	*

Table 9. Values of the model coefficients

MODEL	**MAPE**	**MAD**	**MSD**	AIC	SC	RMSE	DW	**Adjusted R2**
AR (1,1,0)	1.351	19.338	385.958	14.50561	14.64834	294.2424	1.803291	0.522376
MA(0,1,1)	**1.229**	**12.060**	**151.688**	**14.47447**	**14.61591**	**31.97038**	**1.847094**	**0.524810**
ARIMA (1,1,1)	1.912	21.245	540.220	14.57671	14.76703	66.46703	1.831928	0.502635

Table 10. Forecasting results for the period 2011-2030

Period	***Forecast***	***Lower***	**Upper**
2011	1104.24	450.45	1758.02
2012	1141.72	438.03	1845.41
2013	1179.21	428.92	1929.50
2014	1216.69	422.54	2010.85
2015	1254.18	418.46	2089.90
2016	1291.67	416.35	2166.98
2017	1329.15	415.96	2242.34
2018	1366.64	417.08	2316.20
2019	1404.12	419.54	2388.71
2020	1441.61	423.20	2460.02
2021	1479.10	427.95	2530.24
2022	1516.58	433.69	2599.47
2023	1554.07	440.34	2667.80
2024	1591.55	447.81	2735.30
2025	1629.04	456.05	2802.02
2026	1666.53	465.01	2868.04
2027	1704.01	474.63	2933.40
2028	1741.50	484.86	2998.13
2029	1778.98	495.67	3062.29
2030	1816.47	507.03	3125.91

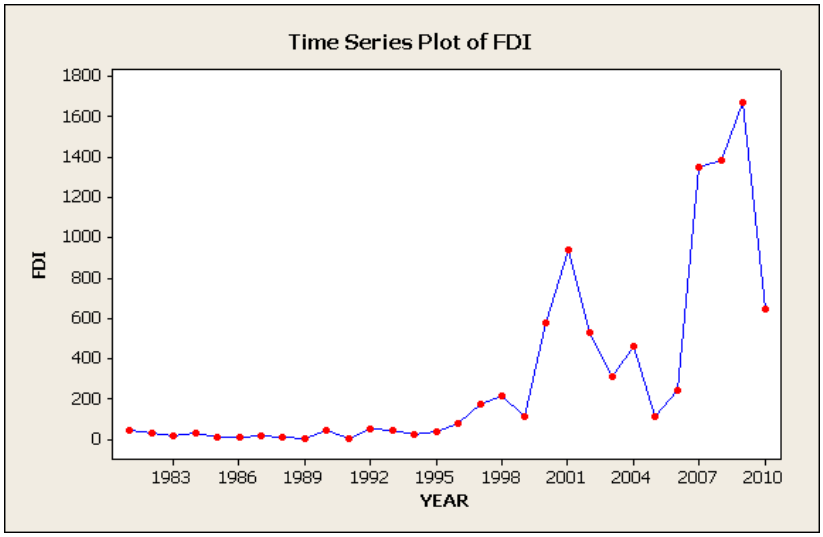

Figure 1. Plot of FDI in Millions of Jordanian dinar (JD)

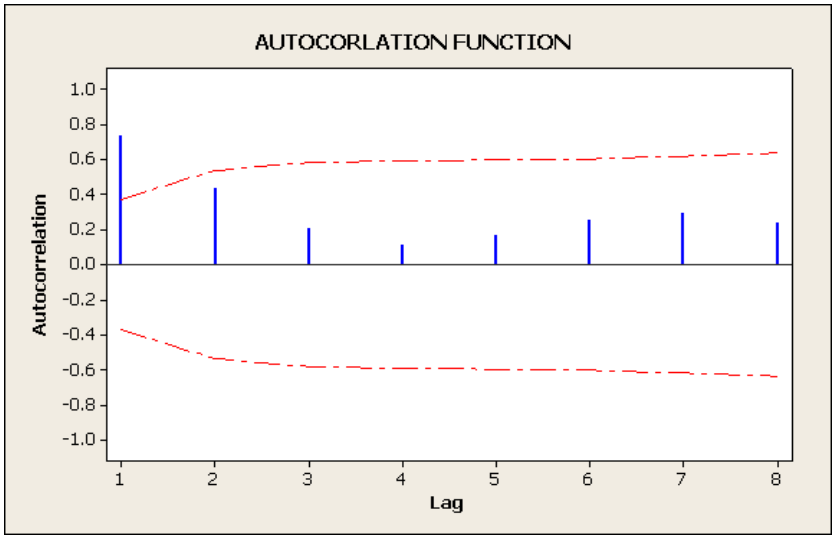

Figure 2. Autocorrelation Function (ACF) for FDI

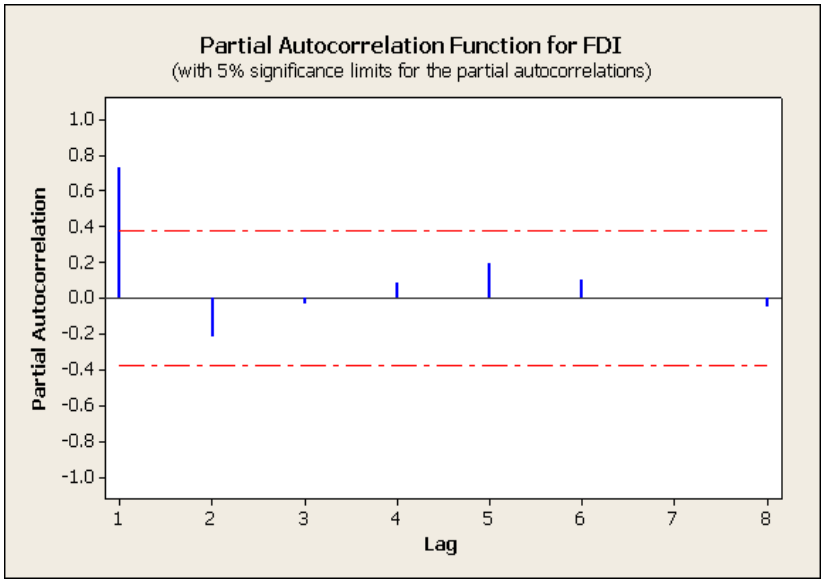

Figure 3. Partial Autocorrelation Function PACF for FDI

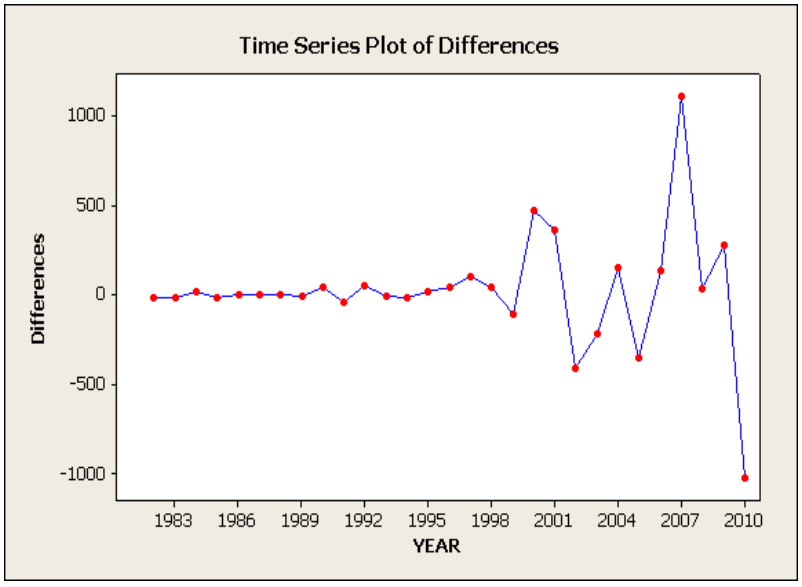

Figure 4. Plot of time series for FDI after taking differences in Millions of JD

ISSN 1833-3850 E-ISSN 1833-8119

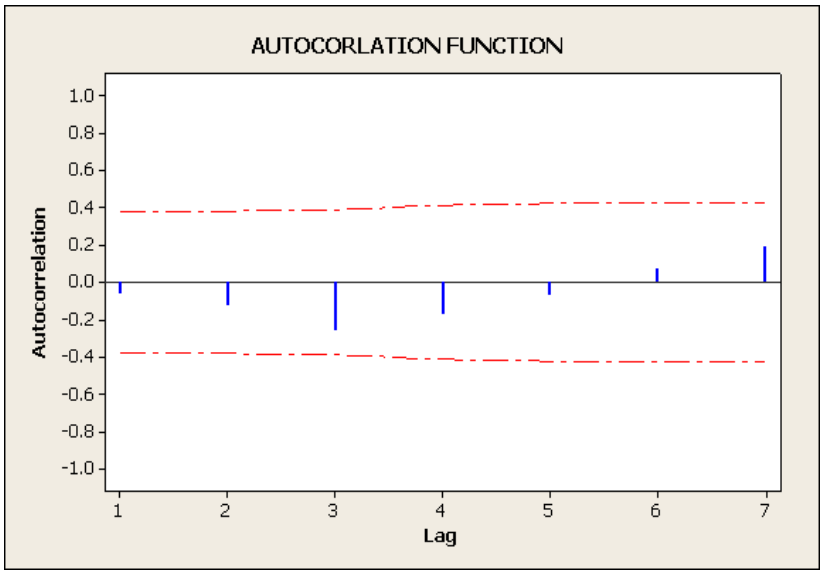

Figure 5. ACF for FDI after taking differences

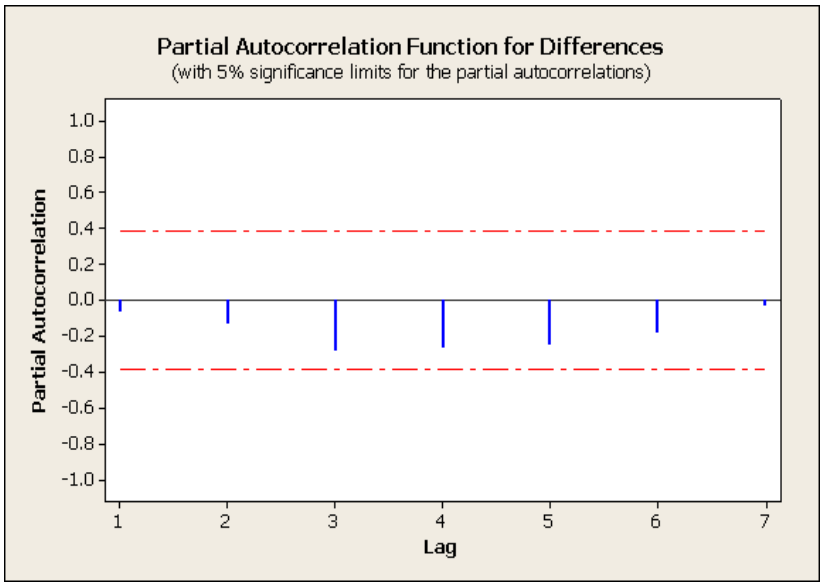

Figure 6. PACF for FDI after taking differences

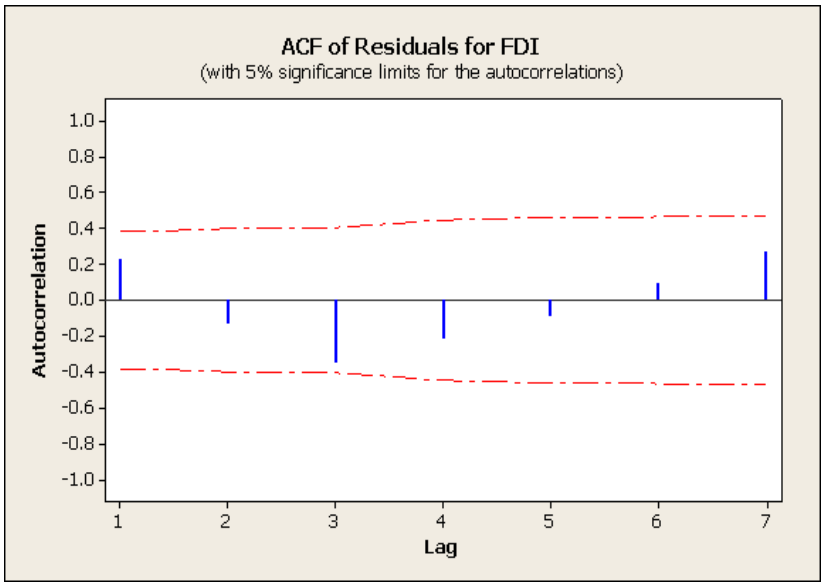

Figure 7. ACF for MA (0, 1, 1) model

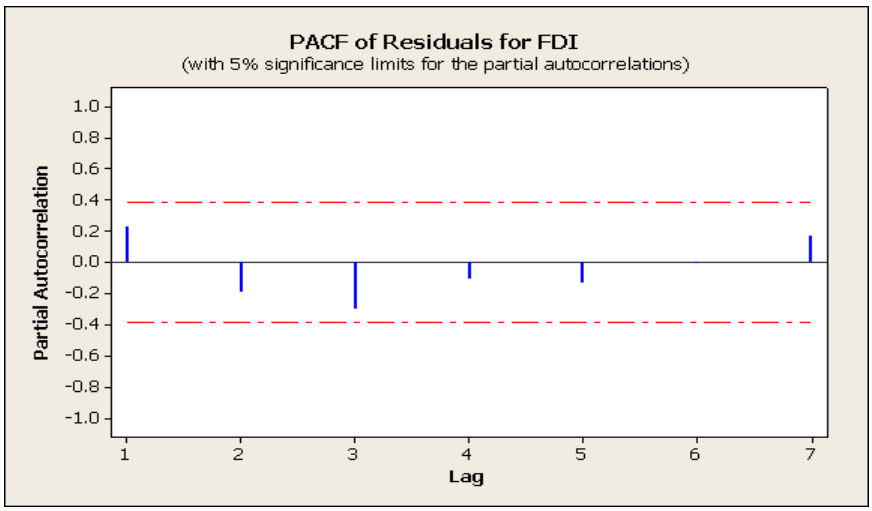

Figure 8. PACF for MA (0, 1, 1) model

ISSN 1833-3850 E-ISSN 1833-8119