The Impact of the Inflows of the Foreign Direct Investment on the Egyptian Economic Growth Rate - Time Series Analysis

Ghada Gomaa A. Mohamed
ECO-ENA: Economics & ECO-Engineering Associate., Inc.®, Canada
Department of Public Finance, Faculty of Commerce, Alexandria University, Egypt

Eman Gamal El-Deen
Department of Economics, Faculty of Commerce, Damnhour University, Egypt

ABSTRACT
This paper tests empirically the effect of the real inflows of the foreign direct investment on the Egyptian growth rate by utilizing a simple intervention time series model to capture the dynamism of such effect over time. The results show positive significant effects of the real foreign direct investment inflows on the Egyptian growth rate but recommendations show that this effect should be enhanced from time to time in order to prolong the convergence to the saddle path of the growth and hence to guarantee a sustainable growth over-time.

Keywords: Economic Growth Rate, Growth, Foreign Capital Inflows, Foreign Direct Investment, Egypt, Dynamic Analysis, Sustainability, Steady-state, Intervention model, Time series analysis
JEL: C58, E00, C00

INTRODUCTION
This paper tests empirically the effect of the real foreign direct investment inflows on the Egyptian growth rate by utilizing a simple intervention time series model to capture the dynamism of such effect over time. All required time series data from 1977 to 2016 were collected from the financial statistics yearbook: International Monetary Fund's Official Website.. All data were modified to figure out the main variables of the adopted models. All time series were checked for possible existence of hetroscedasticity and unit root. No possible existence of unit root was found. Yet; an existence of the hetroscedasticity in the main time series was found so the analysis used the relevant regression method to control for this issue. The analysis were run on three levels; the first intervention model captured the dynamic effect of the real foreign direct investment inflows on the Egyptian growth rate. The second model & the third models were run to capture the same effect but on two stages that other intertwined variables were enlisted in an instrumental vector to control for their effect and to avoid any existence of multicolinearity as well. the best fit-intervention models were selected out of 15 potential models until ARMA (3,3) depending on criteria of diagnostic checks in addition to the lowest AIC & SC. The results of the three models concluded that there is a positive significant effect of the foreign direct investment inflows on the Egyptian economic growth yet this effect vanishes along the path to the long-run growth because of the convergence criterion of the elected best fit models. Hence; recommendations are to encourage more inflows of the foreign capital to prolong the convergence to the steady state growth and hence to guarantee higher positive growth rates during a longer transitional period to the steady state.

This paper is not intended to review relevant previous literatures but only to present a simple dynamic model to empirically test the dynamic effect of the foreign direct investment inflows

on the Egyptian growth rate over time and to stress on the importance of the foreign capital inflows for the Egyptian economy.

This paper is structured as follows; section II introduces to the data used in the analysis, section III describes the intervention models used for the analysis and their results. The summary, the conclusion and the implication follow section III.

DATA

Data of nominal GDP in millions of Egyptian pounds, the GDP deflator, specific types of foreign capital inflows (balance of payments, supplementary items, direct investment, net incurrence of liabilities (excluding exceptional financing) in millions of USD - calling it foreign direct investment inflows for short, the foreign exchange rate (USD in terms of Egyptian pounds), the central bank policy rate (the discount rate) were all collected from the IMF International Financial Statistics Yearbook: official website. The data were modified to form the real GDP, the economic growth rate in addition to the real foreign direct investment in real of millions of Egyptian pounds. Consistent data were found from 1977 to 2016 in the same report.

Figure 1 shows the time path of the Egyptian economic growth rate from 1977 to 2016, the time path of the foreign direct investment inflows from 1977 to 2016, the time path of the foreign exchange rate (USD to Egyptian pound) from 1977 to 2016, and the central bank policy rate (the discount rate) from 1977 to 2016 to control for both the monetary policy and the purchasing power at the same time) consecutively.
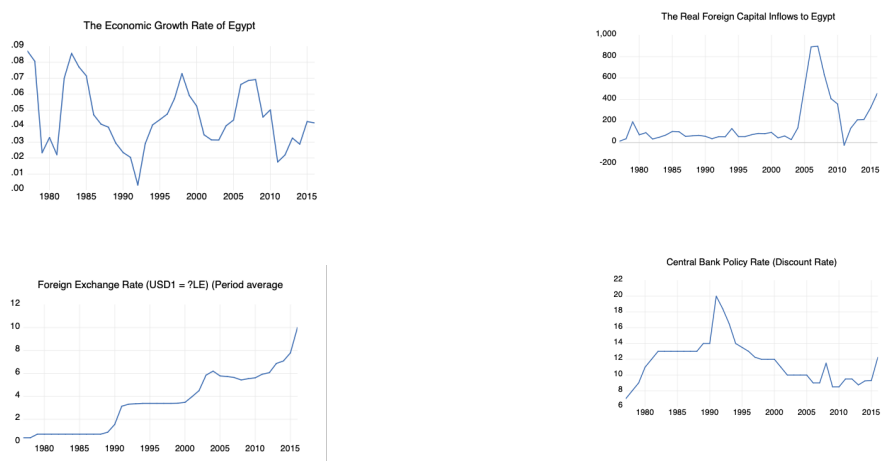

Figure 1: The time path of the Egyptian economic growth rate from 1977 to 2016, the time path of the foreign direct investment inflows from 1977 to 2018, the time path of the foreign exchange rate (USD to Egyptian pound) from 1977 to 2018, and the central bank policy rate (the discount rate) from 1977 to 2016 to control for both the monetary policy and the purchasing power at the same time) consecutively.

THE EMPIRICAL MODELS

To figure out the impact of the foreign direct inflows to Egypt on its economic growth rate over time; a linear intervention model was employed in this paper. The model was given by the following equation:

$$GROWTH_t = a_0 + A(L)GROWTH_{t-1} + c_0 REALFDI_t + B(L)\varepsilon_{t,,} \quad (1)$$

Where; **Growth** represents the economic growth rate of Egypt, **REALFDI** is an intervention variable that represents the real foreign direct inflows to Egypt, ε is the disturbance term, and **t** refers to time.

On the other hand, $A(L) [1 + a_1L + a_2L^2 + \dots + a_qL^q]$ and $B(L) [1 + b_1L + b_2L^2 + \dots + b_qL^q]$ are polynomials in lag operator **L**.

Prior to estimating the parameters in equation 1, the time series of the dependent variable; **GROWTH** properties was checked. The Philips Perron unit root test in level by including in the test equation both the trend and the intercept was used for testing whether the series of **GROWTH** is stationary or not. No evidence of unit root was found. The series of GROWTH was also checked for the presence of autoregressive conditional hetroskedasticity (ARCH) effects by using the correlogram test. An evidence of conditional heteroskedasticty was found. Therefore the ARCH regression method was used instead of the LS regression method to control for the evidence of the autocorrelation found in the series of the dependent variable. All possible **ARMA** models were run to figure out the impact of the **REALFDI** on **GROWTH** until ARMA (3,3). The selected best fit ARMA model depended on all diagnostic checks in addition to the lowest AIC and SC criteria of selection. The best fit model (1) was summarized then below:

$$GROWTH_t = 0.027951 + 0.661859\ GROWTH_{t-1} + 4.59E\text{-}05\ REALFDI_t + \varepsilon_{t,,}$$
$$\quad\quad\quad (0.000)\quad\quad\quad (0.000)\quad\quad\quad\quad\quad\quad (0.000)$$

Adj R² = 0.383071
AIC = -5.991177
SC = -5.735244   **Model (1)**

From model (1) we can conclude that the impact of the real foreign direct investment inflows on the economic growth rate of Egypt is positive and significant but it converges over time because of the convergence characteristics of the best fit model selected by using both the diagnostic checks and the normal best ARMA criteria. Figure (2) shows the forecast of the best fit model (1).
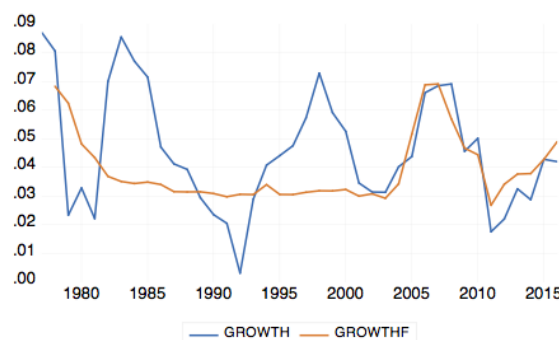

Figure (2): The forecast of the best fit model (1) as a comparison to the raw data of the economic growth rate of Egypt from 1980 to 2016. "*Note that 3 lag periods were eliminated because of the consistency of the checked ARMA models until ARMA (3,3)*".

Because of the well-known political unrest happened in Egypt during the period 2010 - 2013; Model (2) was utilized to control for this period of time by including in an instrument; the

PINST dummy variable that takes on the value zero before and after this 2010 - 2013 period of time and takes on the value one during this period of time. The regression was run by using the GMM - Generalized Method of Moments regression method in order to control for such political unrest. Model (2) summarizes this result after controlling for the political unrest of 2010-2013 period of time:

$$\text{GROWTH}_t = 00.028325 + 0.638296 \text{ GROWTH}_{t-1} + 5.71\text{E-}05 \text{ REALFDI}_t + \varepsilon_{t,,}$$

$$\qquad\quad (0.0113) \qquad\quad (0.000) \qquad\qquad\quad (0.0233)$$

Adj R² = 0.365670

With I = [PINST]; where; PINST is the political instability during "2010-2013".
Model (2)

Model (2) confirms again that the foreign direct investment inflows to Egypt has a positive significant impact on the economic growth rate of Egypt and as well this impact converges over time. The same model has been re-utilized but after including in the instrument the central bank interest rate (the discount rate) (***DISCOUNTRATE)*** to control for both the monetary policy and the purchasing power parity at the same time. The best fit model after controlling for the political unrest in addition to the monetary policy show as well that the foreign direct investment inflows to Egypt has a positive significant impact on the economic growth rate over time with a convergence over time. Model (3) summarizes the last regression model by incorporating both the political instability (***PINST***) variable and the the discount rate (***DISCOUNTRATE***) variable at the same time.

$$\text{GROWTH}_t = 0.029720 + 00.630318 \text{ GROWTH}_{t-1} + 5.57\text{e(-05) REALFDI}_t + \varepsilon_{t,}$$

$$\qquad\quad (0.0085) \qquad (0.000) \qquad\qquad\quad (0.0247)$$

Adj R² = 0.371723

With I = [PINST, DISCOUNTRATE]
Model (3)

Figure (3) shows a comparison between the actual growth rate series and the three best fit models of the growth rate series to confirm on the same conclusion that the impact of the real foreign capital inflows is positively significant with convergence over time.
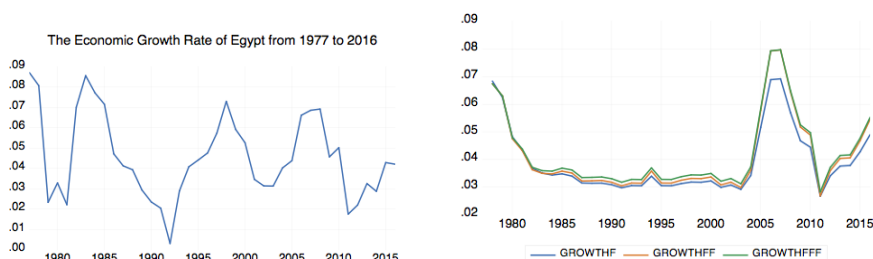

Figure (3): A comparison between the actual economic growth rate series and the forecast of the best fit three growth models; (1), (2) and (3) of Egypt from 1980 to 2016. *GROWTHF* refers to the forecast of model (1), *GROWTHFF* refers to the forecast of model (2) and *GROWTHFFF* refers to model (3).

According to the above results we may recommend an enhancement to the foreign direct investment inflows from time to time to shift the convergence path further so to prolong periods of positive economic growth rate over time.

SUMMARY, CONCLUSION & IMPLICATIONS

This paper utilized three simple intervention models to empirically test the impact of the foreign direct investment inflows on the Egyptian growth rate over time. Results found positive significant impact of the foreign direct investment inflows on the Egyptian economic growth rate whereas this effect vanishes in the long-run because of the convergence criterion of the elected best fit-models. Hence; the paper recommends an encouragement to more foreign direct investment inflows from time to time to guarantee higher periods of positive growth rates over time. More analysis would be adopted in further papers to capture the impact of the foreign capital augmented technology on the Egyptian economy over-time.

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