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DEBT SUSTAINABILIY AND ECONOMIC GROWTH IN EGYPT

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Abstract

The persistence growth of Egypt's public domestic debt has raised concerns regarding its impact on economic growth and fears are being express about the debt sustainability. Utilizing data for the period 1981-2006, the results obtained from cointegration model reveal that the public domestic debt in Egypt has a robust negative impact on growth. The sustainability of debt was examined used some algebra methods. The results suggested that the recent path of debt followed in Egypt was sustainable. For debt to remain sustained in future, substantial fiscal reforms are needed and policies should be adopting to maintain an increasing growth-interest rate differential.

Keywords: Public Domestic Debt; Fiscal Budget; Debt Sustainability; Economic Growth; Cointegration**.**

JEL Classification: H61; H62; H63; H68; O40; C15; C51

Introduction

The growth of public debt for many developing and developed countries has raised the concerns about the impact of domestic public debt on economic growth and the government's capability to serve its debt obligations without detention the future and target rates of economic growth. When the debt rises beyond the overall size of the economy, the sustainability of domestic debt become a serious issue. The challenge for policy makers is to halt the rising in public domestic debt to reestablish a sustainable and growth enhancing path for debt in the long run.

Public domestic debt in Egypt has increased from LE 97 billion in 1991 to LE 246 billion in 2000, and then it has reached LE

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593.5 billion in 2006. At the mid of 2007, the total outstanding public domestic debt was more than LE 637 billion. Over 1994 -2006 the interest payments on domestic public increased sharply going from LE 11.8 billion to LE 33.8 billion. Furthermore, the interest rate on domestic public debt has picked to more than LE 44.5 billion in the mid of 2007.[1]

The growth rate of public domestic debt has accelerated over the period 1985 – 2006. It grew more rapidly than did the overall economy. Reality, the public domestic debt in Egypt has accumulated from 1991 due to the implementation of ERSAP, which imposed a challenge for the government. In recent years the public domestic dept grew rapidly because the high volume of public spending, especially in the non-productive areas: the high prices of imported materials, subsidies and salaries of the civil service.With the onset of increasing domestic public debt/GDP ratio in Egypt, the sustainability of public debt came under scrutiny. If the government continues to accumulate debt at a faster rate and macroeconomic conditions maintain, this may lead to unsustainable debt levels.

The main objective of the paper is to assess and analyze whether the behavior of debt in Egypt is consistent with a sustainability path. For the government debt to remain sustainable more efforts should be geared to increase economic growth. Therefore, to evaluate the debt sustainability in Egypt, the growth impact of public domestic debt must be addressed firstly by employing cointegration techniques to examine the long-run equilibrium growth relationship with debt as well as short-run dynamics. Secondly, the study sheds some light on the current and expected behavior of debt-GDP ratio in Egypt to explore the sustainability of debt utilizing a simple algebra approach.[2]

In the context of assessing debt sustainability, the behavior of some macroeconomic variables, such as, the interest rate on the debt, the growth rate of the economy, the primary balance of the government budget and debt ratio are tested. There are several

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1. CBE, Economic Review, various issues.
2. There are many suggested methodology and approaches regard the debt sustainability. For example; Buiter (1985(, Bispham (1987(, Fanizza and Mourmouras (1994), Wickens (1992) and Blanchard O.(1993)

sustainability indicators varying in how closely they are related to the intertemporal budget constraint (the finite horizon gaps), whether they take account of the future evolution of the key variable of sustainability. In other approaches target value of debt is set. One of the most widely used indicators for assessing debt sustainability is the primary gap indicator, which measures the difference between the actual primary deficit and the primary balance required to stabilize the debt-to-GDP ratio. Further more some broad scenarios were developed based on various assumptions to determine the future potential path of domestic debt and to show whether or not Egypt's future public domestic debt path is going to be sustainable.

The remainder of the paper is arranged as follows: the second section presents an overview about the findings of the related literature; it describes the theoretical debate and mechanism of the possible growth effect of public domestic debt. Section 3 provides an econometric study for the growth effect of public debt in Egypt. The description of econometric model; methodology, data specification and the analysis of empirical results are given within this section. Section 4; tests the public domestic debt sustainability in Egypt. Moreover, section 4 provides some scenarios to obtain the sustainable future debt output ratio in Egypt. Finally, section 5 presents a summary of the main conclusions and policy implications.

Theoretical literature reviews; growth – debt nexux

The impact of domestic public debt on economic growth remains a controversial issue in both academic and policy making circles. In recent time empirical and theoretical studies try to analyze the question of whether the rising of DD shows positive or negative effects on the growth rate of an economy.This section provides some possible effects of public domestic debt on growth particularly obtained from the literatures which have gone up on that issue.[3]

Excess government sector demand for domestic fund tends to push up domestic interest rates. Higher interest rates increase the cost

[3.] For example see; Abbas (2005, 2007), Abbas and Christensen (2007), Blavy (2006), Cashell, (2007), Jayaraman, T. K.(2006), Majumder (2007) and Gong, Greiner and Semmler (2001)

of financing new private investment " crowding – out " and hence limit economic growth. Moreover, in a financially repressed economy in which interest rates are kept artificially low, when governments borrow domestically, they use up domestic private saving which have been available for private sector, hence the cost of private credit will be high reducing private investment demand, ensuing capital accumulation and growth to deteriorate. There is also a crowding out effect associated with public investment. If the economy is characterized by a high dept ratio, a large fraction of the tax revenue must be used for interest payments on public dept, implying that fewer resources are left for public investment. Interest burden of domestic dept may absorb a significant portion of domestic resources which contribute to less pr-poor and growth enhancing. High level of domestic dept may raise the uncertainty, since the dept overhang raises the discount rate for potential investors due to the future tax accompanying a dept burden. As a result, short-term investment projects should be favored over long-term ones. Also uncertainty associated with high levels of domestic dept creates incentive to postpone any activity that involves future return toward that projects that will yield fewer but sooner returns. Accordingly, less efficient investment could thus contribute to slower productivity growth. The higher interest rate may also have an adverse effect on the trade balance, and hence on growth. Since The government assets become more attractive to foreign investors, so the demand for local currency will increase. which tends to push up the price of domestic currency in terms of other currencies, the imports will rise (since it become cheaper) and the exports tend to decline (it became more expensive), hence large trade deficit will ensue which ultimately hinder the economic growth. At some point, when a government is no longer able to finance its deficits, the need to service the outstanding debt motives the government to contract spending or raise revenues, when government cannot take these actions, a debt crisis ensues and the government is forced to default or inflate the debt away, both of which entail large economic and welfare costs. This further adds to the growing public debt burden. However, the public domestic dept could exert positive spillover for growth by enhancing the volume and efficiency of investment and by boosting private savings through a risk-diversification effect. Government

dept markets may widen the size of capital markets and facilitate the financial funds available to riskier and strategic sectors. Since the Banking sector in many developing countries face unpredictable business environment which make them reluctant to engage with those sectors, so domestic debt may serve as collateral and compensates that juncture. This implies better allocation of capital to product sectors. otherwise, if the government debt became more attractive so that bank have less incentive to expand credit to riskier private sectors which force the banking sector to reduce their drive to fund private sector projects or cut their margin. In the long run, this should partly alleviate the efficiency of financial sector and greater crowding out. Conversely, yield on government securities could boost competition in the banking and financial sector. Since, when private sector returns are falling, the government's domestic tax revenue and foreign aid receipts would also likely fall, leading to a widening of the fiscal gap. To the extent that the latter is financed domestically, yields on government bonds will rise, boosting bank profitability which leads the private sector to provide loans with low return, this stimulates saving mobilization and growth. Availability of government instruments may be an attractive tool to direct saving inside the country instead of capital flight or short – term yield activities.

Although there are a lot of theoretical views about the possible growth impacts of public domestic debt, the implications for growth aren't clearly derived. As a result the question about the kind of public domestic debt contribution to economic growth has remained unsolved. The question of the impact of debt on growth is expected to remain broadly a serious issue during the coming years when the analysis is concentrated for Egypt, given the increased and continuous scope for expanding domestic debt during the recent period which reflects continued accumulation in domestic debt burden. In order to place Egypt's public debt on a firmly declining path to achieve high sustainable growth, the paper expands on previous research by quantitative assessing for the growth impact of public domestic dept in Egypt. The next section provides the econometric analysis and results.

Econometric analyses

The appropriate approach to elucidation the growth effects of public domestic debt in Egypt would therefore seem to consist in studying the effect within the well-established framework of econometric growth model. Unit root test (test of stationary), Johansen co-integration test and hence Error Correction Model are used with a view to estimating the short run and the long-run impact of public domestic debt on economic growth.

Model Specification and Data Framework

The model specification follows closely that which proposed by Pattillo et al. (2002) who investigate the nonlinear growth effects of external debt, but the external debt variable are replaced –in our paper- by the public domestic debt variable. For assess the quantitative effect of domestic debt on economic growth, the following equation would be estimated;

$$gt = \alpha 0 + \alpha 1\ Xt + \alpha 2\ DDYt + ut \qquad 1$$

where g_t is the growth rate in GDP per capita. X is a vector of control variables. DDY denotes to the public domestic debt/GDP ratio. Finally, ε_t captures random disturbance term (residual).

The control variables for the current growth regressions are similar to those used in Pattillo: the log of lagged income, population growth, investment rate, and openness to trade, gross enrollment rates, and the additional control variables here are; quality institution variable which tracks countries' political environment affect risk and stability for long rum higher rate of growth. The financial development index was initiated as an explanatory variable in equation 1. It has peroxide by private sector credit/GDP. The quadratic variable of public domestic debt is included in the regression model to test if the growth impact of domestic debt is non-linear. For examining the impact of public domestic debt on economic growth, we use annual data for growth in GDP per capita, the values of public domestic debt as ratio to GDP, and the control variables are covering the period (1981-2006) for Egypt.

The DDY series is extractable from the CBE, the proxy for quality institution was the democracy index, and this index is available for freedom house. The data of other control variables will

be collected from the World Bank - World Tables, UN Human Development Report and United Nation Statistics Divisions.

The expected impacts of the coefficients of the control variable are based on the results of several number of empirical growth studies. Lagged income as donated by the log of lagged GDP per capita should, in accordance with Solow's convergence hypothesis, have a negative impact on growth. High population growth rates are also expected to comprise economic growth. In contrast, investment rates and school enrolment would have positive effects on growth. The Log of openness index (log of Trade% of GDP) variable is likely to be positively associated with growth. Inflation rate is expected to exhibit a negative sign confirming the wisdom that high inflation distorts economic activity and reduces investment in productive enterprises, which reduces economic growth. For financial development, it would have positive impact on growth; since the expansion of the financial system is accompanied by an increase in the flow of funds to private sector ensure the allocation of recourses towards productive investment activities. Better level of democracy may lead to a better allocation for domestic and foreign resources. Therefore higher democracy expected to exert positive contribution to economic growth. The expected sign of DDY on growth could be positive or negative. If the sign of DDY is positive, and the quadratic term of DDY bears a negative signed coefficient, these views may be justified by the existence of a non-linear impact of debt on growth. On the other side if the sign of both DDY and the quadratic term of DDY reveal a negative signed, so the accumulation of public domestic debt is considered as a persistence calamity for economic growth. Therefore, the domestic debt continues to detention the growth.[4]

Methodology, Estimations and Empirical Results

The paper employs the econometric technique of cointegration and error correction modeling (ECM) in order to estimate the impact of public domestic debt on growth. The estimation was made using

[4.] After estimation the equation 1, population growth and Inflation rates were found to be systematically insignificant, so they were dropped from the estimated equation. Due to the insufficient data for school enrollment it was dropped as a control variable.

vector autoregressive (VAR) approach. In principle, there can be a long-run or equilibrium relationship between the series in a VAR relationship only if they are stationary or if each series is at least integrated of the same order. That is, if some series are integrated of the same order, then those series are said to be cointegrated and the regression on the same levels of that variables is meaningful and on long-run information is lost. Therefore, the first task is to check for the existence of stationary property in the series of the model which is specified in the paper. Having tested the stationary of each time series, the next step is to search for cointegration between the non stationary series. This step investigates whether the stochastic trends in and that contained unit roots have a long-run relationship. If the variables are cointegrated then the final stage of the empirical methodology is to construct dynamic Error Correction Model (ECM) that takes into account the underlying cointegration properties of the variables. See Annex for results.

Estimation of an Error-Correction Model

Equation 2 ignores any reference to the long-run aspects of decision-making. The theory of cointegration addresses this issue by introducing an error-correction (EC) term (which is the residual variable of the cointegrating vector normalized for equation (2) to measure deviations of the series from the long-run equilibrium relations. The error-correction models produce better short-run forecasts and provide the short-run dynamics necessary to obtain long-run equilibrium.

This leads us to the specification of a general error correction model (ECM). The procedure involves re-estimating equation (2) in the first-difference form and adding the error-correction term (*EC*) as another explanatory variable. The error-correction term is the lag of the estimated error term from equation (2).

This leads us to the specification of a general error correction model (ECM):

$$\Delta gt=\beta 0+\sum\beta 1i\ \Delta gt\text{-}i+\sum\beta 2i\ \Delta Xt\text{-}i+\sum\beta 3i\ \Delta DDYt\text{-}i+\beta 4ECt\text{-}1+\beta_5\varepsilon\tau \quad 3$$

where, ECt-1 = error-correction term lagged one period. All variables were entered in first and second difference form. The coefficient β_4 is expected to capture the adjustments of the depended

variable towards long-run equilibrium showing the speed of adjustment to long run solution that enters to influence short run movements in growth, while the coefficients of other independent variables are expected to capture the short-run. After experimenting with the general form of the ECM (equation 3) and dropping the insignificant variable from the ECM equation, therefore the following model is found to fit the data best, since the error correction model empirical results appear in Table 3 below.

Table 3: Estimated Error Correction Model

Dependent Variable: Δgt

Variables	Coefficients	
Δg-1	-0.902	(-5.04)*
ΔLagy-1	-0.683	(-3.26)*
ΔlogInv-1	0.556	(2.33)**
ΔlogOpen-1	0.645	(4.18)*
ΔlogOpen-2	-0.316	(-2.28)**
ΔFD-2	0.205	(3.72)*
ΔDDY-1	-0.175	(-5.16)*
ΔDDY-2	-0.172	(-4.66)*
EX-1	-0.0122	(-2.04)**
R^2	88.72%	
D.W	2.13	
Akaike info criterion	-2.764	
F-statistic	9.444	
Prob(F-statistic(	0.000287	

Notes: Figures in parentheses are t-statistics.*, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively.

From the estimated model above, the results shows that all the short run impacts have the a priori hypothesized signs and are statistically significant. Log of capital formation lagged one year, log of lagged income, log of openness lagged one year and financial development lagged two years have emerged as significant positive determinants of the growth rate in Egypt. However, unexpected result that the coefficient of the log openness two lagged revealed a negative sign, which could be attributed to some adverse channels through which openness affects economic growth, for example; the composition of

imports (distinguishing between capital goods and consumption goods and the effects of trade on domestic prices (possible imported inflation). the statistically significant negative coefficients of the lagged value of growth reflect feedback between current changes in growth and its own lagged values in Egypt, but the reaction is in the opposite trend. The values of the coefficient of DDY lagged one and two years are statistically significant and equal -0.175 and -0.172 respectively. The previous results mean that increasing the domestic public debt in Egypt by 1%, is then set to deter the growth rate by 0.17% after both one and two periods. The estimated coefficient of the error correction term (-0.012) is statistically significant at 5% level and with the appropriate (negative) sign. This suggests the validity of a long-run equilibrium relationship among the variables in equation (1).

The estimated coefficient value of -0.012 suggests a weak speed of convergence to equilibrium. Therefore About %1.2 deviations from the long run path of the economic growth is corrected within one period indicating a highly weak adjustment process to long run equilibrium relationship. Thereat, the results presented in the above table provide evidence on the long-run impact from domestic public debt, as well other control variables- to economic growth.The main finding from the empirical analysis is that the persistent uptrend of domestic debt exerts negative short run and long run impacts for economic growth in Egypt. High public domestic debt pushes up interest rates and has crowded out effects. When government revenues are devoted to debt servicing, fiscal policy cannot used to provide basic services. When public domestic debt goes beyond the overall growth of the economy a larger fiscal deficit become unavoidable, as a result inflation climbing and then pushing the cost of debt servicing further up. Given the hug macroeconomic problems and the needing for enough resources to ensure stability long run growth, the issues of affordability and debt sustainability should evolve.

Public domestic debt sustainability en Egypt

The Egyptian debt level has absorbed a significant proportion of government finances in servicing it. Over 14% of the expenditure is channeled towards interest payments on domestic debt

only. Naturally, the higher the primary surplus, the more likely the chances are for the debt to be sustainable, but unfortunately, the overall balance to GDP in Egypt was in deficit of -3.5% in 1992/93, and this ratio continued to rise to -5.2 in 2005/06. As public debt accumulates, there is legitimate concern over whether the government will be in a position to serve its debt.

Such a high debt-servicing imposes challenges for policy makers in Egypt to place government debt on a persistence declining path. This issue raises the concerns about the issue of sustainability in Egypt.

The concept of sustainability has been discussed for at least two decades. Many general approaches have been followed; the first one considers that the interest rate at which a government borrows shouldn't be greater than the rate of growth of the economy, so that the ratio of debt to GDP does not rise. In other word, debt sustainability can be defined as the fiscal position that maintains debt at a level that can be serviced without an undue burden of adjustment. The second approach due to IMF and the World Bank which define debt sustainability of a country as its ability and willingness to meet current and future debt service obligations in full, without recourse to debt rescheduling or accumulation of arrears and without comprising growth. One of the most important approaches for sustainability is one that encompasses the concept of solvency. A government is said to be solvent if it is expected to be able to generate sufficient future primary budget surpluses to be able to repay its outstanding debt (in more technical terms, the present discounted value of future primary fiscal surpluses must be at least equal to the value of the existing stock of public debt). Contrary, public domestic debt becomes unsustainable if it continues to rise indefinitely as a share of GDP, or if the cost of debt servicing absorbs an excessive amount of resources. The concept of sustainability has been defined as a group of indicators. These indicators are usually based upon projections of such variables as interest rates, economic growth rates, government revenues and expenditure. Another indicator discussed in the literature is the present value of interests payments compared with the present value of future primary surpluses.

Methods for assessing public debt sustainability usually start from the basic accounting identity that links public sector revenues and expenditures to the change in the debt stock stabile. In this relation, Bispham (1987) developed a set of equations that fulfils that the priority beyond assessing debt sustainability issue is to indicate whether a present level of fiscal budget causes the debt/GDP ratio to explode, implode or remain stabile.

What happened to the debt/GDP ratio depends on the relationship between the interest rate, r, and the economic growth rate, g, which can be presented by the following equation that indicates the maximum bound of debt afford. By other word, the domestic debt stock as a ratio of GDP which any country can sustain at the relevant magnitudes of nominal rate of growth, nominal interest and nominal level of primary public balance[5]

$$DDY_{max} = -b\ (1+g/g-r) \qquad 4$$

Thus a government will have sustainable level of debt if it generates a stable debt-to-GDP ratio. For a government to stabilize its debt/output ratio, and ignoring the 1+g term in the denominator that has only a small effect, it needs to ensure that the nominal rate of interest rate r equal nominal rate of economic growth g, but this depend on the values of both the primary fiscal deficit and the level of debt. Thus, a zero primary deficit is required for stabilization of debt as a percent of GDP, if the nominal rate of growth of GDP (g) is equal to the interest rate on debt (r). When r > g the change in the debt/GDP ratio depends on the size and sign of initial debt/GDP ratio and primary balance. If there is initial public debt and primary deficit, the debt/GDP ratio explodes. Thus, unsustainably is indicated as a position where the interest rate r exceeds economic growth g, and where the primary balance b is persistently either in deficit or in a surplus not large enough to cover the excess of the interest rate over the growth rate. Thus, to establish sustainability government should run a primary surplus sufficient enough to cover the excess caused by the real interest rate over real growth rate, i.e. sustainable

[5]. Overall fiscal deficit can be defined as the algebraic sum of the interest due on inherited debt, and the primary deficit, defined as the excess of residual no-interest expenditures over total non-debt receipts. The primary deficit (b) can clearly also be negative, denoting a primary surplus

primary surplus. It is possible to stabilize DDY with a positive primary deficit if and only if g > r , so from above equation we can observe the usual sustainability condition, which requires the growth rate of GDP to be larger than the interest rate in order to have a non-increasing debt to GDP ratio. In that case, the government can run the primary deficit, too, without increasing the proportion of the debt in GDP. One of the most widely used indicators for assessing fiscal sustainability is the primary gap indicator, which measures the difference between the actual primary deficit and the primary balance required to stabilize the debt-to-GDP ratio.[6]

First, the sustainable level of the primary balance; that is the primary balance required to stabilize the debt-to-GDP ratio is calculated. This can be done using the following equation

$pb^* = (i - g)/(1+g)$ ddy or neglecting (1+g), ; $pb^* = (i - g)$ ddy 5

where, ddy denotes to the debt-to-GDP ratio at specific time and pb* stands for the primary deficit (as a percentage of GDP) required to stabilize the debt. Equation (5) appears that an interest rate exceeding the rate of economic growth leads to a higher primary deficit, ceteris paribus. The government will in this case need to run an operating surplus in order to prevent the debt-to-GDP ratio from rising. Given the size of the gap between interest rates and growth, the size of the operating surplus required will depend on the size of the existing debt-to-GDP ratio; the higher the debt-to-GDP ratio, the bigger the operating surplus needed to stabilize it.

If the interest rate equals the GDP growth rate, hence, the primary deficit must be zero to stabilize the debt-to-GDP ratio. Second, the primary balance gap is defined as the difference between the sustainable primary balance (the one that stabilizes the debt-to-GDP ratio) and the actual current level of the primary deficit. If the current primary deficit is higher than the sustainable one, the debt ratio will rise without any limits and then, can be called unsustainable.

Therefore, the sustainable primary deficit pb* can be used directly as a target towards a sustainable deficit path and reflects the adjustment that is needed in order to return the fiscal balance to its

6. See Blanchard, O.; J. C. Chouraqui, R. P. Hagemann and N. Sartor (1990).

sustainable level. Due to cyclical fluctuations in the economy, a fiscal deficit in a period of time couldn't need to be considered as a sign of long-term sustainability of domestic debt if there is a probability that the conditions could change after that. Therefore, because equation (4) ignores the dynamic relationship between the real interest rate, primary deficit and the real economic growth rate when analyzing the sustainability of DDY, so, as alternative, a simple form equation (4), can also be solved to obtain the public debt ratio at any future time, T, given a starting debt ratio ddo and an actual (constant) primary deficit /surplus fiscal b. Hence, the equation reveals the path of overall debt-GDP ratio take place over finite horizon time. The following equation is expressed by "Explosive Debt Dynamics" (EDD) equation. It has taken the following form;

$$E_{DDY_t} = b\left[\left(\frac{1+r}{1+g}\right)^t - 1\right] \div \left[\left(\frac{1+r}{1+g}\right) - 1\right] + ddy_0\left(\frac{1+r}{1+g}\right)^t \qquad 6$$

Assuming r > g, then $(1+r)/(1+g)$ will tend to up along time, hence the debt-to-GDP ratio is regarded as being explosive debt-dynamics as contrast when g > r, so $(1+r)/(1+g) < 1$ then debt-dynamics convergent over time. If the Government wants to achieve a stable of debt-to-GDP ratio by a certain time period, while at the same time debt/GDP ratio is explosive they must run primary surpluses large enough to fill the gap each year.

Another approach to estimate the sustainability of domestic public debt is the divergence of the actual debt ratio from a target threshold. More importantly, there is no theory to indicate what a sustainable debt threshold is, so the choice of the target value of debt might be arbitrary.[7]

An alternative could be to assess sustainability on the basis of the maximum limit debt ratio, or finite horizon as expressed by equation (6). In such a case debt path would be found sustainable if it

[7]. The government of Egypt declared that 65 debt-to-GDP ratio is considered as a desirable targeted ratio to achieve at the end of FY2010/l2011

was maintained below the maximum limit. If we are looking for the primary deficit that will stabilize the debt ratio at the initial level at time t, ($ddy_t = ddy_0$,) equation 6 can be recalculated as follows

$$pb^* = \frac{r-g}{1+g}\left[1-\left(\frac{r-g}{1+g}\right)^{-t}\right]^{-1} \times (-ddy_0)\left[1-\left(\frac{r-g}{1+g}\right)^{-t}\right] \qquad 7$$

The primary deficit stabilizing the debt ratio at a finite horizon (maximum limit) does not differ from the sustainable primary deficit satisfying by equation (5), the difference rests in what will be substituted for i and g should be applied when calculating the primary gap indicator.

Overall, for debt ratio to be sustainable; two conditions are required. Firstly, g > r, so that the debt ratio stabilize or convergence rather than explodes. Even when the primary budget is in deficit, but its path must be stable and consistent with debt-GDP ratio. Debt ratio explosives when the interest rate on government debt exceeds the growth rate of GDP unless there is a sufficient amount of primary budget surplus to stabilize the debt-GDP ratio. The second condition indicates that the current debt is sustainable as long it doesn't exceed the maximum affordable level. If the current debt ratio exceeds the maximum, sooner or later the government will have to alter its fiscal policy and generate a primary surplus in order to reduce or stabilize the debt ratio at the affordable finite horizon level, as implied by equation 7.

Equations 6 would be estimated for Egypt over (2000-2006) to calculate the maximum or finite horizon level (affordable limit) of DDY that would Egypt afford a long the period 2000-2006. The calculated values would be compared to the actual values of domestic debt-GDP ratio along the corresponding period to assess whether the actual path of domestic debt Egypt experienced during the last period 2000-2006 was indeed stable and sustainable. The primary balance which is required to stabilize the domestic public debt to GDP ratio (pb^*) would be calculated from the relationship given in equation 7.The empirical results are summarized in Table 4. Columns (2-4) show the relevant magnitudes (public domestic debt/GDP ratio, nominal rate of growth, nominal interest rate level

and the level of primary public balance. Column 5 reveals growth-interest rate differential

Table4: Debt-GDP Ratio Sustainability in Egypt

Years (1)	Actual Public domestic Debt DDY % (2)	Growth rate of nominal GDP (g) % (3)	Nominal interest rate (i) % (4)	Growth – interest Differential (5)	Actual primary Budget % GDP (b) (6)	E_{DDY} Calculated from eq; 6 (7)	Δ E_{DDY} % (8)	b* Calculated from eq; 5 % (9)	Debt Gap (2-7) (10)	*Primary balance gap (9-6) (11)*
00	75,5	10,7	9,1	1.6	2,36	76,8	11,39	1,9	-1,3	*-1,3*
01	84,0	8,8	8,5	0,3	0,47	84,3	7,46	0,23	-0,2	*-0,2*
02	87,9	9,3	8,4	0,9	4,28	91,4	7,14	0,72	-3,6	*-3,6*
03	91,45	10,3	8,7	1,6	3,69	93,8	2,36	1,33	-1,6	*2,4*
04	96,3	16,2	11,1	5,1	3,80	95,9	2,15	4,33	-2,0	*0,4*
05	100	10,9	10,9	0	4,58	104	8,63	0	-1,6	*-4,6*
06	101	14,7	9,5	5,2	3,38	100	-4,50	4,59	-2,3	*1,2*
Av %	*90,9*	*11,6*	*9,46*	*2,10*	*3,22*	*92,4*	*4,95*	*1,74*	*-1,8*	*-1,4*

Note: Av%=Average %. Sources: CBE, IDSC, Ministry of Finance, various years, author's calculations. Nominal interest rates are 364 T-bill rates (percent, average). Primary budget deficit + / surplus (-).

. The figures reported in column 7 show the maximum limit of affordable debt which is computed from equation (6). Further, column 9 shows the computation of equation (7) which is the maximum fiscal adjustment Egypt can sustain to stabilize the actual domestic debt ratio to GDP at finite horizon in each year. The column 10 shows the gap between the corresponding calculated (columns2 and 7) which reveals the historical actual trend of Egypt's domestic debt whether to converging or to explosive. Column 8 shows the change in the maximum debt-GDP ratio take place over 2000-2006. Finally, column 11 appears the calculated gap between the sustainable primary deficit and the current level of the primary deficit. The importance of the primary gap indicator lies in its ability

to measure the size of the fiscal retrenchment needed in order to return the fiscal balance to sustainable level.

The estimated results of (EDD) equation reveal the maximum limit of Egypt's debt afford. The values appear to exceed 100% in recent years, which indicates debt-GDP ratio to be explosive. Unless the economy remains robustly below this maximum level and sufficient fiscal space is projected, it may be a difficult to service its debt in near future, hence the debt became unsustainable. From the table above, it appears that growth-interest differentiate is positive during and on average the period 2000-2006, meaning that until now, the government still has the capacity to meet or afford current and future debt services obligation without comprising growth. While Egypt has a primary deficit over and on average 2000-2006, amounted to (3.2%), this deficit wasn't pose any serious concern to the sustainability path of debt along this period, insuring a steady growth in debt/output ratio. The change of maximum debt-GDP ratio declines persistently during 2000-2006, except between 2004- 2005. Moreover, the change in maximum DDY exerts a negative value in 2006 indicating that the maximum path of DDY tended to convergent in that year. Otherwise, the actual value of debt-GDP ratio marginally exceeded the maximum limit in that year, meaning that some cautious should be taken about the continuous of Egypt's domestic debt sustainability in the future and some policies are needed to keep Egypt's debt path to grow in affordable limits. However, as long output growth indeed exceeded the interest rate over the period 2000-2006; the government could be solvent until their debt/GDP ratios grow in the safe limit, provided it is able to absorb the debt service. But given the estimated results of equation 7 reported in the column 9, attempts should be made to deficit retrenchment. If the government would to stabilize the debt-to-GDP ratio at the average (2001-2006) level (90.9%), the primary deficit has to be 1.7%. In this case, the primary balance gap would be around -1.5% on average, to stabilize the debt-to-GDP ratio at the 91% level and prevents the debt/GDP to go beyond the maximum limit. The size of the required fiscal reduction generally declined through those years which witness a big positive differentiating between g and r. On average, during 2000-2006, the public domestic

debt in Egypt would grow by steady rate and remained under the maximum limit, which seems to be in sustainable position. Therefore, we can conclude that the debt level projected by the Egyptian economy during the last seven years appeared sustainability path.

Despite the historical path of domestic public debt for Egypt shows a sustainable trend, public domestic debt as percentage of GDP would still remain 90% or more of GDP, this would continue to impose some burden on the Egyptian economy under the continuous of primary deficits exceeds what is needed to stabilize the debt – GDP path. Nevertheless, we should have in mind, that debt is sustainable only if the assumption made about the variables hold. But if the behaviors of macroeconomic variables tend to change in the future the picture would change.

In order to assess whether Egypt's future debt path is likely to converging or diverging and for better understand the probability for Egypt of going into an unsustainable path for the public debt over the next few years, some scenarios were traced and stimulation for the debt ratio path was projected under each scenario. These scenarios capture exogenous and endogenous changes come from the variables defined in equation 6. Using that equation, maximum limit of the trajectory debt GDP-ratio (DDY) given b, r and g was generated for each scenario. If the calculated debt ratio would be higher at the end of the projection horizon than the initial level, then debt ratio is likely to be explosive in future. See Annex.

The simulation results of alternatives scenarios -as underpinned by the methodology adopted in equations 6 and 7- are reported in Table 6 below.

The result for the projected scenario shows that for the baseline scenario, the trajectory path of debt ratio fell moderately; it expected to be 91% at the end of 2017. Given the positive g-i differentiation and the moderate primary deficit under the baseline scenario, Egypt may follow a convergence and sustainable path for debt-GDP ratio even after ten years. The Table shows that government must run a primary deficit of at least 1.18% of GDP to stabilize the debt on average, over the horizon (at the level 95%). In this case, the government must bring the deficit down by more than 2%. Moreover, if the government plane to stabilize the debt/GDP

ratio at the target level it should to run lower primary deficit about 0.76% on average for next 10 years. Thus the size of fiscal adjustment would enlarge to (-4.7%).

Table 6: Summary Results of Simulation under Alternatives Scenarios

	Scenario1 Baseline E_{DDY_t} %	Scenario 2 % E_{DDY_t}	Scenario 3 % E_{DDY_t}	Scenario 4 % E_{DDY_t}	Scenario 5 % E_{DDY_t}	Scenario 6 % E_{DDY_t}
2007	100,0	99,0	101,0	100,0	103,0	97,0
2008	99,0	97,0	100,7	98,0	104,0	94,0
2009	98,0	94,0	100,3	97,0	105,0	90,0
2010	97,0	92,0	100,1	96,0	106,0	87,0
2011	96,0	90,0	99,8	94,0	107,0	84,0
2012	95,0	89,0	99,5	93,0	108,0	82,0
2013	94,0	87,0	99,2	92,0	109,0	79,0
2014	93,0	85,0	99,0	91,0	110,0	77,0
2015	92,0	84,0	98,7	90,0	111,0	75,0
2016	91,0	82,0	98,5	89,0	112,0	73,0
2017	91,0	81,0	98,3	88,0	113,0	71,0
Average	95	89	99.5	93	108	83
Average pb^*	1.18%	1.48%	1%	1.18%	0.67%	1.72%
Average $pb^* - pb$ debt-stabilizing over 10 years	-2.1%	-1.9%	-2.4%	-1.8%	-3.1%	-1.3%
Average pb^* At target debt assumption (65%)	0.76%	0.9%	0.6%	0.77%	0.43%	1.1%
Average $pb^* - pb$ Target debt-stabilizing	-4.7%	-2.4%	-2.9%	-2.3%	-3.3%	-1.9%

All figures are % of GDP.

Under the second scenario, as a consequence of improving the nominal rate of growth by 10%, the DDY will expect to reveal a dramatically deviation from the starting level. If the primary deficit had initially been adjusted to about 1.5% of GDP (rather than 3.3%), the debt ratio would have been stabilized on average of the entire horizon. Therefore, more additional fiscal adjustments would be required (on average- 1.9% of GDP). Indeed, the debt-to-GDP ratio will tend to decrease under this scenario, but it relatively higher than the desired level (65%), this should be followed by a deeper cut in the primary deficit (amount by 2.4%) on average the entire horizon. Alternatively, column 3 of Table 6 presents a weakling scenario. Interest rates are 10% higher; this reflects the current policy of central bank to raise the interest rate in order to control the inflation. The simulations results suggest that the debt ratio path would have fallen slightly over the entire horizon period. Indeed the interest rate is assumed to rise, but the g-i gap is steel positive, thus, Egypt's domestic public debt path is regarded to be marginally sustainable. So far, this scenario is considered a conservative one. The table also shows that the size of the required fiscal adjustment would enlarge markedly under this scenario. To keep the debt at the desired level, attempts should be made to project primary deficit no more than 0.6% on average for the entire period, this again impose more fiscal risk for government.

Under the fourth scenario, this assumes lower primary deficit (3% of GDP) in 2007 until the end of horizon, the results appear a moderate and continues downward trend in the debt ratio path. Under this scenario, the attempting of government to run lower fiscal deficit would insure a sustainable position for future path for debt-GDP ratio. Furthermore, to keep the debt from rising, the primary deficit which assumed to be 3.3% of GDP need to be monitored. As Table 6 appears that 1.18% primary deficit could insure steady and sustainable growth for Egypt's debt-GDP future path. Given the desired level of debt/GDP ratio of 65%, to stabilize this ratio to a target level, more fiscal retrenchment must be put in place (2.3%) on average.

Under the fifth scenario, it is assumed that the key variables of sustainability equation go worse. As a consequence, as showed above, debt to GDP ratio will explode and substantial divergent from

its start value indicating unsustainable path for DDY. As can be seen from the table above, the greatest fiscal risk is posed by this scenario. Predictably, the best outcome obtained when fewer deficits in the entire period is projected, higher growth and lower interest rate are assumed. The debt – GDP ratio would substantially decrease from its initial level denotes sustainable pattern. As results show above, the debt–GDP ratio will decline sharply over a first six year. After that, debt ratio falls less dramatically and hence convergence to the desired level to amount about 71% of GDP in end of horizon. Although the debt path is appeared to be sustainable during the first eight years of the horizon, it is interesting to note that it is above the target level. The debt to GDP ratio is planned to decrease to approach the target level after nine years. For the government to bring the debt at the target level, the required fiscal retrenchment average about 1.9%. Projections for the future indicate a significant increase and deviating in domestic debt as percentage of GDP from 103% in 2007 to 113 % in 2017 under worst scenario, but declines from 97% to 71% under the best scenario.

It appears that the target level of debt (65%) gets even more difficult to achieve under the projected scenarios. Furthermore, indeed the results showed strongest sustainable debt path under the best scenario, but for the next 4 years, which corresponding with the 2010/2011 the trajectory debt-GDP ratio is expected to be 87%, that is above the target level in that year. Accordingly, for Egypt to attain stabilizing debt and in order to avoid accumulating excessive debt and becoming insolvent in the future, it is conditioned on projecting rate of growth surpass the rate of interest payment on debt and on maintenance of the substantial fewer primary deficit. The latter (optimal primary deficit) is the main and robust condition for debt sustainability under each scenario.

Overall, the current debt – GDP ratio exerted a sustainable path, but in the wake of primary deficit fiscal exceeds that required to maintain the sustainability, the debt path might take an upturn trend, hence, government may find it difficult to serve its debt in near future. The high burden of debt payment exerts downward pressure on the growth of GDP, which in turn makes it more difficult to reduce the debt-to-GDP ratio. Thus, if the debt–GDP ratio continued

to increase on the ground of debt sustainability, the economic growth may tend to compressed.

To protect against such an event, Egypt has to run low size of deficit and pursue a path of growth that surpass the path of interest payments on debt.

Conclusion and Policy Implication

Egypt's public debt stock, in 2007, amounted to LE637 Billion, compared to LE593 Billion at the end of 2006. At the end of 2006, Debt/GDP ratio was 101% compared to Debt/GDP ratio of 75% in 2005. Public domestic debt payments increased threefold, from LE12.2 Billion in 1998 to LE45 Billion in 2007. Public debt service would absorb a substantial share around 22% of revenues by the end of 2006. Rising public debt for Egypt poses challenges about the implication of higher debt level for economic growth and some cautions are called about the sustainability of current and future public domestic debt in Egypt. Using annual data for the period 1985-2006, the empirical analysis of cointegration model confirmed a strong and negative impact of public domestic debt on growth, indicating credence the crowding out argument. The error correction models methodology was used to estimate the short-run and long-run relationships. The selected vectors gave the error correction terms affirmed the negative impact of public domestic debt on growth.

Several sustainability indicators and methodology are performed. Explosive debt dynamic equation which covers nominal growth rate, nominal interest rate, primary deficit, debt-output ratio has been estimated. Moreover, primary gap methodology was used as a target guiding the government towards a sustainable deficit path. The sustainability methodology was projected to the period (2000-2006) to evaluate the sustainability of the path followed by Egypt's domestic public debt during that period. The empirical results reveal that during 2000-2006, the level of public domestic debt was sustainable and grew in steady path. The actual levels of debt-GDP ratio didn't grow beyond the maximum limit during that period, indicating that until the end of 2006 the debt obligation of Egypt was at tolerable level. Despite the sustainability of domestic public debt in Egypt, the computed maximum limit exerts that the debt is likely to increase further in the coming years. Accordingly, projections for

the future have been made based on the alternative assumptions allowed the key macroeconomic variable to modify in next ten years. In addition to the historic scenario, five possible scenarios for several assumptions were projected. The worst results are expected when the rate of economic growth go down by 10%, having an interest rate more than 10%, primary deficit of 3.7% and initial debt as ratio o GDP at 101% (that is prevailed at the end of 2006). This is an extremely explosive and vicious debt path for Egypt. Otherwise, the debt would be sustainable and in downward trend if and only if, the economy could run a higher economic growth, lower interest rate and primary deficit no more than 1.1% on the average horizon of the scenario.

The issue of sustainability becomes more difficult when the government stabilizes the future debt-GDP ratio at the target level, which was specified at 65% for Egypt. The empirical results of the projected scenarios affirm that even the future debt reveal a sustainable debt; it is still beyond the target level in the presence of the current or even the assumed size of fiscal deficit. Thus, it is difficult for this target to be maintained. To be more realistic, insuring sustainable path for debt implies that the government should continue to operate under its current fiscal policy without creating a rapidly growing debt to GDP ratio.

Certain measures and policy implication put in place to bring down the ratio of public domestic debt to the sustainable level –even in higher level- without compromising growth. The Government should improve the efficiency of public expenditures as a way to stop the ongoing increase in the ratio of expenditure to GDP. Streamlining of revenue efforts is essential, these would boost fiscal surplus, and help to sustain and possibly even reduce the debt/GDP ratio in the long term. Tax reform is a key factor in maintaining debt sustainability. Create an environment conducive to growth to ensure that the economy remains on higher growth path. Support the development of the capital market, especially the secondary market for domestic debt instruments; development of a money market represents the important possibility of placing domestic debt. Ongoing efforts to modernize Egypt's budget and improve treasury cash management. Recommendations for

establishment of a treasury single account to prevent a continued accumulation of government bank deposits.

Mechanisms and accompanied by measures must take place to strengthen the public sector management. Rules should be laid down relating to the use of higher than expected revenues. Lastly, all these measures should be implemented in parallel with structural reforms, such as the necessary reform of the system of subsidies, as well as institutional reforms to ensure transparency and accountability.

References

Abbas, A. (2005), "Public Debt Sustainability and Growth in sub-Saharan Africa: The Role of Domestic Debt", GDN Project on the Macroeconomics of Low Income Countries.

(2007), "Public Domestic Debt and Economic Growth in Low Income Countries", Mimeo, Department of Economics, Oxford University.

Abbas, A and Christensen, J. (2007), "The Role of Domestic Debt Markets in Economic Growth: An Empirical Investigation for Low-income Countries and Emerging Markets", IMF WP 07/127.

Abdel-Khalek, Gouda, (2007), "MDG-based Debt Sustainability Analysis", Country Discussion Paper Prepared for a Joint UNDP/UNDESA Initiative on Defining a more MDG-Consistent Debt Sustainability Framework, February.

Akyüz, Yilmaz, (2007), "Debt Sustainability in Emerging Markets: A Critical Appraisal", DESA Working Paper No. 61, United Nations Department of Economic and Social Affairs, November.

Alba, Pedro, Sherine Al-Shawarby and Farrukh Iqbal (2004), "Fiscal and Public Debt Sustainability in Egypt", MENA Working Paper Series No. 38, the World Bank, September.

Amakom U. (2003), "Nigeria Public Debt and Economic Growth: An Empirical Assessment of Effects on Poverty", Research Fellow, African Institute for Applied Economics Enugu, Nigeria, August.

Aristovnik, Aleksander and Berčič, Boštjan (2007), "Fiscal Sustainability in Selected Transition Countries", Journal of Economics, Vol. 7, No. 55, 659-675.

Bernie, Zaaruka Benethelin, Titus Ndove and Tjiveze Tjipe (2004), "Central Government Debt Sustainability", Working Paper 8/4/2/WP, Bank of Namibia, Research Department, January.

Bispham, J.A. (1987), "Rising Public Sector Indebtedness: Some More Unpleasant Arithmetic", In: Boskin, M.J., Flemming, J.S. & Gorini, S. (eds.). Private saving and public debt, 40-71.
Blanchard, O. (1990), "Suggestions for a New Set of Fiscal Indicators", Economics Department Working Paper 79, Paris, OECD.
Blanchard, O.; J. C. Chouraqui, R. P. Hagemann and N. Sartor (1990), "The Sustainability of Fiscal Policy: New Answers to an Old Question", OECD Economic Studies, No. 15, 7-36.
Blavy, Rodolphe (2006), "Public Debt and Productivity: The Difficult Quest for Growth in Jamaica", IMF Working Paper, WP/06/235.
Bohn, Henning (2005), "The Sustainability of Fiscal Policy in the United States, CESIFO, Working Papers, 1146, April
Buiter, W. (1983), "Measurement of the Public Sector Deficit and its Implications for Policy Evaluation and DesignC, IMF Staff Papers, 30, June.
Cashell, Brian W. (2007), "The Federal Government Debt: Its Size and Economic Significance", CRS Report RL31590.
Central Bank of Egypt, Economic Review, Various Issues.
Christensen, J. E. (2004), "Domestic Debt Markets in Sub-Saharan Africa", IMF Working Paper No. 04/46.
El-Mahdy, Adel M. (1999), "Public Debt Sustainability & Economic Growth in Egypt", Journal of Commercial Studies and Researches, Faculty of Commerce, Banha University, Vol.19, No.1.
Fanizza, D., and Mourmouras, A. (1994), "Fiscal indicators; Seminar on Fiscal Policy Management in Economies in Transition", (Lecture No. 16) – 7-18 November. Washington D.C.: Fiscal Affairs Department and IMF Institute, IMF.
Gong, Gang; Greiner, Alfred and Semmler, Willi (2001), "Growth Effects of Fiscal Policy and Debt Sustainability in the EU", Empirica, Vol. 28, 3 – 19
Majumder, Md. Alauddin (2007), "Does Public Borrowing Crowd-out Private Investment? The Bangladesh Evidence", Policy Analysis Unit, Working Paper Series: WP 0708, Research Department, Bangladesh Bank, Dhaka, Bangladesh
IMF (June 2005), Arab Republic of Egypt; 2005, IMF Country Report No. 05/179
(June 2006), Arab Republic of Egypt: 2006, IMF Country Reports No. 06/253.
IMF and IDA (2005), "Debt Sustainability in Low-Income Countries", Proposal for an Operational Framework and Policy Implications, March.

IMF and World Bank (2001), "The Challenge of Maintaining Long- Term Debt Sustainability," Progress Report presented to the Development Committee and the International Monetary and Financial Committee (IMFC), Washington.

Islam, Md. Ezazul and Bisnu Pada (2006), "Public Debt Management and Debt Sustainability in Bangladesh", Working Paper WP0705, PAU, Bangladesh, Bank, Dhaka.

Jayaraman, T. K. (2006), "Public Debt and Economic Growth in The South Pacific Islands; A Case Study of Fiji", Working Paper, No. 2006/16, School of Economics University of The South Pacific, Bangkok: UNESCAP.

Krejdl, Aleš (2006), "Fiscal Sustainability – Definition, Indicators and Assessment of Czech Public Finance Sustainability", Working Paper of the Czech National Bank 3/2006.

Mackliman, R.T., D. Rose and R. Tetlow (1995), "Government Deficits and Debt in. Canada: A Macro Simulation Analysis",

Panizza, U. (2008), "Domestic and External Public Debt in Developing Countries", UNCTAD/OSG/DP/2008/3.

Patillo, Poirson and Ricci (2002), "External Debt and Growth", IMF Working Paper 02/69

Presbitero, Andrea F. and Arnone, Marco (2006), "External Debt Sustainability: An Extended Framework for HIPCs?", Manuscript, Submitted for publication, February 2006.

Working Paper 95-4 /Document de travail 95-4, Bank of Canada, Ottawa, Ontario K1A OG9.

Rajaraman, Indira, Shashank Bhide and R. K. Pattnaik (2005), "A Study of Debt Sustainability at State Level in India", Reserve Bank of India, August.

Reddy, Mahendra. (2006), "Assessing Sustainability of Fiji's Public Debt: A Cointegration Analysis Approach", Paper Presented at the Economic Association of Fiji Seminar, Reserve Bank of Fiji, February.

Tanner, Evan and Issouf, Samake (2006), "Probabilistic Sustainability of Public Debt: A Vector Autoregression Approach for Brazil, Mexico, and Turkey", IMF Working Paper WP/06/xxx

World Economic Outlook (2003), "Public Debt in Emerging Markets; Chapter III: Public Debt in Emerging Markets: is it too high?", IMF, September.

Annex

Annex

Unit Root Test results

To confirm the presence of one and only one unit root in our data series which runs from 1981-2006, an augmented DF tests on their first differences were run, an alternative and more robust test to ADF is the test that was developed by Phillips and Perron (1988). The PP test has an advantage over the ADF test as it gives robust estimates when the series has serial correlation and time-dependent heteroscedasticity, and there is a structural break. Both tests are achieved assuming the presence of a unit root (non-stationary variable) with the null hypothesis (Ho), and a stationary variable with the alternative hypothesis (Ha). If the calculated statistic value is lower than critical statistic value, then we do not reject (accept) Ho and the considered variable is non stationary. The test was employed for both the level and the first differences of each series in the equation (1). If the test fails to reject the test in levels, then the series contains one unit root and is of integrated order one I (1). The results reported in Table 1 below indicate that all the series of equation 1 are integrated of order one I (1), i.e., non-stationary, except for democracy under PP test, which is stationary in the level I(0). However, first differencing of all the variables shows stationary under the tests.

Table1. ADF and PP Tests for Unit Roots

	ADF		PP	
Variables	Level	Fist Difference	Level	Fist Difference
G	-3.1334	-2.6524***	-3.6727	-8.2095*
Lny-1	-3.6025	-5.5940*	-3.3591*	-9.4855*
DDy	-1.9892	-3.112*	-1.1675	-4.5464*
Log INV	-1.4127	-5.3555*	-5.1104	-10.5906*
log Open	-2.2317	```````````````	-1.5666	-4.6473*
FD	-0.7899	-3.918**	-.10969	-7.3300*
Dem	-3.3924	-7.1131*	-4.346*	-10.362*

, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively. The critical values of ADF statistics are -4.39, -3.61 and -3.24 at 1%, 5% and 10% levels of significance respectively. The critical

values of PP statistics are -4.37, -3.60 and -3.23 at 1%, 5% and 10% levels of significance respectively.

Having confirmed the existence of unit roots for most the data series, the next step involves applying cointegration procedure to check whether a set of I (1) variables are cointegrated

Cointigration Test results

A linear combination of two or more non-stationary series may be stationary. If such a stationary exists, the non-stationary (with a unit root), time series are said to be cointegrated and may be interpreted as a long-run equilibrium relationship between the variables. In order to test cointegration, there are two different competing approaches proposed by Engle and Granger (1987) and and Johansen and Juselius (1990). Engle and Granger procedure only identifies the existence of cointegration not the number of cointegrating vectors. However, Johansen and Juselius multivariate cointegration framework overcomes this weakness. The procedure for cointegration followed in this paper is the Engle-Granger (E-G) approach. According to E-G approach testing for cointegration involves two steps. Firstly; perform an OLS regression; then; perform a unit root test on the residuals of this regression to see if they are stationary. Hence, the procedure is to obtain the residuals from Equation 1, which should be stationary in its level.

The equation (1) is first estimated by ordinary least squares (OLS) method during 1981-2006, inclusive of all the considerable variables. As revealed from the results-which not reported here, all the variables in Equation 1 are significant and have the expected signs, the democracy index was the only one which was insignificant. At this juncture, the equation 1 was re-estimated after excluding the democracy variable. The final preferred long-run equation using the full sample period is as follows, with their respective coefficients and t-values in parentheses.

g =-24.05 -0.739 log (lag Y) -0.15DDY + 3.92 FD+ 4.89 log Open + 2.4681 log INV 2

(-2.655)* (-4.965)* (4.506)* (4.317)* (1.96)**

R^2 = 74% D.W. = 2.976 F-S = 10.88

; ** and * indicate significant at 1% and 5% critical levels, respectively.

Lagged income reveals its expected negative sign supporting the convergence hypothesis for Egypt. As expected, the coefficient of capital formation (log INV) is positive and statistically significant at 5% level. The regression results reveal a positive and highly significant relationship between economic growth and the size of the financial sector as measured by credit to the private sector as a percentage of GDP. That result confirms the role of financial development in Egypt regarding boosting saving and channeling of funds to worthwhile investments, which enhances the productivity of other factors of production. The results in equation 2 confirm that international trade (openness) has a positive effect on growth. The coefficient of domestic debt as a ratio to GDP exhibits a negative and significant coefficient which corresponds with the prior expectation of the adverse impact of domestic public debt to growth, since domestic debt could squeeze private investment due of credit constraints, put forward potential risks and macroeconomic instability because its sever future burden to the government burden, threatens social development and eventually hinder the economic growth.

To affirm the nonlinearity of the impact of debt on growth the previous equation was estimated by including both the DDY and the quadric variable of DDY. The estimated coefficient for both two variable are negative and highly significant which is supportive to the idea that rather a nonlinearity relation- there exists a persistent and continuously negative impact of domestic debt on growth.

The second step involves directly testing the stationary of error processes of the cointegration regression estimated in previous equation. Hence, the stationary of the residuals from the long-run equation is thus performed using the ADF and PP testing procedure to see if they have a unit root but excluding the trend and the intercept. If a unit root is not present, the residuals are stationary and the variables are cointegrated, thus a stable long-run relationship exists between the variables of the growth equation. Results of Unit root test for the residuals are reported in Table 2 below. Both The

Dickey Fuller and the PP statistics are greater than the critical values, indicating that the null hypothesis of a unit root in the residuals can be rejected convincingly at both levels, thus leading to the conclusion that the residuals are stationary and integrated of order zero, suggesting an existence of a long-run, cointegrating relationship among the variables.

Table2. Unit Root Test for the Residuals ut (At Level).

ADF	PP
-3.0573*	-9.0589*

(*) Significant at 1% critical level. Critical values for ADF and PP statistic (without trend or intercepts) = -2.665 and -2.6603 respectively at significant leve1%

Accordingly; mayhap a long- run relations exists in the estimation of the growth equation. Thus, it can be implied that an error correction exists in the equation as well. Therefore, following Engle and Granger (1987) an error-correction model is developed in order to capture the long-run relationship among the variables.

Annex 2. Scenarios

The first scenario used the baseline values for all the specific variables. The latest available figures for 2006 have been taken assuming that the macro economic conditions provided in the last year remain unchanged in next 10 years—during 2007-17. Under that scenario the main goal is to examine whether historical policies were to be continued into the future, or will a modification of policies be required? The other scenarios allow adjustments for the key macroeconomic variables in the next ten years. The following table summarizes the assumptions of each scenario.

Table 5: The Assumptions of the Suggested Scenarios

	Baseline Scenario	Scenario 2 Better growth	Scenario 3 higher i	Scenario 4 lower deficit	Scenario 5 The worst	Scenario 6 The best
DDY	101.3%	101.3%	101.3%	101.3%	101.3%	101.3%
g	14.7%	16.2%	14.7%	14.7%	13.2%	16.2%

r	9.5%	9.5%	10.5%	9.5%	10.5%	8.6%
pb	3,38%	3,38%	3,38%	3%	3.72%	3%

Under each scenario debt-to-GDP ratio is assumed to be what is for the year 2006 (101%). As shown above, this ratio went beyond the maximum limit at the year 2006, and then it is unaffordable ratio. Alternatively, it is assumed that 65% is a desirable comfortable tolerating ratio. We calculate the primary gap to measure the size of the adjustment needed for stabilizes the debt-to-GDP ratio. If we consider actual public domestic debt on 2006, therefore, the calculated pb* reveals the size of primary deficit that stabilizes the debt-to-GDP ratio on average, over the projection horizon. On the other hand, if we take into considerations targeted domestic public debt (65% of GDP), thereat, pb* appears the size of deficit needed if the government wants to stabilize the debt-to-GDP ratio at the target or the desirable level.