



RESEARCH ARTICLE

PUBLIC DEBT AND INVESTMENT GROWTH, EVIDENCE FROM EGYPT

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ABSTRACT

In this paper we are trying to investigate the impact of public debt accumulation on the Egyptian public investment growth to ascertain the validity of crowding out theory. The research adopts Vector Error Correction Estimation techniques to determine the terrible nature of the relationship between public debt accumulation (both internal and external debt) and public investment growth in Egypt. We are using data covering the period 1981-2015 sourced from the Central Bank of Egypt and the World Bank data base. The results reveal that external debt, debt serving and exchange rate coefficient are significant at all levels indicating their strong negative impact on the public investment growth. Additionally we find a very low speed of adjustment mechanism of just 31% in the economy's long-run equilibrium.

INTRODUCTION

The burden of public debt accumulation and its servicing on country's investment growth specifically the developing economy has been of a great concern to policy makers and researchers. Capital inadequacy and its consequent economic implication on economic activities have been the sole reason behind debt accumulation by the developing economies (Al-Zeaud 2014). Although public debt has been extensively studied (Kumar and Guidotti, 1991; Lin and Sosin, 2001; Adofu and Abula, 2010; Alzeaud, 2014; Cholifihani, 2008; Ajayi and Oke, 2012; Greiner, 2012; Hameed *et al.*, 2008; Longanathan *et al.*, 2010, among others); the subject matter needs to be further explored vis-à-vis investment growth. Apparently, most studies on public debt as much as can be established have rarely addressed the nexus between public debt and investment growth; because prior studies as noted above, have focused on economic growth with little or no research attention to investment growth. Therefore, until a research is conducted on public debt to further investigate its relationship with investment growth, it will be impossible to fill the apparent gap in the extant literature. Debt crisis in Africa according to Ajayi (1991) started since early 1980s and servicing it has imposed enormous challenge; such that once the debt ratio to the economy's size is high, it becomes difficult to repay a significant amount of the debt in the short-run without imposing a burden to such economy and its investment base, especially when external debt is involved. In the case of Egypt for instance, the challenges of debt burden originated from 1985 external debt crisis, although the genesis of Egyptian public debt is traced to 1964. The debt burden and its crisis greatly deepened in Egypt because of the debt rescheduling, the interest and the amortization payments. In addition, another factor that escalated the debt burden and its attendants crisis in Egypt was the fiscal expansion in the country as a result of the oil boom, in which the policy makers

and the government did not change when the oil boom actually declined in 1982 (El-Mahdy and Torayeh 2009). The oil boom decline, no doubt immensely led to more debt accumulation because the government of Egypt was unable to bring down its fiscal expansion policies, but rather, embarked on borrowing more debt both internally and externally for the purpose of meeting up her rising expenditure profile; coupled with the fact that greater percentage of the oil revenue are used to service debts which sometimes accrue as default charges or rolled over because of its short-termism.

Literature Review

Conceptual framework on debt/public debt: Debt is act of borrowing which can be domestic or external (Utomi, 2014). Again, debt is a contractual obligation of owing or borrowing with a promise of repayment at a future period (Ogba, 2014). A country's Public debts are broadly made up of domestic and external debt and are sometimes incurred when the economy needs to cover large fiscal deficits (Edo, 2002). Erhieyovwe and Onovwoakpoma (2013) defined public debt as debts incurred through borrowing by the economy's government in both domestic and international market. From economic theory view point, it is suggested that reasonable amount of borrowing by a developing economy is likely to improve the economy's growth (Pattillo *et al.*, 2002). That is why Amakom (2005) argued that public debt can only be effective in achieving economic growth when the fund and other internally generated revenue are efficiently used for productive investments.

Hausmann and Panizza (2011) argued that foreign currency debts are very risky as it increases a country's inability to implement macroeconomics policies, increase instability and thus reduce the economy's growth rate. Therefore, every sovereign nation is capable of achieving economic growth with debt when it borrows wisely, manage efficiently and invest the fund in productive projects that generate revenue in excess of cost of borrowing such fund.

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Theoretical and empirical evidence on public debt-investment growth debate: Policy makers and researchers globally have shown ostentatious concern over the economic theories that demonstrate the existence of relationship between public debt, investment growth and economic growth. Yet, there is still unclear evidence to the real effect of public debt accumulation and its servicing on public investment growth due to the mixed empirical evidence by existing literature (Real *et al.*, 2014). Economic theory according to Pattillo *et al.*, (2002) suggest that investment growth (and even economic growth) of a developing economy is likely to be enhanced when it borrow reasonably. This is because less developed economies always faced capital inadequacy, and need to borrow in order to supplement their internally generated funds to carry out some capital intensive investments (Al-Zeaud, 2014). However, viewed differently, high stock of government debt can likely have a crowding out effect on the economy's investment. This occurs because servicing such debt dries up the government budget resources and reduces the funds which would have been used to carry out productive investment thereby lowering the economy's growth (Pattillo *et al.*, 2002; Al-Zeaud, 2014). Furthermore, Reinhart and Rogoff (2010b) and Afonso and Jalles (2013) argue that high public debt increases the expected future tax, inflation and lowers consumption, public spending, investment and employment. Additionally, Servén (1997) assert that high debt discourages private investment as it may increase macroeconomic uncertainty in the economy. This goes with the debt overhang theory which suggests that high debt act as a tax on investment when it get beyond a certain point, and lowers the incentive for investment.

Another conduit through which high public debt can deter growth (both investment and economic growth) is the reliance on debt that impede growth as it raises interest rates, which in turn raises the cost of borrowing for investment and consumption. High public debt affect the economy's counter cyclical fiscal policy, lead to higher volatility in the economy's output thus lowering the growth rate (Woo, 2009 cited in Balassone *et al.*, 2011). In other words, these studies all suggest that public debt can have positive or negative impact on the economy depending on the level and use of such fund. Neo-classical economic and endogenous theory, arguably demonstrated that public debt always act as a distortion to the economic activities thus hampering both investment growth and economic growth (Saint-Paul, 1992 cited in Afonso and Jalles, 2013; Panizza and Presbitero, 2014; and Real, 2014). They are of the view that government intervention in the form of fiscal policy, all contribute to economic instability. Further empirical evidences also abound; for instance, the work of Greiner (2012), who emphasized on how public debt distress allocation of resource, using AK endogenous-growth model. He argued that high public debt-to-GDP ratio can negatively influence growth by crowding out private investment. He argued that this can occur only if governments' tries to meet its inter-temporal budget constrain by reducing public spending but if it adjusts transfers that such impact will never exist. Reinhart and Rogoff (2010a); and (2010b) investigated the effect of public debt on the growth of 20 advanced countries and 44 countries (respectively), for the period 1790-2009. According to the interpretation of their results, they found a fragile correlation between debt and long-run economic growth for a debt-GDP-ratio below 90% but have a strong negative correlation at a threshold for debt above 90% of GDP. In their second study on the same topical issue, they found that

emerging economies have a lower threshold of 60% for its total external debt after which their growth rate both investment and economic growth start decreasing annually. They argued that there is possibility of country specific issues and also the fact that high debt ratio lead to tighter fiscal policies which leads to economic and investment risks and consequently lower growth rate. Furthermore, Checherita and Rother (2012) analyzed the channels which public debt affects economic growth for twelve Euro area countries, for the period 1970-2008. They found a non-linear impact through total factor productivity, public investment, and private savings and other channels simultaneously. After addressing for endogeneity and reverse causality between the variables, they found a turning point for debt to GDP ratio of 90%-100% from which public debt starts having a negative impact on the long-run economic growth. Afonso and Jalles (2013) investigated the effect of government debt and its maturity structure on growth and productivity of OECD emerging/developing economies, using a panel of 155 countries. They found that a 10% increase in debt ratio above 90% will result to -0.2% growth rate (decrease), while it will lead to 0.1% increase in growth for countries with debt ratio below 30%.

MATERIALS AND METHODS

In our study we aim to determine the impact of Egyptian public debt on investment growth as suggested by crowding out theory and ascertain the validity of such claim. Based on the crux of this study, we therefore hypothesized that public debt and its servicing have not negatively impacted on Egyptian public investment. The data employed for the study are secondary data for the period of 1981-2015. The data were variously sourced from Central Bank of Egypt statistical bulletins and annual reports and World Bank development indicator for the periods under study.

Justification for the Research variables: The research variables of this study constitute public investments in Egypt (dependent variable), and in this study it is represented by real investment. Whereas, the independent variables of the study are: external debt outstanding, domestic debt outstanding; and public debt servicing. External debt and its servicing according to Cholifihani (2008) and Hameed *et al.* (2008) reduces a country's capital stock since it represent a transfer of wealth, thus hampering the economy's growth. Other controlling variables used in the estimation include; Exchange rate which its fluctuation determines the value for capital flight; Interest rate for borrowing these debt and lagged values of real GDP. RGDP which are GDP values adjusted for inflation effect is used for the analyses in order to determine the actual performance of the economy. The use of lagged value(s) in this study is to tackle the problem of endogeneity often associated with time series data. The application of the lagged values of the GDP is also justified in the work of Cecchetti *et al.* (2011) and Panizza and Presbitero (2014); and the lagged value(s) are determined using lag selection criteria. In other words, external debt; domestic debt; public debt servicing; exchange rate; interest rate; and real GDP are the independent variables regressed on RInvest (dependent variable).

Model specification: A linear regression model is specified thus:

$$RInvest_t = \alpha + RExtdb_t^{\beta_1} + RDmdb_t^{\beta_2} + RDbtser_t^{\beta_3} + RGdp_t^{\beta_4} + RExcr_t^{\beta_5} + RIntr_t^{\beta_1} + \mu \dots \dots \quad (1)$$

RInvest = Real public investment
 RGpd = Real gross domestic product
 RExtldb = Real external debt outstanding
 RDmdbl = Real domestic debt outstanding
 RDbtser = Real public debt servicing
 RExcr = Real exchange rate
 RIntr = Real interest rate
 α and $\beta_1 - \beta_6$ = the parameters to be estimated

Model transformation: Due to the natural characteristic of time series data, which is always associated with a strong trend, coupled with the non-linearity of parameter associated with Cobb Douglas function, it is consider essential to transform the data and the estimated function to its natural logarithmic form.

Estimation technique: For our research we use the Vector Error Correlation Model (VECM). It is re-emphasized that the justification for using VECM is to take account of some issues associated with time series data. The entire necessary diagnostic test required of time series properties are duly taking care of. In a more general form, the VECM specification is presented thus:

$$\Delta Y_t = \mu + \sum_{i=1}^{n-1} \alpha_i \Delta Y_{t-i} + \sum_{i=0}^{n-1} \gamma_i \Delta X_{t-i} - \pi \hat{e}_{t-1} + t \dots$$

Where:
 ΔY_t = change in the dependent variable
 \hat{e} = disequilibrium error
 π = error correction coefficient which denotes the magnitude equilibrium adjustment.
 t = the error term
 t = time (year t).
 α_i and γ_i = the parameters to be estimated and n = number of observations

RESULTS

Unit Root Test: In order to aid accuracy and comparison and to boast the confidence in the result, Augmented Dickey-Fuller (ADF) and Philips-Perron (P-P) tests is used for determining the stationarity of the variables, both at logarithmic and differenced values.

Table 1. ADF and P-P unit root test

Variables	ADF		P-P	
	Log level	First dff.	Log level	First dff.
LNRGDP	-0.215	-4.316***	-0.039	-5.671***
LNREXTDBT	-1.223	-4.211***	-1.359	-5.352***
LNRDMDBT	-1.814	-4.645***	-2.274	-5.976***
LNRDSERV	-1.466	-6.127***	-1.365	-8.463***
LNRIINVEST	-1.373	-4.038***	-1.193	-7.469***
LNREXRATE	0.406	-3.341***	0.834	-4.760***
RINTRATE	-4.383***	-7.536***	-3.991	-7.118***

Note: the critical values for this test at 1% = -3.580; 5% = -2.930; and 10% = -2.600

The results indicate that all the variables except interest rate have a unit root at their logarithmic values but became stationary after their first differencing. Interest rate result shows stationarity at it logarithmic value in both ADP and P-P test. Thus all the other variables are integrated of order one denoted as I(1), while interest rate is integrated in the order zero denoted as I(0). The values with three asterisks indicate the stationarity of these variables at both levels of significant.

Lag selection: For the purpose of avoiding spurious results and to efficiently test the hypothesized theory, it is necessary to determine the time series properties of the variables used for this study. As a matter of fact, the selection criteria for number of lags used in our test was determined by applying the lag selection order criteria as indicated in Table 2. From Table 2, all the criteria (FPE, AIC, HQIC, and SBIC) indicated a maximum of 1 year lag and as such, 1 year lag of each of the variables is used for the test.

Co-integration Test: To determine the existence of a long-run relationship among the variables under study, Johansen test for co-integration was carried out. This was done using the logarithmic values of the variables apart from interest rate which does not need to be logged as it is in rate. From Table 3, the trace statistics shows the existence of three (3) co-integrating equation among the variables (indicated by the two asterisks), as the trace statistics became less than 5% critical value from the third rank. This test established the existence of a long run relationship among the variables; hence we proceed to VECM estimation.

VECM estimation results: After establishing the existence of long-run relationship among the variables by co-integration test above, VECM was estimated and is used to determine the dynamic behavior of the variables in the model.

Table 2. Lag selection order criteria

Lag	LL	LR	df	P	FPE	AIC	HQIC
0	11.015				.0497	-1.638	-.0613
1	29.737	36.441*	1	0.000	.0245*	-8.968*	-.7612*
2	30.113	.6556	1	0.478	.0264	-8.554	-.7267
3	30.856	1.785	1	0.179	.0254	-8.518	-.7035
4	30.946	.0821	1	0.764	.0252	-8.368	-.6677

Table 3. Johansen co-integration test

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistics	5% Critical Value
0	7	-294.9676	.	153.756**	124.24
1	20	-271.2781	0.5984	106.324**	94.15
2	31	-252.9760	0.5049	69.745**	68.52
3	40	-238.7151	0.4221	41.223	47.21
4	47	-229.4738	0.2996	22.711	29.68
5	52	-223.7964	0.1956	11.411	15.41
6	55	-219.8756	0.1406	3.548	3.76
7	56	-218.0965	0.0661		

The adjustment coefficient in VECM model indicates the speed of adjustment of dependent variable from its short-run to long-run equilibrium. This equally validates the existence of a long-run relationship between the variables as suggested by the co-integration test. Thus, the a priori expectation of this model is $-1 \leq \text{VECM} \leq 0$, meaning that the coefficient of the target equation in VECM must be negative and significant to show that there is indeed existence of an errors which tend to be corrected as equilibrium converges.

The result for this estimation is presented in Table 4.

Table 4. VECM estimation result lag = 1

Variable	Coefficient	Std. error	t-stat	p-value
CE_1	-0.314	0.0819	-3.75	0.001
$\Delta \text{LNREXDBT}(-1)$	-0.651	0.230	-2.81	0.005
$\Delta \text{LNRMDBT}(-1)$	-0.154	0.103	-1.47	0.135
$\Delta \text{LNRDSEV}(-1)$	-1.085	0.425	-2.53	0.011
$\Delta \text{LNGDP}(-1)$	0.273	0.176	1.51	0.122
$\Delta \text{LNREXRATE}(-1)$	-0.325	0.148	-2.29	0.028
$\Delta \text{RINTRATE}(-1)$	2.624	7.548	0.41	0.728

$R^2(\text{CE}_1) = 0.6677$ (67%)

DISCUSSION

From table 4, the target model in the estimation is the first model (CE_1). As it can be seen, the coefficient of the error-correction is -0.314 with a t-statistics of -3.75 and probability value (p-value) of 0.001. These indicate the robustness of the coefficient that it does not occur by chance since the t-statistics and p-value shows that it is significant at both 5% and 1% significant level. The value of the adjustment coefficient, -0.314 implies that the system's adjustment mechanism is slow, showing that only 31% of the previous year's error in the system are corrected in the current year. The t-statistics of external debt, domestic debt, debt serving, RGDP, exchange rate and interest rate, are -2.81, -1.47, -2.53, 1.51, -2.29 and 0.41 respectively. This result of external debt, domestic debt, debt serving, RGDP is in conformity with prior expectations while that of interest rate which is expected to be negative but turned out positive. Interestingly, the results reveal that, external debt, debt serving and exchange rate coefficient is significant at all levels indicating their strong negative impact on the Egyptian public investment growth. This equally validates the existence of a long-run relationship between the variables as suggested by the co-integration test.

The adjustment coefficient in VECM model indicates the speed of adjustment of dependent variable from its short-run to long-run equilibrium. It has shown how slow the errors in the variables converge from its short-run position to long-run equilibrium. However, the insignificance of other variables explain the earlier point of this work that most of the effects of these independent variables on the dependent variable are not immediately felt in the economy but after some period. Additionally, from our results, the adjustment coefficient is rightly signed showing that independent variables indeed have a negative effect/implication on public investment growth in Egypt. This is in favor of the crowding out theory explained above, just as other diagnostic results validate the outcome of the VECM results. By implication, public debt and its servicing affect economic growth through crowding-out of public investment, and it is not the only channel through which the economy's growth is affected. It could equally crowd-out private public investment as suggested by other studies through

its impact on interest rate, taxation and other uncertainties which it may cause in the economy. After estimation, it was deemed necessary to carry out some diagnostic test in order to be confident about the result outcome. See table 5 for instance

Diagnostic results: Language multiplier test for residual autocorrelation was done. This is a test to ensure that the error terms of the variance-covariance matrix of the disturbance vector are not correlated with each other, as this could produce a misleading result. The result with a p-value of 0.116 (more than 5%) therefore confirmed that the errors are spherical and we conclude that there is no autocorrelation of the disturbances at lag order 1. This therefore, validate that the result is a robust estimation of our model. Further to the diagnostic test, Jarque-Bera tests for disturbance distribution were carried out. See for instance Table 5.

Table 5. LM test

Lag order	Chi2	Df	Prob chi2
1	59.4566	52	0.116

Conclusion

Debt is theoretically view as one of the key drivers to growth in underdeveloped world. This is for the fact that less developed economies acquire debt to complement their generated revenue due to their capital inadequacy in order to carry out their public project. However, having established the consequence of large public debt accumulation on public investment, the Policy makers should be wise in debt contraction. This is important because most debt contracted by leaders is not constantly used for its main purpose rather for their selfish/political interest. Meanwhile proper management of public debt is always the bedrock of productive debt which in turn leads to investment growth and concurrently economic growth. Policy makers should always put into considerations other channels such as external shock importation, through which debt accumulation specifically external debt component can affect the economy. Secondly, the consequences of some imposition being placed on the economy by most of the international creditors once there is high debt ratio, which always act as an indirect distortion to the macroeconomic activities should be considered. This imposition undoubtedly restricts the economy's implementation of it macro-economic policies and increase instability as suggested by Hausmann and Panizza (2011). In other words, debt-GDP should not go beyond international ratio for debt sustainability.

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