DEBT SERVICES, CAPITAL INFLOWS AND ECONOMIC GROWTH IN NORTH AFRICAN COUNTRIES

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ABSTRACT

The North African countries namely Algeria, Egypt, Mauritania, Morocco and Tunisia rely heavily on external funds for financing its development. Such external funding usually takes the form of external loans. This study advances the argument that the real problem that impedes the process of economic growth is the challenge of inadequate real resources for capital formation, due to high external debt servicing. The mounting debt stocks have discouraged the inflow of foreign capital in the form of Foreign Direct Investment (FDI) for fear of macroeconomic distortions. It is scarcely surprising that high debt-service obligation has not only made North African economies to perform poorly but also to rely heavily on foreign sources of budgetary support, thereby creating an unending cycle of economic crisis. In a nutshell, this study used a simultaneous equations model to test the process of interaction between FDI inflows, external debt service and economic growth. The analysis uses the Three Stage Least Square and panel cointegration test to investigate the relationship between debt service, FDI inflow and other determinants and economic growth. The results showed a negative sign and significant relation between debt service and economic growth. The results also show that FDI inflows play an important role and increased the economic growth. The interaction variables between debt crisis with FDI inflows, debt crisis and domestic saving show a negative effect on economic growth in some countries and a positive effect on economic growth in others. In terms of policy, the governments should promote rational and proper utilization of resources, while trying to get more concession on newly acquired debt inflows. It also indicates that policymakers should act early when choosing to lean against credit booms, before the debt service reaches critical levels.

Keywords: debt service, capital inflows, multi-simultaneous equation, panel cointegration, economic growth

ABSTRAK

Negara-negara Afrika Utara seperti Algeria, Mesir, Mauritania, Maghribi dan Tunisia amat bergantung kepada dana luar untuk membiayai pembangunannya. Pembiayaan luar seperti ini biasanya dalam bentuk pinjaman luar negara. Kajian ini mengutarakan hujah bahawa masalah sebenar yang menghalang proses pertumbuhan ekonomi adalah cabaran dari segi sumber sebenar yang tidak mencukupi untuk pembentukan modal, kerana khidmat hutang luar negara yang tinggi. Peningkatan dalam stok hutang tidak menggalakkan aliran masuk modal dalam bentuk pelaburan langsung asing (PLA) kerana bimbangkan keherotan ekonomi makro. Adalah tidak menghairankan bahawa obligasi terhadap khidmat hutang yang tinggi bukan sahaja telah membuatkanekonomi Afrika Utara berprestasi lemah tetapi juga terpaksa bergantung sepenuhnya kepada sokongan belanjawan sumber asing, dan keadaan ini mewujudkan kitaran krisis ekonomi yang tidak berkesudahan. Secara ringkasnya, kajian ini menggunakan model persamaan serentak untuk menguji proses interaksi antara aliran masuk PLA, khidmat hutang luar dan pertumbuhan ekonomi. Data kajian akan dianalisis menggunakan ujian Kuasa Dua Terkecil Tiga Peringkat dan ujian kointegrasi panel untuk menyiasat hubungan antara khidmat hutang, aliran masuk PLA serta penentu lain dan pertumbuhan ekonomi. Keputusan menunjukkan tanda negatif dan hubungan yang signifikan antara khidmat hutang dan pertumbuhan ekonomi. Dapatan kajian juga menunjukkan bahawa aliran masuk PLA memainkan peranan yang penting dan telah meningkatkan pertumbuhan ekonomi. Pembolehubah interaksi antara krisis hutang dengan aliran masuk PLA, krisis hutang dan tabungan domestik menunjukkan kesan negatif ke atas pertumbuhan ekonomi di beberapa buah negara dan kesan positif kepada pertumbuhan ekonomi di negara-negara yang lain. Dari segi dasar, kerajaan harus menggalakkan penggunaan sumber secara rasional dan sebaik-baiknya, disamping cuba mendapat lebih konsesi untuk aliran masukperolehan hutang yang baharu.Hal ini juga menunjukkan bahawa pembuat dasar perlu bertindak awal apabila memilih untuk bersandar kepada hutang yang banyak, sebelum khidmat hutang sampai ke tahap kritikal.

Kata kunci: khidmat hutang, aliran masuk modal, persamaan serentak berbilang, kointegrasi panel, pertumbuhan ekonomi

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LIST OF ABBREVIATION

2SLS	=	Two Stages Least Square
3SLS	=	Three Stages Least Square
ADF	=	Augmented Dickey-Fuller
BOP	=	Balance of Payment
DF	=	Dickey-Fuller
DSR	=	Debt Service Ratio
FCI	=	Foreign Capital Inflows
FDI	=	Foreign Direct Investment
GDP	=	Gross Domestic Product
GMM	=	Generalized Method of Moments
GNP	=	Gross National Product
HIPC	=	Heavily Indebted Poor Countries
IMF	=	International Monetary Fund
IV	=	Instrumental Variables
LDC	=	Less-Developed Country
LR	=	Likelihood Ratio
NPV	=	Net Present Value
OLS	=	Ordinary Least Squares
WAMZ	=	West African Monetary Zone

CHAPTER ONE

INTRODUCTION

This chapter outlines the introduction of the thesis. In this context, the rationale of the study is presented in the form of a problem statement, research questions and research objectives. The importance and scope of the study are also outlined in this chapter. The chapter closes with the research organization.

1.1   Background of the Study

At the global scene, external debt and foreign direct investment (FDI) have been considered as major sources of capital financing. FDI is the main form of capital inflow to many countries, while nations experiencing account deficit are advised to borrow funds, external debt, from the international community to boost their economic growth (Malik, Hayat and Hayat, 2010).   Unfortunately, external debt and its repayment have become a hindrance to several developing North African countries' economic growth like in Algeria, Egypt, Mauritania, Morocco and Tunisia. As noted by Malik *et al.*, (2010), in the past thirty years, it has been seen that foreign debt had been the major culprit in the decline in investment and growth performance of many countries. International debt can be likened to unnecessary tax paid by future generations on wasted services; in addition, the rise of debt servicing ratio can adversely affect economic growth of any country (Chowdhury, 1994).

However, Chenery and Strout (1966) observed that the justification of external debt in developing countries is to fill in the saving investment gap. Inevitably, external debt not only affects investment, but also economic growth. Rahman, Bashar and Dey (2012) stated that besides filling in the saving investment gap, it negatively affects the growth of developing nations. One of the reasons is the conditionalities of the donor agencies such as the demand by both World Bank and the International Monetary Fund (IMF) for loan repayments on developing countries. The fact that the total external debt of developing countries has been on an upward trend means that many of these developing economies, faces huge impediments in their quest for economic growth due to high interest payments associated with external debt servicing. The situation is compounded by heavy public expenditures and budget deficits that characterize developing economies.

Generally, Africa's international aid challenges with its source necessities directly linked to their ability to develop and previously accumulated saving. Nonetheless, before the origins of the debt trap since the 1980s, international aid efforts to alleviate the African crisis to engage the IMF and it emerged as a major lender to African nations. Expectedly, the channeling of capital to debt servicing purposes has been done at the expense of critical domestic priorities in the debtor countries. It is scarcely surprising then that the debt servicing takes care of a larger portion of Africa's GDP annually. It should be noted that a good number of North African countries have experienced and encountered major episodes of financial disasters that were characterized by untenable budgetary deficits. One of the main causes of the financial crisis in North Africa has

been the problem of external indebtedness which has had an adverse impact on economic development.

A number of studies have examined the effects of huge external debt servicing and its servicing requirements on the economies of developing countries' growth (Adegbite, Ayadi & Ayadi, 2008). It has been observed that the debt burden has affected capital accumulation resulting in the depletion of countries' foreign reserves. Such development indirectly affects key programs such as employment creation, literacy enhancement, and poverty alleviation. A cursory inspection of the external debt profile, as well as debt indicators of countries like Algeria, Egypt and Morocco, reveal the magnitude of the debt burden in these countries. According to the IMF's Country Report No. 11/40 of 2011, Algeria is one of the most indebted countries with a total external debt of 17.2 billion USD in 2005, 5.6 billion USD in 2006; 5.6 billion USD in 2007; 5.6 billion USD in 2008; and 5.4 billion USD in 2009 respectively (IMF, 2011).

The magnitude of the problem was amplified by the levels of the country's total debt service obligations in the same period. According to an IMF report, Algeria's total debt service was 5.9 billion USD in 2005, 13.3 billion USD in 2006; 1.1 billion USD in 2007; 1.2 billion USD in 2008; and 1 billion USD in 2009. However, the export revenue inconsistency was due to the global price fluctuation of oil and gas (hydrocarbon) which constitute 98% of Algeria's total exports. Thus, Algeria's total export receipts had oscillated from 46.3 billion USD in 2005, 54.7 billion USD in 2006; 60.6 billion USD in 2007; 78.6 billion USD in 2008; and 45.2 billion USD in 2009 (IMF, 2011). Efforts

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by the international community to help debtor countries reduce their external debt burdens like the policy of debt rescheduling, adopted by the Algerian government since January 1994, and the implementation of IMF-imposed measures had caused undesirable effects on their economic and social effects.

Rescheduling will only result in a temporary debt relief while, in the long run, it will significantly lead to greater sums of money being transferred to meet debt service obligations. Furthermore, an IMF-imposed measure induces high levels of inflation, reduces domestic purchasing power, and indirectly increases social problems. The measures force the government to reduce public expenditure, as demanded by the IMF conditionality, which in turn will create problems in the health, education, housing and transportation sectors of the indebted nation. Given this environment, it is no wonder then that the highly indebted countries continue to endure high external debt burdens, unacceptable levels of poverty, and low economic growth rates.

Another North African nation, Egypt also faces a similar economic predicament. With its large amount of external debt affects not only its economic growth thrust, but also its economic revival attempts. Since the economic slump began in the 1990s, Egypt's public debt also experienced a sharp rise. By the end of June 2004, the outstanding stock of gross and net public debt had amounted to 112 percent and 66 per cent of GDP, which mirrored the levels recorded in 1994 at the height of the economic decline (IMF, 2005). Notably, in earlier times, the composition and structure of the country's public debt differed from those of typical North African countries. In essence, Egypt had a

fairly small share of foreign currency denominated debt in its total debt, and a significant ratio of national government bonds to GDP than the average of African countries.

Additionally, Egypt's borrowings from international donors' capital markets were virtually zero, and issues were mostly nominal domestic debt with fairly long maturities. It was evident that Egypt's external debt had remained quite stable since the debt rescheduling of the early 1990s, mostly demonstrating the government's discreet approach to foreign borrowing. To a large extent the country's new public foreign borrowing had largely been matched by amortizations. The only exception was a US$1. 5 billion sovereign Eurobond issued in June 2002. Basically, the rise of Egypt's external debt-to-GDP ratio recorded during the 2002 – 2003 period was solely caused by valuation changes affected by the large depreciation in the Egyptian pound (IMF, 2005). The trend continues to escalate and Egypt's external debt rose to $ 29.2 billion at the end of June 2007. The country's external debt service commitments had increased by 188.8 million USD during July/March 2003/04 to reach the level of 2 billion USD. This was a result of the 212.7 million USD increase in principal repayments, to reach 1.5 billion USD and the 23.9 million USD decrease in interest payments, to stand at 525.1 million USD. Despite the increase, the debt service ratio to export proceeds of goods and services declined to 11.7 per cent during July/March 2003/04 from 13.3 per cent in the corresponding period a year earlier, mainly due to an increase in commodity exports, travel receipts and Suez Canal dues. In much the same way, debt service ratio to current receipts decreased to 10.1 per cent from 11.1 per cent (CBE, 2004).

Morocco is also facing economics issues and overwhelmed by the implications of the global recession. The impact of the crisis in Morocco is mainly due to the economic downturn in Europe, its principal trading partner. For the first half of 2009 relative to the same period in 2008, exports were down by 34 per cent, tourism receipts and remittances fell by 14 and 12 per cent respectively, and FDI was down by 34 per cent. However, after a sharp fall in recent years, nonperforming loans are likely to pick up moderately given the economic slowdown; thus, the authorities' vigilance in this area is warranted (IMF, 2010). According to the IMF Public Information Notice (PIN) No. 10/19 of February 16, 2010 in which the IMF Executive Board concluded in 2009 Article IV Consultation with Morocco, the country's total foreign debt expressed as a percentage of GDP was 29.1 in 2004; 24,2 in 2005; 23.9 in 2006; 23,7 in 2007; 20,6 in 2008; 23,0 in 2009 and 24,5 in 2010 (IMF, 2010). Given the foregoing permutations, it is not surprising that Morocco's external debt stood at $ 19.91 billion in 2007 (World Factbook, 2007).Nonetheless, the external debt of Morocco was on a declining trend and stood at 24 per cent of GDP (62 per cent of exports) in 2006 as compared to 48 per cent in 2002 (115 per cent of exports). This declining trend is attributed to foreign debt and reserve accumulation. Moreover, the share of public sector debt is relatively modest, as the government is increasingly relying on domestic financing rather than international. The government prepaid a significant share of its debt to multilateral in 2004 to 2006. Most of Morocco's external debt (65 per cent) was denominated in euros and the external debt service obligations are reasonably manageable, as indicated by a debt service ratio of around 13 per cent in 2006, compared to 37 per cent in 2002. Another

positive indicator is that external assets continue to surpass foreign debt. However, in the long run, a surge in the private sector external debt is expected once the liberalization of the capital account begins (Rabobank, 2007).

A cursory comparative view of the above external debt stock of the three North African countries shows that the debt volume for Algeria is significantly higher than that of Egypt and Morocco. Upon closer examination, the debt stock followed a stable trend in Egypt and Morocco; because the two countries took advantage of the debt relief offered by their international partners to offset the substantial part of its debt. It was noted that the external debt in these countries served as one of the main sources of capital funding to stimulate economic growth. As noted by Adepoju and others (2007) cited in Ayadi and Ayadi (2008), developing countries in Africa have insufficient internal capital formation due to a number of reasons including low productivity, income, and savings. As a result, governments turned to international donors and sought financial, technical, and managerial assistance to fill the resource gap. Like many African countries, Algeria, Egypt, Mauritania, Morocco and Tunisia rely heavily on external funds to finance their countries' development. Such dependence usually comes in the shape of external loans. Paradoxically, the external debt that arises from these external loans is a major impediment to capital formation in the developing countries. Overall, the dynamics and challenges of external debt suggest that these avenues do not significantly contribute to the economic growth of the debtor countries. As cases in most situations, debt accumulates mainly due to the servicing conditions. Ironically, external debt as a mode of capital financing has become a vicious circle of the poverty aggravation and a

constraint on growth in the developing economies (Nakatani and Herrera, 2007). For this reason, Karagol (2002) investigated the impact of external debt on the economic performance of three selected North African countries with regards to debt stock, debt redemption and debt servicing using simultaneous equation models for a period covering four decades which were neglected in previous studies.

The growth factor of the economy is attributed to many variables. These variables may specifically affect the real sector. The North Africa sub-region depends mainly in the oil sector, export of essential products and tourism (on the export of oil and its necessary products; and tourism). In short, economic growth in the region depends on the prospects of uncertainties, according to World Bank Data, 2012. Uncertainties occur due to environmental factors - crisis prone which affected the real sector and essential aspects like the GDP, exchange rate and inflation. The average rate of inflation in Africa, measured by CPI, is usually high at 9.2% in 2012, the same as in 2011 which is 9.3% (ECA-NA/ICE, 2013). Table 1, the trends show diverse pictures, with the performance of some economies generally stable. Generally, the picture of the region is grim in 2011 with upward trend in 2012. Thus growth indicators have shown a sluggish picture of the region especially for the period 2002-2012. (Table 1.1 illustrates the economic growth trend in five North African countries. Some of the countries economies' performances were generally stable. However, in 2011 the growth trend in all the countries deteriorated but slightly improved in 2012.

A closer observation on Table 1.1 concluded a presumption of the economics growth trend of these countries in the region. For example Egypt in (2006), the exchange rate shows adverse state, due to the fall of GDP in the five countries, indicating economic instability and weak position of the countries involved. A detailed study and observation of some countries show the micro-picture of countries in the region. For example, Egypt as shown in Table 1.1, the exchange rate shows an adverse position, due to the declination in GDP of the five countries in the region, showing the economic instability and low positions of the 5 countries.

On the whole, the economic growth is sluggish in these countries; mostly due to social unrest as a result of political instability (Amin *et al*., 2012). Efforts to create more employment and price stability by curbing the increase of inflationary trend and exchange rate are low. Table 1.1 shows a modest progress of GDP growth in Algeria and Morocco in 2012, while the is a slow growth in the general economic environment.

This is due to the crisis-ridden society in all the region as a result of the Arab uprising (Amin *et al.,* 2012). Major economic activities to boost the economic level of inflationary trends and exchange rates, thus creating the employment and price stability in the region are rather low.

Table 1.1
Important Growth Trends in North African Countries, 2002-2012

Year	Sector	Algeria	Egypt	Mauritania	Morocco	Tunisia
2002	GDP Growth	4.7	3.19	3.66	3.31	1.8
	Exch. Rate	97.68	5.03	271.72	11.02	1.42
	Inflation (%)	1.41	4.50	3.89	2.07	1.89
2003	GDP Growth	6.9	4.09	5.97	6.31	5.5
	Exch. Rate	77.39	6.15	263.03	9,57	1.28
	Inflation (%)	4.24	11.77	5.15	1.16	2.72
2004	GDP Growth	5.19	4.49	5.17	4.91	6.1
	Exch. Rate	72.45	6.01	264.14	8.8	1.24
	Inflation (%)	3.96	4.64	10.36	1.49	2.71
2005	GDP Growth	5.13	6.84	8.96	2.96	4.08
	Exch. Rate	73.27	5.74	265.53	8.86	1.29
	Inflation (%)	1.38	7.67	12.12	0.98	3.63
2006	GDP Growth	5.11	7.08	8.81	7.75	5.34
	Exch. Rate	72.64	5.7	268.6	8.79	1.33
	Inflation (%)	1.38	9.51	0	3.28	2.01
2007	GDP Growth	2.11	7.15	1.99	2.7	6.34
	Exch. Rate	96.29	5.5	258.23	8.19	1.28
	Inflation (%)	2.31	18.31	7.25	2.04	4.19
2008	GDP Growth	2.99	1,.86	3.15	5.8	4.52
	Exch. Rate	64.57	5.51	238.45	7.75	1.23
	Inflation (%)	4.38	11	7.34	3.7	3.41
2009	GDP Growth	2.45	5.15	-1.22	6.75	3.05
	Exch. Rate	72.64	5.5	262.36	6.06	1.35
	Inflation (%)	5.73	11.57	2.22	0.99	4.46
2010	GDP Growth	3.31	1.8	5.08	3.67	3.05
	Exch. Rate	74.38	5.95	275.89	8.41	1.43
	Inflation (%)	3.91	10.05	6.28	0.98	3.52
2011	GDP Growth	2.51	2.78	3.95	4.58	-2
	Exch. Rate	72.93	6.11	281.34	8.08	1.4
	Inflation (%)	4.52	8.6	5.67	0.98	4.32
2012	GDP Growth	na	na	5-5	4.81	4.8
	Exch. Rate	77.53	na	296.62	8.62	1.56
	Inflation (%)	8.9	na	4.9	1.3	3.36

Source: World Bank data; 2012

Most North African governments in the past decade had decided to open up their

economies to world trade to encourage competitiveness. Notably, Algeria, Egypt, and

Morocco are key North African economies that have decided to benefit from FDI in

their quest to attain sustained economic development. One should note, however, that

the three countries are different in the stage of economic development, size, and

structure. For example, Egypt has estimated population of 82,079,636 with per capita income of $6,200 as of 2010 (CIA World Factbook, 2011).The people of Algeria are approximately 34,994,937 as of July 2011, and its per capita income is estimated at $7,300 as of 2010 is slightly higher than that of Egypt. Morocco, a smaller country in terms of population, has 31,968,361 people and per capita income of $4,800 as of 2010 (CIA World Factbook, 2011). All three cited countries had implemented a number of policy measures in an attempt to attract foreign investment at a huge scale. For example, the measures adopted and implemented in Egypt included reduction in export taxes, control over foreign exchange and relaxation of 'red tape' on foreign investment procedures (Metwally, 2004).

One of the major goals of the Egyptian Government has been its quest to address the country's persistent trade imbalance and deficit. In the past thirty years, the country's imports have been exceeding exports each year. In much the same way, both Algeria and Morocco have long been implementing a number of measures and incentives to attract FDI. However, in Algeria, structural reforms have been timid and need acceleration to promote private sector development and improve financial intermediation, business climate, and further integration in the regional and world economies (IMF Country Report No. 10/57, 2010). According to the IMF (2010) the new regulations of limiting stake-holding and financing of FDI; and the slow pace of regional and multilateral trade negotiations could impede Algeria's economic growth.

Notably, the economies of low income countries have been "bedeviled by the twin economic crises of mounting debt burden and foreign investment inadequacies accompanied by more than proportionate FDI income remittance out of these economies" (Ezirim, Chinedu, Anoruo, and Muoghalu 2006). The debt problem is incredibly odious and appears to have no solution. The ratios of debt service to exports of low income economies gravitated between 16% and 19% since 1990 till 1998. Those of Algeria, Egypt and Morocco have ranged between 10% and 40% in recent years. For example in Egypt, the ratio of debt service to exports had a range between 9.7% in 2006 and was projected to be 5% in 2010/11 (IMF, Country Report No. 10/94, 2010). As for Algeria the ratio of external debt to exports was 9.8% in 2006; 8.8% in 2007 and 6.85 in 2008 (IMF Country Report No. 10/57, 2010). As a result, these economies suffer undue pressures to breaking points. One of the natural remedies for low income economies is to resort to foreign investment capital. Contrary to expectations, this appears to have become a two edged sword for these countries. The size of remittances from income accruing from foreign investment was a real surprise.

As noted by Ezirim *et al.,* (2006), the observed trend is that foreign investors came in with a small amount of capital, which is further magnified by the depreciating exchange rates, and end up carting away huge sums of capital out of the host countries in the form of investment income. Ironically, these funds are reinvested in the capital markets of developed countries to the detriment of national markets. In a way, the resulting capital flight further worsens the crisis relating to the generation of foreign investment income. This keeps the low income countries from "ever enjoying the freedom associated with

plough-back capital reinvestment and subjects them to the condition of always wooing foreign investors for capital inflows" (Ezirim *et al.,* 2006).It appears from raw statistics that the worst hit by these trends is the highly-indebted poor African countries, including the North African countries.

1.2 Statement of the Problem

Houssou and Heidhues (2005) stated that the international donor community has provided assistance to debtor countries to reduce their external debt trap to spur economic growth, alleviate poverty, and achieve external viability. This support has taken the form of concessional financing provision from International Financial Institutions (IFIs), and debt relief from official donor creditors, such as the Paris Club. The Paris Club is the major forum where creditor countries renegotiate official sector debts. Official sector debts are those that have been issued, insured, or guaranteed by creditor governments. It should be pointed out that these measures have produced great success in reducing the external debt burden of most middle-income countries. Nonetheless, many poor countries continue to experience unacceptable levels of poverty and the heavy external debt burden due to a combination of factors, including policies of inappropriate development, poor external debt management policy, give up the structural adjustment and reform economy, the decline of their terms of trade, and poor governance. In North Africa, high levels of external debt service have negatively affected savings and foreign exchange earnings resulting in the crowding out of public investment. This scenario, in return, has also affected the provision of social services for

the populace in the affected countries. This study advances the argument that the real problem that impedes the process of economic development in the North African countries is the challenge of inadequate real resources for capital formation, due to high external debt servicing. In many instances, the countries are compelled to resort to high levels of foreign borrowing in order to mitigate the effects of worsening economic conditions. However, further foreign borrowings have aggravated the debt trap as most of these countries have a history of debt service arrears and difficulties.

Many resources that could have been channeled back in the form of investments have instead been used to service external debt. Some of the countries in North Africa have problems of funds available for debt-service commitments which, in their countries and economic systems have almost collapsed as they grappled to free themselves from the debt trap.

The mounting debt stocks in the North Africa countries have discouraged the inflow of foreign direct investment as a result of fears of macroeconomic distortions. Ironically, instead of attracting outside capital, much needed national capital is fleeing to the rich countries either for debt servicing purposes or for safe keeping. Against this background, high debt-service commitments have not only made the North African economies to perform poorly, but also to rely heavily on foreign sources of budgetary support, thereby creating an unending cycle of economic crisis. In a nutshell, this study will use a simultaneous equations model to test the process of relationship between FDI

inflows, external debt service and economic growth in three North African countries, namely Algeria, Egypt, and Morocco; and tests for any possible feedback effects.

The influence of inflation on debt stock, debt redemption, and debt servicing in the economies of North African countries has been neglected by previous research (Maitheme, 2006; Cohen, 1997), indicating that there are theoretical and empirical gaps. Unsurprisingly, this study intends to uphold this feature because of the macroeconomic impact on these economies. In a way, this glaring vacuum needs to be filled and thus justifying the need for a conscious research of this nature. In much the same way, the results of the worsening exchange rate of the five key economies of Algeria, Egypt, Mauritania, Morocco, and Tunisia and how they are related to economic growth, debt stock, debt redemption, and debt servicing have not been captured in any existing researches (Yaqub (1994), Kransey (2002) and Sharul (2005) on this field. Therefore, this study is expected to fill these theoretical and empirical gaps. Furthermore, some literature on North African countries is silent on the impact of exchange rate of economic growth during the debt crisis episode in the region. For this reason, the issue needs to be explored, as well.

In the year 1970, less developing economies' fund borrowing was fairly insignificant and principally official. This meant most of the loans were taken by outside country governments and IFIs such as the World Bank as well as regional commercial banks. More importantly, most of these loans were liberal, meaning that, they were obtained below market interest rates to investments in growth related programs, in addition to a

drive to; increase the import of capital goods. But since the late 1970s and early 1980s, commercial banks have played a significant role in the provision of loans to developing countries. This development was triggered by the banks' motion to convert a large volume of the organization of the Petroleum Exporting Countries (OPEC) funds into borrowed funds to support less developing countries shortfall balance of payments and export led growth. Although international loans are beneficial and drawbacks to the borrowing countries, in the present era of the debt crisis, the costs of international borrowing seem to overshadow the gains particularly for poorest countries in Africa. In essence, funds put aside for repayments of debts constitute the succeeding disbursement of primary funds plus the added amounts of interest, known as paying back through the period of the loan. In this context, the problems relating to debt-service is measured by the size of the debt as well as the interest rate. Hence, as the amount borrowing volume of the debt rises or the payment of interest rate rises, so do the debt-service ratio. Another problem associated with foreign debt servicing is its repayment in the form of external currency since most foreign borrowing is given out in foreign currency. Meanwhile, debt-servicing challenges may also arise in situations where the export earnings decline or where interest rates rise. Both scenarios may result in sharp increases in funds earmarked for debt-service payments. The North African countries are also included in the above issue.

In this study, there is also a methodological deficiency that has prompted the research. Previous studies either dealt with few variables or few years' data set like in Olgun *et al.* (1998), Chowdhurry (1994), Metwally & Tamaschke (1994) and a host of others. For

example, Metwally & Tamaschke (1994) carried out almost a similar study on the link amid debt servicing, inflows and economic development of three chosen countries, that is, Algeria, Egypt, and Morocco. Moreover, Metwally & Tamaschke study's time series data covered the 1975-97 periods that are a period of 17 years. Unlike Metwally & Tamaschke (1994), this study uses longer time series data (four decades-40 years). Moreover, the time series data will be based on relatively recent data. The variables will be utilized to approximate the many-sided model by 3 Stages Least Squares (SLS) method, which is also another contribution and so far there are few studies that provide the same factors using the simultaneous equation model as is the case in this study, and is in line with the suggestion of previous researches (Chowdhurry, 1994; Metwally & Tamaschke, 1994; Maitheme, 2006).

The North Africa region represents an exasperating paradox with regard to the flow of Foreign Direct Investment (FDI). Despite being home to some of the richest oil-producing countries in the world and almost two decades of implementation of structural adjustment, the region continues to attract abysmal flows of FDI (Rivlin, 2001). There are some distinctive features about FDI flows to the Middle East region. Many of the flows are concentrated in a few countries such as Saudi Arabia, Egypt, Tunisia, Bahrain, and Morocco. The least recipients include Libya, Kuwait, and Yemen (Eid and Paua, 2002). A preponderance of FDI in the region has gone into petroleum-related and other primary activities. Non-petroleum FDI, such as Bahrain, Egypt, Morocco, and Lebanon has gone into tourism, banking, telecommunication, manufacturing, and construction

(Eid and Paua, 2002). While there is a consensus that the flow of FDI to the Middle East region is unimpressive, the reasons for this disappointing flow of are less clear.

Lastly, one of the contributions of this study is to include Tunisia and Mauritania, which are not featured in previous literatures amongst other research as far issues related to external debt services and its effects on growth prospects of the two North African region countries. Other studies have investigated the link between external debt service and growth in particular North African countries such as Algeria, Morocco and Egypt (Metwally and Tamaschke, 1994; Alogalah *et al.,* 2010). Based on the author's knowledge, no study has been carried out another two North African countries of Tunisia and Mauritania (African Economic Outlook, 2013)

1.3 Research Questions

i. Do the debt service and foreign direct investment have any effects on the economic growth of selected North African countries?

ii. Do inflation, exports and external debt stock have any effects on the economic growth of   selected North African countries?

iii. Do inflation, exports and exchange rate have any effects on the growth rate of debt service in the North African countries?

iv. Are there any effects of economic growth, exchange rate and external debt stock on FDI inflows of the North African countries?

v. Are there any effects of the interaction term between debt crisis and domestic saving, debt crisis and FDI inflows on the economic growth of North African countries?

vi. Are there any long run relationships between debt service, FDI inflows, and other determinants with the economic growth in the selected North African countries?

1.4   Objectives of the Study

1.4.1 General Objective

The overall objective is to examine the impact of debt service; FDI and others determinant such as inflation, exports, exchange rate, and debt crisis on the economic growth of five North African economies namely Algeria, Egypt, Mauritania, Morocco and Tunisia.

1.4.2 Specific Objectives

The specific objectives of the research are:

i. To examine the effects of debt service, FDI inflows, and other determinants on the economic growth in the selected North African countries,

ii. To examine the effects of debt stock, FDI inflows, inflation, economic growth, rate of growth of exports of goods and services and the exchange rate on the debt service in the selected North African countries,

iii.   To examine the effect of exchange rate, economic growth, external debt stock on FDI inflows to the North African countries,

iv.   To examine the effect of the interaction term between the dummy of debt crisis and the rate of growth of domestic savings and Foreign Direct Investment net inflows on the economic growth, debt service and FDI inflows in the selected North African countries, and

v.   To examine the long run relationship between debt service, FDI inflows, and other determinants of the economic growthin the selected North African countries.

1.5 Significance of the Study

Generally, the findings of this study will make an important contribution to the scholarly debate and literature on the effect of heavy indebtedness on development and growth, particularly in North Africa. A clear understanding of the implications of heavy debt-servicing will assist policy makers and academicians to devise appropriate policies to mitigate the macroeconomic distortions that have arisen from debt burdened economies like those in North Africa. In this sense, this study will probably reiterate the importance of proper utilization of external debts especially towards development policies and strategies that are targeted at promoting economic growth in the region. A review of the extant literature indicated that much has been written about the relationship of heavy debt servicing and economic growth, but little attention has been given to this relationship in the context of North Africa, especially through the lens of causality

analysis and equilibrium analysis or simultaneous equation modelling. As indicated earlier, this research will explore the relationship between economic growth, external debt service and capital inflows using time series data for Algeria, Egypt, Morocco, Tunisia and Mauritania using a wide range equation model. The approach will be peculiar from other researchers, especially Metwally & Tamaschke(1994)in the following ways; that is, longer time series data are employed, the time series used will be premised on the most current data, all share variables and development trends will be employed where possible and stationary variables will be used to estimate the multi-equation model by 3 Stages Least Square (SLS) procedure.

The views in current studies indicate that the relations between international borrowing and development trends is a complex one since many variables used for judgment might be endogenous, and the results of international borrowing have both direct and indirect impacts. Thus examining the external debt-growth relationship with a multi-equation model should be rewarding and exciting. In sum, as noted by an IMF *Working Paper on international borrowing, Investment, and Growth in Low-Income Countries* the extant literature provides limited evidence on how the stock of international borrowing and debt service impact growth, especially in poor nations. As such, there is always room for further research to explore the impact of such links on low-income countries that enjoy debt relief. Additional work is required to investigate the channels through which external debt affects growth. In a way, this study attempts to fill this gap in the existing literature, by paying especially attention to the impact of external debt service on investment.

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1.6 Scope of the Study

Generally, this study examines the effect of debt service, FDI inflows on economic growth in North Africa, but the empirical analysis focuses only on Algeria, Egypt, Mauritania, Morocco, and Tunisia. It will use a simultaneous equation model to examine the relationship between debt service, FDI inflows, and economic growth. Notably, the analysis is applied to the aforementioned five heavily indebted North African economies. The results are based on a three-stage least square method. Due to the non-availability of data, Libya is excluded from this study; because it is not faces any serious external debt situation. However, Egypt presents a unique challenge to the study. There is incomplete debt information on Egypt, such as the exclusion of debt data from official sources or the showing of lower figures in government budgetary computations.

1.7 Organization of the Study

This study comprises of seven chapters. Chapter One, the introductory chapter discusses briefly on the debt service, FDI inflows, inflation and economic growth situation of five North African countries, namely Egypt, Algeria, Morocco, Tunisia and Mauritania; presents - the problem statement, research questions, objectives of the study, importance of the study, scope of the study, and the structure of the study. Chapter Two provides an in-depth discussion of North African economies, including their debt burden. Chapter Three critically reviews the literature and theories related to the study. Chapter Four

discusses the methods and techniques used in the study. In this chapter, the simultaneous equation model and panel cointegration are thoroughly examined. Analyses of data and conclusions of the study are carried out in Chapter Five and Chapter Six respectively. This chapter presents complete findings and analyses of the study in the form of figures, tables and text so that the key information is highlighted. Finally, Chapter Seven summarizes the arguments of preceding chapters and give the conclusion. It also makes specific recommendations of the study.

CHAPTER TWO

**AN OVERVIEW OF EXTERNAL DEBT AND ECONOMIC GROWTH IN
SELECTED NORTH AFRICAN COUNTRIES**

This chapter provides an overview of the external debt situation in North African countries with a special focus on Algeria, Egypt, Mauritania, Morocco, and Tunisia. The environment of the economic performance of the North African countries and the vital features of the economies will be discussed. It will also cover analyses of factors that contribute to the weak economic performance of these economies with special emphasis on external debt. This chapter concludes by presenting an evaluation of North African economies vi's-à-via their external debt situation.

**2.1 General situation of the Linkages between External Debt and Economic
Performance of North African Economies**

External debt is one of the main sources of capital financing in any economy especially in developing countries. As noted by Adepoju *et al.,* (2007) most developing countries need technical, managerial, and financial support from Western countries to bridge the resource gap in their countries. The IMF (2003) defines the key elements of debts to include: Outstanding and Actual Current Liabilities, Principal and Interest, current and non-contingent, and Residence. These factors must define and explain the content of external debt; it is also the basis for countries, especially developing countries to draw up considerations for a debt in their policy framework because the definition of debt

takes into consideration all factors. For instance, World Bank and IMF defined external debt as the component of the country's overall debt that is owned by creditors outside of the country. External debt can be owned by corporations, governments or individuals. In the case of significantly poor nations, external debt may also be held by external funding agencies such as the World Bank or IMF

During the 1970s, sub-Saharan African countries borrowed money from abroad, but these loans did not promote sustainable growth of output and exports. The "Volcker" recession in the early 1980s and the collapsed of Africa's terms of trade ignited the debt problem and crisis. For over a decade thereafter, the sub Saharan African countries have faced a debt crisis that has stunted growth, undermined poverty reduction and degraded the environment (Nguyuru and Lipumba, 1999).

Over the past decades, developing countries had borrowed large amounts of funds, often at highly concessional interest rates. The purpose of the borrowing was that these funds would be invested in projects that would hasten economic development. But as debt ratios grew higher, when compared to the growth of domestic resources in the 1980s, it introduced various dimensions of liabilities in these economies accrued from the payment of debt services; repayment and other requirements tied to these debts. These situations had brought about constraints on the economic performance and increased inequalities, poverty and vices that prolong underdevelopment features of the colonial regimes.

Most African countries including the North African countries are characterized by the inadequacy of internal capital formation due to the vicious circle of low productivity, income and savings. Nonetheless, the burden and dynamics of external debt indicate that they do not contribute significantly to financing economic development in most developing countries. Thus, in many instances, debt accumulates because of the servicing requirements and the principal itself. In view of the above, external debt becomes a self-sustaining dynamic of the poverty aggravation; bring about over-exploitation and a constraint on growth in developing economies (Nakatami and Herera, 2007). North African economies are no exception to this rule (to this setting).

Like most Third World countries, the North African countries depend substantially on external funds to support their development projects and programs. In most cases, such external funding usually takes the form of external loans. In essence, the three North African countries of Algeria, Egypt and Morocco have found themselves heavily indebted especially since the 1990s. The practice of external borrowing spurred by the needs to finance, among other things, ambitious development schemes have largely contributed to the debt crisis in these countries.

The situation in these countries presented epidemic uproar and was known as the Arab uprising, mostly due to the conditions of (un)employment, increase inequality and many vices (Lynch, 2012). Significant debt began to build up only when the countries showed signs of being unable to repay their debts. In a way, the external debt situation in

Algeria, Egypt and Morocco has been disastrous because it consumed all the surpluses accumulated which could otherwise have been invested in their economic growth.

Table 2.1 shows the inflation and growth of real GDP, computed in terms of the prevailing price level. This is important to determine the strength of the economy and inflation level. The inabilities of several economies in the region are portrayed by the rate of real GDP because it indicates inequality, employment levels and the value of the real wage. These were the kick-starters of the unrest in the region.

Table 2.1
Inflation and Growth in North African Countries

Indicators	Country	2006	2007	2008	2009	2010	2011(a)
Real GDP Growth (%)	Algeria	2	3	2.4	2.4	3.3	2.8
	Mauritania	11.4	1	3.5	-1.2	5.2	4.3
	Morocco	7.8	2.7	5.8	4.5	3.7	4.6
	Egypt	6.8	7.1	7.2	4.7	5.1	1.8
	Libya	5.9	6	5.6	0.5	2.9	-41.8
	Tunisia	5.7	6.3	4.5	3.1	3.1	-1.3
Consumer Prices (Inflation in %)	Algeria	2.3	3.6	4.9	5.7	3.9	3.6
	Mauritania	6.2	7.9	7.3	2.2	6.3	5.5
	Morocco	3.3	2.2	3.7	1	1	0.9
	Egypt	4.2	10.9	11.7	16.2	10.1	11.8
	Libya	1.4	6.2	10.4	2	2.5	11.4
	Tunisia	4.5	3.1	5.1	3.5	4.4	3.5

Sources: African Development Bank Group in North Africa, 2012 (AFDB statistics).

A run-down shows rates the unrest that followed several the country's revolution has discouraged foreign tourists while investors maintain a "wait and see" approach. The tourism sector in Egypt and other countries in the region created the widespread unrest.

This situation continued in the 2011 in most the countries as shown in the table above. Lynch (2012), the analytical design is based on the determination as to whether the country can meet its current and future debt service obligations in full; without recourse to debt relief, rescheduling or the accumulation of arrears.

2.2 Algeria

Algeria is an oil-dependent economy and economically sound, but facing key medium-term challenges (International Monetary Fund, *Country Report No. 10/57* March 2010: 4). As noted by the IMF, *Country Report No. 10/57* of March 2010), for many years, Algeria has enjoyed strong economic performance driven by public spending and was in a relatively good position to face the present global recession. More importantly, Non-hydrocarbon (NH) growth has been robust, low inflation and the government have accumulated large savings in the oil stabilization fund (FRR) to finance a sizeable public infrastructure program (PIP). However, the fall in global demand for hydrocarbons has exposed Algeria's vulnerabilities (IMF, 2010). Despite the recent recovery of oil prices and the improvement of medium-term economic perspectives, the economy remains too dependent on hydrocarbon exports (and with a high rate of) unemployment productivity and business climate still lag behind its main trading partners. Non-hydrocarbon (NH) growth and job creation are largely supported by public spending, highlighting the pressing need to accelerate structural reforms to diversify the economy and let an (and outward-oriented private sectors (to) emerge.

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However, a major area of business interest to Algeria relates to the country's external debt and debt-service payments. Algeria's substantial debt dated back to the 1970s, when the government heavily borrowed funds to finance development projects and to meet the rising consumers' needs. When the debt amounted to US$16.9 billion in 1980, the authority decided to limit borrowing to DA50 million a year, which reduced the debt steadily until 1984 (CIA *World Factbook* 2010). However, the debt-service ratio (grew) more than double between 1985 and 1988, increasing from 35 per cent to 80 per cent. (Meanwhile) Similarly, amortization increased by 38 per cent until it reaches US$6.2 billion in 1990 (CIA *World Factbook* 2010). Despite the falling of oil production and price, the government had managed to avoid debt rescheduling by cleverly obtaining soft finance (loan) and trade credits.

A brief summary of Algeria's external debt history indicated that, by the end of 1990, the country's external debt had slightly exceeded US$26 billion, of which almost US$2 billion was in short-term loans. To reduce the debt-servicing burden, the government subsequently concentrated on obtaining medium and long term loans to repay its financial obligations as soon as they became due. Also, to boost its efforts to obtain more concessional financing, such as bilateral lines of credit, the government had discouraged importers from borrowing from suppliers. The logic being that supplier's loan are usually of short duration and thus are more expensive than long-term lines of credit. In this regard, countries that have bilateral credit lines with Algeria include Belgium, France, Italy, Japan, and Spain.

Furthermore, Algeria had viewed the IMF-driven debt rescheduling and regarded as politically unacceptable measure. Nonetheless, the government was compelled by circumstances to make an unpopular move in 1991, by reaching a standby agreement with the International Monetary Fund. The FLN-led government had always opposed to such move as an encroachment on its sovereignty. The IMF standby agreement, however, had a positive effect on creditors and potential donors, including the World Bank, which decided to grant Algeria a US$300 million structural adjustment loan. In much the same way, the European Community also, agreed in 1991 to provide a loan worth US$470 million. A year earlier, the Banque Nationale de Paris (BNP) had provided a seven-year loan of 1 billion French francs to be used in converting short-term borrowing into longer-term loans. Another positive sign was Algeria's apparent determination not to default debt-service payments despite the debt service exceeding US$7 billion in 1991.

In spite of the impressive debt management practice, the country's debt situation, however, is untenable. Put another way, the country is still not out of the woods yet. As shown in Table *2.2,* Algeria's external debt situation has remarkably improved from a total debt of US$21,6 billion in 2003 to a projected US$4,1 billion in 2011 (CIA World Factbook 2010). Similarly, total external debt as a percentage of GDP declined from a high 16.7 % in 2005 to 3.8% in 2009 (IMF Country Report No. 11/40, Statistical Appendix, February 2011).

One should note that increase in debt generally leads to high debt service liability. However, the severity of the debt service liability of a country depends on the relationship of its GDP and the level of debt in relation to its debt service obligation. The absolute volume of debt of the country is not a matter of concern as the extent of debt service liability. There is a fluctuated trend in debt servicing (in percentage of GDP) in Algeria. The figures show a decreasing trend in debt servicing between 2004 and 2007 (29.1% in 2004; 24.2% in 2005; 23.9% in 2006 23.7% in 2007; & 20.6% in 2008), then there was an increase in debt servicing in 2009 (23%); and 2010 (24.5%). However, what's more encouraging was that in real terms there had been a decrease in debt services from US$6.1 billion in 2005 and US$13.6 billion in 2006 to US$1.1 billion (when).

Table 2.2
Algeria's External Debt Situation (2003 – 2011)

Year	Debt - external	Rank	Percent Change	Date of Information
2003	$21,600,000,000	39		2002 est.
2004	$22,710,000,000	41	5.14 %	2003 est.
2005	$21,900,000,000	43	-3.57 %	2004 est.
2006	$19,450,000,000	62	-11.19 %	2005 est.
2007	$5,000,000,000	99	-74.29 %	2006 est.
2008	$3,957,000,000	109	-20.86 %	31 December 2007 est.
2009	$2,700,000,000	128	-31.77 %	31 December 2008 est.
2010	$5,413,000,000	101	100.48 %	31 December 2009 est.
2011	$4,138,000,000	114	-23.55 %	31 December 2010 est.

Source: CIA World Factbook -   March 11, 2010

2.3 Egypt

Egypt has a long history, indebtedness which can be traced back to the 19th century, when it was under the rule of Muhammad Ali, who sought external funds to finance, among other things, his ambitious development schemes. Ironically, since 1990 Egypt has found itself once again, heavily indebted as it had been in the past. In a strange twist of fate, in the 1880s, when Egypt was unable to repay its debts, Britain, the main lender, used this pretext to occupy Egypt for the next half century. Since the 1990s, it has appeared that the history is repeating itself because Egypt had increased the practice of

external borrowing under Hosni Mubarak (181-2011). Unsurprisingly, external debt has become a nagging problem for the country's struggling economy. The extent of the problem is also reflected in the incomplete data on levels of debt, particularly the exclusion of the debt data from the official statistics or the showing of lower figures in government budgets. For example, official statistics showed that publicly guaranteed, long-term debt climbed from more than US$3 billion in 1974 to about US$15.8 billion in 1980, or more than fivefold. However, if short-term debts were considered, the gap between the growth of debt and that of GDP and exports would be greater.

Egypt, however, like other developing countries, entered the final decade of the twentieth century with burdensome debt. In 1988, the total external debt was expected to reach US$46 billion or about double the amount of debt in 1981. Most of the country's debt was owed to other governments or guaranteed by them, especially when military debt factored into the debt information. For example, in 1987 debt to private creditors was about 21 percent of the civilian total (debt), and debt to multilateral organizations was about 17 percent of the civilian total. Since 1979 in the aftermath of the peace treaty with Israel, the largest creditors in Egypt are from the OECD countries. Hence, in 1987 Egypt owed US$10.1 billion to the United States (US). Interestingly, military debt constituted about US$4.6 billion, or about 23 percent of the foregoing combined debt owed to the US.

 Unexpectedly, as debt increased, Egypt became vulnerable to pressure from outside creditors who wanted it to repay and to restructure the economy. During the 1980s,

prolonged tussling occurred between Egypt and several creditors represented by the IMF and the Paris Club. As noted by Jensen (2004) Previous researches to date still debate on the effects of IMF programs on the balance of payments, current account balance, and long-run economic growth. These findings were perplexing because, in addition to providing capital to countries in crisis, the IMF 'negotiates' conditions on lending, encouraging national governments to make policy changes on fiscal solvency. The conventional wisdom or orthodoxy is that IMF programs and conditionality should have positive effects on FDI inflows. In other words, multinational investors would prefer countries of the IMF agreements. Thus, conventional wisdom would lead to believe that IMF programs should be associated with higher inflows of FDI, after controlling the factors that lead countries to seek financing from the IMF (Jensen, 2004). Other things being equal; countries in the financial crisis improve their ability to attract FDI inflows by signing IMF agreements (Jensen, 2004).

In view of the foregoing, before concluding agreements with other creditors, Egypt first had to win the endorsement of the IMF on the soundness of its financial position. In return for a financial package to ease repayment terms, the IMF policy requires that the government undertakes a macroeconomic stabilization program, known as the IMF conditionality, which touches primarily on every aspect of the economy. The program consists of two interlinked components, one external and the other internal. The external part applies to the reduction of the trade deficit, and in Egypt's case through the devaluation of the Egyptian pound to make exports more competitive. The internal part is far-reaching and aimed at minimizing the role of the state in the economic governance

process. It calls for, among other things, appreciable cuts in the budget deficit, elimination of price controls, and the closing of inefficient public enterprises with the ultimate goal of privatization. However, such austerity measures such as the demand for cutting the budget, which would have entailed mainly reducing the subsidies of basic commodities, was officially resisted as politically destabilizing. Within the cabinet itself, there were different voices.

There is no doubt that Egypt were encountering serious problems in balance of payments deficit with negative trade balance being experienced in 2008/09 and also projected in 2009/10 and 2010/11 (IMF, 2010). Inevitably, to source funds for financing this balance of payments deficit the country consulted outside financial sources. As expected, the World Bank has classified Egypt as one the countries seriously indebted country in North Africa. External debt fell from 32 % of total GDP of Egypt in FY2004/05 to around 17 % in FY2008/09 (International Monetary Fund (IMF) *Country Report No. 10/94*, April 2010). Egypt's sources outside debt sustainability framework shows the percentage of foreign exchange earnings or exports. Information shows that the external debt was more than 75% of foreign exchange earnings in 2006/7; over 63% in 2007/8 and 67% in 2008/9. The data also indicate a continuous increase in the external debt. In 2005/6 external debt in Egypt was US$29.6 % and in 2008/09, it had steadily increased to US$31.2 billion dollars. According to the IMF, the external debt was projected to increase in 2009/10 (US$35.1 billion) and 2010/11 (US$37.9 billion) respectively. Generally, the decreasing figures of the national budget expenditures and lack of dynamism in revenue figures have generated persistently large fiscal deficits,

which have resulted to a heavy dependence on external sources of funds. As indicated earlier, high debt usually leads to high debt service liability. Nonetheless, the severity of the debt service liability of a country depends on the relationship of its GDP and the level of debt in relation to its debt service obligation. The fixed volume of the country is not a matter of concern as the range of debt service liability. More pleasing is the fact that the data shows that there has been a decreasing trend in debt servicing as a percentage of exports or foreign exchange earnings between 2005/06 and 2010/11 For example, in 2005/06 external debt service comprised of 9.7% of exports and by 2010/11 it was projected to fall to 5% (IMF, 2010).

As mentioned earlier, external borrowing fell almost half, from 32 percent of GDP in FY2004/05 to around 17 percent in FY2008/09, indicating in part a large part of fast growth of the nominal GDP growth. Under the starting point of the external funds, external debt is projected to fall marginally, to around 13 percent of GDP by FY2014/15. The makeup and decrease size of Egypt's outside funds achieved its relatively elastic to adverse external shocks. External debt is relatively low (at most around 22 percent of GDP in FY2014/15) under the option and each of the boundary tests (IMF, 2010). For example, an increase fall or a continuous unfavourable alarm to the current account only raise the projected path of external funding by 5 to 9 percentage points of GDP by FY2014/15 (International Monetary Fund (IMF) *Country Report No. 10/94*, April 2010). The current state of changes, given the rate of change in the capital inflows to emerging market economies during the financial crisis, and the significance of capital inflows into Egypt recently, a permanent one-half standard deviation shock to

non-debt creating capital inflows was simulated. Even under this risk situation, international funding is estimated to increase by only 8 percentage points of GDP in relations to other small sources.

2.4 Morocco

The direct result of the global financial crisis in Morocco has been limited, primarily affecting Morocco through real channels. In this regard, exports, tourism receipts, remittances, and FDI have all declined, especially in 2010, due primarily to the slowdown in Europe (IMF, 2010). Nevertheless, with a strong starting position, reflecting in large part the range of macroeconomic and structural reforms introduced over the last decade, Morocco has been well-positioned to weather and respond to the crisis. In particular, Morocco's financial system is sound, with little exposure to international markets. Furthermore, the governing authorities have responded appropriately to the prevailing situation. A moderate loosening of fiscal and monetary policies, coupled with vigilant financial sector supervision, has supported confidence and domestic demand, while minimizing risks. As well, the continued implementation of structural reforms has signaled that investment and growth prospects will remain robust.

Generally, Morocco has experienced a fluctuated economic growth. In the early 1980s, there was a downward trend in the economic growth of Morocco due to the global debt crisis and its aftereffects. Since the 1990s, Morocco has experienced a respectable growth rate due to consistent economic policies. Since 2004, the country's GDP growth

rate has been fluctuating, which is due to inconsistent economic policies. However, in recent years the Moroccan economy has weathered relatively well the impact of the present global crisis (IMF, 2009). Real GDP growth in 2009 is estimated at 5% with the non-agricultural sector growing by about 2,5 percent, down from 4 percent in 2008 (Mohammed Dairim, 2010).

Morocco has experienced debt problems since the 1980s, which has had an adverse impact on conditions that affect the macro economy in Morocco like economic growth and investment which has resulted on high ultimately lead to the high occurrence of poverty. However, the external debt since 2007 constitute about 10-11 percent of the GDP, but its national debt has ranged between 37 per cent and 43 per cent of total GDP. More telling is the fact that the country's external debt has hovered around 20 per cent of total GDP since 2007 (IMF, 2010).The data also show a continuous increase in the external debt. More importantly, the data show that Morocco has a high debt servicing liability. The data show that external debt- to-exports ratio (in per cent) has fluctuated from 98.8 % in 2004 to 54.9% in 20008. However, this condition expected to increase from 2009 to 2014 (IMF, 2010).

2.5   Tunisia

Generally, the economy of Tunisia has been ranked most competitive economy of the African continent by the World Economic Forum in the 2007 edition of its Global Competitiveness Report, despite the country's political and social structures. The

political crisis that affects the performance of many African countries, including the debt overhang had begun to affect the economy of Tunisia, especially the Tunisian Dinar. In the 1980s, the economy performed poorly. In 1983, the International Monetary Fund (IMF) forced the government to increase the price of common foods like bread and other staple food in the country. This situation was responsible in causing severe hardship and protest riots. This led to the rise of oppositions like the, Islamic Tendency Movement (MTI) which was led by Rashid al-Ghannushi, which provided a popular leadership. Public programmes were aimed at alleviating the current state of the economy. This led to a change of government, which brought Ben Ali as the prime minister.

As earlier stated, Tunisia has featured in the headlines in the economic development report, as one of the African leading economies in terms of economic performance and political stability over the past decade. Tunisia's public debt, which is mostly outside, has been at the centre of public attention lately. International financial institutions, multilateral development agencies and economists are keenly interested in its large volume compared to Tunisia's real capacity to repay it, its sustainability and how it was used during the last two years in particular. In comparison with other economies in the region, a glance shows that the GDP performance and the dinnar-US trade is favourable relative to other economies. But, with the passing of time, irresponsible borrowing and an overall failure to attract investment has revealed the failure of Tunisia's ruling powers to set the national economy back on track.

Table 2.3
Tunisia Economy: Performance of the economy, 1980-2000

Year	Gross Domestic Product	US Dollar Exchange	Inflation Index (2000=100)
1980	3,540	0.40 Tunisian Dinars	28
1985	7,018	0.83 Tunisian Dinars	45
1990	10,816	0.87 Tunisian Dinars	64
1995	17,052	0.94 Tunisian Dinars	85
2000	26,685	1.37 Tunisian Dinars	100
2005	37,202	1.23 Tunisian Dinars	113

Source: IMF, 1990

Tunisia heavily borrowed from abroad under disastrous conditions and doubled personal income taxes, which caused a revolt that was harshly suppressed. The financial chaos continued and led to the intervention of European powers, therefore placing the state finances under the supervision of the international finance commission, bringing Tunisia

2.6   Mauritania

Up to the mid-1980s, iron ore mining and agriculture was the backbone and the springboard for economic development in Mauritania. Exploitation of rich, high grade iron ore deposits began in 1963. In the 1960s, mining directly, given almost one-third of the gross domestic product (GDP) and contributed more than 80 per cent of the

country's export earnings. Mauritania also began mining copper deposits in 1973; the mine closed in 1975, however, because of falling world copper prices. The worldwide recession that caused a fall in demand for copper also affected iron exports. Iron mining stagnated during the late 1970s. By the mid-1980s, the mining sector had lost its predominance in the economy, accounting for between 10 and 11 per cent of GDP in fiscal year (FY) 1984, and by 1985, export earnings from mining despite being rich in natural resources.

Mauritania has one of the lowest GDP rates in Africa. A majority of the population still depends on agriculture and livestock for a livelihood, even though most of the nomads and many subsistence farmers were forced into the cities by recurrent droughts in the 1970s and 1980s

In recent years, drought and economic mismanagement have resulted in a buildup of foreign debt. In March 1999, the government signed an agreement with a joint World Bank-International Monetary Fund mission on a $54 million enhanced structural adjustment facility (ESAF). The economic objectives have been set for 1999–2002. Privatization remains one of the key issues. Mauritania is unlikely to meet ESAF's annual GDP growth objectives of 4%–5%.

Oil was discovered in Mauritania in 2001 in the offshore Chinguetti field, though potentially significant for the Mauritanian economy, its overall influence is difficult to

predict. Mauritania has been described as desperately poor desert nation, which straddles the Arab and African worlds and is Africa's newest, if small-scale, oil producer. Mauritania has a harsh environment which makes extraction expensive and had resulted to fall oil revenue to around 40 per cent in its exploitation. Table 2.4 shows a steady rise in the productivity of internal resources from which responsible for growth, especially from 1991-2003, (shown on the graph). By 2008, the situation was worst; these amongst others triggered the discontentment for the ruling class and hardships face in the desert environment.

Table 2.4
External debt: Global ranking, 1991- 2012 (Mauritania)

Country	Global rank	External debt(percentage of GDP)
Guyana	55	71.6
Macedonia	56	70.3
Lebanon	57	70.2
Kazakhstan	58	69.8
Bhutan	59	69.5
Mauritania	60	69.0
Lao PDR	61	68.2
Sudan	62	66.1
Bosnia and Herzegovina	63	62.7
Puerto Rico	64	60.8
Cape Verde	65	59.8

Source: mecometer.com
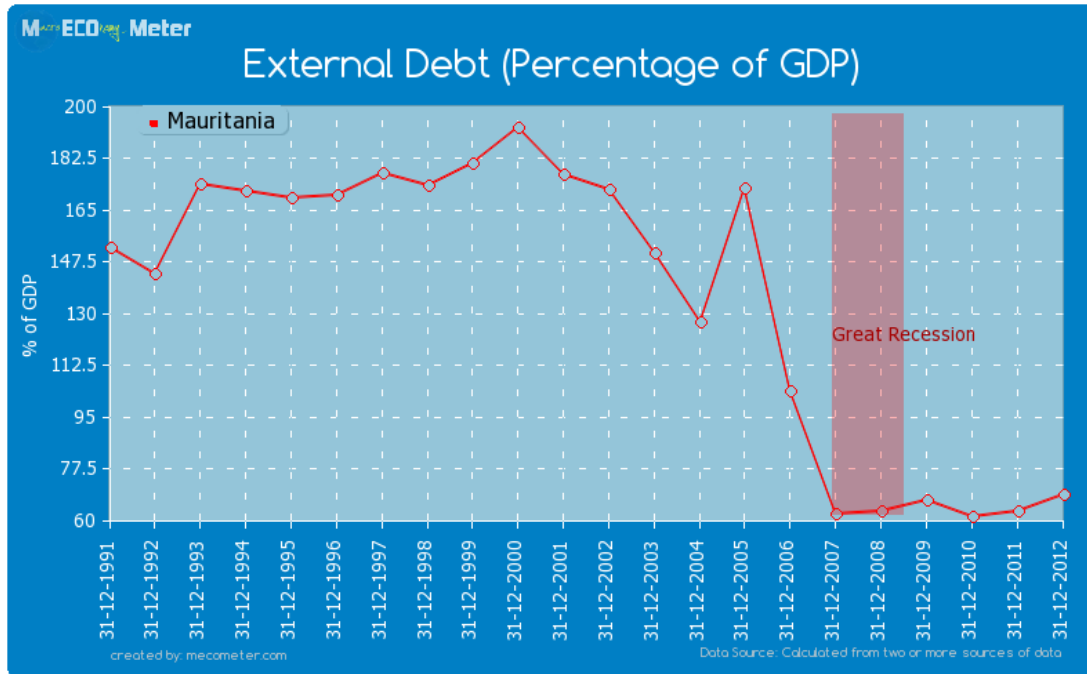
Figure 2.1
Mauritania external debt trend (data above), 1991-2012.
Source: mecometer.com (http://mecometer.com/whats/mauritania/external-debt-percentage-of-gdp)

2.7 Conclusion

The main goal of this chapter is to analyze the relationship between external debt and the economic growth of five selected North African countries. These countries, as reflected in this chapter have relied much on foreign debt to finance their balance of payments deficit and saving investment gap. This heavy dependence on external financial resources has become problematic, especially in the late 1980s and recent years due to global financial crises. Generally, it is assumed that foreign debt can help the developing countries to meet developmental needs of those countries. But external debt has not played an effective role, especially in the case of Algeria and Egypt. This

was partly a result of mismanagement of the external debt. For instance, in Egypt most of the external debt is related to military spending. It is scarcely surprising that the external debt has become one of the major obstacles in the economic development of these countries. As a result, these five North African countries have to spend significant portions of their Balance of Payments to service their external debt. Also, due to the surging external debt these North African countries have had to agree to many unfavorable conditions designed by the Breton Woods Institutions, that is, IMF and World Bank. Unsurprising these countries have to narrow down on their international trade because the countries have to save their BOP to meet debt servicing commitments. Although the primary purpose of external debt in the case of Algeria, Egypt and Morocco was to boost development activities, this could also be complemented by increased export earnings spearheaded by national policies such as an export-led growth strategy. In a way, North African countries still have a chance of overcoming their external debt difficulties by developing the right policies, but will need considerable support through debt relief or reduction initiatives as pointed out in the next chapter.

CHAPTER THREE

LITERATURE REVIEW

Previous studies have extensively examined and explored the key concepts of economic growth, external debt, debt servicing, investment and other determinants. In view of this reality, this chapter shall first review these three aspects of the study. This chapter will also discuss on the key theoretical framework and models that underpin and guide the research. Some of these models include the Harrod-Domar model, the Neo-Classical Growth model, Endogenous Growth model. Notably, academic interest in the relationship between external debt and economic growth only gathered momentum after the emergence of the debt crisis that has devastated many countries. The empirical framework and review of empirical studies on growth, debt services and other determinants as well issues on model estimation is discussed in the subsequent subsections. Finally, the chapter presents the conclusion.

3.1   Theoretical Framework

3.1.1   Economic Growth

In conventional wisdom, economic growth is used interchangeably with economic growth. In practice, however, the growth of the economy is perceived as an essential condition for development of the economy. Despite this confusion, one should note that whereas views of economic growth focus on the evolutionary paths of economic

structures and institutions, the research on growth of the economy, focuses on the applications of econometric models that describe the use of quantitative relationships between monetary variables. It should be taken into considerations that theoretical work on economic growth can be traced to the classical economists. Classical work by economists such as Adam Smith (1776), Thomas Malthus (1798) and David Ricardo (1817) amongst others that show the paths and the origins of the study on economic growth. Continuing alongside the classical works by recent neoclassical economists who are widely lauded as pioneers of formal study on economic growth. These economists analyzed economic growth with various models has a wide range of economists. Some of these are Allyn Young (1928), Joseph Schumpeter (1934), Ray Harrod (1939), Frank Knight (1944), and Evsey Domar (1946). The essential drivers use after the classical growth models include Ramsey (1928), Solow (1956), and Swan (1956), while Romer (1986) and Lucas (1988) were the main contributors to development research that are known as endogenous growth theories.

The Harrod-Domar development model is one of the important models which explain the process of economic growth. It indicates using quantitative models, the continuation of a direct interaction in relation to savings and the state of economic growth, non-direct relations among capital and development. The form which tries to incorporate Keynesian study with essentials of development, assumes that economic growth is a direct result of accumulated capital in the form of savings. The Harrod-Domar form has been used by economists to approximate the financing gap of developing economy. According to Effendi (2001), assuming that there is an abundant supply of labour; they

claim that scarcity of capital is the only constraint to production. Interestingly, the model itself shows that the increase will be proportional to the rate of outlay. In that sense, expansion of the economy will be equated to investment relating to the Incremental Capital Output Ratio to see the level of output that relates to capital. If the goal of growth sets the level of investment needed to the level of such increase level or goal that can be estimated by both the ratio of capital and labour. As such, the finance gap is the gap between funding available for investment required. By meeting these requirements, outside capital in the form of external debts or aid, most countries in Africa and other less developed nations will obtain the needed funds that will bring a return to the objective rate. Both theoretical and empirical proof does not, nevertheless, maintain this form of the model because of the large foreign debt in most less developed nations from the 1960s.

One should note that the loophole of the Harrod-Domar growth model was addressed and to bridge the growth model of Solow (1956) and Swan (1956), which generally referred as the Neoclassical Growth model. Both use different forms of the production functions which reveals normal returns to scale, meaning that diminishing returns to all input, and has positive substitutability to inputs. The production function is understood to be a function of capital, labour and technology.

The Ramsey model is another key neoclassical growth theory which basically built upon the work of Solow-Swan model. It is generally regarded as a fine tuning of the Solow-Swan model. Ironically, the development of Ramsey's growth theory evolved before

the Solow-Swan even though research is usually placed after the Solow-Swan model. One of the key characteristics of Ramsey's model is the assumption that households optimize their utility over time. Thus, this assumption essentially makes the model dynamic. Using Ramsey's model as their starting point, Cass (1965) and Koopmans (1965) recast the saving rate that is exogenous under Solow-Swan model as endogenous. Even though this is regarded a refinement of the neoclassical growth model, it does not eliminate the dependence of the long-run growth rate on exogenous technological progress. In a way, the works of Cass and Koopmans mark the end of the basic neoclassical growth era.

In recent times, the approach and the emergence of economic growth theory have attracted to a more recent scholarly study of the growth rates can be endogenously determined. This new approach was evolved through the various treatises of Romer (1986) and Lucas (1988). Contrasting the model Solow-Swan model, in the long run growth rate is examined by exogenous technical progress, Romer and Lucas propose a research that indigenous the rate of growth rate of different countries. A study that has an endogenous source of per capita economic growth are appropriately referred to as Endogenous Growth models. Upon closer examination, Endogenous growth models emerged to be similar to neoclassical models, but are also significantly dissimilar in their basic assumptions and their conclusions

One of the main contributions of endogenous growth models is the assumption that the occurrences of diminishing returns do not results or and in the cases of its occurrences, it

is offset by some other factors. In this sense, this augmentation theory can assist to assess the abnormal external inflows of capital that affects wealth differences amongst rich and less developed nations. Less developed countries have potentials to be able to have high have high rate of return on outlay because of diminishing returns, but it is worsen by smaller rates of alternative outlays in human resource capital, essential infrastructure, or alternatively in research and development. Consequently, less developed (LDCs) nations' accrued profit less from a wide range of community gains related with all of the options and different of capital spending. The theories of endogenous growth supports the desired role for government policy making to promote economic growth using direct and indirect outlays in human capital types and external private investment. In this evolving growth theory, another dimension opined that public supplies productive services that increase additional output of private capital, thus, this relates to shaping economic growth. Thus, if the production function is the same (homogenously linear) in private and public capital concurrently, and public expenditures are endogenous, this technique brings about growth within the country (endogenous rate).

3.1.2 Relationship between External Debt and Economic Growth

There is no doubt that developing countries face extreme resource constraints owing to the first levels of increase in national output(development). This is characterized by low national capital for use in productive ventures. Furthermore, the situation is compounded by the countries low-income per capita, and the county's low national savings compared to rich nations. Given that developing countries' current account

shortfalls exhibit a rise, most of them are left with no option but to augment internal resources with capital inflows from abroad in the form of external borrowing. It is, therefore, not surprising that external borrowing is now regarded as a common phenomenon for all developing countries (Todaro and Smith, 2006).

The idea of Basic Transfer that refers the mechanisms of resource into and out of countries from debtor nations is outlined by Todaro and Smith (2006). According to Todaro and Smith, this idea is considered as disparities in relations the margin capital inflow (that is, capital into the country less capital out of the country) and payment of interest on the balance of accumulated debt. Basically, the margin of capital into the country is the variation between the gross of capital into the country and the paying back on past debt. Vitally the importance of this approach is highlighted showing facts which indicate the amounts of external currency exchange a less developed country is receiving or a fall in annually as a result of external capital movement. Considering most countries that are indebted are poor countries, the primary movements of funds had been negative, leading to the loss of large foreign exchange or increased levels of capital outflows during the onset of the predictions in the 1980s.

The actual GDP growth per capita from a country may experience adverse effect whereby the countries may have problems of such aspects - a bigger international borrowing stock or the effects of debt-service on public spending. Cunningham (1993) used the production function to explain the relationship of GDP growth and debt burden. The production function is similar as export considering production function. The debt

burden affects the productivity of labour and accumulation of capital. So it is rational to include debt burden in the production function.

$$Y = f(K, L, DB) \tag{3.1}$$

Where, Y = GDP growth, K = capital, L = labour, DB = debt burden

Only external public debt burden is included in this model though Cunningham model includes nation`s total debt burden. Although the national and external debts affect the economy in different ways, yet to make the analysis more specific only external public debt is included. While Ilyo (1999),used external debt stock to GNP and total external borrowing service payments of export of merchandise and services to capture the external borrowing overhang and crowd out respectively in the investment equation.

Karagol (2002) studies on the relationship between the debt burden and GNP in Turkey and employed a standard production function model with the framework of export-growth design on various aspects of the relationship between export and economic growth. The model is as follows:

$$Y = (K, LF, DS) \tag{3.2}$$

Where Y, K, LF and DS are the measure of GNP, K capital stock, labour force and debt service respectively. Karagol (2002) also included human capital as a new variable and the model will be:

$$Y = (K, LF, H, DS) \tag{3.3}$$

Where *Y, K, LF, H* and *DS* are the measure of GNP, capital stock, labour force, human capital and debt service respectively. This makes the standard assumption in equation (3.3) that the input elasticities of output are constant and that technical change is neutral.

Patenio and Tan-Cruz (2007) stated that the relationship between external debt and economic growth as discussed by Karagol (2002) is not very simple. This subject usually attracts the interest of highly developing countries due to the reduction in economic growth via investment, namely debt overhang. Debt overhang theory is based on the premise that if the debt will exceed the country's repayment capacity with some probability in the future, expected debt service is likely to be an increasing function of the country's output level. Thus some of the returns from investing in the national economy are effectively taxed away by existing international creditors and investment by domestic and new foreign investor is discouraged. Debt servicing, including interest payments and repayments, may also be a real linkage from an indebted country. It takes large benefit from the national economy to transfer to the international economy. Therefore, the country foregoes some spectacular multiplier accelerator effects. According to Metwally and Tamaschke (1994) as cited by Karagöl, this decreases the domestic country's ability to grow its economy and raises its dependence on foreign debt. It is argued that a debt overhang creates adverse incentive effects on the economic growth in the long run.

Claessens et al., (1996) showed that, countries in regions of Africa, especially the Sub-Saharan Africa, current economic problems resulted into poor growth performance

and incessant challenges in servicing external debt. Even though literature on external borrowing, barely the reasons specific countries are unable to use funds borrowed to produce sufficient output, and alternative reasons for international aid in broadly speaking, to maintain that it affects countries positively than negatively (Moyo, 2009). It is most times stated that increase in a nation's country's international borrowing which is above a certain critical threshold can result to an untenable debt and inability for the country to honour its payment obligation. There are possibilities that the borrowing country may lose its credit worthy rating, resulting to a leading to an abrupt turn-around of its fortunes including reduced capital flows. In addition this in turn causes a currency and funding problems and bigger output loss, thereby creating the need for more foreign borrowing.

3.1.3 External Debt, Foreign Investment and Economic Growth

Generally, the poor investment and increase performance of the highly indebted countries in recent years is frequently attributed, at least to some extent, to the debt burden of their foreign debt, a phenomenon which has been defined as the debt overhang (Karagöl 2002). In essence, extant economic literature has indicated several direct and indirect channels through which a large foreign debt affects investment and finally negatively output:

> *The debt overhangs effect, indicates a reduction of incentives to invest; the high*
>
> *domestic real interest rates due to the impaired access to international credit;*

the low profitability due to the downturn in economic activity; the reduction in

public investment that is complementary to private investment.(Karagöl, 2002).

Traditional economics and finance literature defines external debt burden in terms of the ratio of external debt service to total exports, total external reserves, or total output or income of a debtor-country. By implication, it addresses the question of how much of the country's external obligations due (in terms of principal repayments and interest) is financed from exports proceeds for example. Debt service payments stand for the 'returns' on the 'investments' of the creditors. In this regard, when the debt service payments are high compared to the volume of export proceeds, in which case total debt is equally high, the burden becomes high for the debtor country (Ezirim *et al.,* 2006).

Apparently, it is argued that nations in their first periods of growth plans experienced smaller stock of inflows and are probable to create options for investments that may results into higher returns. More so, it is noted that as a result a shortfall in the capacity of savings in less developed countries, which show their fall in incomes, national reserves should be augmented by international resources. Pattillo, Poirson and Ricci (2004), noted that as long as these nations make use the borrowed funds for productive outlays, it reduces adverse economic conditions of the country.

Just as debt service payments are important in explaining future movements in foreign debt, investment-income remittances are similarly a key factor in predicting foreign direct investments. This is so because the income remittances are in some way 'returns'

on the FDI outlay. Hence, when the foreign investment remittances are high compared to what was earlier invested (or the export earnings, or the outside reserves), the host country experience a serious investment burden or crisis (Ezirim *et al.,* 2006). This is so much so since there would be a need for foreign exchange (generated through exports or reserves) to cover the requirements of income remittance out of the country. This also applies when the country needs to settle debt service obligations. From this perspective, debt service payments and investment remittances are thus "returns" from the same portfolio of assets (debts and equity securities). One should note that when the remittances are so much that the host country suffers huge drain of investible capital, it succumbs to the tyranny of investment burden or crisis.

A country borrowing repayment plans crowds out options for using domestic by debtor nations, and, considering the noticeable indicator which directly reveal the effect that borrowing results to various constraints of a nation's economy. The proportion of funds required for debt-service shows that the required borrowing nation may experience lost in debt-service. Nonetheless, current debt-service ratios may reduce the borrowing nations burden of debt due to the previous payment outstanding repayment.

A related concept to external debt and economic growth is the aspect of international aid. Since 1970s, both research hers and public policy maker's shows doubts about the benefits and impacts of international resources such as help on the economies of developing countries (Were, 2001). Actually, the probable positive effect of

international resources on the volume of savings is not supported by empirical evidence, neither is the presumed increase.

Traditional economics and finance literature defines external debt burden in terms of the ratio of external debt service to total exports, total external reserves, or total output or income of a debtor-country. By implication, it addresses the question of how much of the country's external obligations due (in terms of principal repayments and interest) is financed from export proceed for example. Debt service payments stand for the 'returns' on the 'investments' of the creditors. In this respect, when the debt service payments are high compared to the volume of export proceeds, in which case total debt is equally high, the burden becomes high for the debtor country. What then should be the desired level of foreign debt for low income countries? According to Williamson (1999:15), "external debt should not exceed 40% of GNP or 200% of exports, and that the debt service ratio (ratio of debt service to exports) should not exceed 25%,and they are consistent with the third (rule of thumb) when debt service (interest plus amortization) costs 12.5% of the debt each year". Although these rules lack strong analytical fundamentals, they, however, provide a rough guide for the country's debt management. In this respect, for example, if the debt service ratio (DSR) is higher than 25%, then the country can roughly be described as experiencing excessive debt burden, or is only in external debt crisis (Ezirim *et al.,* 2006).

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3.2   Empirical Framework

3.2.1   Relationship between External Debt and Economic Growth

Cunningham (1993) explored the relationship between national borrowing stock burden and economic growth for sixteen countries for the period of 1971-2007. The study shows that the growth of the country's debt burden has a negative or adverse effect on the economic growth. Cunningham also posited that when a country is considerably indebted to foreigners, this depressingly affects both labour and capital efficiency. In much the same way, Chowdhury (1994) examined the connection between level of debts and economic growth for Bangladesh, Indonesia, Malaysia, Philippines, South Korea, Sri Lanka and Thailand for the time of 1970-1988. The study findings showed that the

external debt leads to mismanagement in exchange rate. However, these research findings also shows that foreign debt does not affect the GNP growth rate.

Amoateng and Amoako-Adu (1996) utilizing data pooled into time series and cross sectional form examined the relationship between external debt servicing, economic growth and exports for thirty-five African countries during 1971-1990. The study by Amoateng and Amoako-Adu shows that that there is a unidirectional and positive causal relationship between external debt service and GDP growth after excluding exports revenue. Fosu (1996) examine the affiliation between economic growth and external debt for the sample of sub-Saharan African countries for the period 1970-1986. The study shows, on average, a heavily indebted country faces about one percentage reduction in the GDP annually. In another study, Fosu (1999) utilized an augmented production function to examine the impact of external debt on economic growth in sub-Saharan Africa for the 1980 -1990 time. The study showed that there is a negative relationship between debt and economic growth. The study also indicated that a rather weak negative impact of debt on investment levels. Similarly, Iyoha and Milton (1999) examined the relationship between external debt and economic growth for Sub-Saharan countries but their time was much longer, that is, 1970-1994. Moreover, this study showed that the external debt adversely affects investment. The study also indicated that a reduction in debt stock would lead to improvement in investment and economic growth. On the way forward, the authors preferred that the debt of Sub-Saharan African countries should be forgiven to stimulate economic growth. Another study on Africa is by Abdelmawla and Mohamed (2005) who examined the impact of external debt on

economic growth of Sudan during 1978-2001. The finding of the study shows that the external debt and inflation adversely affected the country's economic performance. The study also indicates that export earnings have a significant positive impact on economic growth.

As mentioned earlier, Karagöl (2002) examined the relationship between economic growth and external debt service for Turkey during 1956-1996. Crucially, Karagöl employed multivariate co-integration techniques. Karagöl's study shows that there is an exists in a negative relationship between external and economic growth in the long run. Ahmed (1997) made use of the three-gap model to examine the international borrowing problem of Pakistan. Ahmed's study indicated that if Pakistan was to scale down its debt impact then it had to focus on national budget policy measures. These national budget procedures can bring about changes in tax rate, government consumption and public expenditures. In 2001, Ahmed also applied the three-gap dynamic model of the macroeconomic model of macroeconomic equilibrium to analyze the international debt problem of Pakistan. In this study, Ahmed found that if the pattern of external debt continues, Pakistan's foreign debt position will further deteriorate in the future. In a related study, Chaudhary (1998) study focused on Pakistan, as well. But in this study there was a particular importance on the impact of trade and savings on the external debt. This research revealed that if Pakistan was to scale down its debt burden than its trade policy should be acceptable than saving policy.

However, Easterly (2001) and Choudhry(2001) suggest that the effects is indicated in the reverse direction, that is, sluggish growth results into increase in debts. For Easterly (2001), the global economic recession in the 1970s has resulted into the debt crisis of the mostly developing countries in the category of low and middle-income countries in the 1980s and the HIPCs in the 1980s and 1990s, respectively. In this context, Easterly points out that adverse growth has the capacity to lowers tax revenue and most important needed surpluses, that in turn makes increases the incidence of international borrowing to be explode. Similarly, Choudhry (2001) gives similar data that shows the effects has a wide range of impacts: runs from debt to development. Applying panel data assessment based on a forceful linear model, Choudhry (2001) shows an important and negative causal impact of debt on growth in various categories of countries in low income countries and non HIPC developing countries.

A study by Ashinze and Onwioduokit (1996), which examines the relationship between external debt and growth in Nigeria using a macroeconomic model, found that a period of effective utilization of external finance resulted in a significant level of economic growth. This study also reports that periods when external funds were not judiciously used the resultant effect was economic decline. In a related study, Edo (2002) analyzes the African external debt problem with reference to Nigeria and Morocco. He concludes that external debts adversely affect the investment. Other key results of the study include the fact that fiscal expenditure, balance of payments, and global interest rates are main factors behind debt accumulation in the studied countries.

Malik, Hayat and Hayat, (2010), show that external debt is negatively and considerably related with economic growth. The data suggests that an increase in external debt will lead to decline in economic growth. Furthermore, the study found that the debt servicing has also significant and negative impact on GDP growth. As the debt servicing tends to increase, there will be fewer opportunities for economic growth. The study examined the relationship between the external debt and the economic growth in Pakistan for the period of 1972- 2005, using the time series econometric technique.

3.2.2   External Debt, Foreign Investment and Economic Growth

Perasso (1992) examined twenty middle-income highly indebted nations for the 1982-1989 periods, examined the causal effects between economic growth and international borrowing stock. The study results show that relevant country policies national policies have a stronger impact or effect on public increasing investment and growth in severely indebted countries compared to decreasing debt-servicing requirements. Similarly, Cohen's (1993) examined the relationship between international borrowing and investment of less developing countries in 1980s. Cohen's research indicates the level of small effects of the degree of stock of debts on the country's investment. He contested that real flow of net transfers impact on investment. The study also shows the actual debt.

In a related study, Metwally and Tamaschke (1994) utilized Two Stage Least Square (2SLS) and regression analysis (OLS) techniques to examine the relationship between debt servicing, capital to the country and the growth of the economy for Algeria,

Morocco and Egypt during 1972-2002. The findings of this research showed that capital that flowed into the various countries have important effects on the rise in country-borrowing. In a related study, Deshpande (1997) examined the relationship between the level of investment in highly indebted during the period, 1971-1991 using the regression analysis method. The results of the study indicated that there exists a negative relationship between external debt and investment. In another related study, *Olgun et al.* (1998) deployed 2SLS and 3SLS methods to examine the relationship between capital inflows, foreign debt stock, investment and economic growth during the 1965-1997 periods for Turkey. The study findings indicate a two-way interaction between the level of international borrowing stock and funds required for debt service. More importantly, this particular study found that the domestic payment obligation of debt service does not affect economic growth. Sawada (1994) used annual time series information for atrial sample period from 1955-1990 to show that highly indebted countries have international borrowing problems, due to difficulties in assessing future gains in relationship with creditor nations. For, Elbadawi et al. (1996) cross-sectional information was used for ninety-six countries to measure the relationship between various countries international borrowing and economic growth. The findings of their study showed that international flows to countries as a ratio of the gross domestic product, previous debts that have piled over the years have negatively affected the growth of their economies.

Shabbir and Mahmood (1992) and Khan and Rahim (1993) had made conclusions that international aid has concluded that international aid had propelled the rate of growth of the gross domestic product. Also Aslam (1987) showed that for FCI, it did not show

impacts considerably of the country's investment,   did not affect the national investment significantly, whereas the private FCI had broad scope of national savings-investment gap. Other research finding examines the effects of international aid on savings in Pakistan. Khan, Hasan and Malik (1992) had made a long run forecast that the FCI affected national savings fall in Pakistan in the years from 1950-60 to 1987-1988. In the same vein, Shabbir and Mahmood (1992) also discovered that there was an unfavorable impact of international capital on the national saving in Pakistan for a period of time, especially the same period. Nonetheless, for Mahmood (1997) Pakistan was most likely to be found in the group of highly debts thus, the likelihood that they will be in the group caught up in highly indebted due to mismanagement, macroeconomic mismanagement, mishandling of foreign aid and inappropriate policies in the country.

The impact of huge foreign debt on African economic integration is acknowledged by Mutasa (2003). Mutasa observes that the heavy debt burden affecting low income countries and their unending reliance on rich countries for hard currencies has been a major obstacle to accelerate integration within and across regional groupings in Africa. According to Mutasa, there is mounting concern over the huge amounts of borrowings, the servicing of such foreign debt, and the future strain on regional schemes and general sustainable development. In this sense, resources transferred abroad for debt servicing represents a reduction in what can be devoted to regional schemes and economic development. Besides, not only is possible regional integration foregone but, also in many cases, previous development achievements are being eroded.

The above discussion shows that the correlation between international borrowing and growth is not seen as one-way connections. We assumed that extreme international borrowing has effects on a country's economic growth in several ways. Large payment obligations/requirements are capable of shrinking international foreign exchange and capital, the reasons: they are transferred to principal and repayments of accumulated interest. Savvides (1992) noted, that countries benefits accrue only partially from an rise in output or exports because part of this rise is devoted to service payments of debts accrues to creditors. Moreover, in situation when the borrowing countries are not able to meet up their obligations in the specified time, it will show a record of that the credit rating which, then affects future ability to borrow. As a result, borrowing countries may be require to pay a higher debtor countries will pay high payments to premiums to attain new credit standing from international creditors.. Lastly, to be able secure or access international financial resources to meet international borrowing obligations, several borrowing nations have decrease imports to their countries and trading activities, many debtor countries have reduced imports and trading activities, and this cause poor rating in trade with the rest of the world.(Geiger, 1990).

Colaco (1985) explained debt service vulnerability in developing countries using three contexts, namely, (i) when the size of external loans has reached a level that is much larger than equity finance, resulting in an imbalance between debt and equity; (ii) when the proportion of debt at floating interest rates has risen dramatically, so borrowers are hit directly when interest rates rise; and (iii) when maturities have shortened

considerably in large, part because of the declining share of official flows. Interestingly, this study will show the relevancy of the above three factors to Arab-African countries.

Many experts have focused exclusively on the role of debt-servicing the debt crisis during the 1980s. They concluded that a key factor responsible indicates theft of debt-service on other non-interest spending. In this context, Reisen and Van Trotsenburg (1988) are the first researchers to explore the 'internal reassign difficulty'. They found that those governments adjusted to higher debt-service payments principally by cutting back on other non-interest expenditure, particularly public expenditure. Similarly, Dornbusch (1988) showed that the problem encountered by nations was net transfers turned negatively and where the public policy was obliged to meet debt-service obligation from other sources. The findings of Gallagher's study in 1995 based on a cross-country estimation of 16 African countries showed important indicated a vital crowding-out of other types of expenditure like education that increases in interest payments of debt obligations. Another important issue in debt acquisition and management is the determination of a sustainable level of debt. According to Ajayi and Khan (2000), sustainable international borrowing is measured by various ratios, such as debt to export, debt service to export, debt to GDP (or GNP), and external debt to Gross National Income among others. Nonetheless, the resolution of the sustainable level of these ratios is indeterminable, and their utility is reduced to a warning of potential explosive growth in the stock of foreign debt. For example, if the acquisition of additional foreign debt increases the debt servicing burden more than it increases the country's ability to bear the burden, such an acquisition becomes undesirable, and the

situation must be reversed through export expansion. If exports are not expanded, more borrowing will be necessitated for servicing debt and external debt will pile up above the country's capacity to bear, creating the debt overhang.

Karagöl (2002) argues that debt service burden has a negative impact on investment and capital accumulation. According to Karagöl, the main reason is that the higher percentage of foreign reserves, that is, foreign currency, goes to meet debt service resulting in a reduction in outside capital because of a reduction in the creditworthiness. This study also extends the model of Cunningham (1992) and utilizes multivariate cointegration techniques to develop a vector error correction model useful for investigating the long-run effects of external debt service on GNP level. More specifically, the information on cointegration as articulated by Johansen (1988) and Johansen & Juselius (1990) in variables are also applied in specifying the correct model. The findings of the study show how international borrowing repayments is has a negative short-run effect on economic growth in Turkey. The results also show that there is a uni-directional causal relationship between debt service and GNP level.

3.2.3 Selected Empirical Studies on the Simultaneous Equation Model

There are many leading studies that examine the link between economic growth and international borrowing relationship between economic growth and external debt through utilizing simultaneous equation. For instance, Chowdhury (1994) investigated the direct, indirect and holistic effects of international borrowing on the gross national

product debt on GNP and a line-up of other, by means of an array of equations. He applied panel data for the period 1970-1988 on some specific countries in Asia and the Pacific, namely; Malaysia, Bangladesh, Indonesia, Philippines, South Korea, Thailand and Sri Lanka. Thus, simultaneous equation model is evolved to investigate the correlation between government spending and private international borrowing, past funds and productivity. The findings of Chowdhury's study indicated that the results of government and private international borrowing on the GNP of the countries are relatively marginal and not significant. Therefore, such findings cannot support debt problems arguments which posit that the outcome supports the reason for a fall in economic growth in the indebted countries. Though debt burden prevents nations from making expenditure for future gains, especially to raise productivity, Chowdhury argues that lack of incentives could bring about factors related to investor's expectation on economic policy making it required to make repayments obligation for debts. In this sense, Chowdhury found that the external debt of emerging economies is not the main cause of economic slowdown. Chowdhury's findings support previous research findings by Bullow-Rogoff (1990) who dismissed the urgent need for setting up and international body for coordinating debt relief.

Perhaps a very influential study that has a lot in common with this study is the research conducted by Metwally and Tamaschke in 1994. These two studied the relations between international borrowing debt servicing, capital inflows and growth for each of the countries involved, namely; Algeria, Egypt and Morocco, during the period 1975-1992 (17 years). More importantly, for this study, tool of two-stage least square and

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regression model were used in estimating the simultaneous equation. One of the reasons for applying this model was to establish the relations between international borrowing and economic growth may not be enough in explaining by a-way relations because of the complex relationship between international borrowing service obligation, capital stream and economic growth which is adequate for simultaneous model. A number of key findings were obtained in this study such as debt repayment obligations and growth communication should be examined with two way relationship; the rise in debt servicing ratio have impacts on the growth of the economy negatively; such debt service repayments reduces the economy's growth of productive capacity and therefore may have adverse effects of the problems associated with the indebted nations; it is also recommended that direct private businesses are vital for borrowing nation, given that direct private investment have little or no effect on growth goals, but it is also affected, and finally increase in growth rates bring about equity capital and growth in funds into the country assistance towards rapid growth or accelerated growth. The results of the simultaneous model as reflected in Metwally and Tamaschke (1994) study show that funds into the country have a valuable effect on the growth-debt relationship. If FDI inflows in at significant rates, development will be accelerated, and the need for additional foreign borrowing will be diminished. Additionally, it shows that equity capital inflows are not resultant of economic growth, can also affect economic growth. As indicated earlier, the significant differences between Metwally and Tamaschke study and this research are that the previous one is based on time series data covering 17 years as opposed to the 40 years' time series data utilized in this present study. In a way, my

present study hopes to enlarge the scope of the causality analysis and not only to make temporal study but to extend it the long run analysis.

In much the same way, Olgun *et al.* (1998) empirically examined relations between capital inflows, international borrowing stock, the growth of the economy and investment expenditure using time series of Turkish data spanning the 1965-1997 period. In this research Two-stage least squares (2SLS) and three -stage least squares (,3SLS) instruments are applied. The model are made of five equation includes five equations that are similar to Metwally and Tamaschke (1994), they are however, some different equations with exogenous variables as part of the equations. Their conclusion shows that there are statistically important two-way connections between the debt stocks including debt service. It is in addition found that an increase in the growth rate in the country can result into an increase in funds set aside for debt service, which may cause such obligations in payment to increase overtime. In another dimension, a rise in the growth rate of the obligation of funds earmarked for debt service raises will rises the growth rate of debt stock. In another vein, a key finding is that such payment obligations have little impact on the rate of growth rate of the economy.

Equally, Levy and Chowdhury (1993) investigates various effects of the debt stock both directly, indirectly and a complete results of international borrowing on gross national product (GNP) and so on, by making use of a structure of simultaneous equations that indicates the connections between the GNP, previous stock records overtime, government, capital stock, and the probable interaction between probable relations

between GNP, capital stock accumulation, public and publicly guaranteed international borrowing. Markedly, this was a probable utilizing panel data ranging from the period of 1970-1988 on thirty six heavily-debt nations, low income countries categorized into three distinct regions: Latin America, Asia-Pacific and Sub-Saharan Africa. Lastly, showed that they posited country's level of borrowed funds may have effects on the GNP ranging from a given order: the higher the level of borrowed funds, the bigger the level of the nation's controls. The lack of adequacy in the international avenues of credit and higher occurrences, incidences financial inadequate of the external sources of credit. The higher the number of incidences of financial problems related to lack of performance and insolvency that affects the GNP directly or indirectly which discouraging the national investment. Lastly, the research findings indicates a raise in government and government study findings show that an increase in the government public and publicly guaranteed international insolvency may lower the level of GNP by hindering capital formation and supporting capital out of the economy due to a raise in taxes able to finance to tax increase international borrowing. This has an implications on governments desire to raise taxes to enable finance international obligation Morisset (1991) examines the impact of the stock of debt fall in a macroeconomic agenda and an examination of direct and indirect relationship between external debt, venture and economic growth. He examined the expected results of simultaneous models and performed simulations on Argentina ranging from the year 1962-1986 by applying the three-stage least squares model. Moreover to show features of the strong reduction in private investment, Morisset (1991) also looked into considered other direct and indirect

channels. The expected estimates of the findings indicate that results of 30% debt relief

is only 2.43 % and 5.4% on GDP level for the first and the fifth year accordingly.

Hwang, Chung,& Wang (2010) in their study uses panel data of 20 high external debt

countries selected from Asia and Latin-America to investigate the business sector

development-debt-growth nexus within the framework of endogenous growth and

business development mechanism. Firstly they found that, among 20 high external debt

countries, the external debt-to-GDP ratio is considerably negative correlated to the

economic growth rates, signifying that extreme debt is damaging the growth of the

economy. Secondly, the study introduced the simultaneous GMM equations between

financial sector development and economic growth to evaluate the interaction effects

among economic growth, international debt, and financial sector development. Their

empirical results found that the negative impact of high debt on growth appears to

operate through a strong insignificant effect, in provisions of compulsion to resort to

financially repressive policies. In addition, the research also showed a two-way

relationship between financial sector development and economic growth. On the

contrary, the study by Udo and Obiara (2006) which used a simultaneous-equation's

design on a panel of West African Monetary Zone (WAMZ) countries over the period

1980 to 2002, found that there is no evidence of a two-way causal relationship between

FDI flows and economic growth. Rather FDI tends to be attracted by high per capita

income, better infrastructure and political steadiness. Consequently, a few meaningful

attempts at attracting FDI must take cognizance of these determinants. This study

departs from previous studies by specifically analyzing the candidate determinants of

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FDI in the West African Monetary Zone (WAMZ) and investigating the cause-effect relationship between FDI and growth.

More importantly, the above discussion indicate the level of economic grows that, in extant literature, the association variables of international borrowing and the growth level of the economy is complicated because many variables used for estimation might be related or have unverified relations, and the impact of international borrowing on development indicators and growth may have both direct and indirect effects. For this reason, testing the foreign borrowing growth in relation wide range and different equations model should be rewarding. Notably, several low income nations are alarmed about the quick and constant rise in the portions of their resources devoted to the service of their external debt. Debt servicing can be a real burden on heavily-indebted countries since it deprives the economy of the direct and indirect benefits of a large share of exports. Therefore, the country foregoes some important multiplier-accelerator effects. Inevitably, this reduces the ability of its economy to grow and enhances its dependence on external debt (Metwally and Tamaschke, 1994). Thus the funds set aside for debt service not only affect economic growth but it is also affected by the degree at which growth takes place. There are two explanations for this dynamic (Karagol, 2002). In the First place, economies that enjoy moderately higher rates of growth thrive in attracting FDI. Regarding this, capital that come into the domestic economy at generous rates will have effects on the desire of borrowing by the domestic economy. As the amount of resources committed to fund set aside for debt repayments is optimistically related to the level of the debt, the growth of the economy will, taken the effects of the capital flow

into the economy, a decrease in the burden examine ratio. Secondly, it is noted that the level of accelerate growth results increase incomes, and hence national savings increasing. This will invariably decrease the desire for international borrowing to fund outlays in projects. Ultimately, the lack of growth rate on the stocks borrowed funds will result in the decrease of funds available and earmarked for debt service ratio. Furthermore, a country may, in the period of developmental stage, will borrow to reform its productive capacity. This this will speed growth and evolve policy that laid down machinery for international investment, and raise the rate of national saving. Accordingly, an agenda for international borrowing will decrease, and the need for foreign borrowing will be reduced, and the problems of debts accumulation will overtime diminish.

Essentially, available literature indicates that the connection between international borrowing and the growth of the economy is a one-way relationship. Generally, it is assumed that high debt problems have effects on the country's growth in many ways. In the first place, high funds devoted to debt service necessities results to bankruptcy in international exchange reserves and capital, since they are transferred to main funds or capital and interest payment. Therefore countries benefit only momentarily from the expansion in output levels or goods exported since fraction of this increase is used to service international borrowing and payments to creditors (Savvides, 1992). Secondly, when the borrowing nations are not able to honour the obligations of debt service on time, the debtor countries will face low rating in their credit standing and find it an uphill task to borrow most especially on concessionary grounds. When this results,

borrowing nations which are already poor will pay high premiums to get new credit. Thirdly, previous figures of debts which had accumulated overtime results to a reduction in the countries' effectiveness, since it has complex interactions, thus it will create some shocks and international finance and distortions in the domestic economy. Fourthly, in obtaining additional international alternative to meet legal responsibility, several debtor nations are bound to reduce imports and trade to reduce imports and trade, which yields poor trade regimes (Geiger, 1990).

The global environment of finance for a long time acknowledged that, in its take off initial period stage in a country needs levels of reasonable inflow of FDI in order to fill the savings and international exchange gap. If the nation is capable of attracting loan of from abroad, it can ease the international substitute deficiency and thus provide a source for necessary imported goods for investment. Generally, when investment increases, the economic grow of the country economic growth also increases. In the same vein, the connection from needed funds flow from within the economy through. Additionally, higher economic growth in turn increases a country's standing in terms of credit rating, and this may be a basis for attracting more capital into the country. If the capital into the country is long term or FDI, the desire to borrow decreases. There is need to determine the rate of fall international borrowing of the debt stock will decrease in subsequent periods. Supposed that the funds available for international borrowing service are dependent on the stock of debts overtime, it means that the possibility of higher domestic investment expenditure and accordingly a raise in growth, and hence higher credit standing and more capital coming into the economy. The correlation proposes that

all possible links between the level of burden for service payments, funds coming into the domestic economy and the growth level of the economy be able analyzed using the simultaneous equation, funds that come into the economy and the development rate be able of analysed with a simultaneous equation using the 3SLS method for the selected North African countries. To recap earlier findings from past studies, the connection between international borrowing and economic growth is not simple; several variables that are estimated may be endogenous. The effects of international borrowing on the level of growth of the economy may show direct and indirect effects overtime. In addition, due to a round relationship or reciprocally dynamic among funds coming into the economy, and the amounts earmarked for debt services, a particular estimation procedure is not the best to investigate the relations between other variables that cover the whole economy. There should be a note of previous multi-equations research. One should also note that most previous multi-equation studies principally use cross-sectional or cross-country methods. As such there are few individual country studies as in the case of the present study. Simply put, several past studies used shares of variables in their many previous studies used only shares of variables in their evaluation while in this present study, the time series data for individual country study uses actual growth rates of variables. As a result, the present study makes use of both share variables and actual growth rates variables where data can be found.

3.2.4   Issues Related to Model Estimation

The survey of study uses time-series for Algeria, Egypt and Morocco during the 1970-2009 period, and employs the 3SLS (Three Stage Least Squares) estimation method.

The three-stage least squares estimator was introduced by Zellner and Theil (1962). It combines two-stage least squares (2SLS) with seemingly unrelated regressions. However, one should note that the simplest and the most common estimation method for the simultaneous equations model is the two-stage least squares method, developed independently by Theil (1953) and Basmann (1957). It is an equation-by-equation method, where the endogenous regressors on the right-hand side of each equation are being measurement with the regressors X from all other equations. The process is called "two-stage" because it conducts estimation in two steps. Gujarati (1995)discusses to an extent that the primary idea behind the 2SLS method is to replace the basic suggestion relating to the 2SLS method is to reinstate the stochastic endogenous explanatory variable by a linear grouping of the prearranged variables in the model and use this arrangement as the explanatory variable in lieu of the original endogenous variable. Consequently the 2SLS method is the same with the instrumental variable method of estimation in that the linear combination of the predetermined variables serves as tool, or proxy, for the endogenous regressors. Due to this reasoning, the 3SLS is used in this study for estimation procedures. The arguments of this method; the 3SLS is a edition on 2SLS with the dissimilarity that the structural measures are predictable for the whole system and not for individual equation (Ruxanda and Muraru, 2010). The primary reason for using the 3SLS (three-stage least squares) is, the 2SLS is a single equation evaluation process and is a form of a restricted information process because it does not consider information in the other equations. In addition, the 3SLS is used since it takes into account the information-contained in the of-diagonal elements of covariance matrixes; thus 3SLS is asymptotically vital (important) than 2SLS as argued by Judge *et*

al.,(1988). Moreso, 3SLS is a structural method, which is applicable to all the equations of the model, and at the same time and produces estimations of all the measures used at the same time. It has e application of the method of least squares in three successive stages. As noted by Kotsoyiannis, (1977), 3SLS it uses additional information than individual equations techniques, that is, it takes into cognizance holistic structure of the model with all constraints that the system has on the estimations of the values of the measurement instruments.

Specifically, structures of the equations were predicted using a three-stage least squares (3SLS) method as indicated in the foregoing, for a number of arguments. (i). Ordinary least squares individually applied to each structural equation would result in subjective and contradictory estimators, given the relationship between the error terms and endogenous variables. (ii). The other condition shows that all equations are over predictable, so that an indirect least squares method cannot be used, since it is not possible to get unique estimates of structural parameters. (iii). 2SLS method would solve the simultaneous equation bias as well as the identification problem when the equations are over well-known. Since each structural equation is not exactly identified, and the contemporaneous variance-covariance matrix was no diagonal, 3SLS method is asymptotically more efficient than 2SLS. Identifying restrictions are required in any simultaneous systems method. These restrictions, which typically involve the exclusion of variables from some equations, enable the parameters of the model to be derived uniquely. The simplest identifying restriction is the order condition which requires that the number of exogenous variables excluded from the equation is at least as large as the

number of endogenous variables included in that equation. To check for correctness of the specification and for the internal consistency of the entire system the Likelihood Ratio (LR) test has been employed. This tests whether the model is a valid reduction of the system. The examination consequences show that we cannot decline the intention that the model is a valid reduction of the system and then the most efficient estimates may be obtained with 3SLS. As a result, 3SLS is used as the assessment method in the remainder of this study.

3.3 Conclusion

This chapter has taken us through the major concepts and perspectives which cover three broad areas of this study, that is, economic growth, external debt, and debt servicing. Most important, it surveyed several existing literature on the connections between international borrowing and the level of growth rates of less developing countries. The appraisal of these literatures also showed levels of economic growth models for countries use as Harrod-Domar, Neo- Classical and Endogenous growth models. In addition, the chapter examines important theories and practical (empirical) models that are used in assessing the impact of international borrowing and funds earmarked for debt repayment of international borrowing and debt service and levels of investment expenditure over time.

CHAPTER FOUR

METHODOLOGY

This chapter focuses on the model specification based on the theoretical arguments in the literature. Data from five North African countries, namely Algeria, Egypt, Mauritania, Morocco, and Tunisia are analysed using the multi-simultaneous equation estimation for the purpose of investigating the relationship between debt services, FDI inflows, inflation, and exchange rate with economic growth. The study will also extend the estimation by using the panel cointegration test for the same purpose as the above. The data employed will be described at the end of the chapter.

4.1   Specification of the Model

Under this section, each empirical model that are used for the estimation and test the relationship between debt service, capital inflows, other determinants and economic growth follows the work of Metwally and Tamaschke (1994), Cunningham (1993), Iyoha (1999), Karagol (2002), and Patenio and Tan-Cruz (2007). The simplest model based on the Cobb-Douglas production function is also presented and the model is then extended based on the existing literature.

4.2   Theoretical Growth Model Uses Production Function

The conventional growth accounting framework and the production function below takes the standard neoclassical form with a minor modification which includes human capital in the Cobb-Douglas production function:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} [A(t)L(t)]^{1-\alpha-\beta}, 0 < \alpha < 1. \tag{4.1}$$

where Y at time t is real output; K and L at time t are the stocks of physical capital and labour, respectively; H is the stock of human capital; A is a similar measure of physical capital; α and β are the share of capital and human capital on output. A is a labour-augmenting factor reflecting the level of technological development and efficiency in the economy and the subscript t indicates time. This equation merely states that at any moment (given time), the total output of the economy depends on the quantity and quality of physical capital employed, the quantity of labour employed, and the average level of skills of the labour force. Output can increase if K, L, A, or H increases, and continues increase in output per worker can only occur if the stock of capital per worker or the average quality of labour or of capital also increases perpetually.

It is assumed that $\alpha + \beta < 1$ indicates that there are decreasing returns to all raw capital labour; and labour-augmenting technologies are assumed to grow according to the following functions:

$$L_{(t)} = L_{(0)} e^{nt} \tag{4.2}$$

$$A_{(t)} = A_{(0)} e^{gt + p\emptyset} \tag{4.3}$$

where *n* is the exogenous rate of growth of the labour force, *g* is the exogenous rate of technological progress, *P* is variety of vector of debt service, investment and other determinants that can affect the level of technology and efficiency in the economy, and θ is a vector of coefficient related to these variables.

Demetriades and Law (2006) stated that variable *A* depends on exogenous technological improvements and the level of other variables. Variable *A* in this study differs from variable *A* used by Mankiw *et al.*, (1992). This modification is more likely to be particularly relevant to the empirical cases of the link between economic growth and debt service, investment and others determinant. The technological improvements are encouraged by development in investment spending and debt service which tend to contribute to economic growth (Ramirez and Nazmi, 2003) and also contribute to the efficiency of others determinant (North, 1990, Nelson and Sampat, 2001).

Equation (3.1) in Chapter 3 was used by Cunningham (1993) and Karagol (2002) with some modifications, where Y, K, LF and DS are the measure of GNP, K capital stock, labour force, debt service and human capital respectively as a basic model. Karagol (2002) also included human capital as a new variable and the model is:

$$Y = (K, LF, H, DS) \tag{4.4}$$

where *Y, K, LF, H* and *DS* are the measure of GNP, capital stock, labour force, human capital and debt service respectively. This makes the standard assumption in Equation (4.4) that the input elasticity of output is constant, and that technical change is neutral.

It was recognized that many non-economic factors interact with the economic growth process. For example, institutional economics in the tradition of North and Thomas (1973) and North (1990) examined the link between economic development and institutions while there is a tradition in political science since Lipset (1959), which explains political institutions and democracy in terms of economic development.

As with studies of the impact of debt service, external debt stock, exports of goods and services, FDI and rate of growth savings, some dispersion of the results is a natural outcome of differences in the data set and specifications. The above discussion and Equation (4.1) and Equation (4.4), it is proposed empirical model is used to test the effect of debt service, Foreign Direct Investment (FDI) net inflows and other determinants of economic growth. In order to examine the interaction effects between rate of growth saving variable, FDI inflows, and economic growth with debt crisis variable, extension of model is include the debt crisis and an interaction. These interaction effects are followed Abdullah *et al.,* (2008).

The following structural equations are proposed for the estimation:

Growth Equation:

$$lnY_t = \alpha_0 + \alpha_1 lnDS_t + \alpha_2 lnED_t + \alpha_3 lnFDI_t + \alpha_4 lnSAV_t + \alpha_5 lnXGS_t$$

$$+ \quad \alpha_6 INF_t + \alpha_7(lnFDI_t * DC_t) + \alpha_9(lnSAV_t * DC_t) + \varepsilon_t$$

$$(4.5)$$

Debt Service Equation:

$$lnDS_t = \beta_0 + \beta_1 lnED_t + \beta_2 lnY_t + \beta_3 lnFDI_t + \beta_4 lnSAV_t + \beta_5 XGS_t + \beta_6 INF_t +$$

$$\beta_7 ER_t + \beta_8(lnFDI_t * DC_t) + \beta_9(lnSAV_t * DC_t) + \mu_t (4.6)$$

Foreign Direct Investment net inflows Equation:

$$lnFDI_t = \delta_0 + \delta_1 lnY_t + \delta_2 lnED_t + \delta_3 lnSAV_t + \delta_4 XGS_t + \delta_5 ER_t$$

$$+ \delta_6(lnY_t * DC_t) + \delta_7(lnSAV_t * DC_t) + \epsilon_t$$

$$(4.7)$$

where:

Endogenous Variable

lnY_t= Rate of growth of GNP (valued at constant process) in period t

$lnDS_t$ = Debt service payment in period t

$lnFDI_t$ = Foreign Direct Investment net inflows in period t

Predetermined Variables

lnY_t= Rate of growth of GNP (valued at constant process) in period t

$lnDS_t$ = Debt service payment in period t

$lnED_t$ = External debt stock in period t

$lnFDI_t$ = Foreign Direct Investment net inflows in period t

$lnSAV_t$ = Rate of growth of domestic savings in period t

$lnXGS_t$ = Rate of growth of exports of goods and services in period t

INF_t = Inflation rate in period t

ER_t = Exchange rate in period t

$(lnFDI_t * DC_t)$ = The interaction of Foreign Direct Investment net inflows and the dummy of debt crisis

$(lnSAV_t * DC_t)$ = The interaction of the rate of growth of domestic savings and the dummy of debt crisis

$(lnY_t * DC_t)$ = The interaction of Foreign Direct Investment net inflows and the dummy of debt crisis

α_0 = constant term

$\alpha_1, \alpha_2, \alpha_3, \ldots. \alpha_9$ = the coefficient show how much a one unit increase in each individual variable will affect rate of growth of GNP.

t = a time series data

ε_t = an error term.

Equation (4.5) establishes the economic growth is determined by debt service, external debt stock, FDI net inflows, the rate of growth of domestic savings, inflation rate, and the interaction effects between rate of growth saving variable and FDI inflows with debt crisis variable. Metwally and Tamaschke (1994) identified the slowdown in growth results in a deterioration of the creditworthiness of the borrowing country, which in turn reduces the net FDI. Generally, it is assumed that huge growth rates attract huge inflows of FDI and contribute to accelerate growth. It does not only through its direct effect on

the productive capacity of the economy, but also by lessening the country's reliance on foreign debt and thereby minimizing the negative impact of debt-servicing on the economy. It is also presumed that In short, FDI net inflows will have a positive effect on economic growth. The assumption state that if a nation is able to borrow from external sources, it can ease the shortage of foreign exchange and provide sources for necessary imported goods as investment. In short, when the FDI increases so will the economic growth. In this respect the nexus between capital flow and economic growth occurs through investment. The assumption is that higher economic growth increases a country's creditworthiness or standing in the donor community which in turn may attract more FDI. This is supported by Calvo *et al.,* (1996) who's studied foreign capital which is finance investment and stimulate economic growth. Foreign capital may help increase the standard of living in low income countries. Thus, capital inflows can increase welfare by enabling households to smooth out their consumption over time and achieve higher levels of consumption. Hence, we expect that the FDI inflows have a positive impact on economic growth. While, it is expected that debt service has a negative effect on economic growth. In this regard the coefficient is expected to be negative. According to Geiger (1990), there is a significant inverse relationship between debt burden and economic growth. Similarly, Sawada (1994) and Rockerbie (1994) also indicated that foreign debt commitments or obligations have a significant negative effect on economic growth. Arguing along similar lines, Savvides (1992) noted that incentives to invest are weakened due to the completion of debt servicing; the debtor country only shares partial increase in output and exports. In a way, from the debtor country's angle, the levels of debt are in fact regarded as a tax on investment.

Fauzi and Nor Aini (2012) stated that the European System of Accounts (ESA) defines gross fixed capital formation as resident producers' acquisitions of fixed assets during a given period, less disposals, plus certain additions to the value of non-produced assets that are realized by the productive activity of the producer or institution. The importance of gross fixed capital formation is in quantifying the value of the acquisitions less disposals of fixed assets which is the future replacement for obsolescence of existing assets because of normal wear and tear. Uremadu (2006) defines gross fixed capital formation as an addition to the stock of capital assets set. It is a part of the stock of capital assets set that is used for future productive endeavours in the real sector. It will conduct to increase physical capital assets of a country. It gains from savings accumulation which gives positive effect of private savings accumulation, in other word contributes more savings. An increase in savings accumulation leads to an increase in the gross domestic investment (GDI), and more investment projects (can be undertaken) will make. Investment projects will generate income and this will increase GDP growth.

Equation (4.6) indicates that the debt service is determined by the export growth rate, exchange rate, growth in external debt stock, rate of growth of GNP and dummy variable of the debt crisis. A closer examination of the debt service equation, it is expected that the coefficient of debt stock determination will be positive. Hypothetically, at a given interest rate on debt, the greater the debt stocks the higher the liability servicing. Alternatively, a country may find itself in a position that it needs new borrowing to service its existing foreign debt even though the interest rate on new borrowing is high. By factoring the

growth rate of debt stock into the debt servicing equation, the study seeks to establish whether the growth of debt stock explains the increasing growth of the liability servicing. It is also expected that the exchange rate will be positively related to the debt service. The weaker a nation's currency the less likely will the foreign capital invests in that country. Unsurprisingly, a country with a weak currency is associated with exchange rate risk. This will in turn spur the need for foreign borrowing to finance investment projects. The increase in debt stock will certainly result in an increase in debt servicing. Export growth has also been factored in the debt service equation, because for a typical developing country, exports represent a significant source of foreign exchange earnings and hence a source for the debt service burden. Thus we expect debt service to decrease when the growth of exports increases. A previous study such as Ram (1986) suggested that exports have a great impact on aggregate output because a high level of exports leads to a more efficient allocation of resources in terms of the basic concept of comparative advantage and production efficiency. Furthermore, exports may speed up the exploitation of economies of scale, increase capacity utilization and lead to greater rates of technological change. Feder (1982) posited that increasing exports may relax the foreign resource restriction and increase the productivity of other production inputs. Conventional orthodoxy was challenged by the debt service problems of many nations during the 1980s when it became clear that it was possible for nations to become weighed down by debt (Cunningham, 1993). For heavily indebted nations, growth in exports only led to the payments of interest and principal on the debt which inhibited incentives for investment and growth in the countries involved. On the other point, Afxentiou (1993) indicated that the ability of countries to pay their debts depends upon ceteris paribus conditions, based

on a comparison between their export growth rates and interest rates on their external debt. As long as the export growth rates are greater than the interest rate on foreign debt, the amortization ability increases and borrowers can service their debt without sacrificing any of their own national resources. Equally when the export growth rates are lower than the interest rates on external debt, the countries' ability to pay debt servicing are compromised; any increase in exports will decrease debt service, ceteris paribus. In order to assess the effect of the debt crisis, we also used a dummy variable for a debt crisis. The last explanatory variable is economic development. It is hypothesized that there is a depressing connection between economic growth and debt service. As such debt servicing does not only affect economic growth but is also influenced by economic growth. This creates a mutually reinforcing dynamic. In short, economies will succeed, when huge growth rates will attract FDI, then will decrease the need for the external debt. Consequently, the slowdown in the external debt stock will result in lower debt service.

Equation (4.7) shows that FDI net inflows are determined by external debt stock, fixed capital formation, the rate of growth of exports of goods and services, inflation, the exchange rate, and economic growth. If a country enjoys high growth rates in GNP and are willing to offer high interest rates, this will attract more capital inflow (Metwally and Tamaschke, 1994). The assumption is that high growth rates attract large inflows of equity capital which will accelerate economic growth. Investment does not only through its direct impact on the productive capacity of the economy, but also lessening the country's dependence on foreign debt and alleviating the adverse impact of debt service on the economy. It is hypothesized that any improvement in the credit could attract more

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foreign capital. Conversely, the slowdown of growth results in a deterioration of the creditworthiness of the borrowing nations, which in turn decrease the net funds inflow. Debt gathering is principally due to reduce in the current account which needs to be financed by running down foreign exchange reserves. Levy and Chowdhury (1993) argued that an increase in the public and publicly guaranteed external debt may indirectly affects the level of GNP by discouraging capital formation and encouraging capital flight due to tax-increase expectations This suggests that any increase in the debt stock, results in a reduce in capital inflow. Thus, the connection between debt stock and capital inflow should be negative.

4.3 Estimation Procedure

The objective of this section is to explain the relevant econometric procedures in testing time series data. The most appropriate estimation procedure will be discussed under various conditions in order to achieve the specific objectives.

4.3.1 Time Series Unit Root Tests

The main requirement in estimating time series model is that the variables must be stationary. The classical unit root test namely the Augmented Dickey-fuller or ADF test (Dickey and Fuller, 1981; Said and Dickey, 1984) provides convenient procedures to determine the univariate time series properties of time series data. This test is based on the null hypothesis that a unit root exists in the time series.

The inference process of unit root is an important step in data analysis. The existence of unit root was tested using the augmented Dickey-Fuller statistic (ADF) where a null hypothesis is non-stationary. Many researchers believe that this is a wise step to examine unit root in each time series used to form a model. There exist several differences in the unit root test. ADF is the extended version of Dickey-Fuller (DF) test by allowing a higher order of autoregressive process and the common approach uses the ADF equation shown here with time trend:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum \beta_i \Delta Y_{t-i-1} \qquad (4.8)$$

$$\Delta Y_t = \delta_0 + \delta_1 t + \delta_2 Y_{t-1} + \sum \delta_i \Delta Y_{t-i-1} \qquad (4.9)$$

where $\Delta y_t = y_t - y_{t-1}$ and t shows time (as an example see, Campbell and Perron, 1991 and Enders, 1995). The null hypothesis of the ADF test is $\beta_1 = 0$ (or non-stationary), against its alternative of $\beta_1 < 0$ (or stationary). If the null hypothesis is rejected, it is concluded that the series is stationary.

4.3.2 Simultaneous Equations Model

Simultaneity means that output with debt services and foreign direct investment are both explained by variables in the simple structural macroeconomic model and by the variables; and these parameters are no longer exogenous. Means that we have for

simplicity two equations where one variable is a function of the other and some explanatory (on the) variables X:

$Y_1 = f(Y_2, X)$

$Y_2 = f(Y_1, X)$

The simultaneous equations model is developed to test for each equation which has been discussed before. The method of ordinary least squares (OLS) to Equations (4.5), (4.6), and (4.7) is used. We also apply the method of two-stage least squares (2SLS), also called the instrumental variables (IV) procedure to (find the estimation) estimate (from) that (the) equation(s). Two-stage least squares have been a widely used method of estimating the parameters of a single structural equation in a system of linear simultaneous equations. It was introduced more or less independently by Theil (1953a; 1953b; 1961), Basmann (1957) and Sargan (1958).

Two-stage least squares involve two steps; First stage: get $\hat{Y}_1$ and $\hat{Y}_2$ from regressing on Y_1 and Y_2. Second stage: Use these predicted values as regressors in the original equations to get $\hat{\beta}_{1,2\,-SLS}$. Technically a 2SLS regression is an IV-regression, the same with 3SLS.

Hausman Test

Note that the 2SLS standard errors are higher. This is an indication of the theoretical result that the variance of the 2SLS estimator is higher than the variance of the OLS estimator. When deciding whether to use OLS or 2SLS, there is a trade-off – OLS has a

smaller variance ("efficient") but 2SLS is consistent under more general conditions ("consistent") . The Hausman test is a widely-used general specification testing method for this and other situations where this trade-off is present. It tests:

H_o: the efficient estimator (OLS) is consistent. (Favours the use of OLS)

H_a: the efficient estimator is not consistent. (Favours the use of 2SLS)

Hausman tests decide whether or not the difference between the two estimators is statistically significant. Then it is evident that the more restricted or efficient an estimator the more consistent it will become that is evidence that the more restricted, or "efficient" one is not consistent.

For 2SLS Hausman- testing, it is necessary to include the sigma (with) more options; otherwise the output will be incorrect. The degrees-of freedom should be equal to the number of endogenous regressors handled by the 2SLS estimator. In this example, the P-value is $0.0264 < .05$, so we reject H_0 at the 5 per cent significance level. This favours 2SLS, since it is evidence that OLS is not consistent.

When estimating econometric models, one of the difficulties that commonly arise is the simultaneity of the economic variables that need to be explained. On account of simultaneity, exogenous becomes endogenous correlated with the inaccuracy term; hence, opinion poses a higher degree of difficulty than in the case of variables independent from the error term. In the attempt to analyse the connection between foreign

direct investments and economic growth the circularity of variables is obvious: capital inflows (FDI) is attracted to a certain location also by the economic growth perspective due to the implication that it has on capital gains; moreover, FDI, in turn, generate domestic investment and economic growth as a result of spill-over effects. Moody and Murshid (2004) considered that the relationship between FDI and domestic investment is mostly a characteristic of developing economies that offer higher marginal capital gains than the global interest rate which is attractive for FDI and consequently favours domestic investment. One of the essential conditions for estimating the parameters in a regression by OLS is the independence of explicative variables from the model residuals (Ruxanda and Muraru, 2010). When modeling economic factors, it commonly happens that the factors intended to be explanatory; and since exogenous variables in the regression model have a simultaneous behavioor with the endogenous variables, the former lose its exogeneity uniqueness. The endogeneity of explanatory variables makes the estimation of efficient and convergent parameter estimators through OLS impossible.

The correlation between debt service, economic growth and FDI inflows and other determinants are very complex. As noted by Karagöl (2002), a number of reasons explain this complexity. First, there is a relationship between debt servicing and economic growth. Second, government policies planned to influence the balance of payments, home interest rates and service may affect the stock of foreign debt and therefore, debt servicing and economic development can both directly or indirectly have impacts on exports, domestic reserves and overseas fund inflows. Third, there may be a two way relationship between debt stock and debt servicing. As a final point, fund inflows

depending on its nature may also affect economic development, venture and debt stock. In addition, capital inflows could be affected by economic growth. One should note that there are two main statistical methods for systems of simultaneous equations that capture the mutual dependence among the variables in the form. The method in which equations are projected one at a time is called Limited Information Methods. On the other hand, information methods are those where all equations are estimated at the same time. Notably, although limited information methods do not take into account connections among variables from different equations inside the method, complete information techniques allow for these associations. In view of the fact that all obtainable facts are incorporated, its produces more efficient parameter estimation.

The final Three Stages-Least-Squares (3SLS) method is utilized in this study for a full information method. Variables in the system are classified as endogenous and exogenous. Simultaneity within the model occurs because some endogenous variables appear as explanatory variables in further actions. The position of exogenous factors often includes the values of the descriptive variables. These programmed factors impose the dynamic structure of the model. All these complications imply that all possible links between debt service, capital inflow and economic growth can be analyzed with a simultaneous equation using the 3SLS method in Algeria, Egypt, Mauritania, Morocco, and Tunisia.

The common type of a structure with m simultaneous equations is elaborated as follows: Assume there are *m* regression equations of the form

$$y_{it} = y'_{-1,t}\gamma_i + x'_{it}\beta_i + u_{it}, \quad i = 1, \dots., m, \tag{4.10}$$

Where i is the equation number, and $t = 1, \dots., T$ is the observation index. In these equations x_{it} is the $k_i \times 1$ vector of exogenous variables, y_{it} is the dependent variable, $y_{-i,t}$ is the $n_i \times 1$ vector of all other endogenous variables which enter the ith equation on the right-hand side, and u_{it} are the error terms. The "$-i$" notation indicates that the vector $y_{-i,t}$ may contain any of the y's except for y_{it} (since it is already present on the left-hand side). The regression coefficients β_i and γ_i are of dimensions $k_i \times 1$ and $n_i \times 1$ respectively. Upright stacking the T observations corresponding to the ith equation, we can write each equation in vector form as

$$y_i = Y_{-i}\gamma_i + X_i\beta_i + u_i, \quad i = 1, \dots \dots, m, \tag{4.11}$$

Where y_i and u_i are $T \times 1$ vectors, X_i is a $T \times k_i$ matrix of exogenous regressors, and Y_{-i} is a $T \times n_i$ matrix of endogenous regressors on the right-hand side of the ith equation. Finally, we can move all endogenous variables to the left-hand side and write the m equations jointly in vector form as

$$Y\Gamma = XB + U \tag{4.12}$$

This representation is known as the structural form. In this equation $Y = [y_1 y_2 \dots y_m]$ is the $T \times m$ matrix of dependent factors. Each of the matrices Y_{-i} is in fact an n_i-columned submatrix of this Y. The $m \times m$ matrix Γ, which describes the relation between the

dependent factors, has a complex structure. It has ones on the sloping, and all other

essentials of each column i are either the components of the vector $-\gamma_i$ or zeros,

depending on which columns of Y are included in the matrix Y_{-i}. The $T \times k$ matrix X

contains all exogenous regressors from all equations, but without repetitions (that is,

matrix X should be of full rank). Thus, each X_i is a k_i-columned submatrix of X. Matrix B

has size $k \times m$, and each of its columns consists of the components of vectors β_i and zeros,

depending on which of the regressors from X are included or excluded from X_i. Finally, U

$= [u_1 u_2 \dots u_m]$ is a $T \times m$ matrix of the error terms.

Postmultiplying the structural equation by Γ^{-1}, the system can be written in a reduced

form as

$$Y = XB\Gamma^{-1} = X\Pi + V. \tag{4.13}$$

The above is a simple general linear model, and it can be approximated for example by

ordinary least squares. Regrettably, the duty of decomposing the estimated matrix $\hat{\Pi}$ into

the individual factors B and Γ^{-1} is relatively complex, and consequently decreases the

form which is more suitable for prediction but not inference.

4.3.3 The assumptions are articulated as follows:

Firstly, the rank of the matrix X of exogenous regressors must be equivalent to k, both in

finite sample and in the boundary as $T \to \infty$ (this later requirement means that in the limit

the expression $\frac{1}{T}X'X$ should converge to a nondegenerate $k \times k$ matrix). Matrix Γ is also

assumed to be non-degenerate. Secondly, error terms are assumed to be serially

independent and identically distributed. That is, if the tth row of matrix U is denoted by $u_{(t)}$, then the sequence of vectors $\{u_{(t)}\}$ must be iid, through zero mean and some covariance matrix Σ (which is unknown). In particular, this implies that $\mathrm{E}[U] = 0$, and $\mathrm{E}[U'U] = T\Sigma$. Lastly, the identification conditions requires that the number of unknowns in this system of equations should not exceed the number of equations. Further, particularly, the order circumstance requires that for each equation $k_i + n_i \leq k$, which can be phrased as "the number of excluded exogenous variables is greater or equal to the number of included endogenous variables". The rank condition of identifiability is that rank $(\Pi_{i0}) = n_i$, where Π_{i0} is a $(k - k_i) \times n_i$ matrix which is obtained from Π by crossing out those columns which correspond to the excluded endogenous variables, and those rows which correspond to the included exogenous variables.

In this section, the empirical model is specified. The analysis of the simultaneity of the relationships requires an estimation technique that is solved simultaneously in order to capture the feedback effects. In view of these, the behavioural relationships of the model are estimated using OLS, 2SLS, and 3SLS estimation technique. As indicated earlier data running from 1970 to 2012 are used for the analysis and the multi-simultaneous equation employed in this study differs with other related existing studies such as Metwally and Tamaschke (1994) in the several ways. For example, this study uses longer time series data spanning four decades including the more recent data. Moreover, this study uses the multi-equation model with 3SLS method as opposed to 2 SLS method employed by Metwally and Tamaschke (1994).

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4.4 Extension of the Model

The former model explained, is the Simultaneous Equations Model. On top of that model, in this study we pool cross-section and time series data to study relationships between GDP and debt service, capital inflows and other determinants using a single equation test which was developed by Pedroni (1997, 2003). Pedroni's equation (1997, 2003) also tests for the null of no cointegration in the bivariate case. Glick and Rose (2002) and Abdullah *et al.*, (2008) extended the model by using fixed country-pair specific intercepts to correct all time-invariant trade determinants, and in a robustness check they also included fixed time effects to account for all country-pair invariant variables. Pedroni (1999) generalized these tests to the multivariate case. Pedroni (1999) used the following model:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{it} + \cdots + \beta_{Ki} x_{KIT} + e_{it} \qquad (4.14)$$

where there are K regressors, which are allowed to be endogenous.

In order to investigate a long-run relationship between the economic growth and debt service, FDI inflows, inflation and exchange rate for the selected of North African countries, we proposed Extension Equation to include the debt crisis and the interaction term is as follows:

$$lnY_{it} = \beta_0 + \beta_1 lnDS_{it} + \beta_2 lnFDI_{it} + \beta_3 lnED_{it} + \beta_4 lnXGS_{it} + \beta_5 lnSAV_{it} + \beta_6 INF_{it}$$
$$+ \beta_7 ER_{it} + \beta_8 (lnFDI_{it} * DC_{it}) + \beta_9 (lnSAV_{it} * DC_{it}) + e_{it}$$

$$(4.15)$$

where:

Endogenous Variable

lnY_{it}= Rate of growth of GNP (valued at constant process) in period t

Predetermined Variables

$lnDS_{it}$ = Debt service payment in period t

$lnED_{it}$ = External debt stock in period t

$lnFDI_{it}$ = Foreign Direct Investment net inflows in period t

$lnSAV_{it}$ = Rate of growth of domestic savings in period t

$lnXGS_{it}$ = Rate of growth of exports of goods and services in period t

INF_{it} = Inflation rate in period t

ER_{it} = Exchange rate in period t

$(lnFDI_{it} * DC_{it})$ = The interaction of Foreign Direct Investment net inflows and the dummy of debt crisis

$(lnSAV_{it} * DC_{it})$ = The interaction of the rate of growth of domestic savings and the dummy of debt crisis

α_0 = constant term

$\alpha_1, \alpha_2, \alpha_3, \dots \alpha_9$ = the coefficient show how much a one unit increase in each individual variable will affect the growth rate of economic growth.

it = a panel series data

ε_t = an error term.

Before we conduct tests of cointegration between those variables, it is necessary to perform unit root tests. Unit root and cointegration tests in the time series dimension suffer from low power and/or size distortion. The addition of the cross-section dimension, however, brings an improvement in the power of unit root and cointegration tests by acting as repeated draws from the same distribution.

4.4.1 Panel Unit Root Tests

In order to examine the possibility of panel cointegration, it is necessary to determine whether the growth rate of GNP and the independent variables evolve as unit root processes. There are several unit root tests specifically for panel data which have been introduced in past decades. Among them are Quah (1992, 1994), Levin and Lin (1992, 1993), Maddala and Wu (1999), Hadri (2000), Levin, Lin and Chu (2002), and Im, Pesaran and Shin (1997, 2003). This panel unit root test is a continuation of the univariate unit root test identified earlier but has low power like the augmented Dickey-Fuller test (Said and Dickey, 1984). The panel unit root test in the above has the specification for a null hypothesis; and (serves) as an alternative and methodology to identify problems such as heterokedasticity and different correlations. Each panel unit root test data has its own benefits and limitations and for this study we have chosen the Levin, Lin and Chu version (LLC); and Im, Pesaran and Shin's (1997; IPS hereafter), which are based on the well-known Dickey-Fuller procedure. This LLC test is not only considered as simple when estimation is carried out, but has also been widely used in empirical studies and the strength of this test has been tested in various Monte Carlo[3] tests.

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[3] see O''Connell (1998) and Maddala and Wu (1999)

4.4.1.1 Levin, Lin and Chu (LLC; 2002)

In Levin, Lin and Chu (LLC; 2002) it is found that the main hypothesis of panel unit root

is as follows:

$$\Delta y_{it} = \Phi_i \, y_{i,t-1} + \sum_{L=1}^{p_i} \rho_{i,l} \Delta y_{i,t-L} + \varepsilon_{i,t} \, m= 1, 2,\dots \qquad (4.16)$$

where Δy_{it} refers to variable lnY_{it}, $lnDS_{it}$, $lnCI_{it}$, $lnEDS_{it}$, lnM_{it}, $lnFC_{it}$, INF_{it}, and

ER_{it} and Δ refers to the first difference. The hypothesis test is $H_0 : \Phi_i = 0$ for the

existence of unit root whereas $H_a : \Phi_i < 0$ for all i for non-existence of a unit root. As

p_i is unknown, Levin, Lin and Chu (LLC) suggest a three-step procedure in the test. In

the first step, obtain the ADF regression which has been separated for each individual in

the panel, generate two orthogonalized residuals. The second step requires an estimation

of the ratio of long run to short run innovation standard deviation for each individual. The

last step requires the computation of the pooled t-statistics.

In the first step, we generate ADF regression for each individual i:

$$\Delta y_{it} = \Phi_i \, y_{i,t-1} + \sum_{L=1}^{p_i} \rho_{i,L} \, \Delta y_{i,t-L} + \varepsilon_{i,t} \quad (4.17)$$

The lag order form p_i is allowed to be distinguished for each individual. Campbell and

Perron (1991) suggested a methodology used by Hall (1990) in choosing the appropriate

lag order; that is providing a sample span of T, choose a lag order which maximizes P$_{MAX}$,

and then use t-statistics for $\hat{\rho}_L$ to determine if the order of a smaller lag order is

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preferred. [*T-statistics* have a standard normal distribution in a null hypothesis ($\hat{\rho}_{iL} = 0$), when $\Phi_i = 0$ or $\Phi_i < 0$]. When the order of autogression has been determined for p_i in the equation (4.11), generate two auxiliary regressions to obtain anorthogalized residuals. Carry out a regression $\Delta y_{i,t}$ and $y_{i,t}$ on $\Delta y_{i,t-L}$ (L=1,...p_i), then get residuals $\hat{e}_{i,t}$ and $\hat{v}_{i,t-1}$ from these regression. Specifically, this model is shown below:

$$\hat{e}_{i,t} = \Delta y_{i,t} - \sum_{L=1}^{pi} \hat{\pi}_{i,L} - \Delta y_{i,t-L} (4.18)$$

$$\hat{v}_{i,t} = \Delta y_{i,t} - \sum_{L=1}^{pi} \tilde{\pi}_{i,L} - \Delta y_{i,t-L} \qquad\qquad (4.19)$$

To control *heterogenity* among individuals, LLC has normalised $\hat{e}_{i,t}$ and $\hat{v}_{i,t-1}$ through standard error regression which is obtained from equation (4.19):

$$\tilde{e}_{i,t} = \frac{\hat{e}_{i,t}}{\hat{\sigma}_{\varepsilon,i}} \qquad , \qquad \tilde{v}_{i,t-1} = \frac{\hat{v}_{i,t-1}}{\hat{\sigma}_{\varepsilon,i}} (4.20)$$

where $\hat{\sigma}_{\varepsilon,i}$ is standardized error from estimation of equation (4.19). This value can also be calculated from regression $\hat{e}_{i,t}$ on $\hat{v}_{i,t-1}$.

$$\hat{\sigma}_{\varepsilon,i}^2 = \frac{1}{T - p_i - 1} \sum_{t=p_i+2}^{T} (\hat{e}_{i,t} - \hat{\Phi}_i \hat{v}_{i,t-1})^2 (4.21)$$

The second step is to estimate the ratio of long run to short run standard deviation. In this null hypothesis for unit root, long term variance in the model can be estimated as shown below:

$$\hat{\sigma}_{y,t} = \frac{1}{T-1}\sum_{t=2}^{T}\Delta y_{i,t}^{2} + 2\sum_{L=1}^{\overline{K}}W_{K,L}\left[\frac{1}{T-1}\sum_{t=2+L}^{T}\Delta y_{i,t}\Delta_{i,t-L}\right](4.22)$$

where w refers to weights. The truncation lag parameter $\overline{K}$ depends on data. For each individual i, LLC define the ratio of the long run standard deviation to innovation standard deviation as:

$$s_i = \frac{\sigma_{y,i}}{\sigma_{\varepsilon,i}}(4.23)$$

and mark this estimation with $\hat{s}_i = \hat{\sigma}y_i/\hat{\sigma}_{\varepsilon,i}$. The average standard deviation ratio is $S_N = (1/N)\sum_{i=1}^{N}S_i$, and the estimation is $\hat{S}_N = (1/N)\sum_{i=1}^{N}\hat{S}_i$. Before we proceed to the third stage, LLC reminds us that there are two items that should be noted. Firstly, the estimation for $\hat{\sigma}_{y,i}$ under a null hypothesis is $\hat{\sigma}_{\varepsilon,i}^{2}/(1-\sum_{i=1}^{pi}\hat{\rho}_{i,L})^{2}$, and as a result of $\hat{\sigma}_{\varepsilon,i}^{2}$ being a constant estimation for $\hat{\sigma}_{\varepsilon,i}^{2}$ under the null hypothesis, thus, $\hat{s}_i$ can be estimated with $\left|1-\sum_{i=1}^{pi}\hat{\rho}_{i,L}\right|$. Secondly, the feature of size and power for the panel unit root test is increased via the first difference to estimate the long term variance. In the null hypothesis for unit root, Schwert (1989) found long term estimation based on the first difference has

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a smaller bias in a limited sample compared to the long term variance based on residuals in level.

The third step in the LLC version of the panel unit root test is to estimate coefficient Φ and to calculate the value of statistic-t for the panel. For this, combine all cross-section and time series observations to estimate,

$$\tilde{e}_{i,t} = \Phi\tilde{v}_{i,t-1} + \tilde{\varepsilon}_{i,t} \tag{4.24}$$

Based on the total of observations $N\tilde{T}$, where $\tilde{T} = T - \bar{g} - 1$ is the average of the number of observations per individual in the panel, and $\bar{p} = \frac{1}{N}\sum_{i=1}^{N} p_i$ is the average interval for individual ADF regression. The conventional statistic-t regression to test $\Phi = 0$ is:

$$t_\Phi = \frac{\hat{\Phi}}{STD(\hat{\Phi})} \tag{4.25}$$

where

$$\hat{\Phi} = \frac{\sum_{i=1}^{N}\sum_{i=2+pi}^{T}\tilde{v}_{i,t-1}\tilde{e}_{i,t}}{\sum_{i=1}^{N}\sum_{t=2+pi}^{T}\tilde{v}_{i,t-1}} \tag{4.26}$$

$$STD(\hat{\Phi}) = \Phi_{\tilde{\varepsilon}}^{2}\left[\sum_{i=1}^{N}\sum_{t=2+pi}^{T}\tilde{v}_{i,t-1}\right] \tag{4.27}$$

$$\Phi_{\tilde{e}}^{2} = \left[\frac{1}{N\tilde{T}}\sum_{i=1}^{N}\sum_{t=2+pi}^{T}(\tilde{e}_{i,t} - \hat{\Phi}\tilde{v}_{i,t-1})^{2}\right] \tag{4.28}$$

In the hypothesis H_0: $\Phi = 0$, LLC states that t-statistic regression (t_Φ) has a normal distribution for the ADF model without intercept and trend, but diverges to a negative for the ADF model with intercept and trend. Subsequently, the calculation of coordinated t-statistic is as shown below:

$$t_\Phi^* = \frac{t_\Phi N \tilde{T} \hat{S}_N \hat{\sigma}_{\tilde{\varepsilon}}^{-2} STD(\hat{\Phi}) \mu_{m\tilde{T}}^*}{\sigma_{m\tilde{T}}^*} \tag{4.29}$$

where tabulated mean value is adjustment for $\mu_{m\tilde{T}}^*$ and standard deviation has been givenby LLC with a deterministic specification (m=1,2,...) and time series dimension $\tilde{T}$.

Levin $et\ al.$ (2002) stated that limited tabulation for corrected statistics if normal where $N \to \infty$ and $T \to \infty$ with $\sqrt{N/T} \to 0$ or $N/T \to 0,$ depends on the model specification. Furthermore, the Monte Carlo simulation shows that this test is still suitable for a moderate-sized panel (value of N is between 10 and 250 individuals and T between a span of 20 and 250) whereby they are almost similar with panel data for this study. Generally, the LLC test has been accepted as one of the panel unit root test. However, it should be mentioned that this LLC test has a homogeneity limitation, where a null hypothesis is $\Phi_i = \Phi = 0$ versus alternative hypothesis $\Phi_i < 0$ for all individual units i.

4.4.1.2 Im, Pesaran and Shin (IPS; 1997)

Im, Pesaran and Shin (1997) denoted that IPS proposed a test for the presence of unit roots in panels that combines information from the time series dimension with that from the cross section dimension, such that little time observations are required for the test to

have power. Since the IPS test has been found to have superior test power by researchers in economics to analyze long-run relationships in panel data, we will also employ this procedure in this study.

The advantage of the IPS method over previous panel unit root tests is that it allows the data generating processes to vary across countries with respect to ADF coefficients and error structures. This can be particularly important with respect to the number of lagged difference terms in the ADF equation. As with univariate tests, where setting the lag length can be a critical step in appropriate implementation, our experimentation suggests that it is important for the IPS test to allow the lag length to vary across countries rather than imposing a uniform lag length (McCoskey and Selden, 1998).

Another advantage of the IPS test is to allow for heterogeneity in the value of ρ_i under the alternative hypothesis. The IPS tests allow for individual unit root processes so that ρ_i may vary across cross-sections. All the tests are characterized by combining individual unit root tests to derive a panel-specific result.

IPS begins by specifying a separate ADF regression for each cross-section with individual effects and no time trend:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \qquad (4.30)$$

The null hypothesis may be written as, $H_0 : \rho_i = 0,$ for all $i = 1,....N$, While the alternative hypothesis is given by:

$$H_1 : \begin{cases} \rho_i = 0 & for \quad i = 1, 2,....., N_1 \\ \rho_i < 0 & for \quad i = N+1, N+2,...., N, with\ 0 < N_1 \le N. \end{cases} \qquad (4.31)$$

IPS use separate unit root tests for the N cross-section units. Their test is based on the Augmented Dickey-fuller (ADF) statistics averaged across groups. After estimating the separate ADF regressions, the average of the t-statistics for p_1 from the individual ADF regressions, $t_{iT_i}(p_i)$:

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(p_i \beta_i) \qquad (4.32)$$

is then adjusted to arrive at the desired test statistics. Under the crucial assumption of cross-sectional independence, this statistic is shown to sequentially converge to a normal distribution when T tends to infinity, followed by N. A similar result is conjectured when N and T tend to infinity while the ration N/T tends to a finite non-negative constant (Hurlin, 2004).

In order to propose a standardization of the $\bar{t}$ statistic, IPS has to compute the value of $E(\bar{t}_{iT}(p_i, \beta_i))$ and $Var\ (\bar{t}_{iT}(p_i, \beta_i))$. The standardization of the $\bar{t}_{iT}$ statistic using the means and variances of $t_{iT}(p_i, 0)$ evaluated by simulation under the null $\rho_i = 0$. IPS shows that a

properly standardized $\bar{t}_{NT}$ statistic, denoted $W_{\bar{t}_{NT}}$, has an asymptotic standard normal

distribution under the null of non-stationary along the diagonal $N/T \to k$, with $k > 0$:

$$W_{\bar{t}_{NT}} = \frac{\sqrt{N}\left(\bar{t}_{NT} - N^{-1}\sum_{i=1}^{N} E(\bar{t}_{iT}(p_i,0)|\rho_i = 0)\right)}{\sqrt{N^{-1}\sum_{i=1}^{N} Var\ (\bar{t}_{iT}(p_i,0)|\rho_i = 0)}} \xrightarrow[T,N\to\infty]{d} N(0,1) \qquad (4.33)$$

The expressions for the expected mean and variance of the ADF regression t-statistics,

$E(\bar{t}_{iT}(p_i,\beta_i))$ and $Var\ (\bar{t}_{iT}(p_i,\beta_i))$, are provided by IPS for various values of T and p and

differing test equation assumptions. The IPS test statistic requires specification of the

number of lags and the specification of the deterministic component for each cross-

section ADF equation.

4.4.2 Cointegration Tests

Conventional cointegration tests tend to suffer from unacceptably low power especially

when applied to a series of moderate length. Therefore, we used the panel data

methodology to address this issue by making available more information by pooling data

across individual countries. The panel cointegration test allows for selective pooling of

information regarding common long-run relationships from across the panel while

allowing the associated short run dynamics and fixed effects to be heterogenous across

different members of the panel (Kumari, 2004).

4.4.2.1 Panel Cointegration Tests

The next step is to test for the existence of a long-run relationship between real per capita GDP growth rates and the independent variables. For panel cointegration, the tests suggested by Pedroni (1999, 2004) are employed. We will make use of seven panel cointegrations by Pedroni (1999, 2004), since he determines the appropriateness of the tests to be applied to estimate residuals from a cointegration regression after normalizing the panel statistics with correction terms.

Pedroni (1999, 2004) extends the Engle and Granger (1987) two step strategies to panels and rely on ADF and PP principles. First, the cointegration equation is estimated separately for each panel member. Second, the residuals are examined with respect to the unit root feature. If the null hypothesis is rejected, the long-run equilibrium exists, but the cointegration vector may be different for each cross section. In addition, deterministic components are allowed to be individual specific. The residuals are pooled either along the within or the between dimension of the panel, giving rise to the panel and group mean statistics (Pedroni, 1999). In the case of the panel statistics the first order autoregressive parameter is restricted to be the same for all cross sections. If the null is rejected, the parameter is smaller than 1 in absolute value, and the variables in question are cointegrated for all panel members. In the group statistics, the autoregressive parameter is allowed to vary over the cross section, as the statistics amount to the average of individual statistics. If the null is rejected, cointegration holds at least for one individual. Hence, group tests offer an additional source of heterogeneity among the panel members (Dreger and Reimers, 2005). To a certain limit, the statistics are distributed as standard

normal with a left hand side rejection area, except for the variance ratio test, which is

right sided. Standardization factors arise from the moments of Brownian motion

functional. The factors depend on the number of regressors and whether or not constants

or trends are included in the cointegration relationships.

The procedures proposed by Pedroni make use of estimated residual from the

hypothesized long-run regression of the following form (Pedroni, 1999):

$$y_{i,t} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \ldots + \beta_{Mi} x_{Mi,t} + e_{i,t} \qquad (4.34)$$

for t = 1,.....,T; i = 1,....,N; m = 1, ..., M,

where *T* is the number of observations over time, *N* number of cross-sectional units in the

panel, and *M* number of regressors. In this set up, α_i is the member specific intercept or

fixed effects parameter which varies across individual cross-sectional units. The same is

true of the slope coefficients and member specific time effects, $\delta_i t$.

The tests for the null of no cointegration are based on testing whether the error process

e_{it} is stationary. This is achieved by testing whether $\rho_i = 1$ in:

$$\hat{e}_{it} = \rho_i \hat{e}_{it-1} + v_{it} \qquad (4.35)$$

Pedroni (1999) has proposed seven tests which can be divided into two groups of panel

cointegration statistics designed to test the null hypothesis of cointegration between the

variables in Equation (4.27) against the alternative hypothesis of cointegration.Gutierrez (2003) states that the first category of four statistics we consider is what Pedroni labels as within-dimension statistic or Panel t-statistic which includes a variance ratio statistic, a non-parametric Philips and Perron type ρ-statistic, a non-parametric Phillips and Perron type t-statistic and a Dickey-Fuller type t-statistic. The second category of three panel cointegration statistics is defined as a between-dimension statistic or Group t-statistic including a Phillips and Perron type ρ-statistic, a non-parametric Phillips and Perron type t-statistic and finally an Augmented Dickey-Fuller type t-statistic.

The first category of test uses the following specification of null and alternative hypothesis,

$$H_0 : \rho = 1, \qquad H_1 : \rho < 1. \tag{4.36}$$

While the second category of tests uses

$$H_0 : \rho_i = 1, \qquad H_1 : \rho_i < 1 \text{ for all } i. \tag{4.37}$$

Pedroni (1999) proposes the heterogeneous panel and heterogeneous group mean panel test statistics to test for panel cointegration as follows:

1. Panel v-statistic:

$$T^2 N^{3/2} Z_{\hat{v},N,T} = T^2 N^{3/2} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \tag{4.38}$$

2. Panel ρ-Statistic:

$$T\sqrt{N}Z_{\hat{\rho}N,T-1} = T\sqrt{N}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{1i}^{-2}\hat{e}_{i,t-1}^2\right)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{1i}^{-2}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i\right) \tag{4.39}$$

3. Panel *t*-Statistic (non-parametric):

$$Z_{tN,T} = \left(\tilde{\sigma}_{N,T}^2\sum_{I=1}^{N}\sum_{T=1}^{T}\hat{L}_{1i}^{-2}\hat{e}_{i,t-1}^2\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{1i}^{-2}\hat{e}_{i,t-1}^2\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i\right) \tag{4.40}$$

4. Panel t-Statistic (parametric):

$$Z_{tN,T}^* = \left(\tilde{s}_{N,T}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{1i}^{-2}\hat{e}_{i,t-1}^{*2}\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{1i}^{-2}\hat{e}_{i,t-1}^*\Delta\hat{e}_{i,t}^* \tag{4.41}$$

5. Group *ρ*-Statistic:

$$TN^{-1/2}\tilde{Z}_{\hat{\rho}N,T^{-1}} = TN^{-1/2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{e}_{i,t-1}^2\right)^{-1}\sum_{t=1}^{T}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i\right) \tag{4.42}$$

6. Group *t*-Statistic (non-parametric);

$$N^{-1/2}\tilde{Z}_{tN,T^{-1}} = N^{-1/2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{e}_{i,t-1}^2\right)^{-1/2}\sum_{t=1}^{T}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i\right) \tag{4.43}$$

7. Group t-Statistic (parametric):

$$N^{-1/2}\tilde{Z}_{tN,T}^* = N^{-1/2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{s}_i^{*2}\hat{e}_{i,t-1}^{*2}\right)^{-1/2}\sum_{t=1}^{T}\hat{e}_{i,t-1}^*\Delta\hat{e}_{i,t}^* \tag{4.44}$$

where

$$\hat{\lambda}_i = \frac{1}{T}\sum_{s=1}^{k_i}\left(1 - \frac{s}{k_i+1}\right)\sum_{t=s+1}^{T}\hat{\mu}_{i,t}\hat{\mu}_{i,t-s}, \tag{4.45}$$

$$\hat{s}_i^2 = \frac{1}{T}\sum_{t=1}^{T}\hat{\mu}_{i,t}^2, \quad \hat{\sigma}_i^2 = \hat{s}_i^2 + 2\hat{\lambda}_i, \tag{4.46}$$

$$\tilde{\sigma}_{NT}^2 = \frac{1}{T}\sum_{t=1}^{T}\hat{L}_{1i}^2\hat{\sigma}_i^2, \quad \hat{s}_i^{*2} = \frac{1}{T}\sum_{t=1}^{T}\hat{\mu}_{i,t}^{*2} \tag{4.47}$$

$$\tilde{s}_{N,T}^{*2} = \frac{1}{N} \sum_{i=1}^{N} \hat{s}_i^{*2} \qquad (4.48)$$

and

$$\hat{L}_{11i}^2 = \frac{1}{T} \sum_{t=1}^{k_i} \hat{\eta}_{i,t}^2 + \frac{2}{T} \sum_{T=1}^{T} \left(1 - \frac{s}{k_i + 1}\right) \sum_{t=s+1}^{T} \hat{\eta}_{i,t} \hat{\eta}_{i,t-s} \qquad (4.49)$$

and where the residuals $\hat{\mu}_{i,t}$, $\hat{\mu}_{i,t}^*$, and $\hat{\eta}_{i,t}$ are obtained from the following regressions:

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \hat{\mu}_{i,t} \qquad (4.50)$$

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \sum_{k=1}^{K_i} \hat{\gamma}_{i,k} \Delta \hat{e}_{i,t-k} + \hat{\mu}_{i,t}^* \qquad (4.51)$$

and

$$\Delta y_{i,t} = \sum_{m=1}^{M} \hat{b}_{mi} \Delta x_{mi,t} + \hat{\eta}_{i,t} \qquad (4.52)$$

Δ is the first difference operator. Pedroni suggests some adjustments for each of all test statistics (both for panel unit root tests and panel cointegration tests) described above that produces standard normal distributions (Hatemi and Irandoust, 2005).

According to Pedroni, those seven test statistics can be rescaled so that they are distributed as standard normal. The standardization of the cointegration statistics can be expressed as

$$\frac{K_{NT} - \mu\sqrt{N}}{\sqrt{v}} \Rightarrow N(0,1) \qquad (4.53)$$

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Where K_{NT} is the standardized form of the test statistic with respect to N and T. The value of the mean (μ) and the variance (ν) are tabulated in Pedroni (1999). The values of the normalized statistics are to be compared to the critical values implied by a one-tailed standard normal distribution. Consequently for the panel variance test the right tail of the standard normal distribution (large positive value) is used to reject the null of no cointegration and for the other six tests the left tail is used (large negative value imply rejection of the null).

Harris and Sollis (2003) argue that in practice it is possible for different tests to give contradicting conclusions. Choosing which test is more appropriate is not easy. The groups mean tests particular strength is that they are less restrictive. Regarding the best way to correct for autocorrelation, non-parametric tests are likely to be more robust to outliers but have poor size properties and tend to over-reject the null when it is true. The ADF-type tests have better power if the errors follow an autoregressive process. Therefore, we followed from the other researcher that we report the adjusted values so that in all cases the reported test values can be compared to the standard normal distribution. This is the case for both the cointegration and unit root tests.

4.4.2.2 Fully Modified Ordinary Least Squares (FMOLS) Estimation

In this section we adopt FMOLS procedures from Christopoulos and Tsionas (2003, 2004). In order to obtain asymptotically efficient consistent estimates in panel series, non-exogeneity and serial correlation problems are tackled by employing fully modified

OLS (FMOLS) introduced by Pedroni (1996). Since the explanatory variables are cointegrated with a time trend, and thus a long-run equilibrium relationship exists among these variables through the panel unit root test and panel cointegration test, we proceed to estimate the Equation (4.15) by the method or fully modified OLS (FMOLS) for heterogenous cointegrated panels (Pedroni, 1996, 2000). This methodology allows consistent and efficient estimation of cointegration vector and also addresses the problem of non-stationary regressors, as well as the problem of simultaneity biases. It is well known that OLS estimation yields biased results because the regressors are endogenously determined in the $I(1)$ case. The starting point OLS as in the following cointegrated system for panel data:

$$y_{it} = \alpha_i + x_{it}'\beta + e_{it} \qquad (4.54)$$

$$x_{it} = x_{i,t-1} + \varepsilon_{it}$$

where $\xi_{it} = [e_{it}, \varepsilon_{it}']$ is the stationary with covariance matrix Ω_i. The estimator β will be consistent when the error process $\omega_{it} + [e_{it}, \varepsilon_{it}']'$ satisfies the assumption of cointegration between y_{it} and x_{it}. The limiting distribution of OLS estimator depends upon nuisance parameters. Following Phillips and Hansen (1990) a semi-parametric correction can be made to the OLS estimator that eliminates the second order bias caused by the fact that the regressors are endogenous. Pedroni (1996, 2000) follows the same principle in the panel data context, and allows for the heterogeneity in the short run dynamics and the fixed effects. FMOLS Pedroni's estimator is constructed as follow:

$$\hat{\beta}_{FM} - \beta = \left(\sum_{i=1}^{N} \hat{\Omega}_{22i}^{-2} \sum_{t=1}^{T} (x_{it} - \hat{x}_t)^2 \right)^{-1} \sum_{i=1}^{N} \hat{\Omega}_{11i}^{-1} \hat{\Omega}_{22i}^{-1} \left(\sum_{t=1}^{T} (x_{it} - \bar{x}_t) e_{it}^* - T\hat{\gamma}_i \right) \quad (4.55)$$

$$\hat{e}_{it}^* = e_{it} - \hat{\Omega}_{22i}^{-1} \hat{\Omega}_{21i}, \qquad \hat{\gamma}_i = \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \hat{\Omega}_{22i}^{-1} \hat{\Omega}_{21i} \left(\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0 \right)$$

where the covariance matrix can be decomposed as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i$ where Ω_i^0 is the contemporaneous covariance matrix, and Γ_i is a weighted sum of autocovariances. Also, $\hat{\Omega}_i^0$ denotes an appropriate estimator of Ω_i^0.

In this study, we employed both the within-dimension and between-dimension panel FMOLS test from Pedroni (1996, 2000). An important advantage of the between-dimension estimators is that the form in which the data is pooled allows for greater flexibility in the presence of heterogeneity of the cointegrating vectors. Specifically, whereas test statistics constructed from the within-dimension estimators are designed to test the null hypothesis $H_0 : \beta_i = \beta_0$ for all I against the alternative hypothesis $H_A : \beta_i = \beta_A \neq \beta_0$ where the value β_A is the same for all i, test statistics constructed from the between-dimension estimators are designed to test the null hypothesis $H_0 : \beta_i = \beta_0$ for all i against the alternative hypothesis $H_A : \beta_i \neq \beta_0$, so that the values for β_i are not constrained to be the same under the alternative hypothesis. Clearly, this is an important advantage for applications such as the present one, because there is no reason to believe that, if the cointegrating slopes are not equal to one, which they necessarily take on some other arbitrary common value. Another advantage of the between-dimension estimators is that the point estimates have a more useful interpretation in the event that the true

cointegrating vectors are heterogeneous. Specifically, point estimates for the between-dimension estimator can be interpreted as the mean value for the cointegrating vectors. This is not true for the within-dimension estimators (Pedroni, 2001).

4.5 Data and Choice of Variables

Economic growth is generally a factor of an increase in the income of a country. In this study, it was measured through the rate of increase in real Gross National Product or GNP. GNP represents or serves as dummy to economic growth, which is defined to be a function of capital stock, labour force, human capital and debt service. The distinction between GDP and GNP is theoretically important, but not often practically consequential. Since the majority of production within a country is by nationals within that country, GDP and GNP are usually very close together. In this study, macroeconomists rely on GNP as the measure of a country's total output.

This study covers the period from 1970 to 2012, and it is restricted to making a cross-country study. Data on GNP, external debt service, external debt stock, FDI inflows, inflation and exchange rate were taken from several different sources such as the World Bank, African Development Bank Group, IFIs, and agencies from respective donor countries.

4.6   Conclusion

This chapter lays out the details regarding the empirical models. To determine the relationship between external debt and economic growth, the work employs the 3SLS multi-simultaneous equation model. The model was specified and previous research on the use of simultaneous equations is also critically surveyed. Estimating the relations between variables through system equations takes into account the simultaneity of the variables and the estimation problems, offering the advantage of simultaneously estimating the coefficients from the system using its whole information. Another advantage of using Structural Equations Model (SEM) is the important economic background they have. By using this type of methods, we tried to reach the purpose of this analysis which was to investigate the correlation between the rate of growth of GNP, debt service and FDI flows in the case of Algeria, Egypt, Mauritania, Morocco, and Tunisia. The analysis was based on an approach that employs the 3SLS method for its estimation so as to take account of all the information existent in the system. This approach reveals a bidirectional connection between the variables and also highlights the importance of economic growth for all the other endogenous variables. Our study also will utilize data from North African countries and the analysis will use panel data techniques. In the next chapter, analysis of data, results and discussion for this study are presented.

CHAPTER FIVE

EMPIRICAL ANALYSIS AND FINDINGS

This chapter provides empirical estimation based on the modelling strategy presented in Chapter Four. Section 5.1 offers some preliminary analysis on the order of integration for each set. The following Section, 5.2 shall illustrate our main focus point, namely the long run equation. Observe the relations among the growth of the economy, international borrowing repayment service and FDI flow into the country using time series figures for the North African countries and using a multi-equation model. Followed by Section 5.3 illustrate the diagnostic test and finally in Section 5.4, presents the summary of the findings.

5.1 Results of Unit Root Tests

In this sub-section, the main issues in time series will be determined, namely the existence of the unit root problem. To avoid spurious results in the time series analysis, in the first stage, the ADF unit root test is conducted to examine the stationarity for each data set in the study.

In this test, the null hypothesis of nonstationarity is examined (Dickey & Fuller, 1979). This test provides a robust technique for exposing the presence of unit roots (Awokuse, 2008). The ADF based on constant, constant and trends are examined. The p-lag is based on user specified starting from 0 to 4. Table 5.1, Table 5.2a, Table 5.2b, Table 5.3a and

Table 5.3b listed the results of ADF for each data set used in the study with the same order of integration for countries of Algeria, Egypt, Mauritania, Morocco, and Tunisia

The calculated t-statistic of ADF test is lower than the critical value of ADF test statistic at 1 per cent level of significance; this suggests that the null hypothesis of unit root for $lnGNP_t$, $lnDS_t$, $lnFDI_t$, $lnED_t$, $lnXGS_t$, $lnSAV_t$, INF_t and ER_t cannot be rejected at 1 per cent level of significance for constant. The first column shows that $lnGNP_t$, $lnDS_t$, $lnFDI_t$, $lnED_t$, $lnXGS_t$, $lnSAV_t$, INF_t and ER_t are not stationary at level either when constant and trend approach is included. The calculated t-statistic of ADF test is higher than the critical value of ADF test statistic at 1 per cent level implying the null hypothesis of unit root $lnGNP_t$, $lnDS_t$, $lnFDI_t$, $lnED_t$, $lnXGS_t$, $lnSAV_t$, INF_t and ER_t cannot be rejected at 1 per cent of significance for ADF's constant with trend approach.

Table 5.1
Algeria: ADF Test for Unit Root

	Level		1st Different	
	Constant	Constant + Trend	Constant	Constant + Trend
$lnGNP_t$	-2.213519	-2.326801	-13.46931***	-13.13808***
	(0.2049) [0]	(0.4104) [0]	(0.0000) [0]	(0.0000) [0]
$lnDS_t$	-2.310144	-1.702443	-6.420740***	-8.311204***
	(0.1738) [1]	(0.7316) [1]	(0.0000) [0]	(0.0000) [0]
$lnED_t$	-1.705054	-2.234951	-2.959206**	-4.245426***
	(0.4209) [0]	(0.4585) [0]	(0.0476) [2]	(0.0090) [2]
$lnFDI$	-1.476483	-1.883572	-5.042342***	-4.991380***
	(0.5353) [0]	(0.6448) [0]	(0.0002) [0]	(0.0012) [0]
$lnXGS_t$	-2.401617	-2.888314	-4.656816***	-4.699332***
	(0.1476) [1]	(0.1769) [1]	(0.0005) [0]	(0.0027) [0]
$lnSAV_t$	-2.539604	-2.690964	-3.811721***	-3.922744**
	(0.1139) [0]	(0.2455) [0]	(0.0057) [2]	(0.0199) [2]
INF_t	-2.369344	-2.448778	-4.838453***	-4.795172***
	(0.1564) [0]	(0.3505) [0]	(0.0003) [0]	(0.0021) [0]
ER_t	-0.454303	-1.900677	-3.371190**	-3.330136*
	(0.8898) [0]	(0.6360) [0]	(0.0181) [0]	(0.0760) [0]

Note: *, ** and *** denote rejection of the null hypothesis at the 10, 5, and 1 per cent level of confidence respectively for ADF. The values in ( ) represent p-value and the value in [ ] represent number of lag

Table 5.2a
Egypt: ADF Test for Unit Root

	Level		1st Different	
	Constant	Constant + Trend	Constant	Constant + Trend
$lnGNP_t$	-2.476668	-2.965231	-3.519224**	-5.968021***
	(0.1286) [0]	(0.1543) [0]	(0.0128) [0]	(0.0001) [0]
$lnDS_t$	-2.021682	-2.997023	-5.040296***	-5.031886***
	(0.2768) [0]	(0.1454) [0]	(0.0002) [0]	(0.0011) [0]
$lnED_t$	-2.056767	-2.740728	-3.403779**	-3.564459**
	(0.2626) [0]	(0.2266) [0]	(0.0167) [0]	(0.0460) [0]
$lnFDI$	-1.517539	-2.853211	-3.982996***	-4.096837**
	(0.5149) [0]	(0.1877) [0]	(0.0037) [0]	(0.0131) [0]
$lnXGS_t$	-2.105007	-2.131168	-2.685099*	-3.504724**
	(0.2440) [0]	(0.5137) [0]	(0.0862) [0]	(0.0528) [0]
$lnSAV_t$	-1.137183	-3.105445	-38.12165***	-5.813004***
	(0.6921) [0]	(0.1212) [0]	(0.0001) [0]	(0.0001) [0]
INF_t	-2.560147	-2.839050	-4.222360***	-4.369874***
	(0.1107) [0]	(0.1938) [0]	(0.0019) [0]	(0.0067) [0]
ER_t	-0.219696	-3.023220	-3.942721***	-3.999613**
	(0.9277) [0]	(0.1385) [0]	(0.0041) [0]	(0.0167) [0]

Note: *, ** and *** denote rejection of the null hypothesis at the 10, 5, and 1 per cent level of confidence respectively for ADF. The values in ( ) represent p-value and the value in [ ] represent number of lag

Table 5.2b
Tunisia: ADF Test for Unit Root

	Level		1st Different	
	Constant	Constant + Trend	Constant	Constant + Trend
$lnGNP_t$	-2.114461	-2.422471	-5.106735***	-4.992981***
	(0.2403) [0]	(0.3629) [0]	(0.0002) [0]	(0.0013) [0]
$lnDS_t$	-2.009709	-1.363822	-5.311921***	-5.798844***
	(0.2817) [0]	(0.8568) [0]	(0.0001) [0]	(0.0001) [0]
$lnED_t$	-2.152877	-2.852758	-2.734224*	-3.228899*
	(0.2261) [0]	(0.1888) [0]	(0.0777) [0]	(0.0945) [0]
$lnFDI$	-1.860571	-2.674398	-4.819271***	-4.787470***
	(0.3470) [0]	(0.2519) [0]	(0.0003) [0]	(0.0021) [0]
$lnXGS_t$	-2.271993	-2.495606	-3.894744***	-4.470205***
	(0.1855) [0]	(0.3286) [0]	(0.0047) [0]	(0.0050) [0]
$lnSAV_t$	-1.676676	-3.075126	-2.710911*	-4.981842***
	(0.4353) [0]	(0.1257) [0]	(0.0818) [0]	(0.0014) [0]
INF_t	-1.512720	-2.552765	-4.624704***	-4.595854***
	(0.5173) [0]	(0.3028) [0]	(0.0006) [0]	(0.0036) [0]
ER_t	-0.225986	-2.879399	-4.597886***	-4.568959***
	(0.9269) [0]	(0.1796) [0]	(0.0006) [0]	(0.0039) [0]

Note: *, ** and *** denote rejection of the null hypothesis at the 10, 5, and 1 per cent level of confidence respectively for ADF. The values in ( ) represent p-value and the value in [ ] represent number of lag

Table 5.3a
Mauritania: ADF Test for Unit Root

	Level		1st Different	
	Constant	Constant + Trend	Constant	Constant + Trend
$lnGNP_t$	-2.323048	-3.065944	-4.915344***	-5.617313***
	(0.1704) [0]	(0.1288) [0]	(0.0003) [0]	(0.0002) [0]
$lnDS_t$	-2.414034	-2.982696	-4.286778***	-3.749456**
	(0.1442) [0]	(0.1492) [0]	(0.0016) [0]	(0.0303) [0]
$lnED_t$	-2.137415	-3.110805	-2.646603*	-3.609345**
	(0.2319) [0]	(0.1184) [0]	(0.0924) [0]	(0.0416) [0]
$lnFDI$	-1.815576	-2.040733	-4.958794***	-4.892059***
	(0.3680) [0]	(0.5623) [0]	(0.0002) [0]	(0.0016) [0]
$lnXGS_t$	-1.052317	-2.535346	-4.808648***	-4.605602***
	(0.7252) [0]	(0.3105) [0]	(0.0004) [0]	(0.0036) [0]
$lnSAV_t$	-1.119673	-2.742616	-4.791550***	-5.806654***
	(0.6990) [0]	(0.2259) [0]	(0.0004) [0]	(0.0001) [0]
INF_t	-2.543039	-2.926529	-4.013380***	-3.985542**
	(0.1137) [0]	(0.1654) [0]	(0.0034) [0]	(0.0175) [0]
ER_t	-0.402129	-2.110245	-3.106556**	-3.872332**
	(0.8993) [0]	(0.5250) [0]	(0.0341) [0]	(0.0224) [0]

Note: *, ** and *** denote rejection of the null hypothesis at the 10, 5, and 1 per cent level of confidence respectively for ADF. The values in ( ) represent p-value and the value in [ ] represent number of lag

Table 5.3b
Morocco: ADF Test for Unit Root

	Level		1st Different	
	Constant	Constant + Trend	Constant	Constant + Trend
$lnGNP_t$	-2.443471	-2.445333	-4.365743***	-4.299878***
	(0.1368) [0]	(0.3521) [0]	(0.0013) [0]	(0.0080) [0]
$lnDS_t$	-2.663237	-1.463662	-4.237600***	-4.880998***
	(0.0912) [0]	(0.8259) [0]	(0.0018) [0]	(0.0017) [0]
$lnED_t$	-1.556204	-2.038601	-4.655274***	-4.665701***
	(0.4955) [0]	(0.5621) [0]	(0.0005) [0]	(0.0030) [0]
$lnFDI$	-1.793396	-2.858834	-5.415280***	-5.353159***
	(0.3785) [0]	(0.1859) [0]	(0.0001) [0]	(0.0004) [0]
$lnXGS_t$	-0.046809	-2.730109	-3.524446**	-5.933244***
	(0.9484) [0]	(0.2308) [0]	(0.0126) [0]	(0.0001) [0]
$lnSAV_t$	-1.891116	-2.499988	-3.011926**	-4.004875**
	(0.3327) [0]	(0.3266) [0]	(0.0430) [0]	(0.0163) [0]
INF_t	-1.883261	-2.256039	-4.654946***	-4.726446***
	(0.3367) [0]	(0.4466) [0]	(0.0006) [0]	(0.0026) [0]
ER_t	-1.627724	-2.252894	-4.182298***	-4.191569**
	(0.4597) [0]	(0.4490) [0]	(0.0021) [0]	(0.0103) [0]

Note: *, ** and *** denote rejection of the null hypothesis at the 10, 5, and 1 per cent level of confidence respectively for ADF. The values in ( ) represent p-value and the value in [ ] represent number of lag

1st difference estimates are done, and the outcome can be found in the third and fourth columns. The third and fourth columns show that the null hypothesis of a unit root is rejected for all data set at 1 per cent level of significance when constant or constant and

trend are included. This is due to the calculated t-statistic of ADF test is high than the critical value of ADF test statistic at 1 per cent level. The rejection of the null hypothesis suggests that there is no unit root and the set is a stationary process at 1 per cent level when both constant and constant and trend is considered. So the first difference tests results from ADF indicating that lnY_t, $lnDS_t$, $lnFDI_t$, $lnED_t$, $lnXGS_t$, $lnSAV_t$, INF_t and ER_t are stationary after first differencing at order one, $I(1)$ and that cointegrating relationships may exist among the variables. There are quite a number of researchers based only on ADF to test on the unit root property, they include Anoruo and Ramchander (1998); Sinha (1998); Asteriou and Agiomirgianakis (2001); Al-Hasson (2005); Alkhuzaim (2005); Furuoka (2007, 2008); Ka (2009); Ngo (2009); Abdullah and Maamor (2010); Nurudeen & Usman (2010); Chew and Woan (2010); Pahlavani, Abed and Pourshabi (2011); Iqbal *et al.*, (2011); and Mishra, Rout and Mohapatra (2011). Thus, the study follows suit.

5.2 Regression Results of the Simultaneous Equations Model

The simultaneous equation model developed in Chapter 4 was tested for each of the sample countries. Hence the method of three-stage least squares (3SLS) was used to estimate the equations. The figures in parentheses under the coefficients are *t* values.

Appendix 1 shows that all coefficients have the correct signs, whether estimated by the OLS, 2SLS, and 3SLS method for all selected North African countries. Furthermore, the values of R^2 indicate a good fit in each case. Finally, we used Hausman test to test whether the OLS and 2SLS coefficient estimates for the potentially endogenous variables

are identical. Its means that Hausman test decide whether or not the disparity in relations the two estimators is statistically important. In this result, the *P*-value is 0.0000, so we reject H_0 at the 1 per cent significance level. This favours 2SLS, since it is evidence that OLS is not consistent. 2SLS is a single equation assessment method and is a type of restricted sequence method since it does not use the information in the other equations. Consequently, we used 3SLS because it is asymptotically well-organized than 2SLS (Judge et al, 1988). 3SLS is a system method, which is functional to all the equation of the model at the same time and gives an estimation of the overall measures concurrently. Based on the results, most of the variables in 3SLS have a relationship with economic growth compare with 2SLS.

In respect of the following analysis is concentrated on 3SLS. This section discusses the results of the regression data and is divided into 3 statistical results of the economic growth equation, debt service equation, and foreign direct investment equation as shown in Table 5.4, Table 5.5, and Table 5.6.

5.2.1: Regression of Economic Growth Equation

Table 5.4 shows the regression of economic growth equation results. In debt service account, there is the negative effect of debt service on economic growth. The coefficients' estimate the effect of debt service ($lnDS_t$) variable is statistically significant; the estimation of coefficient is -0.14 at 1 percent level. As percentage terms, increase by 1 percent in debt service will decrease the economic growth by 0.14 percent. While, there the result is similar for Egypt, Mauritania, Morocco, and Tunisia, there is an

effect of debt service on economic growth and have a negative sign. For Egypt, the coefficients' estimate the effect of debt service $(lnDS_t)$ variable is statistically significant at 1 percent level. The estimation of coefficient is -0.15 means that as debt service increases, the economic growth will decreases. According to percentage terms, an increase by 1 percent in debt service will decrease the economic growth by 0.15 per cent.

For Mauritania, the coefficient of the effect of debt service $(lnDS_t)$is -0.25 at 1 percent level. As stated by percentage terms, an increase by 1 percent in debt service will decrease the economic growth by -0.25 per cent. For Morocco, the estimation of coefficient is -0.31 in d and significant at 1 percent level. For Tunisia, the coefficients' estimate the effect of debt service $(lnDS_t)$ variable is statistically significant; the estimation of coefficient is -0.48 at 1 percent level. Based on the result discussed above, we can conclude that when debt service increases, the economic growth will decreases in North African countries.

This thesis seeks to examine the effect of external debt stock $(lnED_t)$ on the growth of the North African countries economy. The finding indicted the existing of a statistically important and a negative connection between external debt stock and economic growth at 5 percent level for Algeria and Morocco.

Table 5.4
Regression of Economic Growth Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	5.02***	-7.54***	-8.96*	8.56**	9.29**
	(2.62)	(-5.30)	(-1.90)	(2.36)	(2.00)
	[0.00]	[0.00]	[0.05]	[0.03]	[0.04]
$lnDS_t$	-0.14***	-0.15***	-0.25***	-0.31***	-0.48***
	(-5.27)	(-4.92)	(-7.41)	(-5.59)	(-5.62)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$lnED_t$	-0.07**	-0.04**	-0.01**	-0.07**	-0.06**
	(-2.17)	(-2.50)	(-2.21)	(-2.40)	(-2.75)
	[0.03]	[0.03]	[0.02]	[0.01]	[0.00]
$lnFDI_t$	0.35**	0.44**	0.17**	0.28**	0.65**
	(2.25)	(2.64)	(2.04)	(2.18)	(2.61)
	[0.02]	[0.02]	[0.03]	[0.03]	[0.02]
$lnSAV_t$	0.28***	0.11**	0.12**	0.21***	0.24**
	(3.11)	(2.05)	(2.09)	(3.56)	(2.12)
	[0.00]	[0.04]	[0.02]	[0.00]	[0.03]
$lnXGS_t$	0.06	0.03*	0.23	0.05**	1.05**
	(0.26)	(1.88)	(0.43)	(2.75)	(2.14)
	[0.79]	[0.06]	[0.66]	[0.04]	[0.03]
INF_t	-0.77**	0.32***	-0.55*	0.21**	0.41
	(-2.82)	(5.41)	(-1.99)	(2.29)	(0.42)
	[0.01]	[0.00]	[0.06]	[0.02]	[0.67]
$(lnFDI_t$ $* DC_t)$	-0.19**	-0.14**	-0.22**	-0.33**	-0.17**
	(-2.19)	(-2.24)	(-2.19)	(-2.89)	(-2.00)
	[0.03]	[0.02]	[0.02]	[0.01]	[0.04]
$(lnSAV_t$ $* DC_t)$	-0.07**	0.53	-0.06**	1.47	0.06**
	(-2.80)	(1.16)	(-2.20)	(0.47)	(2.03)
	[0.02]	[0.24]	[0.03]	[0.64]	[0.04]
R^2	0.89	0.68	0.88	0.81	0.89

The estimation coefficient is -0.07. As stated by percentage terms, an increase by 1 percent in external debt stock will decrease the economics growth by 0.07 percent for

both countries. For Egypt, the estimates indicted that statistically significant and a negative relationship between external debt stock and economic growth at 5 percent level and the estimated coefficient is -0.04. As percentage terms, increase by 1 percent in external debt stock will decrease the economics growth by 0.04 per cent. While, findings shows that there is a statistically significant and a negative correlation between external debt stock and economic growth at 5 per cent level for Mauritania. The estimation coefficient is -0.01. As stated by percentage terms, an increase by 1 per cent in external debt stock will decrease the economics growth by 0.01 per cent. This result means that an increase in external debt stock will lead to the reduction on the economic growth of Mauritania countries.

For Tunisia, the finding shows that there is a statistically significant and negative correlation between external debt stock and economic growth at 5 per cent level. The estimation coefficient is -0.06. As stated by percentage terms, an increase by 1 per cent in external debt stock will reduce the economics growth by 0.06 per cent. Based on the above discussions, we conclude that an increase in external debt stock will lead to a reduction on economic growth of North African countries.

The estimation coefficient of FDI ($lnFDI_t$) is statistically significant in economic growth equation at 5 per cent level for all selected North African countries. For Algeria, the estimation coefficient is 0.35. An increase by 1 per cent in FDI will result to an increase on the economics growth by 0.35 per cent. In Egypt, the estimate coefficient is 0.44. Due to percentage terms, an increase by 1 percent in FDI will result to an increase on the

economic growth by 0.44 per cent. While for Mauritania, the estimation coefficient is 0.17. Means that increase by 1 per cent in FDI will increase the economic growth by 0.17 per cent. For Morocco, the estimation coefficient is 0.28, means that an increase by 1 per cent in FDI will result to an increase on the economic growth by 0.28 per cent. For Tunisia, the estimation coefficient is 0.65. Increase by 1 per cent in FDI will increase the economic growth by 0.65 per cent.

The results from the analysis revealed that relationship exists between FDI and economic growth. Meaning that the plan to borrow will be reduced and economic growth will be accelerated if foreign international investment comes to a substantial rates The previous studies on capital inflows give a mix results either a positive or negative impact of FDI on economic growth. But our study shows the positive significant impact and follows with Klein and Olivei (2008), Choong *et al.,* (2010), and Ferreira and Laux (2009) where they found that a positive relationship between FDI in economic growth.

The coefficients' estimate on the growth rate of domestic savings ($lnSAV_t$) relationships to economic growth is statistically significant in all selected North African countries. For Algeria, the estimate coefficient is 0.28 at 5 per cent level. Due to percentage terms, an increase by 1 per cent in domestic savings will result to an increase on the economics growth by 0.28 per cent. For Egypt's estimation coefficient is 0.11 at 5 per cent level. Meaning that an increase by 1 per cent in domestic savings will result to an increase on the economic growth by 0.11 per cent. While, the coefficients' estimate on the growth rate of growth of domestic savings ($lnSAV_t$) relationships to the economic growth is

statistically significant for Mauritania country which is 0.12 at 5 per cent level. Due to percentage terms, an increase by 1 per cent in domestic savings will result to an increase on the economic growth by 0.12 per cent. In Morocco, the estimation of coefficient is 0.21 at 1 per cent level. Due to percentage terms, an increase by 1 per cent in domestic savings will result to an increase on the economics growth by 0.21.

For Tunisia, the estimation coefficient of the rate of growth of domestic savings is 0.24. An increase by 1 per cent on domestic savings will increase the economic growth by 0.24 per cent. Based on the above discussion we found that an increase in domestic savings will lead to an increase on the economic growth of North African countries. These results are in line with Anthony and Peter, 2011, Plossner (1992) and Levine and Renelt (1992) who's stated that the domestic savings affects the economic growth.

Table 5.4 also shows that the estimation coefficient of the rate of growth of exports of goods and services export ($lnXGS_t$) is statistically not significant in economic growth equation in all test for Algeria and Mauritania. But it is statistically significant for Tunisia, Morocco and Egypt. In Tunisia, the estimation coefficient of the rate of growth of exports of goods and services export ($lnXGS_t$) is 1.05. Due to percentage terms, an increase by 1 per cent on the growth rate of goods and services exports will result to an increase on the economic growth by 1.05 per cent. For Morocco, the coefficient estimated is0.05. Meaning that if there is an increase by 1 per cent on the growth rate of goods and services export will result to an increase the economic growth by 0.05 per cent. On the other hand, the estimation coefficient of the rate of growth of exports of goods and

services export for Egypt is 0.03 and statistically significant at 10 per cent level. Due to percentage terms, an increase by 1 per cent in domestic savings will result to an increase on the economics growth by 0.03 per cent. Based on the above discussion, we conclude that this empirical evidence also implies that there is a long-run relationship between growth rates and domestic savings and the interesting finding, is that the relationship between domestic saving and growth rates is positive.

The inflation (INF_t) variable is statistically significant and has a negative sign for Algeria and Mauritania; statistically significant and has a positive sign for Egypt and Morocco but not significant for Tunisia. For Algeria, the estimation of coefficient is -0.77 and statistically significant is at 5 per cent level. Meaning that if there is an increase by 1 per cent in inflation it will result to a decrease of growth rates by 0.77 per cent. For Mauritania, The coefficients' estimate the inflation variable is -0.55 and significant at 10 per cent level. Meaning that if there is an increase by 1 per cent in inflation will result to a decrease on the growth rates by 0.55 per cent. This empirical evidence for Algeria and Mauritania implies the existence of a long-run relationship between growth rates and inflation rates and the interesting finding, is that the relationship between inflation and growth rates is negative.

For Egypt, the estimation coefficient is 0.32 and significant at 1 per cent level. Meaning that if there is an increase by 1 per cent in inflation it will result to an increase on the growth rates by 0.32 per cent. For Morocco, the estimation coefficient is 0.21 and significant at 5 per cent level. An increase by 1 per cent in inflation will increase the

growth rates by 0.21 per cent. This empirical evidence for Egypt and Morocco implies the existence of a long-run relationship between growth rates and inflation rates and the interesting finding, is that the relationship between inflation and growth rates is positive. Based on the above discussion, we conclude that there are positive and negative relationship between inflation and economic growth in North African countries.

We used the same explanatory variables in Economic Growth Equation and debt crisis (DC_t) variable is added to the regression model with interaction with FDI ($lnFDI_t * DC_t$) and domestic savings ($lnSAV_t * DC_t$) variable for all selected North African countries. For Algeria, we found that there is a negative coefficient for the interaction term between debt crisis and FDI which is -0.19 at 5 per cent level. Table 5.4 also shows that there is a negative coefficient for the interaction term between debt crisis and domestic savings, which is -0.07 at 5 per cent level.

For Egypt, we found that there is a negative coefficient for the interaction term between debt crisis and FDI which is -0.14 at 5 per cent level. For Mauritania, there is a negative coefficient for the interaction term between debt crisis and FDI which is -0.22 at 5 per cent level. While, there is a negative coefficient for the interaction term between debt crisis and domestic savings is -0.06 at 5 per cent level. For Morocco, there is a negative coefficient for the interaction term between debt crisis and FDI which is -0.33 at 5 per cent level. Again due to percentage terms, the interaction term of FDI and debt crisis will decrease the economic growth by 0.33 per cent for Morocco; we conclude that an additional channel through which debt crisis negatively affects FDI. On the other hand,

there is a negative coefficient for the interaction term between debt crisis and FDI for Tunisia, which is -0.17 at 5 per cent level. The table also shows that there is a positive coefficient of the interaction term between debt crisis and domestic savings; this is 0.06 at 5 per cent level.

5.2.2: Regression of Debt Service Equation

Table 5.5 shows the funds set aside for repayment of debt service equation results. In debt service explanation, assessment the debt stock on debt service is a positive for Algeria, Mauritania and Morocco, while there are negative for Egypt and Tunisia. For Algeria, the coefficients' estimate the effect of external debt stocks $(lnED_t)$ variable is statistically significant that is 0.243 at 5 per cent level. This means as funds set aside for debt stock increases, the debt service also increases. Due to percentage terms, an increase by 1 per cent in debt stock will increase the debt service by 2.43 per cent. For Mauritania, the coefficients' estimate the effect of external debt stocks $(lnED_t)$ variable is statistically significant in 2.66 at 5 per cent level. It means that the level of borrowed fund is higher. Due to percentage terms, an increase by 1 per cent in debt stock will increase the debt service by 2.66 per cent. The debt service equation results in Morocco, the coefficients' estimate the effect of external debt stocks $(lnED_t)$ variable are statistically significant in 0.08 at 1 per cent level. This means that as debt stock increases, the debt service also increases. As terms, increase by 1 per cent in debt stock will increase the debt service by 0.08 per cent in 3SLS method.

For Egypt, the coefficients' estimate the effect of external debt stocks ($lnED_t$) variable is statistically significant in -0.61 at 1 per cent level. As terms, increase by 1 per cent in debt stock will decrease the debt service by 0.61 per cent.

For Tunisia, the coefficients' estimate the effect of external debt stocks ($lnED_t$) variable is statistically significant in -0.31 at 5 per cent level. It means as the stock of debt increases. As terms, increase by 1 per cent in debt stock will decrease the debt service by -0.31 per cent. Based on these findings, North African countries had to borrow more in order to service their debt due to service a heavy debt deteriorate the debt problem. North African countries may have experienced the survival of two way relations to stock of debt and funds earmarked for surviving debts. This can be observed that the earmarked funds for debt service have a negative effect on growth of the economy in Economic Growth Equation.

Table 5.5
Regression of Debt Service Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	-0.22***	0.40**	-0.59**	-0.03**	-0.53**
	(-4.86)	(2.64)	(-2.68)	(-2.12)	(-2.72)
	[0.00]	[0.00]	[0.00]	[0.03]	[0.02]
$lnED_t$	0.24**	-0.61***	2.66**	0.08***	-0.31**
	(2.62)	(-3.93)	(2.22)	(3.27)	(-2.08)
	[0.03]	[0.00]	[0.03]	[0.00]	[0.03]
lnY_t	-0.25***	-0.53**	-4.31**	-0.56***	-0.07**
	(-10.42)	(-2.38)	(-2.24)	(-3.80)	(-2.23)
	[0.00]	[0.01]	[0.04]	[0.00]	[0.03]
$lnFDI_t$	-0.01***	-0.07*	-0.88***	-0.03*	-0.02**
	(-3.06)	(-1.99)	(-7.74)	(-1.98)	(-2.90)
	[0.00]	[0.06]	[0.00]	[0.07]	[0.05]
$lnSAV_t$	-0.34**	-0.51***	-0.06***	-0.18*	-0.37***
	(-2.57)	(-4.09)	(-11.46)	(-1.66)	(-3.83)
	[0.01]	[0.00]	[0.00]	[0.09]	[0.00]
$lnXGS_t$	-0.04**	0.01	-0.02**	-0.08***	-0.10***
	(-2.98)	(1.13)	(-2.23)	(-4.59)	(-2.85)
	[0.01]	[0.26]	[0.04]	[0.00]	[0.00]
INF_t	0.05**	-0.06	0.10	0.01***	0.14
	(2.47)	(-0.98)	(0.98)	(3.16)	(0.36)
	[0.01]	[0.32]	[0.32]	[0.00]	[0.71]
ER_t	0.10**	-0.18*	-0.06	-0.37**	-0.05**
	(3.69)	(-1.87)	(-0.28)	(-2.93)	(-2.14)
	[0.02]	[0.06]	[0.78]	[0.01]	[0.03]
$(lnFDI_t$	-0.91***	-0.66	-4.77	-0.27**	0.01
$* DC_t)$	(-3.50)	(-0.66)	(-1.28)	(-2.13)	(0.26)
	[0.00]	[0.51]	[0.19]	[0.04]	[0.79]
$(lnSAV_t$	-0.99***	-3.70	0.18	-0.52**	-0.23
$* DC_t)$	(-3.72)	(-0.31)	(0.88)	(-2.16)	(-1.05)
	[0.00]	[0.76]	[0.38]	[0.04]	[0.29]
R^2	0.78	0.71	0.84	0.91	0.82

In the funds earmarked for debt service, Debt Service Equation also explained the growth of the economy which has an inverse correlation with debt service. The coefficients' estimates the economic growth (lnY_t) variable is statistically significant and have a negative sign for all selected North African countries. For Algeria, the estimate coefficient is -0.25 at 1 per cent level, while in OLS method the coefficients estimated is statistically insignificant. As terms, an increase by 1 per cent in economic growth will decrease the debt service by 0.25 per cent. For Egypt, the coefficients' estimate is-0.53 at 5 per cent level. As terms, an increase by 1 per cent in economic growth will decrease the debt service by 0.53 per cent. For Mauritania, the estimate coefficient is -4.31 at 1 per cent level. As terms, an increase by 1 per cent in economic growth will decrease the debt service by 4.31 per cent. For Morocco, the estimate coefficient is -0.56 at 1 per cent level. As terms, an increase by 1 per cent in economic growth will decrease the debt service by 0.56 per cent.

For Tunisia, the coefficients' estimate the economic growth variable is statistically significant and has a negative sign; -0.07 at 5 per cent level. As terms, an increase by 1 per cent in economic growth will decrease the debt service by 0.07 per cent. Base on the above finding, an increase in the debt service negatively affects the state of growth in the economy while the decrease in the rate of growth reduces the ability of an economy to service its debt in all selected North African countries.

Table 5.5 shows that FDI inflows have a negative and significant (at 1 per cent, 5 per cent and 1 per cent level, respectively) effect on debt service payment in regression 3SLS for

selected North African countries. For Algeria, the estimated coefficient is -0.01 at 1 per cent level. For Egypt, the estimated coefficient is -0.07 at 10 per cent level. Meaning that if FDI increase by 1 per cent, it will reduce debt service by 0.01 per cent in Algeria and 0.07 per cent in Egypt.

For Mauritania, the result shows that it has negative and significant at 1 per cent level. The estimated coefficient is -0.88, mean that if FDI increase by 1 per cent will reduce the earmarked fund for debt service by 0.88 per cent. FDI inflows have a negative and significant at 10 per cent level effect on debt service payment in Morocco. The estimated coefficient is -0.03 at 5 per cent level. Meaning that if FDI increase by 1 per cent it will reduce debt service by 0.03 per cent.. In Tunisia, there is -0.02 effects on debt service payment at 5 per cent level. If FDI increase by 1 per cent it will reduce debt service by 0.02 per cent. Base on the above analysis, results, show that it could be argued that investors are not risked loving, and are not willing to invest under risky conditions if there are expectations of really low returns.

Table 5.5 show the growth rate of domestic savings has a negative effect on debt service in selected North African countries. For Algeria, the estimation coefficient of the growth rate on national savings ($lnSAV_t$) in debt service equation is -0.34 and significant at 5 per cent. As terms, an increase by 1 per cent in the growth rate of domestic savings will decrease the debt service by 0.43 per cent. In Egypt, the result also shows that the growth rate of domestic savings has a negative effect on debt service. The estimation coefficient growth rate of domestic savings ($lnSAV_t$) in debt service equation is 0.51 and significant

at 1 per cent. As terms, an increase by 1 per cent in the growth rate of domestic savings will reduce the earmarked funds for debt service by 0.51.

To estimate the coefficients of the economy growth for domestic savings $(lnSAV_t)$ in debt service equation for Mauritania is -0.06 and significant at 1 per cent. As terms, an increase by 1 per cent in the growth rate of domestic savings will bring to a decrease in the debt service by 0.06 per cent. For Morocco, the estimation coefficient of the rate of growth of domestic savings $(lnSAV_t)$ in debt service equation is -0.18 and significant at 10 per cent. As terms, an increase by 1 per cent in the growth rate of domestic savings will decrease the debt service by 0.18 per cent.

The estimation coefficient of growth rate on domestic savings $(lnSAV_t)$ in debt service equation is -0.37 and significant at 1 per cent for Tunisia. As terms, an increase by 1 per cent in the growth rate of domestic savings will decrease the debt service by 0.37 per cent. Based on the above discussion, we conclude that the growth rate of domestic savings is as vital as desired. It is hypothesized that the stock of debt service is strongly affected growth of domestic savings in selected North African countries.

Table 5.5 also shows that the growth rate on goods and services export have a negative effect on debt service in selected North African countries except Egypt country. For Algeria, the estimation coefficient of the rate of growth of exports of goods and services $(lnXGS_t)$ in debt service equation is -0.04 and significant at 5 per cent. As terms, an increase by 1 per cent in the growth rate of goods and services exports will decrease

the debt service by 0.04 per cent. For Mauritania, the estimation coefficient of the rate of growth of exports of goods and services($lnXGS_t$) in debt service equation is -0.02 and significant at 5 per cent. As terms, increase by 1 per cent in the rate of growth of exports of goods and services will decrease the debt service by 0.02 per cent.

For Morocco, the estimation coefficient of the growth rate on the exports of goods and services($lnXGS_t$) in debt service equation is -0.08 and significant at 5 per cent. As terms, an increase by 1 per cent in the growth rate on exports of goods and services will decrease the debt service by 0.08 per cent. In Tunisia, the estimation coefficient of the growth rate on exports of goods and services ($lnXGS_t$) in debt service equation is -0.10 and significant at 1 per cent. As terms, an increase by 1 per cent in the growth rate on exports of goods and services will result into a reduction in the debt service earmarked funds 0.10 per cent Based on the above discussion, the growth rate on exports of goods and services are as significant as desired by a country. It is hypothesized that the level of debt service is strongly affected by rate of growth in exports of goods and services.

Inflation is a key macroeconomic indicator of a country, providing an important insight into the state of the economy. A low and stable inflation rate uplifts the poor and vulnerable citizens and provides a nurturing environment for economic growth (Ahmad, Sheikh, and Tariz, 2012). Refer to Table 5.5, the coefficients' estimate the inflation (INF_t)variable are statistically significant and have a positive sign; 0.05 for Algeria at 5 percent level. Meaning that an increase in the inflation (price level) will increase the debt service, even though the effect of inflation on debt service is very small but is statistically

highly significant. For Morocco, the coefficients' estimate the inflation variable is statistically significant and has a positive sign; 0.01 at 1 per cent level. Resources that an increase in the inflation (price level) will increase the debt service, even though the effect of inflation on debt service is very small but is statistically highly significant.

The exchange rate (ER_t) has statistically positive and negative significant on the debt service in selected North African countries except Mauritania. For Algeria, the estimation coefficient of the exchange rate (ER_t) in debt service equation is 0.10 and significant at 5 per cent level. As percentage terms, an increase by 1 per cent in exchange rate will increase the debt service by 0.10 per cent. In Egypt, the estimation coefficient of the exchange rate is -0.18 and significant at 10 per cent level. As percentage terms, an increase by 1 per cent in exchange rate will decrease the debt service by 0.18 per cent.

For Morocco and Tunisia, the estimation coefficient of the exchange rate in debt service equation are -0.37 and -0.05, respectively and significant at 5 per cent level. As percentage terms, an increase by 1 per cent in exchange rate will decrease the debt service by 0.37 and 0.05 per cent, respectively. Based on the above discussion regarding the results of the relationship between exchange rate and debt service, we suppose that the dynamism of exchange rate is firmly reliant on national policy. However, one has to keep in focus that nearly all of the capital goods desired for investment in Tunisia. Nevertheless, an increase in the actual rate of exchange rate constraints in exports, thereby restraining the amount of hard currency inflows that a country can obtain and

spend not only for earmarked amounts for servicing obligations, but for importing capital goods, as well.

We used the same explanatory variables in Model 2 and debt crisis (DC_t) variable is added to the regression model with interaction with FDI $(lnFDI_t * DC_t)$ and domestic savings $(lnSAV_t * DC_t)$ variable. The results show that there is a negative coefficient for the interaction term between debt crisis variable with FDI $(lnFDI_t * DC_t)$ and domestic savings $(lnSAV_t * DC_t)$ variable for Algeria and Morocco.

In Algeria, the estimation coefficient for the interaction term between debt crisis and FDI in three methods which is -0.91 and significant at 1 per cent level. Again as percentage terms, the interaction term of FDI and debt crisis will decrease debt service the by 0.91 per cent; we conclude that an additional channel through which debt crisis negatively affects FDI. Table 5.5 also shows that there is a negative coefficient for the interaction term between debt crisis and domestic savings, which is -0.99 and significant at 1 per cent level, respectively. Again as percentage terms, interaction term of domestic savings and debt crisis will reduce the debt service by 0.99 per cent.

For Morocco, the results show that there is a negative coefficient for the interaction term between debt crisis and FDI; -0.27 and significant at 5 per cent level. Again, as percentage terms, the interaction term of FDI and debt crisis will decrease debt service the by 0.27 per cent. There is a negative coefficient for the interaction term between debt crisis and domestic savings that is -0.52 and significant at 5 per cent level. Again, as

percentage terms, the interaction term of domestic savings and debt crisis will decrease the debt service by 0.52 per cent.

5.2.3: Regression of Foreign Direct Investment Equation

Table 5.6 shows the results of Foreign Direct Investment net inflows (FDI) equation in selected North African countries. The FDI equation expresses the long-term Foreign Direct Investment net inflows to the rate of growth of GNP ($lnGNP_t$) as a function of the economic growth, external debt stock ($lnED_t$), rate of growth of exports of goods and services($lnXGS_t$), rate of growth of domestic savings ($lnSAV_t$), exchange rate (ER_t), the interaction of economic growth and the dummy of debt crisis ($lnY_t * DC_t$), and the interaction of the rate of growth of domestic savings and the dummy of debt crisis ($lnSAV_t * DC_t$); hence it encourages more Foreign Direct Investment net inflows.

For Algeria, the economic growth is a positive sign in the estimation, and it is statistically significant. The estimated coefficient is 0.41 and significant at the 1 per cent level. The outcome of these estimates indicates that the higher rate of growth attracts more FDI funds into the economy. As percentage terms, an increase of 1 per cent in economic growth will increase the FDI inflows by 0.41 per cent.

For Egypt, the estimated coefficient of economic growth is 0.09 and as percentage terms, an increase by 1 per cent in economic growth will increase the FDI inflows by 0.09 per cent. For Mauritania, the estimation coefficient of economic growth is 0.46 and

significant at 1 per cent level. As a percentage terms, an increase by 1 per cent in economic growth will increase the FDI inflows by 0.46 per cent. For Morocco, the estimation coefficient is 0.39 and significant at 5 per cent level. As percentage terms, an increase by 1 per cent in economic growth will increase the FDI inflows by 0.39 per cent. For Tunisia, the economic growth is found to be positive in our estimation, and it is statistically significant for Tunisia. The estimated coefficient is 0.55 and significant at the 1 per cent level. As percentage terms, an increase of 1 per cent in economic growth will increase the FDI inflows by 0.55 per cent.

For Algeria, the estimation coefficient of the external debt stock $(lnED_t)$ is -0.01 with negative sign and it is statistically significant at the 5 per cent level. As percentage terms, an increase by 1 per cent in external debt stock will decrease the FDI inflows 0.01 per cent. For Egypt, the estimation coefficient of external debt stock $(lnED_t)$ is -0.05 and statistically significant at the 1 percent level. As percentage terms, an increase by 1 percent in external debt stock will decrease the FDI inflows by 0.05 per cent.

Table 5.6
Regression of Foreign Direct Investment Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	3.26**	-0.13	1.37**	-2.11	-0.72
	(3.26)	(-0.19)	(2.85)	(-1.20)	(-0.10)
	[0.00]	[0.84]	[0.00]	[0.23]	[0.91]
lnY_t	0.41***	0.09**	0.46***	0.39**	0.55***
	(3.13)	(2.55)	(4.45)	(2.86)	(6.01)
	[0.00]	[0.03]	[0.00]	[0.00]	[0.00]
$lnED_t$	-0.01**	-0.05***	-0.03**	-0.03**	-0.01
	(-2.47)	(-3.58)	(-2.60)	(-2.58)	(-0.40)
	[0.04]	[0.00]	[0.04]	[0.02]	[0.69]
$lnSAV_t$	0.41**	0.15***	-0.06	0.34***	0.84***
	(2.91)	(3.89)	(-0.15)	(3.21)	(4.38)
	[0.00]	[0.00]	[0.92]	[0.00]	[0.00]
$lnXGS_t$	0.24**	0.04***	0.09	0.47**	0.53***
	(2.48)	(3.46)	(0.25)	(2.43)	(4.54)
	[0.03]	[0.00]	[0.80]	[0.03]	[0.00]
ER_t	0.03***	0.04***	0.15**	0.04**	0.19**
	(4.99)	(2.81)	(2.03)	(2.69)	(2.75)
	[0.00]	[0.00]	[0.04]	[0.02]	[0.00]
$(lnY_t * DC_t)$	-0.36***	-0.53	-0.78**	-0.14**	-0.84***
	-2.91)	(-1.54)	(-2.19)	(-2.44)	(-4.38)
	[0.00]	[0.44]	[0.03]	[0.02]	[0.00]
$(lnSAV_t * DC_t)$	-1.09	-0.19*	-0.27***	-1.02	3.52
	(-1.57)	(-1.89)	(-3.90)	(-1.26)	(0.82)
	[0.29]	[0.05]	[0.00]	[0.20]	[0.41]
R^2	0.77	0.77	0.69	0.86	0.67

For Mauritania and Morocco, the estimation coefficients of external debt stock ($lnED_t$) are -0.03 and statistically significant and 5 per cent level. As percentage terms, an increase by 1 per cent in external debt stock will decrease the FDI inflows by 0.03 per cent for both countries.

Foreign Direct Investment Equation in Table 5.6 also shows that the growth rate of domestic savings ($lnSAV_t$) has a positive effect on FDI inflows and the effect of the growth rate of domestic savings is significant for all selected North African countries except Egypt. For Algeria, the estimated coefficient on the growth rate of domestic savings is 0.41 and significant at 5 per cent level. As percentage terms, an increase by 1 percent on the growth rate of domestic savings will increase the FDI inflows by 0.41 per cent.

For Egypt, Morocco and Tunisia, the estimation coefficients of the growth rate on domestic savings in debt service equation is 0.15, 0.34 and 0.84, respectively and significant at 1 per cent level. As percentage terms, an increase by 1 per cent on the growth rate of domestic savings will increase the FDI inflows by 0.15, 0.34 and 0.84 for Egypt, Morocco and Tunisia, respectively. Base on the above discussion, growth rate of domestic savings is as significant as expected, and we can conclude that an FDI inflow is strongly affected by the rate of growth of domestic savings.

Refer to Table 5.6, Algeria and Morocco have the coefficients' estimate the growth rate on exports of goods and services ($lnXGS_t$) variable are 0.24 and 0.47, respectively and statistically significant at 5 per cent level. If it increase by 1 per cent in the growth rate on exports of goods and services ($lnXGS_t$) will increase the FDI inflows by 0.24 per cent for Algeria and by 0.47 per cent for Morocco. For Egypt and Tunisia, the coefficients' estimate the growth rate of exports of goods and services ($lnXGS_t$) variable are 0.04 and

0.53, respectively and statistically significant at 1 per cent level. If increase by 1 per cent in the rate of growth of exports of goods and services ($lnXGS_t$) will increase the FDI inflows by 0.24 per cent and 0.47 per cent for Egypt and Tunisia.

The estimation results in Table 5.6 also show a positive and statistically significant at 5 per cent (Algeria and Egypt) and 1 per cent (Mauritania, Morocco and Tunisia) level relationship between the exchange rate (ER_t) and FDI inflows in all selected North African countries. For Algeria and Egypt, the estimated coefficients of the exchange rate are 0.03 and 0.04, respectively. These indicate that every 1 per cent appreciation of the real exchange rate will increase in FDI inflows by 0.03 per cent for Algeria and 0.04 per cent for Egypt. For Mauritania, Morocco and Tunisia, the estimated coefficients of the exchange rate are 0.15, 0.04, and 0.19, respectively. This indicates that every 1 per cent appreciation of the real exchange rate will increase in FDI inflows by 0.15 per cent for Mauritania, 0.04 per cent for Morocco and 0.19 per cent for Tunisia.

In Table 5.6, the same explanatory variables in Foreign Direct Investment Equation and debt crisis (DC_t) variable is added to the regression model with interaction with economic growth inflows ($lnY_t * DC_t$) variable. For Algeria and Tunisia, there are a negative coefficient for the interaction term between debt crisis and economic growth which is the estimated coefficient -0.36 and -0.84, respectively and statistically significant at 1 per cent level. Again as percentage terms, an interaction term of economic growth and debt crisis will decrease the FDI inflows by 0.36 per cent for Algeria and 0.84 per cent for Tunisia. Similar to the Economic growth Equation and Debt Service

Equation, which included an additional channel through which debt crisis negatively affects FDI inflows.

For Mauritania and Morocco, there is a negative coefficient for the interaction term between debt crisis and economic growth which is the estimated coefficient -0.78 and -0.14, respectively and statistically significant at 5 per cent level. Again as percentage terms, an interaction term on economic growth and debt crisis will decrease the FDI inflows by 0.78 per cent for Mauritania and 0.14 per cent for Morocco.

With similar explanatory variables in Foreign Direct Investment Equation and debt crisis (DC_t) variable is added to the regression model with interaction on domestic saving $(lnSAV_t * DC_t)$ variable. The estimation coefficient of the debt crisis in FDI inflows equation is significant for Egypt country even though has negative signs as well. The coefficients' estimate is -0.19. As percentage terms, an increase by 1 per cent in debt crisis will decrease the FDI inflows by 0.19 per.

For Mauritania, there is a negative coefficient for the interaction term between debt crisis and domestic saving $(lnSAV_t * DC_t)$ variable, we found that there is a negative coefficient -0.27 S and statistically significant at 1 per cent level. Again as percentage terms, an interaction term on domestic saving and debt crisis will decrease the FDI inflows by 0.27 per cent.

5.3 Diagnostic Test

From our study, a fundamental question for economic growth is particular in which explanatory variables are include or exclude. Our models in Equation 4.5, 4.6 and 4.7 that we used in the study for selected North African countries are consistent with the standard assumptions of OLS, the tests such as normality, Heteroskkedasticity: ARCH, serial correlation, Ramsey RESET, are conducted and the results are shown in Table 5.7, 5.8 and 5.9.

Table 5.7
Robustness Tests – Economic Growth Equation

Tests	Statistics / (Probability)				
	Algeria	Egypt	Mauritania	Morocco	Tunisia
Jarque-Bera	0.855	0.363	0.561	0.986	0.337
(normality test)	(0.972)	(0.421)	(0.645)	(0.988)	(0.408)
Heteroskedasticity Test: ARCH:					
F statistics	0.764	0.774	0.837	0.676	0.668
	(0.314)	(0.298)	(0.347)	(0.402)	(0.425)
Obs R-squared	0.597	0.678	0.625	0.795	0.697
	(0.305)	(0.394)	(0.343)	(0.505)	(0.404)
Bruesh-Godfrey Serial Correlation LM test:					
F statistics	0.633	0.833	0.783	0.963	0.833
	(0.468)	(0.366)	(0.296)	(0.728)	(0.368)
Obs R-squared	0.894	0.683	0.883	0.813	0.893
	(0.249)	(0.349)	(0.205)	(0.409)	(0.305)
Ramsey RESET test:					
t-statistics	1.192	2.994	1.692	1.881	1.452
	(0.284)	(0.883)	(0.483)	(0.653)	(0.323)
F-statistics	1.052	2.192	1.782	1.861	1.591
	(0.184)	(0.783)	(0.581)	(0.643)	(0.443)
Likelihood ratio	1.293	2.540	1.290	1.990	1.490
	(0.323)	(0.752)	(0.322)	(0.862)	(0.523)

Table 5.8
Robustness Tests – Debt Service Equation

Tests	Statistics / (Probability)				
	Algeria	Egypt	Mauritania	Morocco	Tunisia
Jarque-Bera	2.962	2.516	0.451	1.189	0.303
(normality test)	(0.193)	(0.122)	(0.654)	(0.288)	(0.820)
Heteroskedasticity Test: ARCH:					
F statistics	0.647	0.567	0.808	1.966	0.316
	(0.563)	(0.452)	(0.603)	(0.164)	(0.574)
Obs R-squared	0.559	0.736	0.336	0.27	0.216
	(0.573)	(0.593)	(0.843)	(0.885)	(0.954)
Bruesh-Godfrey Serial Correlation LM test:					
F statistics	1.096	0.548	0.927	3.739	0.713
	(0.374)	(0.773)	(0.622)	(0.157)	(0.383)
Obs R-squared	0.781	0.718	0.843	0.913	0.823
	(0.382)	(0.864)	(0.605)	(0.433)	(0.635)
Ramsey RESET test:					
t-statistics	0.892	1.543	1.393	1.322	2.022
	(0.322)	(0.643)	(0.453)	(0.451)	(0.421)
F-statistics	1.553	1.993	1.673	1.233	1.133
	(0.684)	(0.584)	(0.435)	(0.451)	(0.245)
Likelihood ratio	0.994	1.586	2.193	1.380	1.120
	(0.524)	(0.789)	(0.573)	(0.698)	(0.328)

a. Normality test (Jarque-Bera)

For normality test, our results obtained from Jarque-Bera are not significant to all selected North African countries, as in Table 5.7, 5.8, and 5.9. Thus the null hypothesis of normality errors in our study failed to reject at 10 per cent level of significant, implying that the residuals are normally distributed.

Table 5.9
Robustness Tests – FDI inflows Equation

Tests	Statistics / (Probability)				
	Algeria	Egypt	Mauritania	Morocco	Tunisia
Jarque-Bera	2.366	1.181	2.845	1.418	1.003
(normality test)	(0.333)	(0.147)	(0.234)	(0.217)	(0.621)
Heteroskedasticity Test: ARCH:					
F statistics	1.325	1.247	1.341	1.476	1.517
	(0.163)	(0.113)	(0.133)	(0.137)	(0.151)
Obs R-squared	0.559	0.736	0.636	0.727	0.616
	(0.573)	(0.593)	(0.745)	(0.655)	(0.654)
Bruesh-Godfrey Serial Correlation LM test:					
F statistics	1.721	1.548	1.946	1.379	1.913
	(0.472)	(0.975)	(0.654)	(0.759)	(0.813)
Obs R-squared	0.771	0.773	0.695	0.867	0.671
	(0.687)	(0.417)	(0.635)	(0.743)	(0.832)
Ramsey RESET test:					
t-statistics	1.295	1.183	1.543	1.872	1.423
	(0.425)	(0.541)	(0.553)	(0.657)	(0.725)
F-statistics	1.231	1.219	1.373	1.553	1.923
	(0.587)	(0.527)	(0.537)	(0.557)	(0.845)
Likelihood	1.239	1.577	1.130	1.786	1.528
ratio	(0.824)	(0.724)	(0.774)	(0.685)	(0.524)

b. Heteroskedasticity

The null hypotheses of no heteroskedasticity in the residuals are tested by using ARCH
approach at 1st lag order. Based on F and chi^2 statistics, the probability for both is
insignificant indicating that the residuals are not heteroskedastic in all selected North
African countries, as in Table 5.7, 5.8, and 5.9..

c. Serial Correlation

Bruesh-Godfrey Serial Correlation LM test is carried out at 1st lag order. The result shows that there is no significant evidence of the serial correlation in the residuals in all selected North African countries, as in Table 5.7, 5.8, and 5.9. Therefore, the null hypothesis of no serial correlation in the residuals is failed to reject at 1st lag order. In other words, the result in this study suggests that the use of lag structure in the model is suitable.

d. Ramsey RESET

Ramsey RESET test in our study for North African countries are carried out to test for model specification. This test fails to reject the null hypothesis of linearity in the parameters in all selected North African countries, showed in Table 5.7, 5.8, and 5.9. In other words, there is evidence of linearity in the model specification. Besides, this test also able to test for omitted variables and incorrect functional form in general. The results obtained suggested that the model specification is appropriate as well as the parameters of the model are stable in the study.

To summarize from the diagnostic tests, the model in the study shows no non normality of errors, no autocorrelation, no heteroskedasticity, well specified functional form and stable regressors. The tests show the model applied in the study is satisfied and qualified for all the above diagnostic tests indicating the robustness of the adopted model. Thus,

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the specification of the model is an adequate representation of the data for all selected North African countries.

5.4 Conclusion

Based on the findings presented above it can be concluded that there is a relationship between dependent variable and independent variables among selected North African country in Equation 4.5, 4.6, and 4.7. The findings show that the coefficient in 2SLS is significantly larger than the magnitude of the corresponding coefficient in OLS. 3SLS also shows that it is more efficient than 2SLS.The robustness of the models have also been confirmed by several diagnostic tests such as LM test (Breusch-Godfrey serial correlation test), Jacque-Bera test (normality test), heteroskedastic test, and Ramsey RESET test as set out in Table 5.7, 5.8, and 5.9. All the tests revealed that the models have the desired econometric properties, namely the residuals are serially uncorrelated and normally distributed, homoscedasticity and all estimated parameters are stable over time, that is, test statistics fall within the 10 per cent critical line. Therefore, the results reported are valid and reliable

CHAPTER SIX

ANALYSIS ON THE LONG RUN RELATIONSHIP BETWEEN THE ECONOMIC GROWTH AND ITS DETERMINANTS OF SELECTED NORTH AFRICAN COUNTRIES

This chapter discusses the major findings for all various regression models used in the study. This chapter starts with a debate on stationarity of the panel data using Levin Lin and Chin (LLC, 2002) and Im, Pesaran and Shin (1997; IPS hereafter) tests and follow by panel cointegration and fully modified OLS (FMOLS), the tests proposed by Pedroni (1999, 2004, 1996). Possible explanations for the findings are discussed in each section, along with their implications. This chapter end with a discussion of the relationship of the findings to the theoretical model proposed in Chapter four.

6.1 Results of Panel Unit Root Test

As with standard co-integration tests this is necessary to discern that the stationarity properties of the data is to make sure that erroneous inferences are not made. Testing for stationarity in panel data is different to some extent from conducting unit root tests in standard individual time series; these differences are discussed below.

Coakley *et al*., (1996), Coakley and Kulasi(1997) and Oh *et al*., (1999) reported in their studies that conventional unit root tests like the ADF test have been found to have low

testing powers. The failure to refuse null of a unit root in a data by conventional ADF unit root test might be because of low testing power of the test. Panel unit root test is found to have higher power than the individual unit root ADF tests. The panel unit root tests take into account both time series and the cross-sectional variations in data and they augment the power of the tests due to increased quantity of observations that are on hand in the panel setting.

For determining the existence of a unit root in a panel data setting and to verify the outcomes from the individual unit root of the ADF tests, we have utilized the panel unit test on the panel data which is based on the procedure of Levin *et al.* (2002) and Im *et al.* (1997) (LLC and IPS, respectively). The LLC and the IPS tests are made in a way that the null hypothesis tested plus all the series in the panel, including a unit root against the alternative that none of the series have a unit root. Hence, this test permits for heterogeneity in the panel, for instance in lag order or precise value for autoregressive parameter, all the series ought to share the similar stationarity properties.

When applying LLC and IPS test we have to be mainly cautious in deciding on the lag length for the ADF tests, because underestimate the correct number of lags might take to lack in power. We also employed the Akaike's Information Criterion (AIC) in selecting the suitable number of lagged differences term for five tests statistics to compute our results. The AIC is acknowledged for choosing the maximum pertinent lag length (Shrestha and Chowdhury, 2005). McKinnon's tables provide the cumulative distribution of the LLC and the IPS test statistics.

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Table 6.1 accounts the output of the LLC and the IPS panel unit root tests for the data on real GNP ($lnGNP_{it}$), debt service ($lnDS_{it}$), external debt stock ($lnED_{it}$), net exports ($lnXGS_{it}$), FDI inflow is a proxy of foreign direction investment ($lnFDI_{it}$), domestic saving ($lnSV_{it}$), inflation (INF_{it})and exchange rate (ER_{it}) for both the situations of constant and constant with time trend term. The tests are run for the full sample of the five North African countries, namely Algeria, Egypt, Mauritania, Morocco, and Tunisia for the period 1970-2012.

Table 6.1 shows the outcomes of the LLC and the IPS panel unit root tests at the level demonstrates that all variables are I(0) in the constant of the panel unit root regression. These findings noticeably demonstrated that the null hypothesis of a panel unit root in the level of the series cannot be thrown out at different lag lengths. We supposed that there was no time trend. Thus, we tested for stationarity permitting for an unvarying plus time trend. In the absence of a constant plus time trend, yet again we found out that the null hypothesis of having panel unit root was in general rejected in all series at level form.

As discussed above, we found out that the majority of the variables are non-stationary with and without time trend specifications at level by applying LLC and IPS tests which are also functional for heterogeneous panel to test the series for the existence of a unit root. The outcomes of the panel unit root tests established that the variables are non-stationary at level

Table 6.1
Panel Unit Root Tests

	Level				1st Different			
	Constant		Constant + Trend		Constant		Constant + Trend	
	LLC	IPS	LLC	IPS	LLC	IPS	LLC	IPS
lnY_{it}	0.32539 (0.6276) [0]	-0.96039 (0.1684) [0]	1.06138 (0.8557) [0]	-0.44947 (0.3265) [0]	-24.6012*** (0.0000) [0]	-4.24249*** (0.0000) [0]	-23.4803*** (0.0000) [0]	-3.08743*** (0.0010) [0]
$lnDS_{it}$	1.46174 (0.9281) [0]	-0.34233 (0.3661) [0]	2.42817 (0.9924) [0]	0.02972 (0.5119) [0]	-9.70673*** (0.0000) [0]	-15.0489*** (0.0000) [0]	-7.52590*** (0.0000) [0]	-13.4931*** (0.0000) [0]
$lnED_{it}$	-1.14985 (0.1251) [0]	-0.99333 (0.1603) [0]	1.32106 (0.9068) [0]	-0.56130 (0.2873) [0]	-7.72797*** (0.0000) [0]	-6.62313*** (0.0000) [0]	-7.43844*** (0.0000) [0]	-6.60728*** (0.0000) [0]
$lnFDI_{it}$	-0.45140 (0.3258) [0]	-0.90516 (0.1827) [0]	0.95384 (0.8299)	-0.77031 (0.2206) [0]	-10.6220*** (0.0000) [0]	-8.29381*** (0.0000) [0]	-8.00817*** (0.0000) [0]	-7.14151*** (0.0000) [0]
$lnXGS_{it}$	-0.20155 (0.4201) [0]	-0.59739 (0.2751) [0]	3.60193 (0.9998)	-0.88147 (0.1890) [0]	-3.15852*** (0.0008) [0]	-3.20916*** (0.0007) [0]	-8.36041*** (0.0000) [0]	-9.92836*** (0.0000) [0]
$lnSAV_{it}$	3.06855 (0.9989) [0]	1.49430 (0.9325) [0]	19.1155 (1.0000) [0]	-1.02631 (0.1524) [0]	-22.5777*** (0.0000) [0]	-3.51748*** (0.0002) [0]	-32.5374*** (0.0000) [0]	-3.08151*** (0.0010) [0]
INF_{it}	1.51369 (0.9349) [0]	-0.68496 (0.2467) [0]	-2.16452 (0.0152) [0]	-1.09078 (0.1377) [0]	-20.0090*** (0.0000) [0]	-28.6687*** (0.0000) [0]	-27.0112*** (0.0000) [0]	-33.5422*** (0.0000) [0]
ER_{it}	0.46745 (0.6799) [0]	2.46352 (0.9931) [0]	-1.19640 (0.1158) [0]	-1.12455 (0.1304) [0]	-7.05057*** (0.0000) [0]	-5.98515*** (0.0000) [0]	-6.46564*** (0.0000) [0]	-4.60606*** (0.0000) [0]

Note: The number in ( ) denotes probability value. The lag length is chosen based on the Akaike's Information Criteria (AIC) where maximum lag order was specified (k) in autoregression and then the appropriate lag order was selected according to the AIC. All the reported values for the LLC *t*-stat are distributed N(0,1) under null of unit root or no cointegration.

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Panel Unit Root Tests

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$lnDS_{it}$	1.46174 (0.9281) [0]	-0.34233 (0.3661) [0]	2.42817 (0.9924) [0]	0.02972 (0.5119) [0]	-9.70673*** (0.0000) [0]	-15.0489*** (0.0000) [0]	-7.52590*** (0.0000) [0]	-13.4931*** (0.0000) [0]
$lnED_{it}$	-1.14985 (0.1251) [0]	-0.99333 (0.1603) [0]	1.32106 (0.9068) [0]	-0.56130 (0.2873) [0]	-7.72797*** (0.0000) [0]	-6.62313*** (0.0000) [0]	-7.43844*** (0.0000) [0]	-6.60728*** (0.0000) [0]
$lnFDI_{it}$	-0.45140 (0.3258) [0]	-0.90516 (0.1827) [0]	0.95384 (0.8299)	-0.77031 (0.2206) [0]	-10.6220*** (0.0000) [0]	-8.29381*** (0.0000) [0]	-8.00817*** (0.0000) [0]	-7.14151*** (0.0000) [0]
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$lnSAV_{it}$	3.06855 (0.9989) [0]	1.49430 (0.9325) [0]	19.1155 (1.0000) [0]	-1.02631 (0.1524) [0]	-22.5777*** (0.0000) [0]	-3.51748*** (0.0002) [0]	-32.5374*** (0.0000) [0]	-3.08151*** (0.0010) [0]
INF_{it}	1.51369 (0.9349) [0]	-0.68496 (0.2467) [0]	-2.16452 (0.0152) [0]	-1.09078 (0.1377) [0]	-20.0090*** (0.0000) [0]	-28.6687*** (0.0000) [0]	-27.0112*** (0.0000) [0]	-33.5422*** (0.0000) [0]
ER_{it}	0.46745 (0.6799) [0]	2.46352 (0.9931) [0]	-1.19640 (0.1158) [0]	-1.12455 (0.1304) [0]	-7.05057*** (0.0000) [0]	-5.98515*** (0.0000) [0]	-6.46564*** (0.0000) [0]	-4.60606*** (0.0000) [0]

Note: The number in ( ) denotes probability value. The lag length is chosen based on the Akaike's Information Criteria (AIC) where maximum lag order was specified (k) in autoregression and then the appropriate lag order was selected according to the AIC. All the reported values for the LLC *t*-stat are distributed N(0,1) under null of unit root or no cointegration.

6.2 Cointegration Test

The non-stationarity of the variables as shown by the unit root tests raises the problem of spurious regressions. The spurious regression problem can be addressed by employing cointegration methodology. However before the cointegration regression model can be estimated, it has to be first ascertained if the non-stationary variables are cointegrated with one another. The cointegration analysis is able to identify whether there is a non-spurious equilibrium relationship between the variables. Therefore, cointegration analysis is carried out on both individual and panel data to determine if the variables are cointegrated.

6.2.1 Panel Cointegration Tests

Further step is to test if the variables are co-integrated using methodology of Pedroni (1999, 2001, and 2004) as explained earlier for Equation4.15. This explores if on the long-run steady state or cointegration presences between the variables and to verify the statement of Oh *et al*. (1999) and Coiteux and Olivier (2000) that the panel cointegration tests have plenty high testing power than conventional cointegration test. As the variables are found to be integrated in the same order $I(1)$, we remain persistent with the panel cointegration tests projected by Pedroni (1999, 2001, and 2004). Cointegrations are performed for constant and constant plus time trend and the results of cointegrations examination are summed up in Table 6.2.

Panel v is a non-parametric variance ratio statistic. Panel-*p* and panel-*t* are similar to the non-parametric, Phillips-Perron *p* and *t* statistics respectively. Panel-*adf* is a

parametric statistic which has its foundation on the augmented Dickey-Fuller ADF statistic. Group-p is similar to the Phillips-Perron p statistic. Group-t and group-adf are similar to the Phillips-Perron t statistic and augmented Dickey- Fuller ADF statistic, respectively. The statistics of Pedroni (2004) are one-sided tests with critical value of 1.64 ($k < -1.64$, entails rejection of the null), with the exception of the u-statistic that has a critical value of 1.64 ($k > 1.64$ implies rejection of the null). Note that means and variances that compute the Pedroni statistics are reported in Pedroni (1999).

Table 6.2
Panel cointegration tests for heterogeneous panel

	Constant	Constant + Trend
	Model 4 (with interaction)	Model 4 (with interaction)
Panel-v	-2.243*	3.503*
Panel-ρ	3.155*	3.728*
Panel-t	2.504*	-3.224*
Panel-adf	2.723*	3.139*
Group-ρ	4.317*	4.468*
Group-t	1.768**	2.632*
Group-adf	2.629*	3.124*

Notes: All statistics are in Pedroni procedure (1999) and the adjusted values and can be compared to the N(0,1) distribution. ***, **, * indicate rejection of the null hypothesis of no-cointegration at 1%, 5%, and 10% level of significance.

At constant level, we analyzed that Model 4 with interaction term indicate that all 7 statistics refuse the null hypothesis of non cointegration at the 1% level of significance except for the group-t which is significant at the 5% level. Outcomes indicate that independent variables show cointegration in the long run for a group of

North African countries respective of economic growth. The panel highlights non-parametric(t-statistic) and parametric (*adf*-statistic) statistics and group statistics that are similar to the IPS-test statistics, the null hypothesis of non cointegration is rejected at the 1% and 5% level of significance.

In the panel cointegration test for Model 4 with constant plus trend level, the results indicate that all 7 statistics refuse the null hypothesis of non cointegration at the 1% level of significance. It is indicated that independent variables obey cointegration in the long run for a group of North African countries respective economic growth. Though the statistics favours cointegration, along with Pedroni`s (1999) view that the panel non-parametric(t-statistic) and parametric (*adf*-statistic) statistics are consistent in constant plus time trend, a long run cointegration among our variables in North African countries is concluded at the end.

As a whole in Table 6.2, it is shown that most of the panel statistics are trustworthy in constant plus time trend as measure up to the panel statistic in constant. It is highlighted by the panel non-parametric (t-statistic) and parametric (*adf*-statistic) statistics as well as group statistics that are analogous to the IPS-test statistics, the null hypothesis of non cointegration is refused at the 1% level of significance.

6.2.2 Cointegration Estimation Results - FMOLS

As the last section confirms all variables among the North African countries are cointegrated. Strictly, the long run equilibrium is present between the variables. This section describes the estimated long-run equation. Following Pedroni (2000 and 2001), cointegrating descriptive variables for the data is estimated with the help of Fully Modified OLS (FMOLS) methodology.

Dreger and Reimers (2005) pointed out that it is essential to note that the panel cointegration tests don`t offer an estimate of the long run relationship. More or less, the cointegration vector should be common for the panel members, as basic economic principles are involved. Moreover, hypothesis testing is a critical issue. Actually the asymptotic distribution of the OLS estimator drives by nuisance parameters. This is a severe issue when comes to panel environment, as the bias can accumulate with the size of the cross section. As Pedroni (2000) described, the problem increased in a panel setting by the potential dynamic heterogeneity over the cross-sectional dimension. Particularly, an increase in dimension leads to a second order biases taken place by the poor performance of the estimators designed for large samples as they are averaged over the panel's members. That is the purpose behind the modification of FMOLS method make inferences in cointegrated panels with heterogeneous dynamics as the cross-sectional dimension turn larger even in short time series (Al-Aswad and Harb, 2005).

Table 6.3
FMOLS (Individual) Results, Dependent Variable: Economic Growth (lnY_{it})

Indicator/country	Algeria	Egypt	Mauritania	Morocco	Tunisia
$lnDS_{it}$	-21.53**	-0.85	-14.40**	-7.16**	-2.55**
	(-2.37)	(-0.24)	(-2.34)	(-2.59)	(-2.11)
$lnFDI_{it}$	36.59***	0.04	10.61	6.65**	2.38*
	(6.73)	(0.82)	(1.32)	(2.70)	(2.80)
$lnED_{it}$	-0.03***	-0.11***	-0.03***	-0.01***	-0.03***
	(-9.82)	(-5.49)	(-5.49)	(-5.88)	-(3.67)
$lnXGS_{it}$	0.09**	0.11**	0.01***	1.04***	0.09***
	(2.39)	(2.51)	(5.35)	(8.49)	(6.87)
$lnSAV_{it}$	1.74	0.46***	0.14***	0.24***	0.50***
	(1.30)	(5.37)	(9.60)	(8.45)	(3.68)
INF_{it}	-0.23***	-0.22***	-0.20***	-0.07***	-0.25***
	(-11.91)	(-6.43)	(-7.83)	(-4.87)	(-5.99)
ER_{it}	-0.55***	-0.36***	-0.21***	-0.02***	-0.73
	(-5.03)	(-7.06)	(-5.16)	(-8.94)	(-0.85)
$lnFDI_{it} * DC_{it}$	-0.72**	-0.02**	-0.16**	-0.52**	-0.20**
	(-2.65)	(-2.49)	(-2.32)	(-2.87)	(-2.28)
$lnSAV_{it} * DC_{it}$	0.07**	0.02**	0.13**	0.43**	0.20**
	(2.20)	(2.50)	(1.99)	(1.94)	(2.37)

Note: The null hypothesis for the *t*-ratio is H$_0$=β_i= 0; Figures in parentheses are *t*-statistics
(*) and (**) significant with 95% (90%) confidence level;

Table 6.3 shows that the estimate of coefficient on debt service ($lnDS_{it}$) for Algeria, Mauritania, Morocco, and Tunisia are negative (-21.53, -14.40, -7.16, and -2.55, respectively) and statistically significant at the 5 per cent level. An estimate of coefficient for debt service for Egypt is statistically insignificant. The estimate coefficient for FDI inflows ($lnFDI_{it}$) for Algeria, Morocco and Tunisia are positive (36.59, 6.65, and 2.38, respectively) and statistically significant at 1 per cent, and 5 per cent level. The estimate of debt stock ($lnDE_{it}$) is negative for all countries [-0.03(Algeria), -0.11(Egypt), -0.03 (Mauritania), -0.01 (Morocco), and -0.03 (Tunisia)] and statistically significant at 1 per cent level. These results show that debt stock lift economic growth, which descripts a long run cointegration between that variable and economic growth in selected North African countries.

The estimate of net exports ($lnXGS_{it}$) is positive for all countries [0.09 (Algeria), 0.11 (Egypt), 0.01 (Mauritania), 1.04 (Morocco), and 0.09 (Tunisia)] and statistically significant at 1 per cent and 5 per cent level. These outcomes show that exports increase economic growth, which means that there is a long run cointegration between that variable and economic growth in selected North African countries.

The estimate of domestic saving ($lnSAV_{it}$) is positive for four countries [0.46 (Egypt), 0.14 (Mauritania), 0.24 (Morocco), and 0.50 (Tunisia)] and statistically significant at 1% level. These findings show that domestic saving increase economic growth, that describes a long run cointegration between that variable and in four North African countries except for Algeria. The same scenario was happen for inflation (INF_{it}), where the estimate coefficient is negative to all the North Africa countries [-0.23 (Algeria), -0.22 (Egypt), -0.20 (Mauritania), -0.07 (Morocco), and -0.25 (Tunisia)] and statistically significant at 1 per cent level.

The estimated coefficient of the exchange rate(ER_{it}) is negative for the four countries [-0.55 (Algeria), -0.36 (Egypt), -0.21 (Mauritania), and -0.02 (Morocco)] and statistically significant at 1 per cent level.

Table 6.3 also presents the interaction term between FDI inflows with dummy of debt crisis ($lnFDI_{it} * DC_{it}$) and domestic saving with dummy of debt crisis ($lnSAV_{it} * DC_{it}$). Every variable reported that tests reject the null hypotheses of non cointegration at the 1 per cent and 5 per cent level of significance. For interaction term between FDI inflows with dummy of debt crisis ($lnFDI_{it} * DC_{it}$), the estimate of

coefficient is negative [-0.72 (Algeria), -0.02 (Egypt), -0.16 (Mauritania), -0.52 (Morocco), and -0.20 (Tunisia)] and statistically significant at the 5 per cent level. Therefore, a long run relationship between interaction variable (FDI inflows with dummy of debt crisis) and economic growth is signified. For the interaction term between domestic saving with dummy of debt crisis ($lnSAV_{it} * DC_{it}$), the estimate of the coefficient is positive [0.07 (Algeria), 0.02 (Egypt), 0.13 (Mauritania), 0.43 (Morocco), and 0.20 (Tunisia)] and statistically significant at the 1 per cent level. The interaction variable (domestic saving with dummy of debt crisis) positively affects economic growth and implies that there is a long term cointegration.

Table 6.4
FMOLS (Group) Results, Dependent variable: Economic Growth (lnY_{it})

$lnDS_{it}$	$lnFDI_{it}$	$lnED_{it}$	$lnXGS_{it}$	$lnSAV_{it}$	INF_{it}	ER_{it}	$lnFDI_{it} * DC_{it}$	$lnSAV_{it} * DC_{it})$
0.88** * (11.19)	0.04*** (6.86)	0.10*** (10.09)	0.16*** (4.95)	0.37*** (5.65)	0.02*** (4.52)	1.06*** (3.56)	0.02*** (4.69)	0.05*** (4.71)

Note: The null hypothesis for the *t*-ratio is H$_0$=β_i= 0; Figures in parentheses are *t*-statistics
(*) and (**) significant with 95% (90%) confidence level

Table 6.4 shows all the variables detailed that tests reject the null hypotheses of non cointegration at the 1% level. All the variables show a positive coefficient [0.88 ($lnDS_{it}$), 0.04 ($lnFDI_{it}$), 0.10($lnED_{it}$), 0.16 ($lnXGS_{it}$), 0.37 ($lnSAV_{it}$), 0.02 (INF_{it}), 1.06 (ER_{it}), 0.02 ($lnFDI_{it} * DC_{it}$), and 0.05 ($lnSAV_{it} * DC_{it}$)] and statistically significant at the 1 level. Thus, it has been discovered that the panel groups give bigger estimation coefficient and better significance (1 per cent level) that would be the best depiction of the average long-run relationship. Hence, it is accomplished that all variables are cointegrated and have a long term relation.

6.3 Conclusion

This chapter examines the nature of each variable in panel unit root test as well as equation. In general, we could say that the integration order of the series are consistently $I(1)$. For this reason, panel cointegration (Pedroni; 1999 and 2004) approach is applicable. Section 6.2 provides the panel cointegration test based on Pedroni's procedure (1999 and 2004). Generally, we found that all the variables are cointegrated in the model. Therefore, the long run equation is extracted from the Fully Modified OLS (FMOLS) analysis (Pedroni; 1996, 2000, 2001).

CHAPTER SEVEN

DISCUSSIONS, CONCLUSIONS AND POLICY IMPLICATIONS

This chapter summarizes and concludes policy implications of the findings (as discussed in Chapter Five and Chapter Six), details limitations of the study, and suggestions for further research.

7.1 Discussions

External debt stock is a major challenge North African countries except Libya, because Libya is a country with a lot of country resources. Then, the repayment or "debt service" creates problems for North African countries because a debt repayment has to be returned with interest. Thus, returning huge debt limit a country's growth. It either wastes restricted resources or limits financial resources for domestic necessities for development of these countries. Another point of view is that debt adds to economic impact and the subsequent exit strategy. Means that war debts is not much troublesome for progress as the war-time government spending comes to an end when the peace return, but peacetime debt blast can be long lasting.

The appropriate estimation method and related econometric issues have been shown to have a significant impact on the quality of the estimation results. Firstly, results contained in Cunningham (1993), Karagol (2002), Metwally and Tamaschke (1994), Muhtar (2004), Pattillo, Ricci and Poirson (2001), and Malik *et al*. (2010)show that the choice of sample is important for studies which aim to predict potential debt

service, FDI inflows and others determinants between certain countries since significant parameter differences were found for estimates using alternative samples. The Three Stages-Least-Squares (3SLS) method was formulated and where the variables in the system are classified as endogenous and exogenous. Simultaneously within the model occur owing to few endogenous variables emerge as explanatory variables and all these limitations show all possible links between debt service, FDI inflow and economic growth has to be evaluated with a simultaneous equation using the 3SLS methods for Algeria, Egypt, Mauritania, Morocco, and Tunisia. The pool cross-section and time series data was used as a panel data analysis to study relationships between GDP and debt service, FDI inflows and other determinants using a single equation tests developed by Pedroni (1997, 2003).

The statistical properties of the explanatory variables in ADF unit root test is conducted to investigate the stationarity for each data series in the study and panel context using the Levin Lin and Chin (LLL) and Im, Pesaran and Shin (IPS) statistics. The first difference tests results from ADF indicating that $lnGNP_t$, $lnDS_t$, $lnFDI_t$, $lnED_t$, $lnXGS_t$, $lnSAV_t$, INF_t and ER_t are stationary after first differencing at order one, $I(1)$ and that cointegrating relationships may exist among the variables. While, the empirical results from the LLC and IPS tests evidently show the entire series in the model are $I(1)$, evident that they are stationary at first difference, while the results based on the tests for panel cointegration give empirical support that the variables can be taken as a cointegrated panel system.

Four vital findings are taken from the analysis according to the objectives of this study. Firstly, it examines the effects of debt service, FDI inflows, and other

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determinants on economic growth of North African countries. Secondly, it examines the effects of the debt service, external debt stock, inflation, the GNP, exports and exchange rate on the debt service of North African countries. Thirdly, it examines the effect of exchange rate, the GNP, Inflation, the debt service on FDI inflows of the selected North African countries. Furthermore, the 3SLS and Panel Data Analysis are augmented with a number of variables to test whether they are relevant in explaining economic growth, debt service and FDI inflows. These variables are the economic growth (proxy with GNP, debt service, FDI inflows, external debt stock, domestic saving, net exports, exchange rate, inflation, and dummy of debt crisis. Finally, we analyse to what extent potentials for the interaction term between a debt crisis with domestic saving and debt crisis with FDI inflows on economic growth, debt service and FDI inflows of North African countries.

A summary of the empirical results for Equation 4.5, 4.6, 4.7, and 4.15 using 3SLS for the selected North African countries are presented in Table 7.1 to Table 7.4. We found that by using 3SLS and Panel Data Analysis, there is an impact between independent variables and economic growth (GDP), debt service and FDI inflows even though some variables are not significant effects.

Table 7.1
Regression of Economic Growth Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	+ (s)	- (s)	- (s)	+ (s)	+ (s)
$lnDS_t$	- (s)	- (s)	- (s)	- (s)	- (s)
$lnED_t$	- (s)	- (s)	- (s)	- (s)	- (s)
$lnFDI_t$	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)
$lnSAV_t$	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)
$lnXGS_t$	+ (ns)	+ (s)	+ (ns)	+ (s)	+ (s)
INF_t	- (s)	+ (s)	- (s)	+ (s)	+ (ns)
$(lnFDI_t * DC_t)$	- (s)	- (s)	- (s)	- (s)	- (s)
$(lnSAV_t * DC_t)$	- (s)	+ (ns)	- (s)	+ (ns)	+ (s)

Note: + (positive), - (negative), s (significant), and ns (not significant)

Table 7.2
Regression of Debt Service Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	- (s)	+ (s)	- (s)	- (s)	- (s)
$lnED_t$	+ (s)	- (s)	+ (s)	+ (s)	- (s)
lnY_t	- (s)	- (s)	- (s)	- (s)	- (s)
$lnFDI_t$	- (s)	- (s)	- (s)	- (s)	- (s)
$lnSAV_t$	- (s)	- (s)	- (s)	- (s)	- (s)
$lnXGS_t$	- (s)	+ (ns)	- (s)	- (s)	- (s)
INF_t	+ (s)	- (ns)	+ (ns)	+ (s)	+ (ns)
ER_t	+ (s)	- (s)	- (ns)	- (s)	- (s)
$(lnFDI_t * DC_t)$	- (s)	- (ns)	- (ns)	- (s)	+ (ns)
$(lnSAV_t * DC_t)$	- (s)	- (ns)	+ (ns)	- (s)	- (ns)

Note: + (positive), - (negative), s (significant), and ns (not significant)

Table 7.3
Regression of Foreign Direct Investment Equation

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
Constant	+ (s)	- (s)	+ (s)	- (ns)	- (ns)
lnY_t	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)
$lnED_t$	- (s)	- (s)	- (s)	- (s)	- (ns)
$lnSAV_t$	+ (s)	+ (s)	- (ns)	+ (s)	+ (s)
$lnXGS_t$	+ (s)	+ (s)	+ (ns)	+ (s)	+ (s)
ER_t	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)
$(lnY_t * DC_t)$	- (s)	- (ns)	- (s)	- (s)	- (s)
$(lnSAV_t * DC_t)$	- (ns)	- (s)	- (s)	- (ns)	+ (ns)

Note: + (positive), - (negative), s (significant), and ns (not significant)

Table 7.4
FMOLS (Individual) Results; dependent variable: Economic Growth (lnY_{it})

Country	Algeria	Egypt	Mauritania	Morocco	Tunisia
$lnDS_t$	- (s)	- (ns)	- (s)	- (s)	- (s)
$lnFDI_t$	+ (s)	+ (ns)	+ (ns)	+ (s)	+ (s)
$lnED_t$	- (s)	- (s)	- (s)	- (s)	- (s)
$lnXGS_t$	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)
$lnSAV_t$	+ (ns)	+ (s)	+ (s)	+ (s)	+ (s)
INF_t	- (s)	- (s)	- (s)	- (s)	- (s)
ER_t	- (s)	- (s)	- (s)	- (s)	- (ns)
$(lnFDI_t * DC_t)$	- (s)	- (s)	- (s)	- (s)	- (s)
$(lnSAV_t * DC_t)$	+ (s)	+ (s)	+ (s)	+ (s)	+ (s)

Note: + (positive), - (negative), s (significant), and ns (not significant)

7.2 Conclusion

Main conclusions can be taken from the study. First of all, this was an attempt to recognize the important role of debt service as a determinant of economic growth rates in a sample of North African countries namely Algeria, Egypt, Mauritania, Morocco, and Tunisia. In 3SLS and Fully Modified Ordinary Least Squares (FMOLS) Tests, the results showed a negative sign and prominent relation amongst debt service and economic growth. The results from these analyses also support for the historical evidence presented by Karagol (2002) and Patenio and Tan-Cruz (2007). They show that debt service will decrease the economic growth.

Secondly, this study provides the important role of FDI inflows as determinants of economic growth in North African countries. Also by using Three-Stage Least Squares (3SLS) and Fully Modified Ordinary Least Squares (FMOLS) Tests, and the results show that FDI inflows play an important role and increased the economic growth in North African countries. These results are in line with Klein and Olivei (2008), Choong et al (2010), and Ferreira and Laux (2009) where they found that a positive relationship between portfolio $capital$ flows in economic growth.

Thirdly, it provides a new framework of a set of linkages to capture most of the important interaction among economic growth, debt service and FDI inflows and economic indicator, especially interacts with non-economic indicator. Interaction between debt crisis with FDI ($lnFDI_t * DC_t$) and domestic savings ($lnSAV_t * DC_t$) variable, there is a negative relationship. That means an additional channel through which debt crisis negatively affects huge economic growth. While interaction with debt crisis and FDI inflows ($lnFDI_t * DC_t$) give positive and negative affects less

economic growth (GDP) as compare without interaction before. The results of the effect of the interaction term between debt crisis and FDI inflows and domestic saving in selected North African countries are interesting. These interaction terms as an added regressor in the equations do not generally affect the sign or absolute magnitude of the estimates; they are not less precisely estimated than their counterparts. These results support earlier findings from other researchers who stated that typically economic agents in models of interaction are thought of as being placed on a lattice and interacting with their neighbours [Durlauf (1990), Blume (1993, Ellison (1993) and Brock and Durlauf (2001)].

Fourthly, by using 3SLS, the empirical evidence on the link between the determinants such as external debt stock ($lnEDS_t$), the growth rate of GNP ($lnGNP_t$), net exports ($lnXGS_t$), inflation rate (INF_t), exchange rate (ER_t), the dummy of debt crisis (DC_t), and the interaction term between debt crisis with FDI ($lnFDI_t * DC_t$) and domestic savings ($lnSAV_t * DC_t$) variable on debt service ($lnDS_t$) in North African countries. The results of the analysis showed a mixed significance effect. Some have a significant impact on some countries and some did not give significant results on a number of countries. But the overall results of the analysis show that there are positive and negative significance effects of the determinants on the debt service in North African countries. For examples, it has the positive effect of external debt stock on debt service for all North African countries. The economic growth has a negative relationship with debt service in all North African countries. An export has a negative effect on debt service and the effect of exports is significant to the North African countries except Morocco. Inflation variable is statistically important and show a

positive sign to all the North African. The exchange rate has a positive statistical significance of the debt service in Algeria, Mauritania, and Morocco but not in Egypt and Tunisia. The estimated coefficients of the debt crisis in the debt service equation are significant to all North African countries except Mauritania even though have negative signs as well. There is a negative coefficient for the interaction term between debt crisis and debt service in the North African countries.

Fifth, we estimate our Equations (4.7) using OLS, 2SLS, and 3SLSfor the effect of determinants on FDI inflows. The results shown is similar to the results in Equation (4.6), some have a significant impact on some countries and some did not give any significant results on a number of countries. But the overall results of the analysis show that there are positive and negative significance effects of the determinants on the debt service in the North African countries. For examples, GNP is negative in our estimation and it is statistically significant to all selected North Africa countries. External debt stock is negative in our estimation and it is statistically significant only for all selected North Africa countries too. While an export positively affects FDI inflows and the effect of exports is significant to the North African countries except Egypt. Inflation and exchange rates have statistically significant and have a negative sign to all North African countries except Algeria which has a positive sign in inflation and exchange rate.

The dummy of the debt crisis is used to find out the relationship between the FDI inflows and domestic saving in Equation 4.5, 4.6, 4.7, and 4.15. The estimated coefficients of the debt crisis in FDI inflows equation are significant for Algeria, Egypt, and Morocco countries except Mauritania and Tunisia even though they show

negative signs as well. There is a negative coefficient and significant for the interaction term between debt crisis and domestic saving to all North Africa countries except Tunisia.

7.3   Policy Implications

In accordance to the objectives of this study, several policy implications emerged from the analysis.   First, increased debt servicing responsibilities minimize the economic growth because huge parts of government income are utilized in returning interest. The normal debt service would affect domestic and foreign investment and reduce economic growth and the prospect of debt growing faster than the economy for the predictable future reduces consumer and investor confidence, inflict risk of huge future interest rates and uncontrollable federal debt service, and diminish the progress of selected North African countries. According to the analysis, it is recommended that the government should further promote the rational and proper utilization of resources, while increasing the concessionality of newly acquired debt inflows. The government also has to monitor the benefit of the debt service costs in the economy. It also indicates that policymakers should act early when choosing to lean against credit booms, before the debt service reaches critical levels.

Clements *et al.,* (2003) stated that debt service load boost taxes in the private sector and lowers private investment. Resources that might have funded investments are consumed by debt servicing. The uncertainty of debt service repayment creates disincentives and difficulties to pursue economic reform. In this context of selected North African countries, it is important to force the government to sustain present macroeconomic policies including prudent debt management policy. Growth- friendly

constituted policies that include infrastructure, trade, tax and social policies and regulatory frameworks that affect economic incentives for private investments and production should be implemented and sustained along with the fight against corruption. Currently the government shows the seriousness and these policy measures are adopted.

Secondly, external debt stock is a contract, and the holder has to fulfil the settled commitment and accruing interest. Therefore, the possibility of compounded and penal charges of debt-service defaults, and the income effect of debt service on economic growth, policy makers enjoined to fully assess the external borrowing to moderate the associated risks. The negative impact of this external debt stock affects areas of critical importance in the economic and development of North African countries.

The government must focus more on internally generated revenue to finance development projects until all debts and its interest are finally resolved. It is important for the government to reduce the cost of government with a view to immediately redeem the loan repayment and its servicing. Government should diversify the economy because they are the necessary development to generate more revenues and avoid selecting for the best loan alternative. The government should make more efforts to drive the attention of foreign direct investors as a cure for capital development.

The government of North African countries should devise new strategies to manage the external debt stock. Foreign exchange reserves are of utmost significance in

returning foreign debt the revenue generated from exports can help North African countries from bankruptcy. The country should be in good relations with other countries that with the consent of mutual imposition of trade barriers can be minimized and leads to the export of the products of North African countries in numerous countries. The government should also encourage local industries so to produce best quality of products in North African countries.

In this study also we propose that the North African countries should mobilize adequately resourced so that they are able to reach their debt service requirements on time and access to meet external resources, utilising the resources to mobilize private investment in them. External debt stock should be sustained otherwise it proves to be poor for the private investment behaviour, and results in congestion out. Through North African countries, need to channelize their resources rather putting energies in generating more chances for investment and attracting new investors to their countries.

In order to reduce the congestion effects of external debt stock, the North African countries should strive to benefit from the implementation of debt reduction schemes. If this could be combined with a strong effort from export expansion policy, it can reduce the resulting debt service ratio of two positive reinforcing conditions to ensure further growth and development of the country. Based on the external debt stock and debt service finding, it is recommended that North African countries should minimise both external and internal loans in order to avoid a large debt problem.

Thirdly, FDI inflows at tremendous rate will lessen the necessity of borrowing. At the same time the volume of resources dedicated to debt servicing has a positive relation to the size of the debt, economic growth, through its impact on FDI inflow; decrease the debt-service ratio. FDI inflows are endogenous to economic development: Removal of capital barriers infuses FDA inflow that corresponds to a transformation in expected outcomes existing in the domestic economy compared to a foreign country

From our finding, it is suggested that more thrust may be given for boosting the FDI inflows in the economy in order to achieve high economic growth in North African countries. These results suggest that the North African countries are more successful in sustaining beneficial levels the inflow of FDI to emphasize prudent macroeconomic policies, and enjoy the benefits of a virtuous cycle of FDI inflows less than trying to enjoy any potential benefits from increasing debt stronger (higher fiscal deficit) that may spark outflows improve in the future and the risk of falling into the trap of a vicious cycle.

Fourthly, our study examined the association of debt crisis with GDP growth, debt service and FDI inflows. It is because we believe that, so far, this profession is not able to deal with some fundamental questions behind the negative relation of debt crisis with GDP growth, debt service and FDI inflows.

The debt crisis is considered by economists as a serious sluggishness hazardous to economic performance. The debt crisis may shorten the policy horizon which leads to

suboptimal short term macroeconomic policy. It can also lead to more often switching

policies, creating uncertainty and thus negatively affect macroeconomic performance.

We suggest that the government's disunited politics as North African countries with a

high degree of debt crisis must address the root causes and try to mitigate its effect on

the design and implementation of economic policies. Only then, the countries can

have economic policies that can produce durable higher economic growth.

7.4   Limitations of the Study

The finding of this work draws some boundaries. Firstly, there are very important

limitations that disallow us to draw strong policy implication regarding the pool data

from the five selected North African countries. In other words, we could not draw

policy implication for every single country. We draw policy implications and explain

in this study as a general idea and applicable to North African countries. Secondly, the

sample size was small; with only 5 countries in North African Countries excluded

Libya because Libya is a mostly desert and oil-rich country.

Thirdly, our empirical analysis excludes target countries themselves. The study's only

econometric weapons are the OLS, 2SLS, and 3SLS equations and panel

cointegration equation. Its performance depends on, among other things, the

reliability of debt service, FDI inflows, and GNP growth data. It is reasonable to

oppose that data on trade flows between targets' neighbours and the rest of the world

are no less reliable than debt service, FDI inflows, and GNP growth in general.

Neighbours might have an incentive to conceal the origin or final destination of the

traded goods, but they don't have an incentive to distort the magnitude of debt service,

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FDI inflows, and GNP growth. On the other hand, it is hard to take seriously the data on debt service, FDI inflows, and GNP growth between targets and anybody else in the world for obvious reasons.

7.5   Suggestion for Further Studies

The empirical work in this literature was completed at the macroeconomic level, while the analysis of mechanisms through which trade and determinants of trade become effective should involve mostly microeconomics investigation. Also, macroeconomic analysis should be extended to include a more detailed breakdown of GNP growth, debt service, FDI inflows and determinants of GNP growth, debt service, and FDI inflows by functions and by type. Such a breakdown would allow extension of the analysis and distinguish between among various measures to reduce debt service and external debt stock and, then, adopted transparency in governance and bureaucracy to improve economic performance. For this purpose some additional variables should be used as control variables. We suggest that further studies on the empirical work should focus also on the implication of the entire mix GNP growth, debt service, and FDI inflows policies and good governing are required in order to improve economic development. Another point for further research it is better to consider the impact of private external debt on economic growth and the impact of external debt on foreign direct investments plus domestic revenue.

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