



Munich Personal RePEc Archive

# **The empirical evidence of corporate tax impact on private investment of developing countries using Ghana as a case study**

Tweneboah Senzu, Emmanuel

University College of Management Studies, Accra-Ghana,  
Department of Economics, Leicester University- UK.

22 February 2019

Online at <https://mpra.ub.uni-muenchen.de/92329/>  
MPRA Paper No. 92329, posted 23 Feb 2019 06:28 UTC

THE EMPIRICAL EVIDENCE OF CORPORATE TAX IMPACT ON PRIVATE INVESTMENT OF  
DEVELOPING COUNTRIES USING GHANA AS A CASE STUDY.

Emmanuel TWENEBOAH SENZU

*Professor of Economics & Investment Banking*

[Tsenzu@UCOMS.edu.gh](mailto:Tsenzu@UCOMS.edu.gh)

[UCOMS-RESEARCH INSTITUTE](#)

*Library of University College of Management Studies, Ghana*

*Frederic Bastiat Institute*

[\(www.fbiresearchedu.org\)](http://www.fbiresearchedu.org)

# CONTENTS

|  | <b>Pages</b> |
|--|--------------|
| Abstract.....  | 03           |
| A. Introduction & Background.....                                  | 04           |
| i. The Objective & Importance of studies.....                      | 07           |
| B. Literature review and theoretical.....                          | 07           |
| C. Methodology & Empiricism.....                                   | 20           |
| i. Hypothetical construction towards the experimental study.....   | 24           |
| ii. Definition of Investment according to this study.....          | 24           |
| iii. Definition of Corporate Tax according to this study.....      | 25           |
| iv. Interest Rate definition according to this study.....          | 25           |
| v. Exchange rate definition according to this study.....           | 26           |
| vi. Inflation definition according to this study.....              | 26           |
| vii. Definition of Public Investment according to this study.....  | 27           |
| viii. Definition of Money Supply according to this study.....      | 28           |
| ix. Technique adopted to estimate relationship among variable..... | 28           |
| 1.1 Unit root Tests.....   | 28           |
| 1.2 Co-Integration Tests.....                                      | 30           |
| 1.3 Granger Causality Tests.....                                   | 34           |
| x. Results & Discussion.....                                       | 36           |
| 2.1. Data summary and statistics.....                              | 36           |
| 2.2. Unit root Test Results.....                                   | 37           |
| 2.3. VAR Lag Length Selection.....                                 | 38           |
| 2.4. Co-Integration Tests.....                                     | 39           |
| 2.5. Long run estimates for private investment in Ghana.....       | 41           |
| 2.6. Short run dynamics for private investment in Ghana.....       | 45           |
| 2.7. Granger Causality Tests.....                                  | 51           |
| D. Conclusion, Recommendations and Research Direction.....         | 52           |
| xi. Conclusion.....  | 52           |
| xii. Recommendations.....  | 53           |
| xiii. Guide to future research.....                                | 53           |
| E. APPENDIX.....   | 55           |
| F. REFERENCES.....   | 58           |

## **ABSTRACT**

To understand and appreciate the crucial role privates' investment plays in developing economies towards it sustainable growth, it became an imperative assignment to investigate the effect of corporate taxes and it impacts on privates' Investment in developing countries, however narrowed the study on the economy of Ghana for the hypothetical test. For this very reason, the study sort to establish an empirical evidence between corporate tax and it impacts on private investment using the country Ghana as a case study, not excluding controllable variables like real GDP, Inflation, which is estimated under consumer price index, exchange rate measured nominally, government expenditure and finally domestic credits as a vector indicator using Johansen approach to co-integration.

**Keywords:** *Corporate Tax, Private Investment, Inflation, Gross Domestic Growth, Government Expenditure*

## A. INTRODUCTION & BACKGROUND

For the past decades, governments around the globe had tried to create an economic environments suitable for technologically intensive economic activities. In countries where the wage costs are relatively high, the economy need to focus on activities that add higher value to products or customers. As part of this development, various countries are resorting to the use of various tax incentives including that of corporate tax to support and to Stimulate higher investments by the private sector in order to expand output growth hence leading to the development of the country. Governments all over the world including the government of the Republic of Ghana are challenged with poverty alleviation, security, education, health and the general welfare of the citizenry. These call for the provision of social infrastructure and implementation of development projects among other things to improve the standard of living of the people. In view of these social commitments, governments need to generate enough revenue to meet their expenditures (Ahiawodzi & Tsorhe, 2013). Even though, it is observed that governments raise revenues from several other sources such as licenses, fees, and fines, etc. Corporate tax remains one of the largest contributors of government revenue comparable to the revenue of all the other sources been put together. This supports the assertion made by Otioku (1992) and cited by Azah (2005) that, “corporate tax has become one of the key sources of domestic revenue for the government. It is the major fiscal tool not only in mobilizing the much needed government revenue but also for directing investment flow and other desirable socio-economic behaviours”. Addo (2008) revealed that, corporate tax revenue in Ghana increased consistently between 2003 and 2006 from 58% to 60%. Governments depend on corporate tax as one of its revenue to fund their economies. Nearly all Sub-Saharan African countries rely on income tax on wages, corporate profit, international trade and excise taxes for a substantial share of their revenues (Terkper, 1996) cited in (Norgah, 1998), for any government to raise the expected revenue to meet its expenditure, depends on a large extent to its tax policies (Addo, 2008). In addition to providing social amenities, governments also have to provide enough jobs to cater for the employment needs of its citizens. But government alone cannot meet the employment demands of the people. Therefore there is a heavy reliance on

the private investors to create jobs to help government absorb the unemployed. It is often said that the private sector is the engine of growth of the economy. However, governments must create the right economic environment for the private sector to thrive. This is done through the use of fiscal or economic policies of which taxation policy is one (Ahiawodzi & Tsorhe, 2013). It is observed that, corporate taxes reduce the amounts of incomes available to the private firms for re-investment to expand the economy. Higher corporate taxes are noticed to be a disincentive to privates' investment since they erode whatever profits that are made by the firms and hence scare away the private investor. Norgah (1998), opined that an economy of deficits is not attractive to foreign investors and taxation is one of the means of ensuring the avoidance of deficits. However, higher taxes tend to drive out or scare off investors. This is a huge problem for any nation that wishes to attract foreign investors. Much as the nation wants to raise the maximum tax revenue from corporate tax, it is faced with the problem of ensuring that tax levels do not serve as a disincentive to private investment. The question to ask therefore is, what is the right level of corporate tax rate that will generate the optimum level of tax revenue and at the same time does not erode the investor's profits to the extent that they are thrown out of business? After all, profit is one of the major aim of every private investor. The extent to which privates' investment responds to the levels and changes in tax rates (elasticity of private investment to tax rates) is therefore the issue under consideration (Ahiawodzi & Tsorhe, 2013). In an attempt to balance the effects of tax on the investor, the tax system provides a lot of tax incentives including tax holidays, investment-tax-credits, capital allowances, lower taxes and tax rebates. These incentives go a long way to lessen the tax burden when taken advantage of by the investor. It is important to mention that, countries must be concerned about the trade-offs between the higher tax revenue from corporate taxes and the tax incentives (Ahiawodzi & Tsorhe, 2013). Apart from the usual factors of government attitude to private Investments, the caliber of public administration, political climate, foreign exchange convertibility and open trade policy, all have a critical effects on private investment. However it is further believed that a favourable tax system acts as an incentive to private investment. It has therefore been an area of concern to any governments, with Ghana not exception. Investment is a necessary condition for the development of every nation. Hormats

(2010) in alluding to how necessary investment is, indicated that “Investment also drives development”. He further expounded on the Monterrey Consensus in March 2002, which outlined sound policies to attract international investment flows and adequate levels of productive investment as a key factors in sustainable development. Investment apart from assisting in producing needs for man’s survival can also be used as a tool for transmitting technical change and product innovations. It is equally important for policy makers in developing countries to be able to assess how investment responds to changes in government policy, not only in designing long-term strategies but also in implementing short-term stabilization programmes (Hormats, 2010). The level of investment in Ghana is generally low, with the total investment in the 1970s standing at 12% of GDP on the average; in the 80s, it was 6% of GDP on the average. In the 1990s, however, the figure rose again to 12% of GDP on the average. There is therefore the need to investigate the factors that inhibit rapid investments growth in Ghana. Political upheavals in the 70s and early 80s reduced the level of confidence in the economy (Asante, 2000). Though private domestic and foreign direct investment has shown a considerable improvement, peaking at 16.7 percent and 3.3 percent of GDP in 2001 and 2000 respectively, there is still much to be done to increase it volume (Aryeetey & Baah Boateng, 2007). According to the World Bank (1991), the level of domestic savings and investments are inadequate to fuel the growth needed to raise living standards and generate sufficient productive employments. The role of taxation cannot be overemphasized as a way of stimulating investments in Ghana. Private investments in Ghana to some extent have been affected by macroeconomic factors like inflation, interest rate and exchange rate volatilities (Asante, 2000). Although these situations have considerably been stabilized, there is still a problem to the privates’ investment in Ghana. Ghana undoubtedly needs to raise her level of privates’ investment to create more employments opportunities but ironically, corporate taxes seem high. In the 60s, corporate tax was around 65%. This figure reduced to 60% in the 70s and later 55%, and 35% in the 80s and 90s respectively. This figure was further reduced to 28% and 25% in 2005 and 2006 respectively (Budget, 2007). The 2012 Budget Statement saw an increase in corporate tax in the mining sector from 25% to 35%.The latter is still astronomical to investors but a revenue opportunity for government of Ghana. Such call for a special need to

look at key issues retarding privates' investment in Ghana, which the compass to this problem signal corporate taxes as an indicative variable to consider, hence the need to investigate variables that impede investments in Ghana. This study therefore intend to empirically examine the economic impacts of corporate taxes on private investments in Ghana, taken into consideration the effect of other variables noted to equally have significant impact on private investments in Ghana . As a result, a lot of effort was displayed to extract quarterly data series from Bank of Ghana and the World Development Indicator from 1985 to 2011 as a bases to subject it into scientific analysis and arrive to a sound deduction, which will define the roots cause of poor privates' investment performance in Ghana.

### **I. The Objective & Importance of Studies**

The aspired objective of the study was to examine both long and short- term economic impact of corporate taxes on private investments, and further establish the causal relation, if any, with these chosen variables analyzed in the context of Ghana to offer policy recommendations. The vital reason behind this work, is to delve deeper into the economic effect of corporate taxes on privates' investment in Ghana. Which we believe is very crucial in understanding of how privates' investment behaves in Ghana as well as most of the developing countries, with an empirical evidence as a guide for policy formulation. It also provide a guide for further studies on performance assessment of the privates' sector investments growth of the economy. Which augments the relatively scarce empirical literature on the short-run and long-run economic effect of corporate taxes on privates' investment in Ghana.

### **B. LITERATURE REVIEW AND THEORITICALS**

The theories governing investment date back to Keynes (1936), who first called attention to the existence of an independent investment functions in the economy. A central feature of the Keynesian analysis was of the observation that, although savings and investments must be identical ex-post, savings and investments decisions are, in general, taken by different decision



makers and there is no reason why ex-ante savings should equal ex-ante investments. The next phase in the evolution of investment theory gave rise to the accelerator theory, which made investment a linear proportion of changes in output. In the accelerator model, expectations, profitability and capital costs play no role. Keynesians, in scholarly writings has traditionally favoured the accelerator theory of investment while disregarding the role of factor costs. A more general form of the accelerator model is the flexible accelerator model. The basic notion behind this model was that, the larger the gap between the existing capital stock and the desired capital stock, then the higher a firm's rate of investment. The hypothesis is that, firms plan to close a fraction of the gap between the desired capital stock,  $K^*$ , and the actual capital stock,  $K$ , in each period. This gives rise to a net investment equation with a formula as

$$I = \delta [K^* - K_{-1}] \dots\dots\dots \text{Eq. (1)}$$

Where  $I$  = net investment,  $K^*$  = desired capital stock,  $K_{-1}$  = last period's capital stock and  $\delta$  = partial adjustment coefficient. In the framework of the flexible accelerator model; output, internal funds, cost of external financing and other variables are classified as determinants of  $K^*$ . The flexible accelerator mechanism may be transformed into a theory of investment behaviour by adding a specification of  $K^*$  and a theory of replacement investment. An alternative econometric models of investment behaviour, which differ in the determinants of  $K^*$ , the characterization of the time structure of the investment process and the treatment of replacement investment. In the flexible accelerator model,  $K^*$  is proportional to output, but in an alternative models,  $K^*$  depends on capacity utilization, internal funds, the cost of external finance and other variables.

Another most influential structural analysis of investment for the last two decades has been the Jorgenson model (Jorgenson, 1971), pioneered by Dale Jorgenson and his followers. The Framework of the Jorgenson investment model is as follows;

$$I_t = \alpha \beta_j \Delta (Y_{t-j} C_{t-j}^{-\sigma}) + \mu \dots\dots\dots \text{Eq.2, } j=0$$

Where “I” is real investment, “Y” is output, “C” is the user cost of capital, to be defined in details later, while “σ” is a constant elasticity of substitution between capital and other inputs in production function, “μ” is a random error, “α” and “β<sub>j</sub>” are the parameters, and “Δ” is a lag operator. Behind this framework is the neoclassical theory, which deduce that competitive firms would maximize their discounted flow of profit by achieving instantaneously and an optimal (desired) capital stock “K” for the given output “Y”, that is,

$$K_t^* = \alpha Y_t C_t^{-\sigma} \text{-----Eq.3}$$

Where “C” is the user cost of capital, defined exactly as;

$$C_t = P_t^1 \left[ \frac{(r_t + \delta)(1 - m_t - Z_t)}{(1 - t_t)} \right] \text{-----Eq.4}$$

Where “P<sub>t</sub>” is relative price of capital goods (relative to price of output), “r<sub>t</sub>” is the Real financial cost of capital, “δ” is the capital depreciation rate, which is assumed to be geometric, “m<sub>t</sub>” is the rate of the investment tax credit, “Z<sub>t</sub>” is the tax depreciation allowance rate, “t<sub>t</sub>” is the corporate income tax rate. Although firms are assumed to be able to obtain any optimal capital stock “K<sub>t</sub><sup>\*</sup>” instantaneously, “α”, distributed lag on new investment orders is also assumed so, that the net investment equals the change in the desired optimal capital stock as given below:

$$I_t = \sum \beta_j \Delta K_{t-1}^* \text{-----Eq.5, } j=0$$

Combining equation (5) with equation (3) will yield the Jorgenson investment function as observed in equation 1. The Jorgenson investment model is considered to be the first systematical framework to define investment as a structural function of both the quantity and the relative price variables, although the framework defined in equation “1” can be treated as a more general form of some earlier investment models prior to Jorgenson. For example, if ‘j’ is assumed to be zero, that is, if the impact of price variables (relative price of capital goods,

interest rate, etc.) on investment is ignored, then equation “1” will become the Flexible-Accelerator, an Investment model developed by H.B. Chenery as cited in (Chenery & Strout, 1966). Furthermore, if the distributed lags are also omitted, then it will become the simple Accelerator-investment-model also proposed by J. M. Clark (Clark, 1917). The policy implications for investment are defined in the Jorgenson model through variables in the user cost of capital. Thus monetary policies would directly affect variable “r”. Then the fiscal policies, especially tax policies, would affect variables “m”, “Z” and “t” directly. The Jorgenson framework has been adopted for specification of investment functions in many macro-econometric models for forecasting and policy analysis. However, it has also received many criticisms (Chirinko, 1993). First of all, it is perceived that, the theoretical framework is inconsistent in terms of the profit maximizing behaviour of firms: Firms are assumed to maximize the profit flow by choosing the desired capital stock ( $K_t^*$ ), nevertheless, the distributed lags of delivery are imposed outside of the maximization decision process so that the investment path generated by the Jorgenson framework may not be optimal except for the case of static expectation. Secondly, the treatment of expectation in this investment framework is essentially static or extrapolative, which is regarded by some economists as to be fundamentally inconsistent with the forward looking nature of investment. Thirdly, the general neoclassical assumptions behind the Jorgenson investment framework are not accepted by all Economists. For example, if the assumption of decreasing the rate of return to scale is not held for the production function, the optimal capital stock, K, will not be well defined. Also, if markets (markets of goods and service, of labour and of finance) in a real economy are not as frictionless as assumed by the neoclassical theory, the framework will not be applicable (more on this criticism in the latter discussion of investment models for developing economies). There are more criticisms, such as the absence of consideration of vintage effect of capital, the new capital and the existing capital are assumed to be homogenous in this investment framework, but in reality they may not be the same and cannot be combined together at any desired proportions (Chirinko, 1993). Structural investment functions, especially the Jorgenson type investment functions, have been widely used in many macro econometric models for forecasting and policy analysis. However, since the late 1970s, these models have been

challenged by the Rational Expectation Theory, known as the Lucas Critique (Lucas, 1976), the Rational Expectation school claims that these models have fundamental flaws and are of no value in evaluating policies, because the expectations of individual agents are either ignored, or miss-specified in these models. The key point of the Rational Expectation theory is not the importance of expectation in economic decision making, which has been recognized by many economists as early as Keynes (1936), instead, it is the hypothesis that individuals are "rational" so they will not make systematic errors in forming their expectations. By further assuming that all individual agents would share the same macro-econometric model, which the theory claims the expectations of all individual agents should converge to the expectation specified in the macro-econometric model and should be equal to the exact true mathematical conditional expectations implied by the model itself. Therefore, whenever government changes a policy (the Rational Expectation theory considers policy rules, not discretionary policies), the expectation would change, that is, the parameters representing expectations in the model should vary for an alternative policy, rather than remain invariant as in most mainstream macro-econometric models (Lucas, 1976). The Rational Expectation theory has equally not been agreed by all economists. Some economists argued that the hypothesis was unrealistic at the micro level and superficial when it is applied to macro analysis (Miller, 1994). While there is no doubt that the Rational Expectation theory did revolutionize economic school of thought and establish a large impact on academic research—at least for a decade, the hypothesis has been used as a fashion in most economic research to generate views totally different from mainstream economics. However it has, had a little impact on the policy-making community who had continued to rely on the traditional models. The reason is, in addition to the theoretical debate, the theory is either irrelevant or inapplicable to empirical model based on policy analysis suggested by (Chirinko, 1993).

Another approach dubbed “neoliberal” (Galbis, 1979) emphasizes the importance of financial deepening and high interest rates in stimulating growth. The proponents of this approach are McKinnon and Shaw (1973). The core of their argument rests on the claim that, developing countries suffer from financial repression (which is generally equated with controls on interest rates in a downward direction) and that if these countries were liberated from their repressive

conditions, this would induce savings, investments and growth. Not only will liberalization increase savings and loanable funds, it will result in a more efficient allocation of these funds, both contributing to a higher economic growth. In the neoliberal view, investment is positively related to the real rate of interest in contrast with the neoclassical theory. The reason for this, is that, a rise in interest rates increases the volume of financial savings through financial intermediaries and thereby raises investible funds, a phenomenon that McKinnon and Shaw (1973) calls the “conduit effect”. Thus, while it may be true that, demand for investments, declines with the rise in the real rate of interest, it is realized, investments actually increases because of the greater availability of funds. This conclusion applies only when the capital market is in disequilibrium with the demand for funds exceeding supply. Boadway (1978) investigated the most efficient scheme of investment tax incentives in the neoclassical theory of investment and concluded that investment allowances and tax credits on gross investment over and above regular depreciation are efficient investment incentives. Sandmo (1974) and Averbach (1987) independently analyzed the effects of corporate income taxes on investments incentives. Sandmo (1974) used the neoclassical framework of investment and capital, which he found that, corporate income tax changes relative prices in favour of either short-term or long-term capital goods, depending on relative magnitudes of parameters involved. Averbach (1987), introduced personal income taxation and inflation in the model and found out that taxation had implications for risk taking and hence the type of investment undertaken. Corporate taxes reduce the return of equity holders and therefore tends to reduce risk taking. Earlier, Sandmo (1974) had concluded also that investment allowances and gross investment tax credit without basis in adjustment, favours short-term investment. However, Shah and Baffes (1991) concluded that investment incentives have not been effective in stimulating investments. The empirical findings though mixed, they are particularly relevant since they provide an explicit treatment of effect of taxation. Se-hark (1985) who had made studies on developing countries on investments planning reveals that investment and inflation are linked, as well as the size of government deficit. The linkage stems from the fact that government deficits were mainly contributed by the Implementation of ambitious Investment programs and predominantly financed by unrestrained credit expansion from the banking system, which is

not able to take independent decisions on monetary policy due to weak capital markets. Attitudes and policies toward foreign direct Investments is very important, if more Investments is to be encouraged in a country. A research carried out in Central American business community towards direct foreign Investments in 1969 under the auspices of the organization of American states show that 77% of businessmen interviewed expressed that direct foreign Investment was desirable in general, but 80% of those interviewed favoured some type of government control or regulation of direct Investment flows. Representation from the privates' sector recognize the possible benefits of private Investment, but nonetheless favours regulation because of the possibility that they themselves will be unable to compete with foreign owned enterprises. A Research carried out by Schneider (1985) found that there was direct empirical link between government policy variable and private capital formation. The result further proves that privates' Investment in developing countries is constrained by the availability of deficit financing as well as it monetary policy, by varying the flow of credit from the Public Sector to the private Sector, this can change Investment decisions in the private sector. The tightening of monetary policy which is an element of stabilization Policy would be expected to have adverse effect on the level of private Investment and would lead to a reduction in economic growth. Furthermore the flow of foreign capital may be affected by inappropriate exchange and interest rate polices and this may impact negatively on private investment. There is empirical findings which suggest that debt overhang and amortization can affect Investment, which is confirmed by Faimi and Melo (1990) paper; assessing that, debt burden has adverse effects on investments. Also Fitzgerald, Vos and Jansen (1994) looked at 22 developing countries from 1970 – 90 and found out that, the ratio of external debt to GDP have negative impact on private Investment. Server (1997) also confirmed this by saying uncertainty and instability are Investments deterrent after his research. He further found out that, terms of trade and real exchange volatility are adversely related and had effect on privates' Investment. Patillo (1997) worked at various regimes and some kind of uncertainty it had on irreversible Investment decisions using Ghana as an example, which has had several political regimes, some socialist, and some capitalist. She found out that, firms that expects unfavourable political regimes is more hesitant to invest and would have only a small level of investment as response

to favourable current response trends, this is driven on the reason of being too cautious about the future. Mint (1994) found out that, when capital is imported, and the government of the foreign investor, taxes the profit of that particular investor and also taxed by the country where it plans to invest, resulting in double taxation, and the Investor knows he can only have marginal profit, this many serve as a disincentive. They also looked at the rate of accelerated depreciation, which is, if an asset is capital in nature and long-lived with depreciation allowances for tax purposes, is accelerated; and yet an attempt is not made by a country to prevent depreciation deduction during periods of peak profits, will prevent a firm from Investing in such a country, even during their tax holidays. He further said, if effective rates and user cost of capital under tax holiday system allows depreciation allowances to be deferred until after the holiday, would be very beneficial to the firm and can act as a good incentive for Investments. According to Lent (1991), re-investment allowance can serve as an incentive for expanding businesses. If, It equally exempt from all income tax or part or corporate earnings that are retained to be invested in approved projects. This is similar to a grant, and lowers the risk element in business and allows a business to recoup its capital quickly and can serve as a good incentive in attracting potential investors into a country. In a related study, Asante (2000) employed the Ordinary Least Squares approach to model private investment behaviour in Ghana using time series data over the period of 1970 to 1992. Asante finds a positive public-private Investment relationship, which was significant at the 1% level suggesting a “crowding-in” effect of public investment on private investment thus confirming the theoretical hypothesis between the two variables. The growth rate of real credit to the private sector also has a significant positive-sign, in all the trials. Furthermore, the measure of macroeconomic instability has a negative-sign in the trials and significant at the 1% level, particularly in inflation rate. Asante in his paper established the detrimental effect of over-valued exchange rates, corruption and erratic import licensing, foreign exchange quotas for various sectors and rent-seeking activities on private investment over a study period. The political dummy representing political instability was highly significant and negative in all the trials. Lagged private investment /GDP ratio was also found to be positive and significant, indicating a good investment climate, which act as a good indicator for current investment decisions. GDP growth rate had negative

significant sign contrary to expectation but marginally significant in a few trials thus rejecting the accelerator theory of investment in Ghana. Badawi (2004) investigated the impact of macroeconomic policies on private investment in Sudan employing annual data over the period of 1969-1998. The focus was on public investment, credit, devaluation, and interest rate policies while blending co-integration, vector autoregressive (VAR) and error correction techniques to estimate the long and short run coefficients. The results suggested significant crowding-out effect of public investment over private investment in Sudan. Devaluation policies also contributed to discouraging private sector capital expansion. Monetary policy in the form of restricting domestic credit appeared to have had a significant impact on private investment. This was indicated by the positive impact of banking sector credit on private investment. Increasing real interest rates has been impacting negatively on privates' investment in Sudan. Blejer and Khan (1984) incorporated features of the neoclassical model into investment models for developing countries. Their approaches took into account the relevant data problems and structural features that caused a gap between the modern theory of investment and the models that were specified for developing countries. They focused on the role of government policy and derived an explicit functional relationship between the principal policy instrument and private capital formation. Using the model, they were able to assess the extent of any "crowding out". The second extension that Blejer & Khan (1984) did was to make a distinction between government investment that is related to the development of infrastructure and government investment of other kinds. They found a positive relationship between the share of private investment in total investment and the ratio of total investment to income. They also found that the larger the share of private investment, the higher the average growth rate of the economy. These patterns indicate the relevance of private investment behaviour in developing countries and call for the testing of formal models of private capital formation in individual countries. Two principal conclusions emerged from Blejer & Khan's (1984) tests of formal model for 24 developing countries. The first was the possibility of identifying well established empirical function for private investment in developing countries. This challenged the traditional view that standard investment theory is not relevant for developing countries and conclude their theory by establishing a direct empirical links between governments of



developing countries and related private investment. Shrestha and Chowdhury (2006) used the Autoregressive Distributive Lag (ARDL) modeling approach for 34-years period data from 1973 to 2007 to test the financial liberalization hypothesis, which specifically relates to effect of interest rate on savings and investments. Their findings strongly supported the crux of McKinnon-Shaw financial liberalization hypotheses that, interest rate has a significant positive relationship with savings, and savings was found to be positively related to investment, hence a positive relationship between interest rate and investment. Reinhart and Tokatlidis (2001), in a study of 50 countries (14 developed and 36 developing) report that financial liberalization appears to deliver: higher real interest rate (reflecting the allocation of capital toward more productive, higher return projects.); lower investment, but not lower growth (possibly owing to a shift to more productive uses of financial resources); a higher level of foreign direct investment; and high gross capital flows. Liberalization appears to deliver financial deepening, as measured by the credit and monetary aggregates-but, again, low income countries do not appear to show clear signs of such a benefit. As regards savings, the picture is very mixed. In some regions, saving increased following financial sector reforms; but in majority of cases saving declined following the reforms. Indeed, it would appear that what financial liberalization delivers is greater access to international capital markets, although this appears to be uneven across regions and income groups. Bandiera, Caprio, Honohan and Schiantarelli (2000) constructed an index of financial liberalization on eight sovereign nations based on these three indicators, which were, prudential regulation; securities markets deregulation; and capital account liberalization. Their data spans from 1970-94 for Chile, Ghana, Indonesia, Korea, Malaysia, Mexico, Turkey and Zimbabwe. Among the key findings of the estimation of their benchmark model is that, there is no evidence of any positive effect of the real interest rate and savings. Indeed in most cases the relationship is negative, and significantly so in the cases of Ghana and Indonesia. Furthermore, the effects of the financial liberalization index on savings are mixed: negative, which is significant in Korea and Mexico; positive which is significant in Turkey and Ghana. The long-run effect of financial liberalization is sizeable. Corresponding to the realized change in the index, the estimated model indicates a permanent decline in the saving rate of 12% and 6% in Korea and Mexico, and a rise of 13% and 6% in Turkey and Ghana

respectively. Naa-Idar, Ayentimi and Frimpong (2012) employed the techniques of co-integration and error correction modeling to identify the determinants and their respective nature of relationship with private investment in Ghana over the period of 1960-2010 both in the short-run and long-run perspectives. Their study employed mechanisms to deal with the problems of unit root faced in time series data and they found that, inflation, exchange rate, public investment, GDP, trade openness, aid and external debt both in a short-run and long-run significantly affect the level of privates' investment. They further applied the general to specific approach to error correction modelling, and the statistical results, suggested the existence of stable long-run co-integrating relationship between macroeconomic and other variables on privates investment. Eregha (2010), with time series data for the period of 1970- 2002, employed dynamic model of two equations using instrumental variable technique estimation to examined the variations in interest rate and its impact on investment in Nigeria. His results revealed that investment decision played a negative and significant role in interest rate behaviour in the short- run and long-run, while aggregate savings, government spending and money stock played a positive significant role in interest rate changes. He then identified that interest rate plays a highly significant positive role in investment decisions in Nigeria. Ronge and Kimuyu (1997) examined the determinants of private sector investment for Kenya, using data over the period 1964-1996. A double logarithmic form of investment equation was estimated using OLS. The results indicated that both the availability of credit and foreign exchange exerts significantly positive effects on private investment confirming the results in most empirical studies. Private investment however, was adversely affected by the stock of debt. Specifically, a 1% increase in the lagged debt to GDP ratio, reduced private investment by 0.3%. The study also established a negative effects of exchange rate depreciation on investment, while public investment crowded in private investment, contrasting the results of Were (2001) for Kenya where crowding-out was found. Interest rate was also found to be less important in determining the level of private investment in Kenya. Akpalu (2002) used annual time series data from 1970 – 1994, on Private Investment, Public Investment, Real GDP, Consumer Price Index (CPI), Lending Rate, Credit to the private sector and GDP per capital, to model the determinants of private investment. He employed the Engle-Granger Two Step procedure and

the Johansen multivariate test. The study reveals that, in relative terms, the private investment in the short-run responds more, to real per capital income growth, credit availability and public investment. Public investment was found to crowd-out private investment. There was also a significant negative relationship between cost of capital and private investment in both the short and long-run. Further, a significant positive relationship between real GDP and private investment was found in both the short and long-run models but was not significant in the short-run. This result indicates a confirmation of the accelerator theory investment in Ghana. The Consumer Price Index however was found not to be significant in both situations. Islam and Wetzel (1991), in a World Bank Study empirically examined the link between real private investment on one hand and real public investment/GDP, corporate tax revenues/GDP, credit to the private sector /GDP, real rate of interest and a dummy from 1976 to 1991. The dummy of 1976 was included because of the large and unexplained drop in private investment in that year. Employing Ordinary Least Squares (OLS), they found a negative public-private relationship and a positive relationship between corporate tax revenue and flow of credit to the private sector in the case of Ghana, thus confirming the findings of Akpalu (2002) but contrast that of Asante (2000), where public investment was found to crowd-in private investment in Ghana. The study also established a positive relationship between corporate tax revenue and flow of credit to the private sector with all the variables having significant coefficients. However, real interest rate was found not to have a substantial effect on private investment even though it has the expected negative sign. Thomas (1997) in his study of 86 developing countries examined data on their terms of trade, real exchange rates, property rights and civil liberties and concluded that, while factors including credit availability and the quality of physical and human infrastructure are important influences, uncertainty in the investment environment was negatively related to private investment in sub Saharan countries. Employing the variability in real exchange rates as an explanatory variable in regression analysis, in his cross-country study on the macroeconomic environments and privates' investment in six Pacific Island countries, observed a statistically significant negative relationship between the variability in the real exchange rate and private investment. Vergara (2004) empirically modeled the link between corporate tax reform and private investment performance of Chile from 1975 to 2003. The

result affirmed the theoretical underpinning that privates' investment is negatively affected by higher corporate tax rates. Furthermore, crowding-in effect of public investment was established while the investment climate, proxied by the lagged private investment was found to boost private sector investment in Chile. Attar and Temel (2002) in their paper "Modeling Private Manufacturing Investment in Turkey", modeled private investment in the manufacturing sector in Turkey. The empirical results showed that in the long run, private manufacturing investment responds positively to an increase in the manufacturing sector's real income and negatively to an increase in public investment or cost of capital. Mbanga (2002) investigated the impact of external debt on private investment in Cameroon from 1970-1999, Using time series data over the period under the study, he finds the investment accelerator effect in existence as a significant positive real GDP-private investment relationship was found. The "debt overhang" hypothesis was also confirmed in the case of Cameroon as well as the "crowding-out" effect of debt service ratio, which public investment however crowded-in private investment. While the investment climate captured by the lagged value of private investment, stimulates current levels of investment. There was also a confirmed positive and significant relationship between credit expansions and private investment, whereas deteriorating terms of trade and depreciating real exchange rate had negative effects on private investment. Mehrara and Musai (2011) investigated the nonlinear relationship (inverted U) between real interest rate and private investment in developing countries during 1970-2007 based on threshold dynamic panel approach. Results indicate that real interest rate have positive effect on the private investment below threshold level, but beyond the estimated threshold, real interest rates have negative effect on private investment. The results indicate that the threshold of real interest rate above which interest rate significantly slows growth is around 5-6 percent for these economies. So if real interest rates increase beyond the threshold, its effect on investment is positive. Marbuah and Frimpong (2010) did an empirical work on factors determining foreign direct investment in Ghana using the error correction technique within an ARDL framework. The findings shows that, in the short-run, private investment is determined by public investment, inflation, real interest rate, openness, real exchange rate and a regime of constitutional rule in the short-run. Again, real output, inflation, external debt, real

interest rate, openness and real exchange rate significantly influenced private investment response in the long-run. Kotlikoff (2011) in a study on the topic: Is corporate income tax regressive? Revealed that, the U.S. corporate tax income is relatively high compared to many other countries. Again, statutory tax rate is 35%, but their effective rate is lower, at 28% due to subsidies and tax credits and other tax breaks that corporations receive on their investments. It came out that, some countries like Portugal lower the effective rate to 19%. High corporate tax encourages U.S. corporations to invest overseas, and discourage foreigners from investing in the United States. This reduces demand for U.S. workers, compared to what it would be if U.S. tax rates were lower. As a result, American workers' wages are lower than, they otherwise would be. Conversely, increased overseas investment raises the wages of workers abroad. The study concluded that US tax system is regressive and that if the United States cut its corporate income tax rate dramatically, the country would likely experience a huge rise in net domestic investment, which is now running at a post-war low of 4 percent. This would, potentially, raise U.S. workers' wages dramatically by as much as 10 percent. As part of the conclusions, the study recommended elimination of corporate income tax in the US. Ahiawodzi and Tsorhe (2013) also investigated the effect of corporate income tax rate reforms on private investment in Ghana where a model was specified with private investment as a dependent variable and six other independent variables including corporate income tax rate, and employed the Ordinary Least Square (OLS) multiple regression technique for the estimation. The empirical results revealed that the level of corporate income tax rate in Ghana, adversely affected the level of private investment during both pre-tax reform and post-tax reform period. In the same study, interest rate also had a negative effect on private investment during the period of the study.

### **C. METHODOLOGY & EMPIRICISM**

The scope of this study, was to critically examine the effects of corporate taxes on the level of privates' investment in Ghana by including other controllable variables for comparative studies. The analysis for deduction was built on the quarterly data series from 1985 to 2011 from World Development Indicator of the World Bank and Bank of Ghana as 26years data study period.

Which was proxies by gross fixed capital formation under privates sector Investment category.

Variables considered for studies were as follows

- I. Corporate Taxes
- II. Inflation measured under consumer price index
- III. Exchange rate measured under nominal rate
- IV. Public Investment
- V. Government Expenditure
- VI. Real GDP
- VII. Domestic Credit

This study employed the Johansen approach to co-integration, however, one major limitation with the Johansen approach to co-integration is that, it is based on VAR methodology that is inherently over parameterized, which is sensitive to both model specification and lag length selection. The selected lag length has implications for the outcome of the co-integration and causality test. Nevertheless, the co-integration and causality test of my work, produced consistent results. Another observed challenges, which has confronted previous researchers, was unavailability of quarterly data, particularly in developing countries, as requisite variables suggested by the theoretical models in the determination of privates' investment analysis. This means that some of the variables either have to be excluded in the empirical model, albeit with the risk of an Omitted variables bias, or proxies have to be found for those variables for a complete model analysis. The risk involved in finding proxies, is the situation of not correctly representing the impact of the actual variables of the material market, resulting in inconsistent results. Striking this balance, poses a serious challenge to empirical studies on the determinants of privates Investment analysis. However, these problems seem not to have significantly affected the constructs of this study, since they were consistent with both the theoretical and empirical literature, resulting in the following hypothetical constructs towards the experimental tests

Hypo-Test 1:

*H0* ; There is no long run economic impacts of corporate taxes on privates’ investment in Ghana

*H1* ; There is a long run economic impacts of corporate taxes on privates’ Investment in Ghana

Hypo- Test 2:

*H2*; There is no short run economic impacts of corporate taxes on privates’ investment in Ghana

*H3*; There is a short run economic impacts of corporate taxes on privates’ investment in Ghana

Hypo-Test 3:

*H4*; There is no causal relationship between corporate taxes and privates’ Investment in Ghana

*H5*; There is a causal relationship between corporate taxes and private’ Investment in Ghana

This study adopted the quantitative research design. In respect to the objectives of this study, systematical approach was adopted to collect and present data in a method of examining the effect of corporate taxes on private investments in Ghana by including other control variables. The significant efforts of this research design, was to maximize objectivity, replication and generalization of findings. This research design ensures that, the researcher set aside his personal prejudices and biases to ensure objectivity in the conduct of the study, for quality conclusions to be drawn. This ensure an accurate and valid representation of the variables that are relevant to the objectives of the study. Analyzing the purpose and the objective of the study in selecting the best model of analysis applicable and realistic, in which flexible accelerator model was adopted and expressed as;

$$I^g = \left(\frac{\alpha}{c}\right) \Delta Y + \delta K \dots\dots\dots \text{Eq. (6)}$$

Where;

$I^g$  ... .. Investment

$\delta K$  ... .. Replacement of Investment

$\left(\frac{\alpha}{c}\right)$  ..... User cost of capital

$\Delta Y$  ... .. Charge in output

To be able to capture all relevant variables from both Keynesian and Neoclassical traditions, the study adopted a general model whose functional form is expressed as depicted in equation (7). The variables in the study were chosen based on theories of investment and empirical literature. Thus the study follows Cebula and Koch (1989) and Asante (2000) by adopting their model specification for private investment with some modifications. The private investment equation is then specified as in equation one (Eq.1)

$$PRIV_t = \eta [CTAX_t, INT_t, PUB_t, RGDP_t, EXR_t, CPI_t, M2_t] \dots \dots \dots \dots \dots Eq. 7$$

- PRIV<sub>t</sub>* ... .. Private Investment
- CTAX<sub>t</sub>* ... .. Corporate Tax
- INT<sub>t</sub>* ... .. Interest Rate
- PUB<sub>t</sub>* ... .. Real exchange rate
- RGDP<sub>t</sub>* ... .. Consumer price Index as proxy for inflation
- EXR<sub>t</sub>*..... Real GDP
- CPI<sub>t</sub>* ... .. Public Investment
- M2<sub>t</sub>* ... .. Money Supply

In consistent with the objectives of the study and in accordance with the literature, the study applied natural logarithm to equations (7), with the exception of the interest rate and corporate tax; resulting in the estimation of a log-linear modelling, forming equation (8)

$$Log PRIV_t = Log \eta + \alpha_1 INT_t + \alpha_2 Log PUB_t + \alpha_3 Log RGDP_t + \alpha_4 Log EXR_t + \alpha_5 Log CPI_t + \alpha_6 Log M2_t + \alpha_7 CTAX_t + \mu_t \dots \dots \dots \dots \dots Eq.8$$

Given that  $\log \eta = \alpha_0$ , then the long run model for private investment will be deduced as;

$$Log PRIV_t = \alpha_0 + \alpha_1 INT_t + \alpha_2 Log PUB_t + \alpha_3 Log RGDP_t + \alpha_4 Log EXR_t + \alpha_5 Log CPI_t + \alpha_6 Log M2_t + \alpha_7 CTAX_t + \mu_t \dots \dots \dots \dots \dots Eq.9$$

However it observed that in the short run, private investment may depend on its own lagged values, lagged values of interest rate, consumer price index, public investment, real GDP,



exchange rate, money supply and corporate tax. As a result, the expected relationship among these variables are deduced below as the equation 10;

$$\begin{aligned} \Delta \text{Log PRIV}_t = & \alpha_0 + \sum_{i=1}^j \delta \Delta \text{Log PRIV}_{t-1} + \sum_{i=1}^k \alpha_2 \Delta \text{Log PRIV}_{t-i} + \sum_{i=1}^q \alpha_3 \Delta \text{Log RGDP}_{t-1} \\ & + \sum_{i=1}^w \alpha_4 \Delta \text{Log EXR}_{t-i} + \sum_{i=1}^n \alpha_5 \Delta \text{Log CPI}_{t-i} + \sum_{i=1}^h \alpha_6 \Delta \text{Log M2}_{t-i} \\ & + \sum_{i=1}^m \alpha_7 \Delta \text{CTAX}_{t-i} + \varphi \text{ECT}_{t-1} + v_t \dots \dots \dots \text{Eq. 10} \end{aligned}$$

The expected signs of parameters according to equation 10 is as follows;

$$\alpha_1 < 0, \alpha_2 > \text{or} < 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 < 0, \alpha_6 > 0, \alpha_7 < 0$$

While PRIV, INT, PUB, RGDP, EXR, CPI, M2 and CTAX are already defined above, “μ” and “v” is the error terms for both the long-run and short-run model respectively, “t” as time subscript and Log, is the logarithm of the respective variables. Note that  $\alpha_1$  to  $\alpha_7$  are the elasticity’s of the respective variables with “φ” showing the speed of adjustment to the long-run, when there is a short run disturbance in the system, “Δ” is a differential operator and  $\text{ECT}_{t-1}$  is error correction term, lagged one period and “ $\alpha_0$ ” is the drift component. We applied the natural logarithm in order to effectively linearize exponential trend (if any) in the time series data, since the log function is the inverse of an exponential function (Asteriou & Price, 2007).

### I. Definition of Investment according to this study

In the theoretical concept of [investment], the change in capital stock during a period was the study focus. The investment flow in a period can be calculated as the difference between the capitals stock at the end of the period and the capital stock at the beginning of the period. Thus, the investment flow at a time period t, could be defined as:  $I_t = [K_t - (K_t - 1)]$  Where ‘ $I_t$ ’ was the stock of the capital market at the end of period ‘t’ and ‘ $K_{t-1}$ ’ is the stock of capital at the end of period ‘t-1’ (and thus at the beginning of period). For the purpose of this study,

investment is any expenditure that is aimed at increasing the value of a business. Thus private investment is aimed at increasing value of a private business, which is not made by the government.

## **II. Definition of Corporate tax according to this study**

Corporate tax refers to a tax imposed on entities, taxed at the entity level in a particular jurisdiction. It could also be interpreted as a levy placed on the profits of firms with different rates based on different levels of profits. Thus corporate taxes are taxes against profits earned by businesses during a fiscal year. Corporate tax reduces the amounts of incomes available to the private firms for re-investment to expand the economy. Higher corporate taxes is a disincentive to privates' investment, since they erode whatever profits made by the firms and hence scare away the private investors. According to Norgah (1998) an economy of deficits is not attractive to foreign investors and taxation is one of the means of ensuring the avoidance of deficits. However, higher taxes tend to drive out or scare off investors. Given that all other factors remain constant and following Norgah (1998), corporate taxes is expected to be negatively related to private investment  $\alpha_7 < 0$

## **III. Interest Rate definition according to this study**

Interest rate is the amount of money paid in addition to the principal capital by the borrower, who has been extended a credit facility. The effect of interest rate on private investment in developing countries is potentially ambiguous. Under the neoclassical investment model, interest rate is treated as a key component of the user cost of capital and therefore affect private investment negatively. However, there is also an argument that, a higher interest rate increases the flow of bank credits, which complements the private sector savings and furthermore facilitates private capital formation and hence private investment. Thus, a negative coefficient of real interest rate will imply user cost of capital effects, whereas a positive real interest rate would support the complementarity hypothesis. In other words, the sign of

interest rate is an empirical issue and depends on whether the data support the McKinnon-Shaw hypothesis or the neoclassical model. But for the purpose of this study and following the neoclassical arguments, interest rate is expected to have negative effect on privates' investment as defined by the parameter  $\alpha_1 < 0$ , when all other factors are held in constant.

#### **IV. Exchange rate definition according to this study**

Exchange rate is the rate in which the Central bank of a nation is prepared to purchase a foreign currency. There is no theoretical debates on the effect of exchange rate in developed countries but developing countries are so vulnerable to imports particularly the intermediate and capital goods. Therefore, changes in exchange rate are crucial for output. Thus an increase in exchange rate or depreciation of the importing country's currency (Ghana Cedi), production cost increases and investment returns decreases thereby discouraging investment. (Serven & Solimano, 1992). Exchange rate acts as an adverse supply shock in the production of investment goods as argued by Chibber and Mansoor (1990). Given that all other factors remain constant and following Serven and Solimano (1992) and Chibber and Mansoor (1990), then exchange rate is expected to be negatively related to private investment  $\alpha_4 < 0$ .

#### **V. Inflation definition according to this study**

Inflation is an explanatory variable in the model and is used as a proxy for macroeconomic instability because it measures the persistent increase in the general price levels. In Tobin Model, a high rate of inflation lowers the interest rate thereby moving portfolio adjustments away from real money and balances it towards real capital assets (Tobin, 1969). Thus a high rate of inflation is expected to decrease interest rate, thereby decreasing investment, according to this model. But in developing countries, inflation act as a proxy for macroeconomic instability and may increase uncertainty and affect private investment adversely. Again, high and unexpected rate of inflation is expected to lead to a contraction of private investments. This is because it causes distortions of relative prices, increases the risk of long term investments and

reduces the average maturity of commercial lending as confirmed by Akporkodje (1998). Given that all other factors remain constant and following Tobin (1969) and Akporkodje (1998) inflation proxied by consumer price index, is expected to be negatively related to private investment  $\alpha_5 < 0$

## **VI. Definition of Public Investment according to this study**

Public investment encompasses investment in physical infrastructure made by government and public corporations. The impact of public investment on private investment is another important issue in many studies of investment in developing economies, since the ratios of public investment to GDP are comparatively high in many developing economies. Theoretically, no general conclusion could be deduced on the effect of public investment on private investment. It can be positive or negative, depending on the specific case. When public investment involve infrastructure, such as transportation and communication system, schools, utility system, it will have positive effect on private investment because the investment in these systems will facilitate the implementation and realization of private business activities. Increased public goods and services from these systems will generate large spillover benefit and tend to increase the total factors of productivity and labor efficiency. Meanwhile, increasing public investment will increase aggregate demand and thus will directly raise the expected rate of return on private investment. However, on the negative side, when public investment involve large state owned enterprises producing competitive goods and services, competing with the private sectors, it will have substitute, or crowd-out effects on private investment. Moreover, when large spending for public capital leads to large internal and external indebtedness, or heavier tax burden, higher interest rates, or credit rationing, it will crowd out private investment. So, the overall effect of public investment on private investment is uncertain and complex. Hence given that all the other factors remain constant, public investment is expected to have a positive or negative effects on private investment  $\alpha_2 > < 0$ .

## **VII. The Definition of Money Supply according to this study**

Money supply (M2) from the World Development Indicators (WDI) is defined as money and quasi money plus foreign currency deposits to the banks excluding those of government. With the quantitative theory of money, money stock can be represented by any monetary aggregate. However the choice of M2 is based on the fact that, it is broad and covers most financial transactions in Ghana. Given that all things remain constant and following Keynesian position, we expect money supply to be positively related to private investment hence  $\alpha_6 > 0$ .

## **VIII. Techniques adopted to estimate relationship among variables**

To examine the long run and short run relationship among the main variables of studies, we employed the Granger causality test within the framework of co-integration and error-correction models. The Augmented Dickey-Fuller (ADF) and the Phillips-Perron test statistics were all equally employed to analyze the time series properties of the data set. This were done by carrying out the following steps carefully, as stated below;

1. Unit roots test was applied to determine whether our variables are stationary.
2. We tested for the co-integration using Johansen's multivariate approach.
3. Finally, granger-causality was employed to test for causality.

The causality test preceded co-integration testing because the presence of Co-integrated relationships; has implications for the way in which causality testing is carried out.

### **1.1. Unit root tests**

The results related to long-run as well as short-run relationship often rests on the observation period and the economic techniques used. In this regard, when time series data are used for analysis in econometrics, several statistical techniques and steps must be undertaken. First of all, unit root tests was applied to each series individually in order to provide information about the stationarity of the data. To test for the presence of unit roots and to determine the order of integration in other to obtain statistically stationary series of variables, Augmented Dickey-

Fuller Test and Philips-Perron was equally applied. The ADF test is based upon estimating the following equation sectioned as 11

$$\Delta X_t = \alpha + \delta t + \rho X_{t-1} + \sum_{i=1}^p \lambda_i \Delta X_{t-1} + \varepsilon_{1i} \dots \dots \dots \text{Eq. 11}$$

The use of ADF, is to test the null hypothesis, that a series of data contains unit roots against the alternative hypothesis with an evidence of no unit root. That is;

$$H_0 : \rho = 0 \mid H_1 : \rho \neq 0$$

Where " $X_t$ " represents the series at time " $t$ ", " $\Delta$ " is the first differential operator, while, ' $\alpha$ ', ' $\delta$ ', ' $\rho$ ', ' $\lambda$ ' are the parameters to be estimated and " $\varepsilon$ " is the stochastic random disturbance term. It is widely known that the ADF tests do not consider cases of heteroscedasticity and non-normality that are regularly disclosed in raw data of economic time series variables, and are also unable to discriminate between stationary and non-stationary series that has a high degree of autocorrelation. The Philips-Perron (PP) test for unit roots is also used in the empirical analysis in order to resolve this problem. It is also observed that, the PP test is superior to the ADF test in situations where the time series variables under consideration have serial correlations and a structural breaks. This is based on the assumptions inherent in both tests. The ADF test assumes the error terms are independent with a constant variance, whereas the PP test assumes, the error terms are weakly dependent and heterogeneously distributed and thus provides robust estimates over the ADF, and is specified as below and sectioned as equation (12);

$$\Delta X_t = \alpha + \lambda_2 X_{t-1} + \theta \left( t - \frac{T}{2} \right) + \sum_{i=1}^m \theta_i \Delta_{t-1} + \varepsilon_{2i} \dots \dots \dots \text{Eq.12}$$

In both equations, which is equation 11 & 12, ' $\varepsilon_{1i}$ ' ' $\varepsilon_{2i}$ ' are covariance stationary random error terms.

The following hypotheses are therefore tested in both situations:

$H_0$ : The series contains unit root

$H_1$ : The series is stationary

So the null hypothesis will depict that: The series containing unit roots, implies non stationary, which is against the alternative hypothesis that depicts, it does not contain unit roots, implying stationary. The rule is that, if the ADF and PP statistics are higher (in absolute terms) than the critical values, then we will not accept the null hypothesis and conclude that, there is no unit root, implying stationary. Also, if the ADF and PP statistics are less negative than the critical values, then we will accept the null hypothesis and conclude that, there is unit root, implying non-stationary.

## 1.2. Co-Integration Tests

Two or more variables are said to be co-integrated, if there is a long-run equilibrium relationship or they share common trend. Co-integration exist when a linear combination of two or more non-stationary variables are stationary. Non-stationary series with a unit root, after first differential; appears to provide appropriate solution to the problems associated with non-stationary series, however, first differential tends to eliminate all the long-run information, which economists are normally interested in. Granger (1986) later identified a link between non-stationary processes, and preserved the concept of a long-run equilibrium. Johansen and Juselius approached co-integration as follows; once pre-testing has demonstrated that the variables are integrated at the same order, OLS is used to estimate the parameters of a co-integrating relationship. It is observed that, the application of OLS to an I (1) series yields super consistent estimates, which such estimates converge onto their true values at a faster rate than the case of I (0) or stationary variables are used in estimation. Then, these parameter values are used to compute the residuals. Co-integration test are the tests for stationarity of the residuals by using DF and ADF tests. If the residuals are stationary, there exist one co-integrating relationship among variables and it will rule out the possibility of the estimated relationship being "spurious". Since the residuals are estimated by OLS, by construction, the





are Co-integrated, further assuming “ $\Delta$ ” represent the first differences, equation (13) is transformed into an equilibrium error correction model of the form sectioned below as equation (14)

$$\Delta X_t = \alpha + \Pi X_t + \psi_1 \Delta X_{t-1} \dots \psi_{k-1} \Delta X_{t-k+1} + \varepsilon_t, t = 1, 2 \dots n \text{----- Eq. 14}$$

Where  $\psi_i = -(\phi_{i+1} + \dots + \phi_k)$ ,  $i = 1, \dots, k-1$  and  $\Pi = -(I - \phi_1 - \dots - \phi_k)$

This  $\psi_1$  represent the matrix coefficient of the first differential variables that capture the short-run dynamics. The coefficient of the lagged dependent variable, indicate inertia as well as the formation of expectations. The coefficient of the other lagged endogenous variables provide estimates for pass-through effect or impact assessments. The coefficient matrix " $\Pi$ " contains information about the long-run relationships among the variables. Which is involved in the model. Since " $t$ " is stationary, the rank of matrix " $\Pi$ ", denoted by " $r$ ", determines how many linear combinations of " $X_t$ " are stationary, i.e., the number of co-integrating vectors. The null hypothesis that submit that, there are at most  $r$  ( $0 < r < m$ ) co-integrating vectors in the system is defined as a reduced rank below;

$$H_0(r): \Pi = \alpha\beta \text{..... Eq.15}$$

While  $\alpha$  and  $\beta$  are  $m, x, r$  matrices. The " $r$ " columns of " $\beta$ " are the co-integrating vectors providing the " $r$ " long-run relationship ( $\beta'X_t$ ) among the series. These co-integrating relation are such that  $\beta'X_t$  is stationary, although  $X_t$  is not stationary. The loading matrix  $\alpha$  contains the adjustment parameters. These adjustment parameters indicate the speed of adjustment of the various markets. That is, the null hypothesis  $H_0$  is tested against alternative hypothesis  $H_1$  ( $m$ ) specifying that " $\Pi$ " is of full rank. That is the rank of  $\Pi = r = m$ . If the alternative hypothesis is accepted, this means that,  $X_t$  is stationary and hence the VAR model as in equation (7) is to be used. If the rank of  $\Pi = r = 0$ , thus  $\Pi = 0$ , then no stationary long-run relationship exist among the variables and hence the VAR model in first differences is to be used. It is only when the null hypothesis is accepted that the error correction model is to be used. The error correction

representation of equation (14) is expressed under the null hypothesis and established as equation (16) below;

$$\Delta X_t = \alpha + \psi_1 \Delta X_{t-1} + \dots + \psi_{t-k} + \theta(\beta' X_{t-p}) + \varepsilon_t \dots \dots \dots \text{Eq.16}$$

Where the columns of “ $\beta$ ” are interpreted as distinct co-integration vectors providing the long-run relationships ( $\beta'X_t$ ) among the variables, and  $\theta$ 's are the adjustment or the error correction coefficients indicating the adjustment to the long-run equilibrium. " $\beta$ " Contains the coefficients of the “ $r$ ”, a distinct co-integrating vectors giving that  $\beta'X_t$  is stationary, meanwhile ( $X_t$  may not necessarily be Stationary). One major problem in the estimation of VAR and VEC models is the selection of an appropriate lag length. Thus strictly speaking, in an m-variable of VAR model, all the “ $m$ ” variables should be stationary. The lag length plays a crucial role in diagnostic tests as well as in the estimation of VECM and VAR models (Bhasin, 2004). As a result, appropriate lag length ( $p$ ) will be chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation. Johansen (1988), Co-integration techniques allow us to test and determine the number of co-integrating relationship between the non-stationary variables in the system using a maximum likelihood procedure. There are two tests to determine the number of co-integrating vectors namely, the trace test and the maximum eigenvalue test. They are defined as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \lambda_i) \dots \dots \dots \text{Eq.17}$$

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \lambda_{(r+1)}) \dots \dots \dots \text{Eq.18}$$

Where " $\lambda_i$ " represent the estimated value of the characteristic roots, “ $T$ ” is the number of usable observations, and “ $r$ ” is the number of distinct co-integrating vectors. In the trace test, the null hypothesis ( $H_0$ ) is that, there is at most “ $r$ ” co-integrating vectors ( $r = 0, 1, 2, \dots$ ) which is tested against an alternative hypothesis. Alternatively, in the maximum eigenvalue test, the null hypothesis ( $H_0: r = 0$ ) is tested against the alternative ( $H_1: r = 1$ ), this is followed by ( $H_0: r = 1$ ) against ( $H_0: r = 2$ ) and so forth. The trace and maximum Eigen value statistics are compared with the critical values tabulated in Osterwald-Lenum (1992). The distribution of the statistics

depends on the number of non-stationary components under the null hypothesis and whether or not a constant is included in the co-integrating vector.

### 1.3. Granger Causality Test

The study of causal relationships among economic variables has been one of the main objectives of empirical econometrics. Also according to Engle and Granger (1987), co-integrated variables must have an error correction representation. One of the implications of Granger representation theorem is that, if non-stationary series are co-integrated, then one of the series must granger cause the other (Gujarati, 2004). Thus, Granger (1986) observed that, it is difficult to determine the direction of causality between two related variables. Therefore to examine the direction of causality in the presence of co-integrating vectors, Granger causality is conducted based on the following, sectioned as equation (19) & (20)

$$\Delta X_t = \alpha_0 + \sum_{i=1}^p \beta_{1i} \Delta X_{t-1} + \sum_{i=0}^p \psi_{1i} \Delta Y_{t-i} + \varphi_{1i} ECT_{t-1} + v_t \dots\dots\dots \text{Eq.19}$$

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^p \beta_{2i} \Delta Y_{t-1} + \sum_{i=0}^p \psi_{2i} \Delta X_{t-1} + \varphi_{2i} ECT_{t-1} + \mu_t \dots\dots\dots \text{Eq.20}$$

Where  $\Delta X_t$  and  $\Delta Y_t$  are non-stationary dependent and independent variables, ECT is the error correction term, where  $\varphi_{1i}$  and  $\varphi_{2i}$  are the speed of adjustments, “p” is the optimal lag order while the subscripts “t” and “t-1” denote the current and lagged values. If the series are not co-integrated, the error correction terms will not appear in equation 19 and 20. To find out whether the independent variable (X) granger-causes the dependent variable (Y) in equation 19, we examined the joint significance of the lagged dynamic terms by testing the null hypothesis;  $H_0 : \psi_{1i} = 0$ , Which Implies, the independent variable (X) does not granger-cause the dependent variable (Y), against the alternative hypothesis, which is  $H_1 : \psi_{1i} \neq 0$  Implying, the independent variable (X) granger-cause the dependent variable (Y). Also to find out whether the independent variable (Y) granger-cause the dependent variable (X) in equation (15), we examine the significance of the lagged dynamic term by testing the null hypothesis;  $H_0 : \psi_{2i} = 0$ , this implies that, the independent variable (Y) does not granger-cause the dependent variable

(X), against the alternative hypothesis as  $H_0: \psi_{2i} \neq 0$ , which implies that the independent variable (Y) granger-cause the dependent variable (X). Using the standard F-test or Wald statistic, four possibilities exist: The first (1st) possibility is the rejection of the null hypothesis in equation (19) and failing to reject the null hypothesis in equation (20) at the same time, implies uni-directional causality is running from X to Y. The Second (2<sup>nd</sup>) possibility is a rejection of the null hypothesis in equation (20) and at the same time failing to reject the null hypothesis in equation (19), which equally implies, there is a uni-directional causality running from Y to X. The third (3<sup>rd</sup>) possibility is the simultaneous rejection of the two null hypotheses, which indicates, bi-directional causality. The finally the forth (4<sup>th</sup>) possibility is the simultaneous failure to reject the two null hypotheses, which indicates independence or no causality relationship between the variables of interest. This study employed both descriptive and quantitative analysis. Charts such as tables and graphs were employed to aid in the descriptive analysis. Unit root tests were carried out on all variables to ascertain their order of integration. Furthermore, the study adopted the Johansen's maximum likelihood econometric methodology for co-integration, introduced and popularized by Johansen (1988), Johansen and Juselius (1990) to obtain both the short and long-run estimates of the variables involved and also to verify the direction of causality among the variables. All estimations were carried out using Econometric views (Eviews) 7.0 package. The robustness of the coefficient was used to determine the nature of the relationship and also whether it is statistically significant. The study followed the standard literature of Cebula and Koch (1989) and Asante (2000) to specify the econometric model for private investment. Quarterly time-series data on interest rate, exchange rate, CPI as a proxy for inflation, real GDP, public investment, money supply and corporate tax from 1985:Q1-2011:Q4 were used for the study, signifying 26years historic data captured. Moreover, the Johansen approach to co-integration and vector error correction model (VECM) were employed to examine the economic implication of corporate tax on private investment in Ghana by including other control variables.

## IX. Results & Discussion

### 2.1. Data Summary and Statistics

Table X4.0

| <i>Statistical Measurement</i> | LPRIV     | CTAX     | INT      | LPUB      | LRER     | LRGDP    | LCPI      | LM2       |
|--------------------------------|-----------|----------|----------|-----------|----------|----------|-----------|-----------|
| <i>Mean</i>                    | 14.34193  | 9.442130 | 25.26620 | 15.10158  | 3.443263 | 21.90125 | 1.663073  | 18.02356  |
| <i>Median</i>                  | 14.34742  | 8.750000 | 26.00000 | 15.08051  | 3.36582  | 21.87690 | 1.955570  | 18.25994  |
| <i>Maximum</i>                 | 16.06386  | 13.97603 | 45.00000 | 16.67931  | 4.813920 | 22.87475 | 4.153610  | 22.16461  |
| <i>Minimum</i>                 | 11.77483  | 5.943627 | 2.076525 | 13.54950  | 2.734651 | 21.29174 | 1.360421  | 13.40058  |
| <i>Standard Deviation</i>      | 1.144592  | 2.778873 | 10.32321 | 0.822531  | 0.356719 | 0.377170 | 1.656197  | 2.510471  |
| <i>Skewness</i>                | -0.255516 | 0.300440 | 0.343195 | -0.002995 | 1.430317 | 0.353267 | -0.293412 | -0.130476 |
| <i>Kurtosis</i>                | 2.217780  | 1.618955 | 2.768674 | 2.294404  | 5.923781 | 2.405543 | 1.766579  | 1.817483  |
| <i>Jarque-Bera</i>             | 3.928599  | 10.20753 | 2.120989 | 2.240558  | 75.29275 | 3.836564 | 8.395599  | 6.598991  |
| <i>Probability</i>             | 0.140254  | 0.051680 | 0.346284 | 0.326189  | 0.155200 | 0.146859 | 0.215029  | 0.136902  |
| <i>Sum</i>                     | 1548.928  | 1019.950 | 2728.750 | 1630.970  | 371.8724 | 2365.335 | 179.6119  | 1946.544  |
| <i>Sum of Square Deviation</i> | 140.1797  | 826.2686 | 11402.86 | 72.39169  | 13.61557 | 15.22155 | 293.4999  | 674.3635  |
| <i>Observations</i>            | 108       | 108      | 108      | 108       | 108      | 108      | 108       | 108       |

Source: E.T. Senzu, (2019), computed from BoG and WDI (1985-2011) data using Eviews 7.0 package

The study outline, the descriptive statistics of the variables involved, which Table 4.0 above illustrates these statistics. It could be observed from the table that, all the variables had positive average values (means). There is a minimal deviation of the variables from their means with the exception of the interest rate comparatively as shown by the standard deviations, attests to the fact that, taking logs of variables minimizes their variances. The standard deviation of interest rate is relatively big because it was not logged. The data from the Table 4.0 further indicates that almost all the variables show signs of negative skewness with the exception of interest rate, real exchange rate, corporate tax and real GDP. The Jarque-Bera statistic test generated from the series, which are drawn randomly from normally distributed populations depicts that the null hypothesis cannot be rejected for most of the variables as shown above.

## 2.2. Unit root test results

In order to examine the relationship between corporate tax and private investment by including other control variables, it was imperative to carry out unit root test to confirm whether the variables are not integrated of an order higher than one. This will guarantee the avoidance in the possibility of spurious regression results. As a result, all the variables were examined by first checking their trends graphically. From the graphs as presented in the Appendix column and captured as Exhibit A and B of this publication, it can be seen that, all the variables appear to exhibit behaviours of non-stationary series at various levels. However, the plots of all the variables in their first differences exhibit some stationary behaviour. This means that all the variables are stationary after first difference. The order of integration of the variables were also tested via the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The Schwarz-Bayesian Criterion (SBC) and the Akaike Information Criterion (AIC) were automatically used to determine the optimal number of lags included in the test. The table below as X4.1 and X4.2 reports the results of the unit root tests with intercepts and trends.

Table X4.1; Unit Root Test/ADF Test for the Order of Integration

| Levels    | Trends and Intercepts |     |          | 1 <sup>st</sup> Difference | Trends and Intercepts |      |
|-----------|-----------------------|-----|----------|----------------------------|-----------------------|------|
| Variables | ADF Statistics        | Lag | Variable | ADF Statistics             | Lag                   | IO   |
| LPRIV     | -1.051063 (0.7325)    | 4   | DLPRIV   | -6.727078 (0.0000)***      | 3                     | I(1) |
| LCPI      | -1.160034 (0.9129)    | 4   | DLCPI    | -4.513012 (0.000)***       | 3                     | I(1) |
| LM2       | -2.892319 (0.1692)    | 0   | DLM2     | -3.189122 (0.000)***       | 0                     | I(1) |
| CTAX      | -2.892319 (0.1692)    | 1   | DCTAX    | -6.871056 (0.000)***       | 3                     | I(1) |
| LPUB      | -1.303570 (0.6259)    | 1   | DLPUB    | -6.565445(0.000)***        | 0                     | I(1) |
| INT       | -1.458086(0.8375)     | 4   | DINT     | -7.128360 (0.000)***       | 3                     | I(1) |
| LRER      | -2.248119 (0.1909)    | 5   | DLRER    | -4.267753(0.0008)***       | 4                     | I(1) |
| LRGDP     | -0.337012 (0.9986)    | 12  | DLRGDP   | -6.585966 (0.0000)***      | 10                    | I(1) |

Source: E. T. Senzu (2019), *Computed from BoG and WDI-Data (1985-2011), Used Eview 7.0 pac. 'D' attached to variables denotes first differentials. \*\*\* Represent significance at 1% level. The number in brackets are P-Values. While 'I0' represent the order of Integration. 'Bwd' denotes bandwidth*

Table X4.2; Unit Root Test-PP Test for the Order of Integration

| Levels    | Trend and Intercepts |     |          | 1 <sup>st</sup> Difference<br>Trends and Intercepts |     |      |
|-----------|----------------------|-----|----------|---|-----|------|
| Variables | PP Statistics        | Bwd | Variable | PP Statistics                                       | Bwd | I0   |
| LPRIV     | -0.609124 (0.8630)   | 10  | DLPRIV   | -5.229474 (0.0000)***                               | 28  | I(1) |
| LCPI      | 0.674051 (0.9996)    | 4   | DLCPPI   | -11.69310 (0.0000)***                               | 3   | I(1) |
| LM2       | -0.792651 (0.9625)   | 1   | DLM2     | -8.394284 (0.0000)***                               | 7   | I(1) |
| CTAX      | -1.822802 (0.6869)   | 2   | DCTAX    | -4.180424 (0.0067)***                               | 23  | I(1) |
| LPUB      | -2.771965 (0.2109)   | 2   | DLPUB    | -6.603554(0.0000)***                                | 4   | I(1) |
| INT       | -1.386962 (0.8595)   | 9   | DINT     | -7.189918 (0.0000)***                               | 19  | I(1) |
| LRER      | -4.449362 (0.1909)   | 5   | DLRER    | -9.579200 (0.0000)***                               | 5   | I(1) |
| LRGDP     | -1.676327 (0.4403)   | 0   | DLRGDP   | -16.12654 (0.0000)***                               | 11  | I(1) |

Source: E. T. Senzu (2019), *Computed from BoG and WDI-Data (1985-2011), Used Eview 7.0 pac. 'D' attached to variables denotes first differential. \*\*\* Represent significance at 1% level. The number in brackets are P-Values. While 'I0' represent the order of Integration. 'Bwd' denotes bandwidth*

From the tables above, the following were observed; both the ADF and PP statistics for all the logged variables were all stationary after first difference. According to the test results from the above, taken into consideration the intercepts and trends, the null hypothesis has to be rejected at the existence of unit root in all the variables after first difference.

### 2.3. VAR Lag Length Selection

One of the problems in the estimation of VAR models, is the selection of an appropriate lag length. The lag length plays a vital role in diagnostic tests as well as in the estimation of VAR models for co-integration, impulse response and variance decomposition (Bhasin, 2004). Appropriate lag length (p) is chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors, with no serial correlation. The results of the VAR lag selection criteria for the models are presented in the table X4.3 below:

Table X4.3: VAR Lag Order Selection Criteria for Private Investment Model

| Lag | Log L     | LR        | FPE       | AIC       | SC        | HQ        |
|-----|-----------|-----------|-----------|-----------|-----------|-----------|
| 0   | -2931.185 | N/A       | 4.12e+08  | 39.70520  | 39.84696  | 39.76279  |
| 1   | -1163.243 | 3344.755  | 0.033771  | 16.47625  | 17.61033  | 16.93703  |
| 2   | -977.3815 | 334.0479  | 0.005335  | 14.62678  | 16.75318* | 15.49073* |
| 3   | -928.1374 | 83.84815  | 0.005374  | 14.62348  | 17.74220  | 15.89061  |
| 4   | -861.3424 | 107.4136  | 0.004313  | 14.38301  | 18.49405  | 16.05331  |
| 5   | -798.4638 | 95.16153* | 0.003698* | 14.19551* | 19.29887  | 16.26900  |
| 6   | -772.0633 | 37.46588  | 0.005281  | 14.50086  | 20.59654  | 16.97752  |
| 7   | -751.4638 | 27.28044  | 0.008336  | 14.88465  | 21.97265  | 17.76448  |
| 8   | -715.2639 | 44.51609  | 0.010951  | 15.05762  | 23.13794  | 18.34064  |

**Source:** E. T. Senzu (2019), computed from WDI and BoG Data from (1985-2011) Using 7.0 Eviews pac. Lag Order selected by the criterion is denoted with \*, LR; Sequential modified test statistic each test of 5% level, FPE; Final predictor error, AIC; Akaike information criterion, SC; Schwarz information criterion and HQ; Hannan-Quinn information criterion.

According to the table X4.3 above, it is observed from the VAR lag selection criteria that there are asterisks attached to some statistics of the five lag selection criteria (AIC, LR, SC, FPE and HQ). Tracing these statistics against the first column labelled 'lag' shows that, they coincide with lag 5, which imply that, the appropriate lag length to be chosen is 5 for the model.

#### 2.4. Co-integration Test

Contributing to the significance and rational, for co-integration analysis, Johansen (1988) argued that co-integration can be used to establish, whether there exists a linear long-term economic relationship among variables of interest. Pesaran and Shin (1999) added that co-integration, enable researchers to determine whether there exists disequilibrium in various markets. In this regard, Johansen (1988) asserts that co-integration allows for the specification of a process of dynamic adjustment among the co-integrated variables and disequilibrium markets. Given that the series are I (1), the co-integration of the series is a necessary condition for the existence of a long run relationship. Under the assumption of linear trend in the data, and an intercept and trend in the co-integration equation, the results of the Johansen co-



integration test of private investment market in Ghana is presented in the table as X4.4 and X4.5 below:

Table X4.4: Johansen's Co-integration Test (Trace) Results

| Hypothesized |            | Trace     |                | 0.05          |  |
|--------------|------------|-----------|----------------|---------------|--|
| No. of CE(S) | Eigenvalue | Statistic | Critical Value | Probability** |  |
| None**       | 0.561734   | 311.7785  | 187.4701       | 0.0000        |  |
| At most 1**  | 0.442677   | 227.6356  | 150.5585       | 0.0000        |  |
| At most 2**  | 0.359400   | 168.0053  | 117.7082       | 0.0000        |  |
| At most 3**  | 0.320069   | 122.5796  | 88.80280       | 0.0000        |  |
| At most 4**  | 0.291670   | 83.23159  | 63.87610       | 0.0005        |  |
| At most 5**  | 0.222408   | 48.05734  | 42.91525       | 0.0141        |  |
| At most 6    | 0.144871   | 22.39886  | 25.87211       | 0.1275        |  |
| At most 7    | 0.061144   | 6.43550   | 12.51798       | 0.4071        |  |

**Source:** E. T. Senzu (2019), Computed from WDI and BoG data from (1985-2011). The Trace test indicates 6 co-integrating equation(s) at both 5% and 1% levels. (\*\*) denotes a rejection of the hypothesis at the 5% (1%) level

Table X4.5: Johansen's Co-integration Text (Maximum Eigen Value) Results

| Hypothesized |             | Max-Eigen |                | 0.05           |  |
|--------------|-------------|-----------|----------------|----------------|--|
| No. of CE(S) | Eigen Value | Statistic | Critical Value | Probability*** |  |
| None **      | 0.561734    | 84.14284  | 56.70519       | 0.0000         |  |
| At most 1**  | 0.442677    | 59.63031  | 50.59985       | 0.0046         |  |
| At most 2**  | 0.359400    | 45.42574  | 44.49720       | 0.0395         |  |
| At most 3**  | 0.320069    | 39.17425  | 38.33101       | 0.0381         |  |
| At most 4**  | 0.291670    | 35.17425  | 32.11832       | 0.0205         |  |
| At most 5    | 0.222408    | 25.65848  | 25.82321       | 0.0525         |  |
| At most 6    | 0.144871    | 15.96331  | 19.38704       | 0.1468         |  |
| At most 7    | 0.061144    | 6.435550  | 12.51798       | 0.4071         |  |

**Source:** E. T. Senzu (2019), Computed from WDI and BoG data from (1985-2011), Using 7.0 Eview pac. (\*\*) denote rejection of the hypothesis at the 5% (1%) level. Max-Eigen value test indicate 5 co-integrating equation at both 5% and 1% level.

It could be observed from table X4.4 that, the trace statistic indicates the presence of co-integration among the variables. Specifically, the null hypothesis of no co-integrating relationship or vector ( $r = 0$ ) is rejected, since the computed values of the trace statistic of 48.05734 is greater than its critical value of 42.91525 at 1% level. That is; applying the Johansen test to the quarterly series spanning from 1985:Q1 to 2011:Q4, enable us to conclude that,

there exists at most six (6) co-integrating relationships. This confirms the existence of a stable long-run relationship among private investment, interest rate, public investment, corporate tax, and money supply, consumer price index a proxy for inflation, real exchange rate and real GDP. But for the purpose of this study, the first co-integration relation will be estimated based on the fact that, there are co-integrating vectors among the variables. The estimated long-run equilibrium relationship for private investment was derived from the un-normalized vectors as presented in Table X4.5 above.

## 2.5 Long Run Estimates of Private Investment in Ghana

Table X4.6: Un-normalised Co-integrating coefficients for Private Investment

| LPRIV     | LPUB      | LRER      | LM2       | LCPI      | INT       | CTAX      | LRGDP     | TREND     |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| -1.341825 | 8.951484  | 17.67215  | -15.40738 | 22.11174  | -0.104694 | 2.970141  | -17.63311 | 0.494097  |
| 0.622851  | 16.19451  | 6.282613  | 11.47178  | 7.031968  | -0.278559 | -0.336561 | -17.76179 | -1.778432 |
| 6.389726  | -8.732799 | 4.600058  | -5.476981 | 5.909384  | 0.347587  | 2.681907  | -11.73939 | -2.032172 |
| 2.044615  | -15.70261 | -9.829984 | 4.078433  | 0.782911  | 0.154694  | -1.081012 | 71.59397  | -1.045045 |
| -2.293398 | 3.909151  | 10.05644  | 24.11714  | -13.38772 | -0.023819 | 0.395705  | -41.86851 | -0.625163 |
| -3.098465 | 7.800673  | 3.121160  | -1.663036 | -2.081841 | 0.061766  | 1.141235  | -45.27798 | 0.781685  |
| 2.935470  | -9.331748 | -5.572641 | -4.206790 | -11.40759 | 0.085396  | -2.258237 | 27.92697  | 0.154315  |
| 0.223957  | -4.526130 | -3.688197 | 0.507141  | 1.333826  | -0.120889 | -0.142051 | 62.21606  | -0.165988 |

*Source: E. T. Senzu (2019), Computed from WDI and BoG data from (1985-2011), Using Eview 7.0 pac.*

From the un-normalized co-integrating coefficients as found in Table X4.6 above, the third vector appears to be the one in which we can normalize private investment. The choice of this vector is based on sign expectations about the long-run relationship as indicated in equation (8). The derivation of the long-run relationship was done by normalizing the LPRIV and dividing each of the co-integrating coefficients by the coefficient of LPRIV. The long-run private investment equation is therefore specified below as:

$$\text{LPRIV} = 0.318037T - 0.419722\text{CTAX} - 0.054398 \text{INT} + 1.366694 \text{LPUB} + 0.857154 \text{LM2} - 0.924826 \text{LCPI} - 0.719915 \text{LRER} + 1.837229 \text{LRGDP} \dots \text{Eq.21}$$

The error correction representation of equation (21) is specified as follow

$$\text{ECM} = \text{LPRIV} - 0.318037 \text{ T} + 0.419722 \text{ CTAX} + 0.054398 \text{ INT} - 1.366694 \text{ LPUB} - 0.857154 \text{ LM2} + 0.924826 \text{ LCPI} + 0.719915 \text{ LRER} - 1.837229 \text{ LR GDP} \dots \text{Eq.22}$$

From equation (21), holding all other factors constant, as time passes by, private investment in Ghana, will increase by approximately 0.318% each quarter. This means that, time has a positive impact on private investment. This is justified by the fact that, as time passes by, technology, institutions and human behaviour changes and such changes will naturally grow the activities in the private sector, promoting economic growth as a whole. From equation (21), with regard to the significance of the corporate tax, which is the main variable of study focus, the results of the long-run estimate on investment in Ghana, the equation above deduce that, corporate tax has the expected sign, that is corporate tax has a negative and significant impacts on privates' investment in Ghana. This equally justify that, the corporate tax in Ghana negatively affect private investments in Ghana and observed to be a similar situation in countries, which fall in the category of developing economies. Thus for every 1% increase in corporate tax, private investments on the other hand will decrease by approximately 0.420% holding all other factors in constant. This is consistent with mainstream economic theory, because higher corporate taxes serve as a disincentive to private investor's efforts, since much of the profits are wiped off by taxes. This is also consistent with the findings of Vegara (2004), Tatom (2007), Romer and Romer (2007), Djankov et al. (2010) and Ahiawodzi and Tsorhe (2013) who found a negative relationship between corporate tax and private investment but contradicts the findings of Attar and Temel (2002) who on the other hand found a positive relationship between corporate tax and private investment. Interest rate from the equation above also had the expected sign, which is, interest rate has an inverse relationship with private investment in Ghana. Thus for every 1% increase in interest rate, private investment under the constant of the other factors will decrease by approximately 0.054% in the long run. This is consistent with the theoretical expectation of the Keynesians and neoclassical view on the effect of interest rate on private investment. Thus according to the Neoclassical, an increase in the rate of interest, crowds-out private investment through high cost of borrowing, making private capital formation difficult. The findings of this study on interest rate is consistent with the findings of Lewis (1992), Bascom (1994), Bandiera et al. (2000), Reinhart and Tokatlidis

(2001), Badawi (2004) and Ahiawodzi and Tsorhe (2013), who also found an inverse relationship between interest rate and private investment, and realize the studies contradicts the findings of Shrestha and Chowdhury (2006) and Eregha (2010), who found a positive relationship between interest rate and private investment in their study. Also, real exchange rate, which serves as an exogenous variable for the study was observed to have a negative and decreasing effect on privates' investment in the long run. Thus for every 1% increase in real exchange rate, private investments will decrease by approximately 0.720% in the long run, when holding all other factors constant. This is because an increase in the real exchange rate will increase the cost of importing certain inputs and raw material needed for production, thereby increasing the cost of production. This increase in the cost of production makes the prices of final output relatively high and un-competitive as compared to the same goods produced in other countries. This in the long run reduces private investments in such a country. The finding however is in consonance with the findings of Ronge and Kimuyu (1997), Asante (2000), Naa-Idar et al. (2012) and Ahiawodzi and Tsorhe (2013) but observed to also contradict the findings of Were(2001), who found a positive relationship between exchange rate and private investment. In the instance of real GDP as a factor of study, which serves as an exogenous variable in this study, exhibited a positive sign, which indicate that, the real GDP of Ghana has a positive and increasing effect on private investments in the long run. Thus for every 1% increase in real GDP of Ghana, private investment in Ghana will increase by approximately 1.837% in the long run, when all other factors are hold in constant. This is consistent with the theoretical expectation of Keynesian views of the role of real GDP on private investment. Thus an increase in real GDP is an indication of expansion of the economy, which has the tendency of increasing the aggregate demand in the long run. This increase in aggregate demand serve as an incentive to the private investors to increase their production output, since there is a potential demand for their supply. This in the long run will increase privates' investment in the country. This further confirms the accelerator theory of investment in Ghana. The findings of this study is in accord with that of Akpalu (2002), Mbanga (2002) and Naa-Idar et al. (2012), who found a positive relationship between real GDP and private investment but contradicts the findings of Asante (2000), who found a negative relationship between real GDP and private investment.

Furthermore, money supply which served as an exogenous variable of this study, was observed to have a positive and increasing effect on private investment in the long run. Thus for every 1% increase in money supply to the economy, private investments will increase by approximately 0.857% in the long run, when all other factors are hold in constant. The availability of funds to the private sector has the tendency of boosting private investment in the country in the sense that, as the central bank increases money supply, interest rate on the other hand has the tendency of reducing and hence making the cost of borrowing relatively cheaper. This has the potential of boosting privates' investment in the long run, since private investors can now expand their production output base at a relatively lower cost. This findings is in total agreement with the studies of Asante (2000) and Akpalu (2002). Probing further into the equation above, consumer price index a proxy for inflation which also serves as an exogenous variable was observed to operate in an inverse relationship with private investment. Thus for every 1% increase in price level under the constant of all the other factors, private investment decrease approximately 0.925% in the long run within the economy of Ghana. This is consistent with the theoretical expectation of the monetarists view of the effect which price level (inflation) has on private investment. Thus according to the monetarists, an increase in price level (inflation) makes prices of goods and services of private investors relatively high and un-competitive thereby reducing aggregate demand hence causing a reduction in private investment in Ghana in the long-run. This revealing concur with the findings of Asante (2000), Naa-Idar et al. (2012) and Ahiawodzi and Tsorhe (2013). Finally in respect of equation (21), public investment which also served as an exogenous variable in the study, indicate clearly that, public investment has a positive and significant impacts on private investment in Ghana in a long-run, suggesting a "crowding-in" effect of public investment on private investment and thus confirming the theoretical hypothesis between the two variables. Thus for every 1% increase in public investment, private investment will increase by approximately 1.367% in Ghana's economy in the long run, when all the other factors are hold in constant. Thus an increase in public investment is an indication of expansion of the economy which has the tendency of increasing aggregate demand in the long-run. This increase in aggregate demand serve as an incentive to the private investors to increase their output since there is a potential demand for

their supply in order to compliment public investment, such efforts has a positive impact in the increase of private investment in Ghana. This finding is also consistent with the findings of Asante (2000), Vergara (2004), Naa-Idar et al. (2012) and Ahiawodzi and Tsorhe (2013) who found a positive relationship between public investments and private investments but contradicts the findings of Islam and Wetzel (1991), Akpalu (2002) who found a negative relationship between public investment and private investment.

## **2.6. Short-run dynamics of Private Investment in Ghana**

Engle and Granger (1987) argued that when variables are co-integrated, their dynamic relationship can be specified by an error correction representation, in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The error correction term indicates the speed of adjustment to long-run equilibrium in the dynamic model. In other words, its magnitude shows how quickly variables converge to equilibrium when there is a shock in the system. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. The larger the error correction term in absolute value, the faster the convergence to equilibrium. Given that our variables are non-stationary but co-integrated, estimation of the ECM, which included a first differential VAR with one period lagged error correction term, yielding an over-parameterized model. The parsimonious ECM for private investment model is presented below in Table X4.8. However, the approach from general to specific model was employed to arrive at a more parsimonious model where insignificant variables were deleted using the p-values. Rutayisire (2010) argued that this process of moving from general to specific brings about a simplification of the model that makes the estimation more reliable and increases the power of the test that is a general to specific model for the private investment model is discussed below in table X4.7.

Table X4.7: Error correction model for private investment

| Variable     | Coefficient | Std. Error | T-Statistic | Probability |
|--------------|-------------|------------|-------------|-------------|
| ECT (-1)     | -0.221588   | 0.056365   | -3.931284   | 0.0002      |
| D(LPRIV(-1)) | 1.305262    | 0.288552   | 4.523495    | 0.0000      |
| D(CTAX(-1))  | -0.371933   | 0.134667   | -2.761862   | 0.0076      |
| D(LRER (-3)) | -0.714008   | 0.351088   | -2.033700   | 0.0463      |
| D(LM2 (-3))  | 0.534741    | 0.293661   | 1.820948    | 0.0735      |
| D(LCPI(-4))  | -0.518263   | 0.298797   | -1.734499   | 0.0879      |
| D(INT(-3))   | -0.022937   | 0.009669   | -2.372081   | 0.0209      |
| D(INT(-4))   | -0.034029   | 0.009632   | -3.533012   | 0.0008      |
| D(LPUB(-1))  | 0.939587    | 0.341297   | 2.752990    | 0.0078      |
| D(LRGDP(-2)) | 1.493232    | 0.834321   | 1.789757    | 0.0785      |
| C            | -0.224519   | 0.075805   | -2.961817   | 0.0042      |

DW=2.109903; R-Square = 0.722002; F-Statistics= 3.960659; Prob= 0.00001

Source: E. T. Senzu (2019), Computed from WDI and BoG data from (1985-2011) Using Eview 7.0 pac

Table X4.8: General Vector Error Correction model for Private Investment

| Variable     | Coefficient | Std. Error | T-Statistic | Probability |
|--------------|-------------|------------|-------------|-------------|
| ECT (-1)     | -0.219352   | 0.060196   | -3.643983   | 0.0005      |
| D(LPRIV(-1)) | 1.304988    | 0.291033   | 4.483987    | 0.0000      |
| D(LPRIV(-2)) | -0.199436   | 0.132571   | -1.504370   | 0.1377      |
| D(LPRIV(-3)) | 0.045915    | 0.127125   | 0.361180    | 0.7192      |
| D(LPRIV(-4)) | 0.022886    | 0.127499   | 0.179499    | 0.8582      |
| D(LPRIV(-5)) | -0.142570   | 0.117567   | -1.212669   | 0.2300      |
| D(CTAX(-1))  | -0.371939   | 0.135784   | -2.739207   | 0.0081      |
| D(CTAX(-2))  | 0.081946    | 0.110995   | 0.738285    | 0.4632      |
| D(CTAX(-3))  | -0.024647   | 0.103704   | -0.237665   | 0.8130      |
| D(CTAX(-4))  | 0.052820    | 0.106232   | 0.497214    | 0.6209      |
| D(CTAX(-5))  | 0.174361    | 0.129597   | 1.345409    | 0.1836      |
| D(LRER(-1))  | 0.362488    | 0.606229   | 0.597939    | 0.5521      |
| D(LRER(-2))  | -0.404784   | 0.574399   | -0.704708   | 0.4837      |
| D(LRER(-3))  | -0.714097   | 0.354005   | -2.017194   | 0.0482      |
| D(LRER(-4))  | 0.013493    | 0.355855   | 0.037918    | 0.9699      |
| D(LRER(-5))  | -0.109310   | 0.395883   | -0.276118   | 0.7834      |
| D(LM2(-1))   | -0.405393   | 0.398040   | -1.018473   | 0.3125      |
| D(LM2(-2))   | 0.310839    | 0.313108   | 0.992752    | 0.3248      |
| D(LM2(-3))   | 0.535893    | 0.297650   | 1.800416    | 0.0768      |
| D(LM2(-4))   | 0.220088    | 0.139559   | 1.577019    | 0.1200      |
| D(LM2(-5))   | 0.092307    | 0.374308   | 0.246607    | 0.8061      |
| D(LCPI(-1))  | -0.414429   | 0.510078   | -0.812481   | 0.4197      |
| D(LCPI(-2))  | -0.071063   | 0.467041   | -0.152039   | 0.8797      |

|              |           |          |           |        |
|--------------|-----------|----------|-----------|--------|
| D(LCPI(-3))  | 0.352255  | 0.477364 | 0.737916  | 0.4634 |
| D(LCPI(-4))  | -0.515273 | 0.311423 | -1.654576 | 0.1032 |
| D(LCPI(-5))  | 0.819134  | 0.557829 | 1.468431  | 0.1472 |
| D(INT(-1))   | -0.005005 | 0.010840 | -0.461763 | 0.6459 |
| D(INT(-2))   | 0.015858  | 0.009884 | 1.604454  | 0.1139 |
| D(INT(-3))   | -0.022934 | 0.009750 | -2.352222 | 0.0220 |
| D(INT(-4))   | -0.034009 | 0.009725 | -3.497002 | 0.0009 |
| D(INT(-5))   | -0.016818 | 0.011429 | -1.471539 | 0.1464 |
| D(LPUB(-1))  | 0.940102  | 0.344393 | 2.729737  | 0.0083 |
| D(LPUB(-2))  | 0.429894  | 0.323053 | 1.330722  | 0.1883 |
| D(LPUB(-3))  | 0.198058  | 0.313948 | 0.630860  | 0.5305 |
| D(LPUB(-4))  | 0.322756  | 0.488460 | 0.660762  | 0.5113 |
| D(LPUB(-5))  | -0.064452 | 0.372351 | -0.173096 | 0.8632 |
| D(LRGDP(-1)) | 0.814732  | 0.981357 | 0.830209  | 0.4097 |
| D(LRGDP(-2)) | 1.492362  | 0.841548 | 1.773354  | 0.0812 |
| D(LRGDP(-3)) | 0.375066  | 0.878906 | 0.426742  | 0.6711 |
| D(LRGDP(-4)) | 0.927946  | 1.220489 | 0.760306  | 0.4500 |
| D(LRGDP(-5)) | 0.688466  | 1.650343 | 0.417165  | 0.6780 |
| C            | -0.222298 | 0.85645  | -2.598612 | 0.0116 |

*Source: E. T. Senzu (2019), WDI and BoG- Data from (1985-2011), Using Eviews 7.0 pac*

From the Table X4.7 above there is no evidence of spurious regression as the Durbin-Watson (DW) is greater than the R-squared. The F-statistic is significant, implying that the explanatory variables in the model are good predictors of private investment. The results from the error correction model as displayed in the table X4.8 above, suggest that the ultimate effect of previous periods' values of private investment on current values of private investment in the short-run is positive and significant at lag one (1). The implication is that current values of private investment are affected by previous quarters' values of private investment. From the table X4.8 above, the results of the short run dynamic coefficient of corporate tax has the expected sign as obtained in the long run. That is, corporate tax has a negative and significant effect on private investment in Ghana on a short-run. This means that corporate tax in Ghana negatively affect privates' investment. Thus for every 1% increase in corporate taxes, privates' investment on the other hand will decrease by approximately 0.372% holding all other factors in constant. This is consistent with mainstream economic theory, because higher corporate taxes serves as a disincentive to private investor's efforts, since much of the profits are wiped off by taxes. It is also consistent with the findings of Vegara (2004), Tatom (2007), Romer and



Romer (2007), Djankov et al. (2010) and Ahiawodzi and Tsorhe (2013) who found a negative relationship between corporate taxes and privates' investment but contradicts the findings of Attar and Temel (2002) who found a positive relationship between corporate tax and private investment in a short run. Furthermore, with regard to the significance of interest rate on private investment in Ghana, interest rate has the indicative sign as obtained in the long run estimate. Thus interest rate in the short run has an inverse relationship with privates' investment. This means that, for every 1% increase in interest rate in a short run, privates' investment will fall by approximately 0.034%, when all the other factors are hold in constant. This however is consistent with the findings of Lewis (1992), Bascom (1994), Bandiera et al. (2000), Badawi (2004) and Ahiawodzi and Tsorhe (2013). Also, real exchange rate which in the studies was serving as an exogenous variable, was observed to have had an indicative sign as obtained in the long run estimate. It was observed that, real exchange rate has a negative and significant effect on privates' investment in Ghana at the short run as well, thus for every 1% increase in real exchange rate, privates' investment decrease by approximately 0.714% in the short run, when all the other variables are hold in constant. This is because an increase in the real exchange rate will increase the cost of importing certain inputs and raw material needed for production, thereby bidding up the cost of production. The increase in the cost of production makes the prices of final output relatively high and un-competitive as compared to the same goods produced in other countries, thereby reducing private investment activities in the country. Which the findings in short run dynamics of real exchange rate is observed to be in consonance with the report of Asante (2000), Naa-Idar et al. (2012) and Ahiawodzi and Tsorhe (2013). Also, the short run dynamic coefficient of real GDP, which served as an exogenous variable in this studies, was observed to have a positive and increasing effect on privates' investment as obtained in the long run. Thus for every 1% increase in real GDP, privates' investment increases by approximately 1.493% in the short run, holding all other factors in constant. This is consistent with the theoretical expectation of Keynesian views of the role of real GDP on privates' investment. This also deepen and confirms the accelerator theory of investment in Ghana, which is consistent with the findings of Akpalu (2002), Mbanga (2002), Naa-Idar et al. (2012) and Ahiawodzi and Tsorhe (2013) who found a positive relationship

between real GDP and private investment but contradicts the findings of Asante (2000) who on the other hand found a negative relationship between real GDP and private investment. From the table X4.8 above, consumer price index a proxy for inflation, which also served in this studies as an exogenous variable, had an inverse relationship with private investment as obtained in the long run. Thus for every 1% increase in price level under the constant of all the other variables, private investment decreases by approximately 0.518% in the long run. This is consistent with the mainstream theoretical expectation of the monetarists view of the effect price level (inflation) has on private investment and further agree with the findings of Asante (2000), Naa-Idar, et al. (2012) and Ahiawodzi and Tsorhe (2013) who found a negative relationship between price level (inflation) and private investment. The study further deduce that, public investments in the short run analysis, indicate a positive and significant effect on privates' investment as obtained in the long run, suggesting a "crowding-in" effect of public investment on private investment and thus confirming the theoretical hypothesis between this two variables. Thus for every 1% increase in public investment, private investment will increases by approximately 0.940% in the short run, when all the other factors are hold in constant. This in the long run will increase private investment. This finding was consistent with the studies of Asante (2000), Vergara (2004) and Naa-Idar et al. (2012) who found a positive relationship between public investments and privates' Investment but contradicts the findings of Islam and Wetzel (1991) and Akpalu (2002). Finally, the money supply as a variable, which served as an exogenous indicator under this study, was noted to have a similar character as noted in the long run effect. Money supply has a positive and increasing effect on privates' investment in the short run. Thus for every 1% increase in money supply, privates' investment will increase by approximately 0.535% in the short run, holding all other factors in constant. The availability of funds to the private sector has the tendency of boosting private investment in the country in the sense that, as the central bank increases money supply, interest rate on the other hand has the tendency of reducing and hence making the cost of borrowing relatively cheaper. This has the potential effect of boosting private investment in the country since private investors can now expand their output base at a relatively lower cost. This also confirms the findings of Asante (2000) and Akpalu (2002), who found a positive relationship between

money supply and private investment. Most importantly the coefficient of the lagged error-correction term was negative and statistically significant as expected at 1% significance level suggesting that, it would take a short time for the system to return to its equilibrium position once it is out of equilibrium. Thus Bannerjee, Dolado and Mestre (1998) asserted that a highly significant error correction term further confirms the existence of a stable long-run relationship between variables. From the results in the table X4.8, the estimated coefficient of the error correction term is -0.221588; which implies that the speed of adjustment is approximately 22.16% per quarter or 88.64% per year. This negative and significant coefficient is an indication that co-integrating relationship exist among private investment and its explanatory variables in the study. The size of the coefficient of the lagged error correction term (ECT-1) denotes that about 22.16% of the disequilibrium in the private investments market caused by previous quarters' shocks, converges back to the long-run equilibrium in a new quarter. Thus, the study discerns that the variables in the model show evidence of moderate response to equilibrium when shocked in the short-run. The rule of thumb however is that, the larger the error correction coefficient (in absolute term), the faster the variables equilibrate in the long-run when shocked (Acheampong, 2007). However, the magnitude of the coefficient in this study suggests that the speed of adjustment to the long-run changes is relatively high. Finally the used models for the various test was also evaluated which was captured as Table X4.9

Table X4.9: Evaluation of the Models

| <b>Diagnostics</b>                            | <b>Statistics</b>  | <b>Conclusion</b>     |
|---|--|-----------------------|
| Ramsey RESET Test                             | F-Statistics= 0.013643<br>(0.9074) Log likelihood ratio<br>= 0.023190 (0.8790) | Equation is Stable    |
| Heteroskedasticity<br>ARCH Test               | F- Statistics = 1.7000071<br>(0.1425)  | No Heteroskedasticity |
| Breusch-Godfrey Serial<br>Correlation LM Test | F- Statistic= 1.390843<br>(0.2417)   | No Serial correlation |
| Multivariate Normality                        | Jarque-Bera Test= 1.390843<br>(0.2417)   | Residuals are normal  |

*Source: E. T. Senzu (2019), Computed from WDI and BoG-data from (1985-2011), using Eviews 7.0 pac.*

The results from the table X4.9, indicate that, by moving from the general to specific model for the private investment model, passes all the diagnostic test of Ramsey’s RESET test of functional form, Heteroscedasticity ARCH test, Breusch-Godfrey serial correlation LM test, as well as the multivariate normality test. Also, the plots of CUSUM and the CUSUMSQ stability tests in the appendix, marked Exhibit A category, also indicates that all the coefficients of the estimated model was stable over the study period since it was within the five percent critical bounds.

## 2.7. Granger Causality Test

After establishing co-integration among the main variables subjected to studies, Granger Causality test was applied to verify the direction of causality between corporate tax and privates’ investment. The table X4.10 below reports the results of the pair wise Granger-causality tests carried out.

Table X4.10: Granger Causality Test between Corporate Tax and Private Investment

| Null Hypothesis                   | F- Statistics | Probability |
|-----------------------------------|---------------|-------------|
| CTAX does not Granger Cause LPRIV | 4.04919       | 0.0023***   |
| LPRIV does not Granger Cause CTAX | 2.54237       | 0.0335**    |

*Source: E. T. Senzu (2019), computed from WDI and BoG-Data from (1985-2011), Using Eviews 7.0 pac. (\*\*)* and *(\*\*\*)* denotes a rejection of null hypothesis at 5% and 1% level of significance

The Granger causality test from the table X4.10 define under the null hypothesis that, corporate tax does not Granger cause private investment, is rejected at the 1% significance level; implying that corporate tax does Granger cause private investment. It also further reject the null hypothesis that, private investment does not granger cause interest rate at the 5% significance level. This means that corporate tax predicts private investment and private investment as well, also predicts corporate tax in Ghana as proofed in the table X4.10. From the results, it is clear that there is a bi-directional causality running from corporate tax to private investment and from private investment to corporate tax in Ghana, however it is evidenced that, the causality

from corporate tax to private investment in Ghana is greater than the causality from private investment to corporate tax, as given by their significance level.

## **D. CONCLUSION, RECOMMENDATIONS AND RESEARCH DIRECTION**

### **3.1. Conclusion**

The economic effect of corporate tax on privates' investment is a central question in both public finance and development. This effect matters not for the evaluation and design of corporate tax policy only, but also for thinking about economic growth (Barro, 1991; DeLong & Summers, 1991 and Baumol, Litan, & Schramm, 2007). Thus the economic effect of corporate tax on privates' investment has been hotly debated both in academic and political circles. This very study is in line with the empirical literature, confirmed in both the long-run and short-run relationship between privates' investment and its determinants. Which deeply outline that, real GDP, public investment, money supply, all have positive effects on private investments, with the greatest impacts observed from real GDP both in long-run and short-run. Corporate tax, interest rate, real exchange rate and price level on the other hand, had a negative effects on private investments with the greatest effect coming from price level and real exchange rate both in the long and short run respectively. Although interest rate had a decreasing effect on private investment, its effects was noted to be very minimal. The error correction term of the private investment model indicated that, we can count on corporate tax, interest rate, real GDP, money supply, public investment, inflation as well as real exchange rate as policy variables to bring back privates' investment market to equilibrium in the face of short run disturbance once the coefficient of the error correction term was significant and did carry the negative sign. This was found to be consistent with the empirical literature, the study found evidence of bi-directional causality between private investment and corporate tax in Ghana. This indicates that, in Ghana private investment and corporate tax predicts each other, which according to the findings, they Granger cause each other.

## 3.2. Recommendations

Based on the findings from the study, the following recommendations are proposed for policy consideration.

- 3.2.1. Since it was observed that corporate tax has negative impact on privates' investment over the study period both in the long and short run, it is recommended that the government keep the corporate tax as low as possible, so as to reduce the rate at which corporate tax reduces corporate profit in order to encourage private investors to expand their output base and by so doing increase the level of private investments in the country.
- 3.2.2. From the findings, real exchange rate and price level had negative and significant impact on private investment both in the long and short run. It is recommended that the Bank of Ghana adopt foreign exchange interventions that do not affect the domestic monetary base, which is a unit component of the overall money supply. Thus by arresting the rate of depreciation of the local currency, as the key effort of the Central Bank of Ghana to restore investor confidence in the local currency. Similarly, interest rate had a negative impact on privates' investment over the study period both in the long and short run. It is therefore recommended that the Bank of Ghana keep the prime rate as low as possible, so as to reduce the high cost of borrowing from the financial institutions in order to encourage private investors to expand their output base and by so doing increase the level of private investment in the country.
- 3.2.3. It was again observed that, real GDP which served as exogenous variables had much positive effect on private investment in Ghana both in the long run and short run. It is therefore strongly recommended that government efficient expenditure should be geared towards productive investment and infrastructural development to help boost economic activity which will promote output growth and by so doing increase privates' investment in the country.

3.2.4. It is also observed from the findings of the study that money supply has an appreciating effect on private investment. It is therefore recommended that monetary authorities keep money supply at a moderate level so as to influence the interest rate downward. This will in the long run boost and create an enabling environment for privates' investment in the country. Also, the more stable the economy, the better it prospects of huge private investments and hence increase in output growth and price stability. It is thus recommended that, price fluctuations should be kept at a moderate level by the monetary authorities since high level of price changes indicate, high levels of economic distortion which discourages private investment in the country.

3.2.5. Finally, once public investment had a positive impact on private investment over the study period both in the long and short run, the government should design policies to promote enabling environment to increase public investment which has a crowding-in effect on private investment. This in the long run will promote the level of private investment in the country.

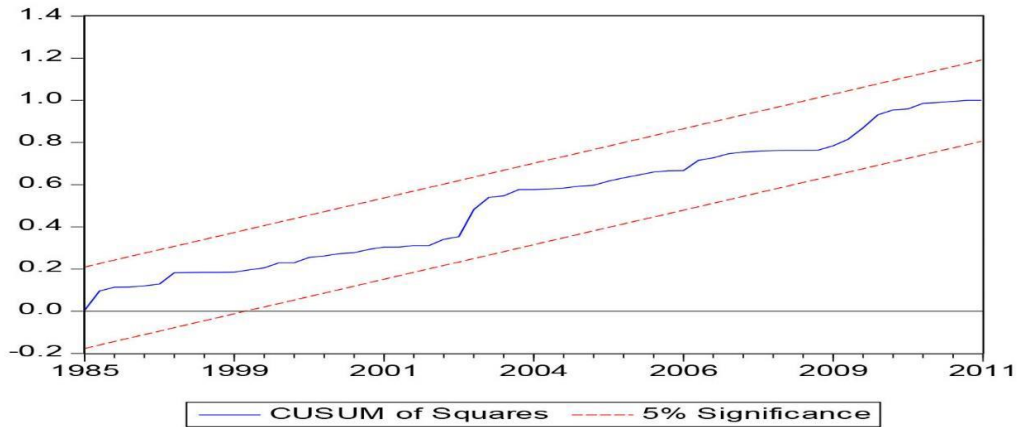
### **3.3. Guide to Future Research**

The study only examined the relationship between privates' investment and corporate taxes by including other controlled variables, in which the long-run and short-run relationship effects were established as well as the direction of causality. The study however did not determine the level or the degree in which these variables under study could either promote or distort stability of privates' investment. Hence, future direction of research on this topic should consider the possibility of exploring the desired levels or degree at which these variables would either propel or harm private investment in the Ghana and mostly within developing countries. The study employed the Johansen approach to co-integration, to establish the long and short run relationship between privates' investment and corporate taxes by including other control variables. Future direction of research on this topic could consider the possibility of exploring other estimation techniques to further confirm the relationship between privates' investment and corporate taxes.

## E. APPENDIX

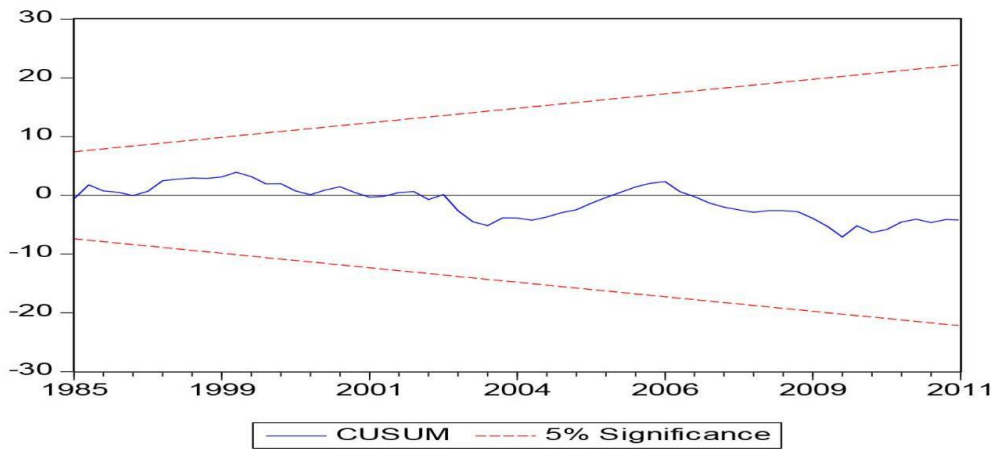
### Exhibit A. Category

Figure A1. Plotting graph of Cumulative Sum of recursive residual of private Investment



. The Straight line represent critical bounds at 5% significance level  
**Source:** E. T. Senzu (2019), Estimation results using Eview 7.0 pac

Figure A2. A plotting graph of cumulative sum of square of recursive residuals of private investment

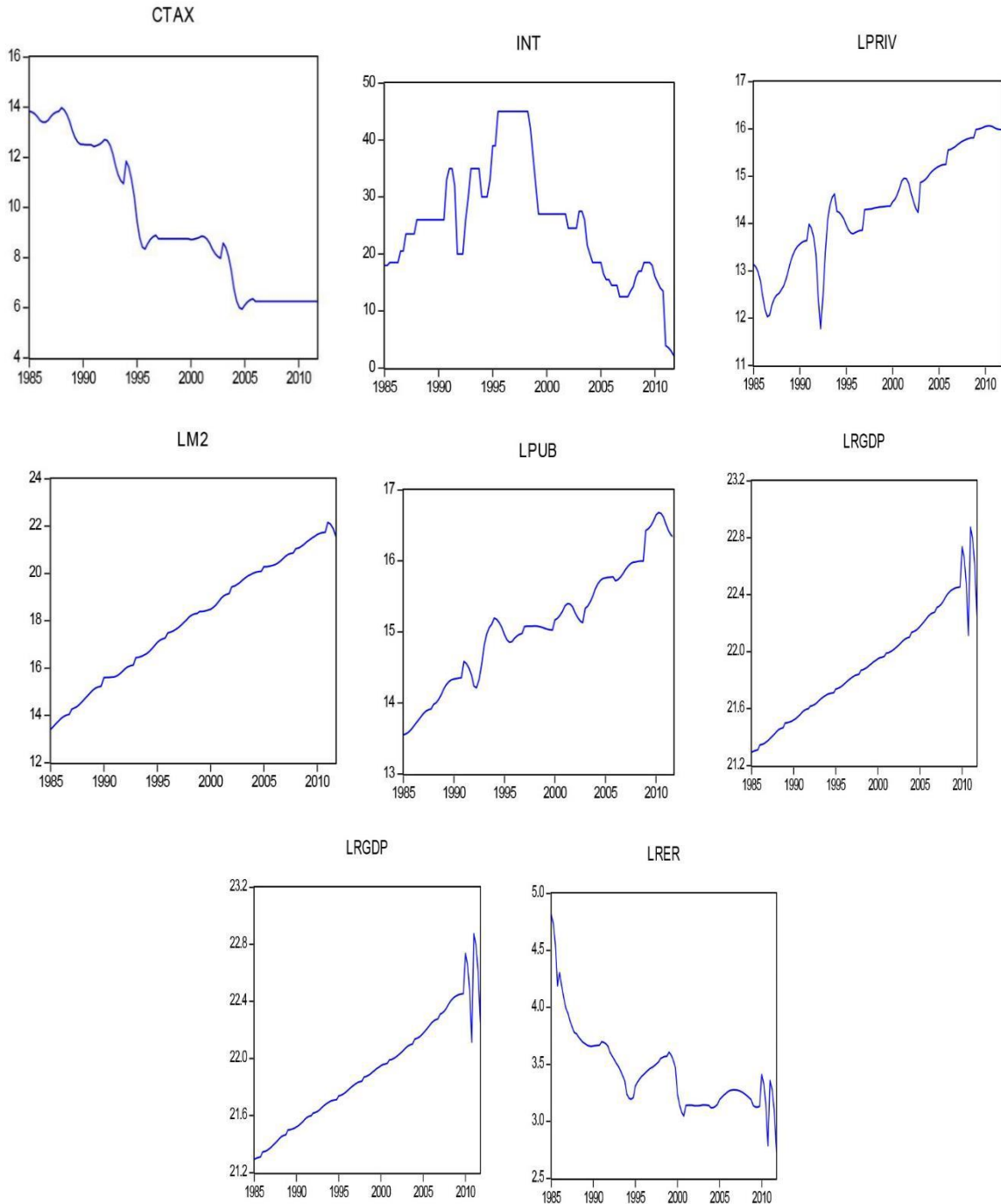


The straight line represent critical bounds at 5% significance level  
**Source:** E. T. Senzu (2019), Estimation results using Eview 7.0 pac



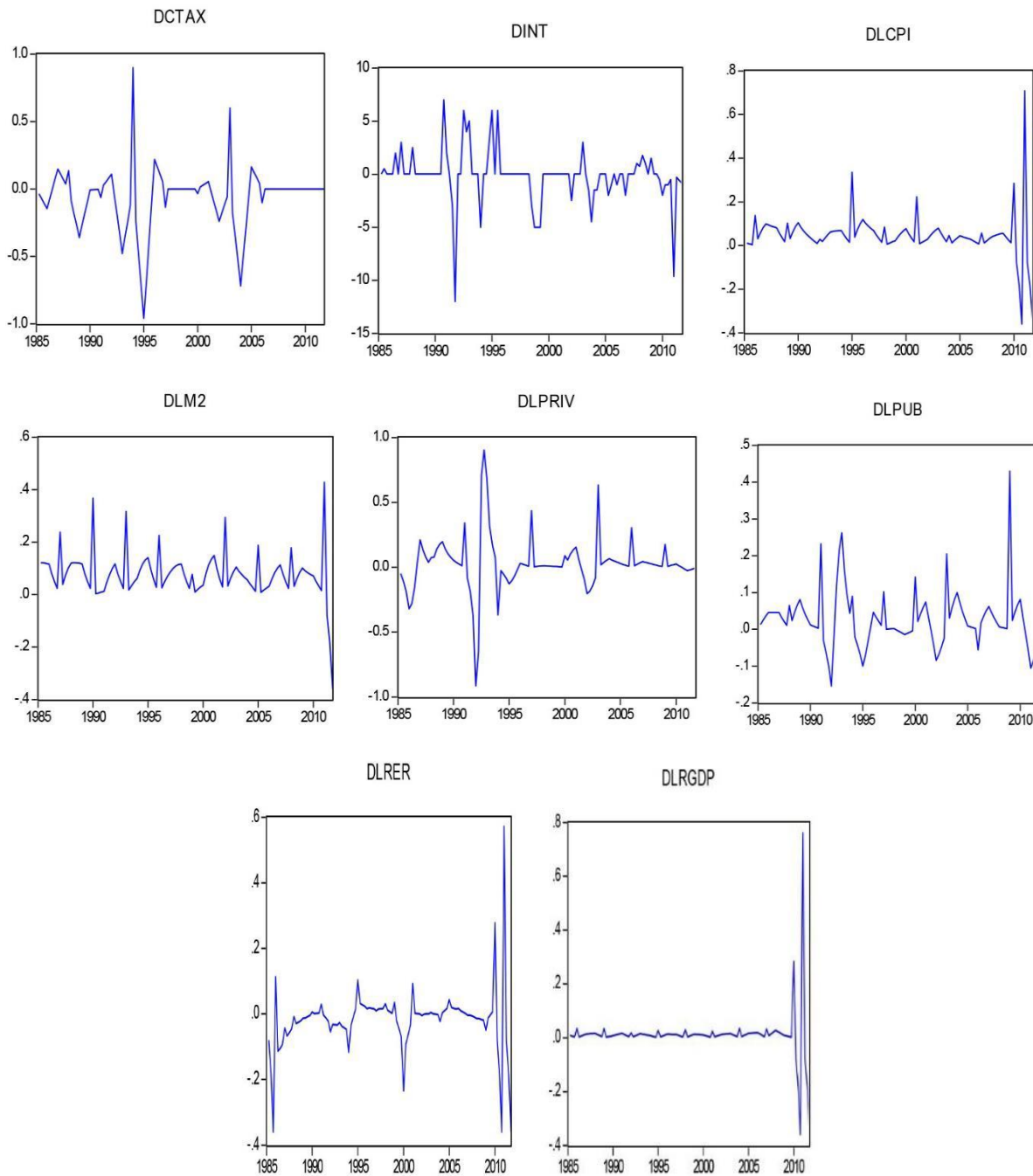
Exhibit B Category:

Figure BX. Plots of Variables in Levels



Source: E. T. Senzu (2019) Estimation result using Eviews 7.0 pac.

Exhibit C. Category  
Figure CX. Plots of Variables in First Difference



Source: E. T. Senzu (2019) Estimation result using Eviews 7.0 pac.

## F. REFERENCE

1. Acheampong, I. K. (2007). Testing McKinnon-Shaw thesis in the context of Ghana's financial sector liberalization episode. *International Journal of Management Research and Technology*, 1(2), 156-183.
2. Ahiawodzi, A. K. & Tsorhe, D. K. (2013). Taxation and Private Investment in Ghana: An Empirical Study. *British Journal of Economics, Finance and Management Sciences* 7 (1)
3. Akpalu, W. (2002). Modelling Private Investment in Ghana: An Empirical Time Series Econometrics Investigation (1970-1994). *The Oguaa Journal of Social Sciences*, Vol. 4. Faculty of Social Sciences, University of Cape Coast.
4. Akpokodje, G. (1998) *Macroeconomic Policies and Private Investment in Nigeria, Rekindling Investment*.
5. Asante, Y. (2000). Determinants of Private Investment behaviour in Ghana. AERC Research Paper 100 African Economic Research Consortium, Nairobi Asterio, D. & Price, S. (2007). *Applied econometrics: A modern approach*. London: Palgrave-Macmillan.
6. Attar, P. K. & Temel, A. (2002). Modelling Private Manufacturing Investment in Turkey, *METU Studies in Development*, 29(1-20), 109-122.
7. Badawi, A. (2004). Private Capital Formation and Macroeconomic Policies in Sudan: Application of simple Co-integrated Vector Autoregressive Model. Department of Economics, University of Khartoum.
8. Bandiera, G. Caprio, P. Honohan, & Schiantarelli (2000). Does Financial Reform Raise or Reduce Saving? *Review of Economics and Statistics*, 82(2), 239-263.
9. Bannerjee, A., Dolado, J. & Mestre, R. (1998). Error-correction mechanism tests for cointegration in single equation framework. *Journal of Time Series Analysis*, 19, 267-83.
10. Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106(2): 407-443.

11. Bascom, W. (1994). *The Economics of Financial Reform in Developing Countries*. London: The Macmillan Press Ltd.
12. Baumol, W. J., Litan, R. E. & Schramm, C. J. (2007). *Good Capitalism, Bad Capitalism, and the Economics of Growth and Prosperity*. New Haven, CT: Yale University Press.
13. Bhasin, V. K. (2004). Dynamic inter-links among the exchange rate, price level and terms of trade in a managed floating exchange rate system: The case of Ghana. African Economic Research Consortium, Research Paper 141. Nairobi, Kenya.
14. Bleaney, M. F., Gemmell, N. & Kneller, F. (2001). Testing the Endogenous Growth Model: Public Expenditure, Taxation and Growth over the Long Run. *Canadian Journal of Economics* 34 (1), 36–57.
15. Blejer, M. & Khan, M. (1984). *Government Policy and Private Investment in Developing Countries*. IMF Staff Papers, Vol. 31, No. 2.
16. Cebula, R. J. & Koch J. V. (1989). An Empirical Note on Deficits, Interest Rates, and International Capital Flows. *Quarterly Review of Economics and Business* 29, 119–126.
17. Chibber, A. & Mansoor, D. (1990). Fiscal Policy and Private Investment in Developing Countries. *Recherche Economique*, XLIV, Numero 2–3.
18. Chinery, H. B. & Strout, W. (1966). Foreign Assistance and Economic Development: *American Economic Review*, 66, 679–733.
19. Chirinko, R. S. (1993). Business Fixed Investment Spending: Modeling Strategy, Empirical Results, and Policy Implications. *Journal of Econometric Literature*. Vol. 3.
20. Clark, J. M. (1917). Business acceleration and the law of demand: A technical factor in Economic Cycles. *Journal of Political Economy*, 25 (3), 217
21. Cullen, J. B. & Gordon, R. H. (2007). Taxes and Entrepreneurial Risk-Taking: Theory and Evidence for the U.S. *Journal of Public Economics* 91 (7–8), 1479–1505.

22. DeLong, J. B. & Summers, L. H. (1991). Equipment Investment and Economic Growth. *Quarterly Journal of Economics*, 106(2): 445-502.
23. Djankov, G., Ramalho, M. & Shleifer, (2010). The effect of corporate taxes on investment and entrepreneurship. Retrieved from <http://www.aeaweb.org/articles.php?doi=10.1257/mac.2.3.31>
24. Engle, R. F. & Granger, C. W. J. (1987). Co-integration and Error-Correction: Representation, Estimation and Testing. *Econometrica* 55, 251-256.
25. Eregha, P. B. (2010). Interest Rate Variation and Investment Determination in Nigeria: Department of Economics, Adeyani College of Education, Ondo, State Nigeria.
26. Feldstein, M. (2006). The Effect of Taxes on Efficiency and Growth. NBER Working Paper 12201. National Bureau of Economic Research, Cambridge, MA.
27. Folster, S. & Henrekson, M. (2001). Growth Effects of Government Expenditure and Taxation in Rich Countries. *European Economic Review* 45 (8), 1501–1520.
28. Galbis, V. (1979). Money, Investment, and Growth in Latin America, *Economic Development and Cultural Change*.
29. Gentry, W. M. & Hubbard, R. G. (2000). Tax Policy and Entrepreneurial Entry. *American Economic Review* 90 (2), 283–287.
30. Gillis, M., Perkins, D. W., Roemer, M. & Snodgrass, D. R. (1987). *Economics of Development*, Second Edition. w. w. Norton.
31. Granger, C. W. J. (1986). Investigating causal relations by econometric models and crossspectral methods. *Econometrica*, 37, 424-438.
32. Gujarati, N. D. (2004). *Basic econometrics* (4th ed.). New York: McGraw Hill.
33. Holcombe, R. G. & Lacombe, D. J. (2004). The Effect of State Income Taxation on Per Capita Income Growth. *Public Finance Review* 32 (3), 292–312.
34. Islam, R. & Wetzel, D. L. (1991). The Macroeconomics of Public Sector Deficits: The Case of Ghana. *Economics Department Working Papers*, No. 672. World Bank.

35. Johansen S & Juselius K (1990). Maximum likelihood estimation of inferences on co-integration with application to the demand for money. *Oxford Bull. Econ. Stat.*, 52(2): 169-210.
36. Johansen, S. (1988). Statistical analysis of co-integrating vectors. *Journal of Economic Dynamics and Control*, 12, 231–54.
37. Johansson, Å., Christopher H., Jens A., Bert B. & Laura, V. (2008). Tax and Economic Growth. Economics Department Working Paper No. 620. Organisation for Economic Cooperation and Development, Paris, France.
38. Jorgenson, D. W. (1971). Econometric Studies of Investment Behaviour: A Survey. *Journal of Economic Literature*. Vol. 9.1111-47.
39. Katz, C. J., Mahler, V. A. & Franz, M. G. (1983). The Impact of Taxes on Growth and Distribution in Developed Capitalist Countries: A Cross National Study. *American Political Science Review* 77 (4), 871–886.
40. Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. London Macmillan.
41. Khan, M. S. & Reinhart, C. M. (1990). Private Investment and Economic Growth in Developing Countries. *Journal of World Development* 18: 19-27.
42. Kneller, R., Bleaney, M. F. & Gemmell, N. (1999). Fiscal Policy and Growth: Evidence from OECD Countries. *Journal of Public Economics* 74 (2), 171–190.
43. Lee, Y. & Gordon, R. H. (2005). Tax Structure and Economic Growth. *Journal of Public Economics* 89 (5–6), 1027–1043.
44. Lewis, J. (1992). Financial Repression and Liberalization in a General Equilibrium Model with Financial Markets. *Journal of Policy Modelling* 14: 135-166.
45. Lucas, E. R. (1976). *Econometric Policy Evaluation: A Critique*.
46. Marbuah, G. & Frimpong, M. (2010). The Determinants of Private Sector Investment in Ghana: An ARDL Approach. *European Journal of Social Sciences*, Vol.15, No. 2.

47. Mbangha, G. N. (2002). External Debt and Private Investment in Cameroon, *AJEP*, 109-124.
48. McKinnon, E. S. & Shaw (1973). *Money and Capital in Economic Development*. Washington DC: The Brookings Institution.
49. Mehrara, M. & Musai, M. (2011). The Dynamic Causal Relationships among Money. *Interdisciplinary Journal of Research in Business*, 1(9)
50. Mendoza, E. G., Milesi-Ferretti, G. M. & Asea, P. (1997). On the Ineffectiveness of Tax Policy in Altering Long Run Growth: Harberger's Super neutrality Conjecture. *Journal of Public Economics* 66 (1), 99–126.
51. Miller, P. (1994). Higher Deficit Policies Lead to Higher Inflation. *Quarterly Review*, 8-19.
52. Miller, S. M. & Russek, F. S. (1997). Fiscal Structures and Economic Growth at the State and Local Level. *Public Finance Review* 25 (2), 213–237.
53. Morisset J. (1993). Does Financial Liberalization Really Improve Private Investment in Developing Countries? *Journal of Development Economics* 40: 133-150
54. Myles, G. D. (2009). *Economic Growth and the Role of Taxation — Theory*. OECD Economics Department Working Paper No. 713. Organisation for Economic Co-operation and Development, Paris, France.
55. Naa-Idar, F., Ayentimi, D. T. & Frimpong, J. M. (2012). A Time Series Analysis of the Determinants of Private Investment in Ghana (1960-2010). *Journal of Economics and Sustainable Development*. Vol.3, No13, 23-33.
56. Norgah, J. H. (1998). *Tax policy and foreign direct investment in Ghana*. MBA Long essay, University of Ghana, Legon. OECD. (2001). *the Development Dimensions of Trade*. Policy Brief, Organization for Economic Cooperation and Development.
57. Osterwald-Lenum, M. (1992). A note with quantiles of the asymptotic distribution of the ML cointegration rank tests statistics (Paper No. 54, 461–472.). *Oxford Bulletin of Economics and Statistics*.

58. Ouattara, B. (2004). Modelling the Long Run Determinants of Private Investment in Senegal Credit, Research paper NO 04/05.
59. Padovano, F. & Galli, and E. (2002) .Comparing the Growth Effects of Marginal vs. Average Tax Rates and Progressivity. *European Journal of Political Economy* 18 (3), 529–544.
60. Pesaran, M.H. & Shin Y. (1999). Co-integration and speed of convergence to equilibrium. *Journal of Econometrics* 71: 117–43.
61. Phillips, P. & Hansen, B. (1990). Statistical inference in instrumental variables regressions with I (1) processes. *Review of Economic Studies*, 57, 99
62. Reed, W. R. (2008). The Robust Relationship between Taxes and U.S. State Income Growth. *National Tax Journal* 61 (1), 57–80.
63. Reinhart, C. M. & Tokatlidis, I. (2001). Before and After Financial Liberalization, [www.puaf.umd.edu/faculty/papers/reinhart/FINLIB1](http://www.puaf.umd.edu/faculty/papers/reinhart/FINLIB1).
64. Romer, C. D. & Romer, D. H. (2007). The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks,
65. University of California, Berkeley  
<http://elsa.berkeley.edu/~cromer/RomerDraft307.pdf>. Retrieved 25/6/13
66. Ronge, E. E. & Kimuyu, P. K. (1997). Private Investment in Kenya: Trends, Composition and Determinants. IPAR. Mimeograph.
67. Rutayisire, M. (2010). Economic liberalization, monetary policy and money demand in Rwanda: 1980–2005 (AERC Research Paper 193). African Economic Research Consortium, Nairobi.
68. Serven, L. & Solimano, A. (1992). Private investment and macroeconomic adjustment: A survey. *The World Bank Research Observer*, vol. 7, no. 1
69. Shrestha, M. B. & Chowdhury, K. (2006). Financial Liberalization Index for Nepal. *International Journal of Applied Econometrics and Quantitative Studies*, Vol.3-1



70. Tatom, J. A. (2007). Is tax policy retarding growth in Morocco? Retrieved 25/08/13 (<http://www.networksfinancialinstitute.org>).
71. Thomas, R. L. (1997). *Modern Econometrics, An introduction*. Sydney: Addison Wesley.
72. Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit, and Banking*, 1(1), 15-29.
73. Tomljanovich, M., (2004). The Role of State Fiscal Policy in State Economic Growth. *Contemporary Economic Policy* 22 (3), 318–330.
74. Ussher, L. J. (1998). Do Budget Deficits Raise Interest Rates? A survey of the empirical literature. *Transformational Growth and Full Employment Project, Working Paper, no.3*.
75. Vergara, R. (2004). *Taxation and Private Investment; Evidence for Chile*. First draft, Economics Department, Universidad Catolica de Chile.
76. Were, M. (2001). *The Impact of External Debt on Economic Growth and Private Investment in Kenya; An Assessment*. UNU/WIDER Discussion Paper DP2001-120, Helsinki.
77. World Bank, (1991). *Ghana: Progress on Adjustment* Yotopoulos, P. & Nugent, J. (1976). *Economics of Development: Empirical Investigations*, New York: Harper and Row.