A Time Series Analysis of the Impact of Economic Infrastructure on Economic Growth in Cameroon: Case of Energy and Telecommunications

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Abstract
This study investigates the impact of economic infrastructure on economic growth in Cameroon. It employs an extended generalized Cobb Douglas production function model, using World Bank Data from 1977 to 2009. All variables were non stationary and of an order I (1), so the Cointegration test was conducted for long run equilibrium using the Johansen approach. All the variables confirmed cointegration and as such the conventional vector error correction model was estimated. Electricity consumption has a positive and significant impact on economic growth in Cameroon in the short run. Energy consumption from oil sources has a positive and significant impact on economic growth in the long run. On the other hand, the number of fixed telephone lines was found to have a positive and insignificant impact on economic growth. Policies aimed at stimulating electricity consumption and energy use from oil sources should be implemented. Investment should be tilted from fixed telephone lines to modern means of communication.

Key Word: Economic Infrastructure, Economic Growth, Cointegration test, Error Correction Model, Cameroon.

Introduction

At independence in 1961, Cameroon was in great need of economic development and so the government put in place policies to promote economic growth with economic infrastructure development being one of them. Therefore, the whole economy was motivated by government intervention in all sectors. This was justified by the new growth theories that laid emphasis on the influence of public expenditure on economic activity. The empirical works of Aschauer (1989a and 1989b), Barro’s Model (1990) of endogenous growth, all confirm the main role of public investment and expenditure on economic growth. The economy of Cameroon performed very well from the period 1961 to 1985 with agriculture supporting the economy of Cameroon. From 1961 to 1977, agriculture accounted for 34% of the Gross Domestic Product (GDP), employing over 80% of the labour force.

The discovery of petroleum in 1978 equally stimulated the growth till 1985(Bekolo (1986), Tsafack (2006)). This led to investment in the domain of petroleum production (Ajab (2002)). Government intervention was equally significant in the transport sector, with government setting up enterprises of railway, air travel, urban road transport and maritime transport. With all these major activities, Cameroon enjoyed a stable macro-economic environment and an average growth rate of 7% up to the late 1980s. Therefore, the period after independence up to 1985 was marked by economic infrastructure development mainly undertaken by the state. By 1987, due to the collapse of the world’s economy, Cameroon was plunged into economic crisis. The government abandoned the vision of long term
development strategies, with average annual GDP declining from 7% to -5% between 1987 to 1993. The drastic reduction of public investment during this period aggravated the situation causing most of the infrastructure to be abandoned and enterprises closed down.

The Bretton Woods institutions admitted Cameroon into the Structural Adjustment Programme (Baye (2004), Noula (1995)), which saw a more liberal economy to stimulate competition especially with the devaluation of the FCFA. This had a negative effect on economic infrastructure development. The World Bank Development Report (1994) studies on infrastructure highlighted the crucial role of economic infrastructure in the development process in Cameroon.

Cameroon has made significant progress in many aspects of economic infrastructure, implementing institutional reforms across a broad range of sectors with a view to attracting private-sector participation and finance, which has generally led to improvements in performance. That notwithstanding, the country still faces a number of important infrastructure challenges, including poor quality roads, expensive and unreliable electricity, and a stagnating and uncompetitive Information and Communication Technologies (ICT) sector. This poor state of Cameroon’s economic infrastructure has been a key bottleneck to the nation’s economic growth. Power generation continues to be expensive in Cameroon, with two factors explaining the high costs. Firstly, hydropower resources are seasonal and subject to fluctuations. Secondly, prices are high for the diesel on which the country relies for back-up generation in the dry season.

Despite Cameroon’s oil resources, the country lacks a well developed refinery, and this is reflected in the high prices of kerosene, diesel and gasoil. Deficient power infrastructure held back growth by 0.28 points per capita in 2007. The power supply in Cameroon is unreliable. Investment climate surveys suggest that firms encountered around 128 outages in 2009, almost as twice the average for Africa’s middle-income countries, enduring blackouts of four hours each time. On average, at least 16 days a year are spent without power due to outages (World Bank 2009). It is estimated that as much as 31 percent of the country’s installed capacity is self-generation. Suppressed demand for power is around 241 Gig Watts-hour (GWh) and is expected to progressively increase with growing domestic demand (World Bank and IFC 2010). If Cameroon could improve its economic infrastructure to the level of Africa’s middle-income countries, it could raise its per capita economic growth rate by about 3.3 percentage points (Carolina et al (2011)).

Cameroon has lagged in reforming its telecommunication sector. Even though the sector regulator, ART (Agence de Régulation des Télécommunications), was established by the Telecommunications Act in 1998, no further legislation has been enacted and the regulatory landscape remains unclear. The market is still not fully liberalized. South Africa’s MTN (Mobile Telephone Network) and Orange of France dominate the mobile market, as measured by the Herfindahl-Hirschmann Index\(^1\). There are numerous Internet service providers, but the market is led by CAMNET, a CAMTEL subsidiary offering connections, and the two mobile operators.

In Cameroon’s Growth and Employment Strategy Paper (GESP) 2010/2020, one of the main growth strategies envisaged is economic infrastructure development, mainly in the domain of energy consumption, access to safe drinking water, tarred roads, railways, telephone lines, urbanization, and construction of urban roads. From the above analyses, it is clear that the government of Cameroon is relying on economic infrastructure development for a faster rate of economic growth. As such, can the lack of sustainable economic growth be attributed to the lack of economic infrastructure? Specifically, what is the significant contribution of each identified economic infrastructure variable on economic growth?

\(^1\) The Herfindahl-Hirschmann index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. An HHI of 100 indicates the market is a monopoly, while the lower the HHI the more diluted is the market power as exerted by one company/agent.
This study aims to assess the impact of some selected economic infrastructure on economic growth in Cameroon from 1977 to 2009. We assess the impact of electricity consumption; energy used from oil sources and the number of fixed telephone lines on economic growth. The majority of research supports a significant and positive relationship between economic infrastructure and economic growth based on computing an infrastructure index. Nevertheless, there is an element of risk involved for government policy makers, who depend on such research to predict economic outcomes from various strategies. Financing economic infrastructure is a crucial issue, especially in developing economies like Cameroon, where budgetary surpluses are difficult to be achieved (Merna and Njiru (2002)). Incomes are low in Cameroon, savings are low and thus investment is low. Therefore, generating sufficient infrastructure funds arguably will remain an issue for the government of Cameroon, and therefore academic inquiry is necessary to give some direction to its policy makers to undertake specific policy recommendations. This study apart from its contribution to the theoretical and empirical debate on the effect of economic infrastructure on economic growth in Cameroon, it has strong policy implications. If it is realized that the selected economic infrastructure has a positive and significant effect on economic growth, then, a country which experiences a slow rate of economic growth like Cameroon stands to benefit enormously in terms of an increase in GDP by improving on its economic infrastructure.

**Concepts and Literature Review**

**Theoretical Framework**

Economic infrastructure refers to large scale civic construction which directly or indirectly promotes economic development. This term dates back from the 1920s, referring then to public works such as roads, bridges and rail, which was not given greater attention until later last century (Prud’homme 2004). An earlier definition by Nurske (1953) envisaged infrastructure to comprise elements that provide services for production capacity, Hirschman (1958) and later Biehl (1994) viewed infrastructure as capital that provides public service. Economic infrastructure is accounted as physical units; roads, canals and railways for example, are measured in kilometers and public funds deployed. Measurement is difficult since large infrastructure projects, years of time series data are required. Analysis of public capital stock relies on the availability and quality information which is insufficiently available in many developing countries. Researchers therefore use proxies for economic infrastructure: kilometers of paved roads, kilowatts of electricity generating capacity, and number of telephones (Cannmy and Pedron; 1999; Esfahan and Ramirez 2003). The main strong hold of using physical counts of infrastructure is that they are not reliant on national accounts, which can give prominence to the public investment provider and are not directly affected with ills such as inflation.

Economic growth is an increase in the productive capacity of a country identified by a sustained increase in real GDP over a long period of time. Economic development and growth are both economic concepts which are related. Dudley Seers (1969) emphasized that economic development should not be equated to growth, as it embodies qualitative aspects such as, reduction and elimination of poverty and inequality. Todaro (1989) widened the scope of economic development to be conceived of as, ‘a multi-dimensional process involving major changes in social structures, popular attitudes and national institution, as well as the acceleration of economic growth, reduction of inequality and the eradication of absolute poverty’. Defining economic development as such result to potential factors which are qualitative and difficult to quantify (Jomo and Reinert (2005)). We proxy economic growth with real GDP in this work.

Over the last two decades, considerable efforts have been devoted to theoretical and empirical evaluation of the contribution of economic infrastructure to growth. This is emphasized on the fact that it creates job opportunities, increases productivity, and minimizes transport and transaction costs. Further, we provide theoretical justification to the empirical validation of electricity consumption; energy used from oil sources and the number of fixed telephone lines.
Firstly, in the domain of electricity consumption and economic growth, there are a number of significant studies carried out in this domain. Ongono (2009) found out that there is no Granger causality between electricity consumption and economic performance at the national level and the primary sector in Cameroon. In the secondary sector, it is real GDP that Granger causes electricity consumption while the tertiary sector, the causality goes from electricity consumption to production. Sheng-Tung et al (2006) revealed that a sufficiently large consumption of electricity can ensure a high level of economic growth. Their work was based on 10 Asian countries. Sharif (2012), in his work investigating causality between economic growth, electricity consumption, exports and remittance, revealed that there is a positive and significant long run effect of electricity consumption on economic growth in South Asian countries. We therefore found it necessary to use an annual time series data for electricity consumption in Cameroon. Solarin (2011) reveal that electricity consumption is positively related with the real GDP in the long run.

Secondly, we provide theoretical evidence for the choice of information and communication technology variable. Lehr and Glassman (2001) investigate the impact of competition in Telecommunications on economic growth in the USA and confirmed that the liberalization of the ICT sectors has a positive impact on growth. SRIDHAR et al (2007) investigated empirically the relationship between telephone penetration and growth using data for developing countries. They concluded that telephone penetration has a positive impact on growth in developing countries. Roller and Waveman (1996) traced how telecommunication infrastructure affects economic growth in 21 OECD countries over the past twenty years. They concluded that there exists a positive causal relationship. Keck and Calvin (2006) studied the liberalization of telecommunication services and their impact on growth in Africa. They concluded that ICT has enormously affected growth in Africa positively. The Organisation for Economic Co-operation and Development (2003) investigated and confirmed that ICTs have a positive impact on the economy in OECD countries. In the 10th meeting of the Africa partnership forum (2008) holding in Tokyo, Japan, it was revealed that ICTs in Africa are boosters to economic growth in Africa. Due to insufficient data for ICT indicators in Cameroon, ICT is proxied by the number of fixed telephone lines in this work.

Economic Infrastructure and Economic Growth

Simple Cobb-Douglas (C-D) Function

Studies of public capital expenditure and its relationship with economic growth, as noted, came into prominence during the 1980s. Since then, the majority of quantitative analyses use the simple Cobb-Douglas (C-D) specification because of its simplicity. Ratner (1983) estimated an aggregate production function for the United States of America (USA) private business from 1949 to 1973. The result identified public capital as a significant input, having an output value of 0.06. However the seminal study by Aschauer (1989a) used a C-D production function and examined USA data, from 1949 to 1985. Their findings reveals that service infrastructures such as hospitals, educational buildings and conservation and development structures were, if at all minor contributors to aggregate USA productivity while economic infrastructure such as power, roads, airports and water systems were significant contributors. Aschauer’s estimate for public infrastructure showed a high overall output elasticity value of 0.36, which renewed empirical researcher’s interest in public infrastructure investment.

A significant number of follow up studies showed results that confirmed Aschauer’s findings. Ram and Ramsey (1989), also estimated aggregate production function for private output from annual USA data from 1949 to 1985. Their estimates indicated that public capital had a positive effect on private output, with an elasticity value of 0.24. Munnell (1990) also found results similar to Aschauer’s finding. Using USA data from 1959 to 1989, his estimate of public capital elasticity of output was 0.34 but later regarded it as too large to be credible (Munnell (1992)).

OECD stands for Organisation for Economic Co-operation and Development
Using aggregated time series data, Munnell and Cook (1990) show that public infrastructure is prone to the causation or multiplier effect\(^3\), and they used American States-level cross-section data to avoid the causation issue. As such, they disaggregated data to reduce the probability of spurious correlation between productivity and infrastructure usually in aggregated data. Moreover, with the disaggregated data, the spillover benefit effect between regions also appears reduced. That notwithstanding, using such disaggregated data led to another Specification issue. Holtz-Eakin (1994) claimed that the application of Ordinary Least Squares (OLS) techniques used by Munnell and Cook (1990) and Garcia and McGuire (1992), in estimating the impact of public infrastructure on economic growth appears bias and could deliver inconsistent estimates. He argues that the estimation failed to account for local data, or state-specific effects such as differences in productivity that stem from location, climate and endowment variations.

The use of the C-D production function by researchers presents the following points of contention (Bhanu Murthy (2002)): It cannot manage a large number of inputs, the function is based on restrictive assumptions that perfect competition exists in the factor and product markets, It assumes constant returns to Scale, Serial correlation and heteroscedasticity are common problems in this type of function, Labour and capital are correlated and the estimates are bound to be biased, Unitary elasticity of substitution is unrealistic, It has a restriction on functional form and It cannot measure technical efficiency levels and growth effectively.

**Transcendental Logarithmic Function**

As a result of the shortcomings of simple C-D production functions, economists utilize a flexible functional form of estimation such as the Transcendental Logarithmic (TL) production function which is a generalization of the C-D function. TL production function is conceptually simple and does not impose a priori restrictions on elasticity of substitution and return to scale (Chambers (1988)). Inputs contribute to multiplicative increments in output levels and allow for interaction within and between inputs. TL is an improvement over simple C-D, as it allows for substitution and the returns to scale\(^4\) to vary with the size and type of input. While C-D allows researchers to separately investigate the impact of each input to production, TL captures input substitution effects. In other words, TL facilitates an understanding of the effect of combined inputs on the output which will be the case of our model.

Empirical studies using TL production function has been done by, Merriman (1990) who estimated the relationship between public capital and regional output for nine Japanese regions using panel data from 1954 to1963, reveal that public capital has a positive and significant impact on national output, with elasticity of public capital ranging from 0.43 to 0.58. Dalamagas (1995) investigated public capital formation effect on Greek Manufacturing sector performance using time-series data from 1950 to1992, and concluded that public investment had a positive impact on Greek manufacturing Sector, with a high elasticity of 0.53. Charlot and Schimitt (1999) examined the role of public infrastructure growth in 22 regions in France, from 1982 to 1993. To evaluate region-specific elasticity, they used TL production functions with three inputs: private capital, employment and public capital. They concluded that there was a positive effect of public capital on regional wealth. Webster and Scott (1996) reveal the coefficient estimations of TL functions are less precise than those of C-D functions and there is a possibility of multicollinearity\(^5\).

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\(^3\) It describes how a change in one or more economic variable starts a chain reaction that generates more economic activity than the initial increase.

\(^4\) It measures the relation between a proportional change in inputs to a productive process and the resulting proportional change in output.

\(^5\) Multicollinearity - where two or more predictor variables in a multiple regression model are highly correlated.
Further, as the flexible functional form requires a greater number of inputs, there is the issue in interpreting numerous coefficients. Despite the differences in functional methodologies used by empirical researchers, there is a commonality in their result that confirms a positive and significant relationship between public infrastructure and economic growth. Nevertheless, a number of studies found only weak positive support for the public infrastructure effect at the aggregate level (Ford and Poret (1991); Holtz and Schwartz (1995), Sturm and Haan (1995)) or at the regional level (Hulten and Schwab (1991); Holtz-Eakin (1995)).

The primary issue from the work by Aschauer (1989a), is model specification. Duggal et al, (1999) explain that all studies based on the production function approach treat public capital as a factor of production, similar to that of private capital and labour. However, in standard marginal productivity theory, the market determines per unit cost of factors of production, which in turn determine the optimal use of the factor. In reality, a unit cost of public capital is not determined by the market, as public investment is financed through general tax revenues or government debt. To address this issue, researchers may use estimation. Nevertheless, in an empirical study, Sturm (1998) found that using public capital as either a factor of production or a technology factor makes no difference.

The next issue is reverse causation, which was not satisfactorily explained. Aschauer (1989a, 1989b, 1989c) and Munnell (1992), for example, assumed causation to run from public capital to growth. However, it is also possible that economic growth can contribute to an increase in public capital (Eisner (1991), Gramlich (1994)). For example Tatoom (1993) tested for causality via a series of lead-log type of analyses and found that the direction of causation may be from growth to capital. Causality may cycle. As output increases, there are greater savings to devote to capital formation, thus infrastructure investment is caused by output growth, which in turn creates further infrastructure (Hulten and Schwab (1993)). The causation cycle involves a simultaneity bias (Gramlich (1994)). With this in mind, our work is limited to investigating the effect of economic infrastructure development on economic growth.

It has long been recognised that sets of non–stationary variables can move together over time. Granger et al (1983) formalized this concept, defining such sets as cointegrated variables, which over time produced various tests for cointegration and techniques for working with cointegrated variables. Non stationarity among variables could provide a spurious relationship, an issue which was raised by Aaron (1990) and Gramlich (1994) as a challenge to Aschauer’s (1989a) findings. Estimation using first difference is recommended as a potential solution to this issue (Aaron (1990), Hulten and Schwab (1991), Tatoom (1991)). Their results from first differences showed the effect of public capital as relatively small, possibly negative and generally not statistically significant. Tatoom (1993) for example, modified the aggregate time series analysis approach used by Aschauer and others using first differenced data, finding lower rates of return on public capital, insignificant and possibly negative, than that reported by Aschauer (1989) or Munnell (1992).

Nevertheless, there is an issue with first differencing specification, as it loses the Long-term (co-integrated) relationship that may exist among the variables in the data. Munnell (1992) advised that, instead of applying first difference, the variables should be tested for co-integration, adjusted and estimated accordingly.

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6 Non-stationarity: a time series data set that violates one or more of the stationary properties including the mean and the variance of the variable is constant over time.

7 A spurious relationship result if the estimated parameters using Ordinary Least Square (OLS) is highly significant, and the coefficient of determination ($R^2$) is very high (Granger & Newbold 1974). That is DW statistics is greater than Adjusted $R^2$.

8 First difference: a member of a sequence that is formed from a given sequence by subtracting each term of the original sequence from the next succeeding term.
This review of literature concerning the production function approach to estimate the impact of economic infrastructure on economic growth has not given a clear outcome. While earlier studies found a positive significant relationship (Sama, 2012), later studies reported an insignificant relationship which could also be negative. However, the majority of researchers found a positive relationship between public infrastructure investment and economic growth. The studies using a production function approach are subject to various estimation issues including model specification, reverse causation and spurious regression. In a nutshell, a greater proportion of the works above have their loopholes grouped into the following.

- Firstly, some of their methodological backgrounds show a reverse causation from productivity of public capital and a spurious correlation due to non stationarity of the data (Gramlich, (1994) and Garcia et al (1996)). Our work will test for stationarity first to avoid carrying out a spurious relationship.

- Most of the empirical studies were based on developed countries. It becomes very necessary to carry out a similar work in a developing country such as Cameroon.

- Equally, some of the studies make use of cross country regression and panel data (Charlot and Schmitt (1999)). However, the work of Stephane (2007) showed that a positive effect of infrastructure on growth is more likely to be detected in studies based on a production function using time series data rather than studies based on cross country regressions.

The State of Cameroon’s Infrastructure

In spite of recent increases in electricity generation capacity, power generation continues to be expensive in Cameroon. High costs and subsidized tariffs, compounded by weak operational performance affect the financial sustainability of AES Sonel. Tariffs have historically recovered only 60 percent of the costs significantly below cost-recovery levels in Africa’s middle and resource-rich countries. Due to the prevalence of theft, transmission and distribution losses which historically have been high, at 35 percent, above the level observed in comparable countries. In fact, non technical losses increased from 22 percent in 2006 to 26 percent in 2008 (GTZ (2009)).

Burgeoning illegal connections, decrepit metering systems, and outmoded billing software have compounded the situation. The burden of financial and operational inefficiencies has increased over time. Hidden costs rose from about 108 percent of revenues in 2005 to 121 percent in 2009. In absolute terms, the largest contributor to the hidden costs was the mispricing of power. Relative to several of Cameroon’s West and Central African neighbours, the burden of hidden costs for AES Sonel is high. The power supply in Cameroon is unreliable. To combat erratic power supply, many firms generate their own power. It is estimated that as much as 31 percent of the country’s installed capacity is self-generation.

Investment climate surveys from 2007 determined that unreliable power was one of the top five constraints to business activity. Around 67 percent of firms reported that power was a major constraint to business (Eberhard et al (2009).). Firms that generate their own power face high costs. Self-generation is estimated to cost four times the tariff charged by the power utility, which pushes up the prices of the firms’ products. Looking ahead, simulations suggest that with the development of regional trade, made possible by further development of Cameroon’s hydropower resources, AES Sonel’s long-run marginal costs could fall which would be better aligned with current tariff levels. The cost reductions would come from further development of Cameroon’s hydropower resources. Cameroon has enormous potential within the Central African Power Pool (CAPP) to produce low-cost hydropower and become a major player in regional trade, by exporting power to Chad, the Republic of Congo, Gabon, and Equatorial Guinea. To fully develop

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9Panel data - data set containing observations on multiple phenomena in multiple time periods.
regional trade through the CAPP, however, Cameroon would need to develop 1,400 MW of hydropower over and above the amounts needed to meet domestic demand, and to develop an additional 831 MW in interconnector capacity. This would also result in commercial gain through exporting over half the domestic power production.

Restructuring and privatizing CAMTEL will yield significant fiscal benefits. CAMTEL has been the recipient of large indirect subsidies in infrastructure, highlighting the significant costs of the telecom sector to the government. In most other African countries, the telecom sector is the first to be privatized and to operate without government support, as its sector fundamentals allow for cost recovery through commercial tariffs and a relatively short path to breaking even because of relatively low capital expenditures. The privatization of CAMTEL was launched in 1997, but the process stalled in 2002 after negotiations with the first two bidders failed. The country has yet to benefit fully from its connection to the SAT3 undersea fiber-optic cables. Connection to SAT3 will increase Internet connectivity from 0.2 to 13 bits per person between 2000 and 2009, but that rate of connectivity is low in comparison to Sub-Saharan African peers (Africa Infrastructure Country Diagnosis database (2009)).

Data and Methodology

This chapter describes the nature and source of data that captures issues relevant to the study. It will equally involve the methodology, drawn from the approaches reviewed. The next step will bring in issues related to the ordinary least square method of estimation. This will equally take into consideration the econometric procedures related to studies using time series data. We have two equations that will be estimated using the ordinary least squares method. The current period of study is 1977 to 2009. The study period of 33 years (1977 to 2009) was selected because of data availability. The complete set of data for the variables chosen in this work is from World Bank Development Indicators (WDI) CD-ROM (Compact Disc Read Only Memory), 2011 (WDI CD-ROM 2011). The three economic infrastructure variables considered to quantify infrastructure, are equally taken from the same source, all in excel format.

Definition of Variables

Real Gross Domestic Product (RGDPt)

It is our dependent variable because we want to see the behaviour of real GDP to changes in economic infrastructure variables in Cameroon. It is defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. These data are based on constant local currency unit (World Development Indicators, CD-ROM 2011).

Electric Power Consumption (EPCt)

This variable represents the effect of electricity power consumption on economic growth. Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution and transformation losses and own use by heat and power plants. The physical unit of measurement of this variable is Kilowatt-hour (World Development Indicators, CD-ROM 2011). This variable is used since it actually reflects electric power consumption without production losses.

Fixed Telephone Lines (TLt)

This variable is used to represent the effect of telecommunication infrastructure development on economic growth. These are fixed telephone lines that connect a subscriber’s terminal equipment to the public switched telephone net work. Integrated service digital network channels and fixed wireless subscribers are
included. Because of insufficient data for some variables of Information and Telecommunication Technology, only the number of fixed telephone lines is used (World Development Indicators, CD-ROM 2011).

Energy use from oil sources

This variable captures the effect of energy use from oil sources on economic growth in Cameroon. Energy use refers to primary energy before transformation into other end-use fuels, which is equal to indigenous production plus imported stock changes minus exports and fuels supplied to ships and aircraft engaged in international transport (World Development Indicators, CD-ROM 2011).

Labour Force Total (LFT)

This variable captures the effect of labour force on economic growth since the development of this economic infrastructure improves the productivity of labour. Labour force comprises people aged 15 and older, who meet the International Labour Organisation definition of the economically active population. It includes both the employed and the unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part time workers, in general the labour force includes the armed forces, unemployed, and first –time job-seekers, but excludes home-makers and other unpaid caregivers and workers in the informal sector (World development indicators, World Bank, CD-ROM 2011).

Private Domestic Investment (KPVt)

It is proxy by Gross Domestic Fixed Capital Formation (GDFCF) for the private sector. It covers gross out lays by the private sector (including private nonprofit agencies) and addition to its fixed domestic assets (World development indicators CD-ROM 2011).

Public Domestic Investment (Kpubt)

Edward et al (2006), define public investment as public expenditure that adds to the public physical capital stock. This would include the building of roads, ports, schools, hospitals etc. This corresponds to the definition of public investment in national accounts data, namely, capital expenditure. In this work it’s gotten by taking the difference between total investment and private domestic investment using data from World Bank development indicators CD-ROM 2011.

Methodology of the Study

Since our main concern is to measure the impact of economic infrastructure development on economic growth in Cameroon, we are estimating the economic growth function. To meet our objective, this work gained inspiration from the the generalized Cobb Douglas production function model used by Pravakar et al (2010). They extended their model by including an infrastructure index (It) computed using the principal component approach. From the general model, the major problem is that their work cannot bring out the specific role played by any of the six economic infrastructure indicators used to compute the infrastructure index that can help the government to undertake specific policy recommendations.

We develop the same theoretical model based on the contribution of public investment, private investment and labour force to economic growth. This is essentially based on the production function framework, assuming a generalized Cobb Douglas production function and extending this Neo-classical growth model to include some selected infrastructure indicators as additional inputs of the production function, alongside private capital, public capital and labour force as control variables written as;
\[ \text{RGDP}_t = f(K_{pvt_t}, K_{pub_t}, LF_t, \text{EPC}_t, \text{EU}_t, \text{TL}_t) \] (1)

Where \( \text{RGDP}_t \) is the annual real Gross domestic Product, \( K_{pvt_t} \) the domestic private investment, \( K_{pub_t} \) is the domestic public investment, \( LF_t \) is labour force total, \( \text{EPC}_t \) is electricity power consumption (Kwh), \( \text{TL}_t \) number of fixed Telephone lines, \( \text{EU}_t \) is energy used from oil sources (Kt of oil equivalent) and \( t \) the time trend. From the generalized equation they empirically examined the impact of infrastructure development on economic growth. Finally, we estimate the following equation from our generalized model in equation (1) in the form of a linear model:

\[ \ln \text{RGDP}_t = \alpha_0 + \beta_1 \ln K_{pvt_t} + \beta_2 \ln K_{pub_t} + \beta_3 \ln LF_t + \beta_4 \ln \text{EPC}_t + \beta_5 \ln \text{EU}_t + \beta_6 \ln \text{TL}_t + \epsilon_t \] (2)

\( \ln \) is the natural logarithm e.g \( \ln \text{RGDP} \) is the natural logarithm of real gross domestic product, \( \alpha_0 \) is the constant term, \( \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 \) are parameters of the independent variables and \( \epsilon_t \) stochastic error term. It is expected that \( \beta i > 0 \).

**Estimation Technique**

**Stationarity and Non-stationarity of Variables**

In this study, time-series data of macroeconomic nature are used for the estimation of the model and thus the data generating processes exhibit trends and volatility which could result in a non-stationary issue. Stationarity in time-series data refers to a stochastic time series that has three characteristics: the variable over time has a constant mean, the variance of a variable over time is constant, covariance between any two time periods is correlated. If one or more of these criteria is violated, then the data generating process of the time-series data is a non-stationary series (Gujarati 1995). The usage of ordinary least squares (OLS) methodology on time series data usually requires that the data be stationary to avoid the problem of spurious regression. To establish the order of integration of a series, unit root tests are performed. The most common unit root test, the Augmented Dickey-Fuller (ADF) is used in this study. The following decision rule is used:

- If the ADF test statistic is greater than the test critical value in absolute terms, then the series is stationary.
- If the ADF statistic is less than the test critical value in absolute terms, the series is non-stationary.

In order to avoid any robust in our estimation, we will equally do the unit root test using the Phillips-Perron approach.

If the series is non-stationary at level form, then the test is carried out successively on the differenced series until it becomes stationary. The order of integration is then established. From preliminary test, all variables in the equation are found to be non-stationary at level form I(0) but stationary at first difference I(1), then the cointegration test is conducted to find the existence of a long-run (L-R) equilibrium relationship. If the variables confirm the existence of cointegration, then the conventional Vector Error Correction Model (VECM) is estimated using OLS, confirming short run dynamics and long-run equilibrium, as an error correction term is constructed to estimate for coefficients.

**Cointegration**

If two variables are cointegrated at the first differenced order I(1), their relationship can be expressed as the error correction model (Granger & Weiss (1983), Engle & Granger (1987)). Cointegration refers to the existence of long-run equilibrium relationship between two or more time series variables which are individually non-stationary at their level form but stationary after difference (Gujarati (1995)). The theory of cointegration can therefore be used to study series that are non-stationary but a linear combination of which is stationary. The Engle and Granger cointegration test is not used since it’s a two steps approach
which is valid only when we study the relationship between two variables. In multivariate time series like our case, we can have more than two cointegrating equations which can only be depicted by the Johansen’s cointegration test. As such, the Johansen cointegration test will be used in this work given its ability to dictate more one cointegration relationship among variables.

**Vector Error Correction Model (VECM) of Real Gross Domestic Product**

Initially, VECM was devised to describe a relationship between the short-run dynamic and the long-run equilibrium (Sargan (1964)). Granger and Weiss (1983) and Engle and Granger (1987) pointed out that if two variables are cointegrated at the first difference order, their relationship can be expressed as the VECM by taking past disequilibrium as explanatory variables for the dynamic behaviour of current variables (Maddala and Kim 1998). Some studies compile, in a single model both the short and long run variables (e.g. Fielding, 1997, Agrawal, 2001). For that, an Error Correction Model (ECM) can be used. This approach enables the long run equilibrium relationship and the short-run dynamics to be estimated simultaneously (Gujarati, 2003). This type of technique helps to correct the potential bias in the estimation of the coefficients in models with differences that do not take into account cointegration relationships. When these long-term restrictions are ignored, there could be an omitted variable bias (Gujarati, 2003).

Harris (2000), summarises the four desirable features of ECM as follows: (i) it avoids the possibility of spurious correlation among strongly trended variables; (ii) the long-run relationships that may be lost by expressing the data in differences to achieve stationarity are captured through inclusion of lagged levels of the variables on the right-hand side; (iii) the specification attempts to distinguish between short-run (first-differences) and long-run (lagged-levels) effects; and (iv) it provides a more general lag structure, and does not impose too specific of a structure on the model. The VECM used in this work is specified as:

\[
\Delta \ln GDP = \beta_0 + \beta_1 \Delta \ln Kpvt + \beta_2 \Delta \ln Kpub + \beta_3 \Delta \ln LF + \beta_4 \Delta \ln EPC + \beta_5 \Delta \ln EU + \\
\beta_6 \Delta \ln TL + \beta_7 \Delta \ln GDP_{t-1} + \beta_8 \Delta \ln Kpvt_{t-1} + \\
\beta_9 \Delta \ln Kpub_{t-1} + \beta_{10} \Delta \ln LF_{t-1} + \beta_{11} \Delta \ln EPC_{t-1} + \beta_{12} \Delta \ln EU_{t-1} + \beta_{13} \Delta \ln TL_{t-1} + \varepsilon_t, \tag{3}
\]

Where; \(\Delta \) represents the change in natural logarithm of the variable, \(\varepsilon_t\) stochastic error term, \(\beta_7\) is the coefficient of the error correction term which shows the speed at which short run dynamics are adjusted to long run equilibrium.

**Presentation and Analyses of Results**

The figures on table 1 in the appendix shows the Augmented Dickey Fuller test statistic, which in absolute terms of variables, are all less than their respective test statistic values at various levels of significance of 1%, 5% and 10%. This confirms that all the variables are non-stationary at I (0). The test is conducted at two stages. Firstly, with trend and intercept inclusive and secondly, only with intercept inclusive. After taking their first difference still in table 1, Augmented Dickey Fuller test statistic in absolute terms for each variable, are all greater than their respective test statistic values. This confirms that all the variables are stationary at I (1) except for the case of lnTL which with intercept and trend, was still non stationary. In order to avoid any robustness in our regression, the unit root test was equally performed using the Philips Perron approach. Similar results were obtained (table 2).

The unit root findings, paved the way to investigate if there is a long run relationship between the variables. Using the Johansen cointegration approach, six cointegration relationships were detected using the Trace test at 5% level of significance (table 3.1) while the maximum Eigenvalue test detected three cointegration equations at 5% level of significance(table 3.2).
Table 1: Results of Augmented Dicker-Fuller Unit Root Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level Form I(0)</th>
<th>First Difference I(1)</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inter</td>
<td>Intercept &amp;</td>
<td>Intercept</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trend</td>
<td>I(0)</td>
</tr>
<tr>
<td>lnRGDP</td>
<td>-0.731118</td>
<td>-1.499184</td>
<td>-4.174144***</td>
</tr>
<tr>
<td>lnKpvt</td>
<td>-0.999747</td>
<td>-2.559124</td>
<td>-7.429993***</td>
</tr>
<tr>
<td>lnKpub</td>
<td>-1.371397</td>
<td>-1.652226</td>
<td>-4.102714***</td>
</tr>
<tr>
<td>lnLF</td>
<td>-1.086076</td>
<td>-2.998016</td>
<td>-4.041095***</td>
</tr>
<tr>
<td>lnEPC</td>
<td>-0.284915</td>
<td>-1.329987</td>
<td>-4.659943***</td>
</tr>
<tr>
<td>lnEU</td>
<td>-0.257761</td>
<td>-2.079431</td>
<td>-4.323820**</td>
</tr>
<tr>
<td>lnTL</td>
<td>-0.931112</td>
<td>-1.322494</td>
<td>-4.054380***</td>
</tr>
</tbody>
</table>

Source: Authors calculations using Eviews7

Table 2: Results of Phillips-Perron Unit Root Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level Form I(0)</th>
<th>First Difference I(1)</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inter</td>
<td>Intercept &amp;</td>
<td>Intercept</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trend</td>
<td>I(0)</td>
</tr>
<tr>
<td>lnRGDP</td>
<td>-2.190136</td>
<td>-2.509682</td>
<td>-4.177866***</td>
</tr>
<tr>
<td>lnKpvt</td>
<td>-0.999747</td>
<td>-2.423581</td>
<td>-7.700612***</td>
</tr>
<tr>
<td>lnKpub</td>
<td>-2.135487</td>
<td>-2.117584</td>
<td>-4.142156***</td>
</tr>
<tr>
<td>lnLF</td>
<td>-1.079097</td>
<td>-2.121275</td>
<td>-3.093972***</td>
</tr>
<tr>
<td>lnEPC</td>
<td>-0.373019</td>
<td>-1.562831</td>
<td>-4.662872***</td>
</tr>
<tr>
<td>lnEU</td>
<td>-2.545958</td>
<td>-1.722889</td>
<td>-5.132914***</td>
</tr>
<tr>
<td>lnTL</td>
<td>-0.558121</td>
<td>-1.322494</td>
<td>-4.054380***</td>
</tr>
</tbody>
</table>

Source: Authors calculations using Eviews7

Table 3: Results of Johansen Cointegration Test

Table 3.1 Trace Test

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvale</th>
<th>Trace</th>
<th>0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.946085</td>
<td>235.4120</td>
<td>125.6154</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.597022</td>
<td>147.8014</td>
<td>95.75366</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.693686</td>
<td>100.8787</td>
<td>69.81889</td>
</tr>
<tr>
<td>At most 3 *</td>
<td>0.586916</td>
<td>65.38438</td>
<td>47.85613</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.508558</td>
<td>38.86126</td>
<td>29.79707</td>
</tr>
<tr>
<td>At most 5 *</td>
<td>0.438802</td>
<td>17.54893</td>
<td>15.49471</td>
</tr>
<tr>
<td>At most 6</td>
<td>0.007257</td>
<td>0.218505</td>
<td>3.841466</td>
</tr>
</tbody>
</table>

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Table 4: Results Of Vector Error Correction Model Test

Dependent Variable: D(LNRGDP)
Method: Least Squares.
Date: 06/11/13   Time: 05:26,
Included observations: 31 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>15.22856</td>
<td>4.044021</td>
<td>3.765697</td>
<td>0.0015</td>
</tr>
<tr>
<td>D(LNKPVT)</td>
<td>0.132755</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>D(LNKPUBT)</td>
<td>0.109375</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>D(LNLFT)</td>
<td>0.434560</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>D(LNEPCT)</td>
<td>0.227503</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>D(LNEUT)</td>
<td>0.312713</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>D(LNTL)</td>
<td>0.028300</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNRGDP(-1)</td>
<td>-0.742010</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNKPVTV(-1)</td>
<td>0.151435</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNPUBT(-1)</td>
<td>0.196979</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNLFT(-1)</td>
<td>-0.763696</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNEPCT(-1)</td>
<td>0.128343</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNEUT(-1)</td>
<td>0.785125</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
<tr>
<td>LNTL(-1)</td>
<td>0.055116</td>
<td>0.026928</td>
<td>4.930046</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

R-squared 0.932125 Mean dependent var 0.031540
Adjusted R-squared 0.880221 S.D. dependent var 0.057723
S.E. of regression 0.019977 Akaike info criterion -4.685970
Sum squared resid 0.006785 Schwarz criterion -4.033636
Log likelihood 86.60253 Hannan-Quinn criter. -4.474866
F-statistic 17.95861 Durbin-Watson stat 1.950042
Prob(F-statistic) 0.000000

Table 4 represents the results of the vector error correction model (VECM). Globally, we can notice that the explanatory strength of the model is good. The adjusted R square is very high (about 88.02%). This means that the explanatory variables explain the explained variable for about more than 88%. The overall
significance of the model is good at 1% through the prob (Fisher-statistic), since the p-value (0.000) from table 4 is less than 0.05. As such, we reject the null hypothesis, implying that the parameters are globally significant.

Table 5: Results of Diagnosis Test

<table>
<thead>
<tr>
<th>Table 5.1: Autocorrelation Test</th>
<th>Breusch-Godfrey Serial Correlation LM Test:</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.285429</td>
</tr>
<tr>
<td>Prob. F(2,15)</td>
<td>0.7557</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>1.136520</td>
</tr>
<tr>
<td>Prob. Chi-Square(2)</td>
<td>0.5665</td>
</tr>
</tbody>
</table>

Table 5.2: Heteroscedasticity Test

<table>
<thead>
<tr>
<th>Heteroskedasticity Test: ARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
</tr>
<tr>
<td>Prob. F(1,28)</td>
</tr>
<tr>
<td>Obs*R-squared</td>
</tr>
<tr>
<td>Prob. Chi-Square(1)</td>
</tr>
</tbody>
</table>

The model diagnosis tests are equally good. From table 4 our regression was not spurious since the Durbin Watson stat (1.95) is greater than the adjusted R square (0.88). Using the Breusch-Godfrey serial correlation LM test (table 5.1), both the Prob of F statistics (0.755) and Prob of Obs R (0.566) are greater than 0.05, confirming the absence of autocorrelation. Using the ARCH test (table 5.2), both the Prob of F statistics (0.806) and Prob of Obs R (0.796) are greater than 0.05, equally confirming the absence of heteroscedasticity. The probability of Jarque-Bera (0.554) on table 5.3 is greater than 0.05 implying that jointly, our variables are normally distributed. The Ramsey RESET test for model specification (table 5.4) shows that our model is correctly specified. Our VECM is also stable since the errors from our model over time runs in between the two red lines of 5% level of significance as shown on table 5.5.

Table 5.3: Normality Test

<table>
<thead>
<tr>
<th>Series: Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1978 2008</td>
</tr>
<tr>
<td>Observations 31</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Std. Dev.</td>
</tr>
<tr>
<td>Skewness</td>
</tr>
<tr>
<td>Kurtosis</td>
</tr>
<tr>
<td>Jarque-Bera</td>
</tr>
<tr>
<td>Probability</td>
</tr>
</tbody>
</table>

Table 5.4 Model Specification Test

<table>
<thead>
<tr>
<th>Ramsey RESET Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation: UNTITLED</td>
</tr>
<tr>
<td>Specification: D(LNRGDP) C D(LNKPVPT) D(LNKPVBT) D(LNLFT) D(LNEPCT) D(LNEUT) D(LNTL) LNRGDP(-1) LNKPVPT(-1) LNKPVBT(-1) LNLFT(-1) LNEPCT(-1) LNEUT(-1) LNTL(-1)</td>
</tr>
<tr>
<td>Omitted Variables: Squares of fitted values</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-statistic</td>
<td>0.638547</td>
<td>16</td>
</tr>
<tr>
<td>F-statistic</td>
<td>0.407742</td>
<td>(1, 16)</td>
</tr>
<tr>
<td>Likelihood ratio</td>
<td>0.780102</td>
<td>1</td>
</tr>
</tbody>
</table>
From table 4, the coefficient of the lagged endogenous variable lnRGDP(-1) is -0.742, is highly significant at 1% percent and has the appropriate negative sign, confirming the existence of a good error correction mechanism. Thus, it will rightly act to correct any deviations from the long-run equilibrium up to the tune of more than 74%, which is good. This strong significant value of the lagged dependent variable of our VECM explains the existence of a long-run equilibrium relationship between economic infrastructure and economic growth in Cameroon. This established long-run equilibrium relationship in our result reveals that our findings can be used for forecasting and policy recommendations.

**Discussion of the impact of Exogenous Variables on the Real GDP**

**Impact of Electricity Power Consumption on Economic growth**

Findings from our results in table 4, reveal that electricity power consumption has a positive and significant impact on economic growth in Cameroon in the short run, which answers our first specific alternative hypothesis. In the long run, it has a positive but insignificant effect on economic growth. This result is equally in line with most of what is found in literature. Azlina (2011), looking at the effect of energy consumption on economic growth in Malaysia. Ongono (2009), in his article pointed out that electricity consumption has a positive and significant effect on economic growth. We can observe that a unit percentage increase in electricity power consumption increases real GDP by 0.23% in the short run and 0.13% in the long run.

**Impact of energy use on economic growth**

Still from table 4, energy use from oil sources has a significant and positive effect on economic growth in Cameroon in the long run, which also answers our second specific hypothesis. However, it has a positive but insignificant effect on economic growth in the short run. Our results contradicts with the findings of Olomola (2007), who confirms that oil exporting countries do not experience a fast rate of economic growth because of rent seeking, corruption, lack of democracy and civil war. These results also indicate that a unit percentage variation in energy use, changes RGDP by 0.79% in the long run and by 0.31 in the short run, in the same direction as the change in energy use from oil sources.
Impact of increase number of Fixed Telephone Lines on Economic Growth

Our finding reveals that increase number of fixed telephones lines with our expected relationship with growth but its impact being insignificant both in the short run and long run. However, this can be attributed to the availability of new and better techniques of communication such as mobile phones and the internet. Mobile phones for example cover a wider range and are portable. Most of the works in this area indicate a positive impact on growth. Due to data constraint, we could not get sufficient quantitative information on internet and mobile phone users that might have improve on our results, for the last 33 years.

Conclusion

This study investigated if economic infrastructure has a positive and significant impact on economic growth in Cameroon, as its main objective from 1977 to 2009. To meet the objective of our study, we used the standard theoretical neoclassical growth model, based on a generalized Cobb Douglas production framework with some extensions. The ADF and Phillip-Perron tests were used to test for stationarity.

Looking in terms of specific policy implications in different sectors concerned with economic infrastructure, the following can be recommended to interested parties;

1) Given the high and significant coefficient of electricity consumption with respect to the real GDP, the government of Cameroon should put in place policies to stimulate electricity consumption. The government should completely liberalize the commercialization of electricity. Individuals will fully have the rights in the commercialization of electricity. It will help to minimize consumption losses of electricity. Liberalizing this sector equally means that competition will be speeded up. This will help to improve on the quality of services linked to electricity distribution and consumption, decrease the price of electricity consumption per kilowatt as a result of immense competition. It ends the monopoly power of the electricity sector with its negative effects in Cameroon.

2) The sector of energy consumption from oil sources should equally be liberalized. New discoveries of crude oil reserves should be exploited since it has a spillover effect on the economy. The government should subsidize consumption of energy from this source given its highly significant and positive coefficient of elasticity with respect to economic growth.

3) It was equally revealed that increased number of fixed telephones has a positive and insignificant effect on economic growth in Cameroon. This is mainly due to increase usage of modern means of communication such as mobile phones and the internet as well as the complicated administrative procedure involved in the application for a fixed telephone line. As such, the government should encourage investment in these modern domains. It should equally speed up investment in the domain of fixed wireless modem telephone lines which will wipe out the complicated procedures linked to fixed lines. It is but normal given the portability and wider coverage of mobile phones, as well as important business transactions and publicity through the internet, that, the number of fixed telephone lines should have a an insignificant effect on economic growth.

This research project, however, has its own limitations and therefore cannot cover all aspects of economic infrastructure, in relation to the national and the regional level in Cameroon. For example, issues of poverty and rural economic infrastructure are not discussed. Furthermore, issues on economic infrastructure as a tool of reducing income inequality are not discussed. While it is clear from this study that economic infrastructure development contributes to economic growth, the direct contribution of economic infrastructure development as a tool to reduce poverty or income inequality still needs to be assessed in terms of scope and degree of impact. However, indirect effect through economic growth and job creation that can finally reduce unemployment, income inequality and poverty (pro-poor growth) is conceptually
accepted. However, for policy making, it is important to find out the effectiveness and impact of public utility infrastructure development as a tool for poverty reduction, why not specifically in Cameroon.

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