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Population Change, Telecommunications Usage and Economic Development in Selected sub-Saharan African Countries

Matthew A. Oluwatoyin, Azuh Dominic, Fasina, F. Fagbeminiyi
Department of Economics and Development Studies, College of Business & Social Sciences, Covenant University, P.M.B. 1023, Ota, Nigeria.

Abstract
For decades, demographers, economists and social scientists have debated the influence of population change on economic development. Three alternative positions define this debate: that population growth restricts, promotes, or is independent of economic development. In recent years, a general agreement has emerged to the effect that improving economic conditions for individuals generally lead to lower birth rates. But, there is much less agreement about the proposition that lower birth rates contribute to economic development and help individuals and families to escape from poverty. It is in the light of this that this paper examines recent evidence on the debate that population change if not controlled would affect the use of infrastructures and economic development in selected sub-Saharan African (SSA) countries. In order to achieve the objectives of this study, the study employed econometric analyses involving the Least Square Dummy Variables (LSDV) technique for the period 1988-2012 on twenty-five selected SSA countries. Secondary data were used for the estimations. The study found that population growth has a significant negative impact on economic development, and the population growth rate needs to be controlled in order to have sustainable development in the SSA sub-region. The study concluded that the governments of these countries should incorporate policies and programmes to reduce high fertility in their economic development strategies.
Keywords: Population Change, Economic Development and Infrastructures.

1. Introduction

For decades, economists and social scientists have debated the influence of population change on economic development. Three alternative positions define this debate: that population growth restricts, promotes, or is independent of economic development. Proponents of each explanation can find evidence to support their cases. The first school of thought that believes that population growth restricts economic development tagged the "pessimistic" theory traces its lineage to Thomas Malthus. Writing in the 1790s, Malthus asked whether .the future improvement of society. was possible in the face of ever larger populations. He reached his famously dismal conclusion:

"Taking the population of the world at any number, a thousand millions, for instance...the human species would increase in the ratio of 1, 2, 4, 8, 16, 32, 64, 128, 256, 516 e.t.c. and subsistence as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, e.t.c. In two centuries and a quarter the population would be to the means of subsistence as 512 to 10; in three centuries as 4096 to 13, and in two thousand years the difference would be incalculable"(Malthus, 1798).

In a world with fixed resources for growing food and slow technical progress, Malthus theorized that food production would quickly be swamped by the pressures of a rapidly growing population. The available diet would then fall below subsistence level, until population growth was halted by a high death rate. Living standards could only ever improve in the short term - before they set in motion more rapid population growth. The balance between population and income growth was the 'great law of our nature'. The second school of thought that believed that population growth promotes economic development are "population optimists". They opined that population growth can be an economic asset. For instance, Kuznets (1960) and Simon (1981), argue separately that as populations increase, so does the stock of human ingenuity. Larger societies - with the capacity to take advantage of economies of scale - are better positioned to develop, exploit and disseminate the increased flow of knowledge they receive. Simon, in his influential book "The Ultimate Resource", showed how positive feedbacks such as the tendency of natural resource prices to decline in the long-term due to technological progress induced by the growing demands of rising populations can mean that rapid population growth can lead to positive impacts on economic development. Boserup (1981) used similar arguments to turn the Malthusian world-view around. Population growth creates pressure on resources. People are resourceful and are stimulated to innovate, especially in adversity. When rising populations swamped traditional hunter-gatherer arrangements, slash-burn-cultivate agriculture emerged.

The "population neutralism" school of thought that opined that population growth is independent of economic development is the predominant view today. This third school believed that though countries with rapidly growing populations tend to have more slowly growing economies, this negative correlation typically disappears (or even reverses direction) once other factors such as country size, openness to trade, educational attainment of

the population, and the quality of civil and political institutions are taken into account. Three major research areas that influenced the rise of population neutralism in the 1980s viz: (i) natural resources - exhaustion of natural resources was found not to be as strongly affected by population growth as the Pessimists thought. Technology, conservation and efficient market allocation of resources all play a part in preserving natural resources, and per capita income has been shown to be a key determinant of
supply and demand for these resources, (ii) saving - the impact on economic development of reduced saving as a result of population growth is not borne out by studies and (iii) diversification of resources - where the Pessimists had thought that population growth would lead to a diversion of resources from productive physical capital formation to less economically productive areas such as education and social welfare programs, multi-country studies showed that this did not in fact happen to any great extent (Weil, 1999).

All of these explanations, however, focus on population size and economic development. In recent years, however, the debate has under-emphasized a critical issue, the age structure of the population, that is, the way in which the population is distributed across different age groups, which can change dramatically as the population grows (Bloom *et al.,* 2001).
The relationship between population change and economic development has taken on added salience in recent years because of demographic trends in the developing world. At varying rates and times since the Second World War, developing countries have been undergoing a demographic transition, from high to low rates of mortality and fertility. This transition is producing a "boom" generation - a generation that is larger than those immediately before and after it - that is gradually working its way through nations' age structures. The East Asian nations were at the forefront of this transition; other regions, including Latin America, began their transitions later, in the 1960s and 1970s. Yet other areas - notably some countries in the Middle East and Africa - have not yet fully begun, or are in the early phases of this transition (Bloom *et al.,* 2001). However, rapid population growth in sub-Saharan African countries have had an effect on the use of infrastructural facilities which had made the quantity of these facilities to be insufficient and inefficient when compared to the number of people using such facilities.

Statement of Research Problem

Thus, this study examines the following research problems and seeks to find a solution to them. (i) Is rapid population growth a symptom, rather than a cause, of low national output and poor economic development? (ii) Does rapid population growth adversely affect the efficiency of infrastructural usage in sustaining economic development? (iii) Does human capital development affect economic development? Thus, the objectives of this study is fill the gap in empirical literature that says that population growth has a positive effect on economic development. But is this assertion true in the SSA sub-region where the countries are still classified amongst the less developed countries (LDCs) of the world. This study looks at: (i) to examine the impact of rapid population growth on economic development in SSA countries; (ii) to assess the impact of the use of infrastructural facilities on economic development; and (iii) to evaluate the impact of human capital development on economic development. The hypotheses which this study wishes to test are stated in the null forms as follows:

(i) H_{01}: Rapid population growth and infrastructure usage do not have a significant impact on economic development.
(ii) H_{02}: Human Capital Development does not have a significant impact on economic development.

The rest of the paper, besides the introduction, which occupies section one, is organized in the following way. Section two dwells on literature review and theoretical issues. Section three presents the methodology of the paper, section four contains data analysis and discussion, and finally, summary of findings, recommendations and conclusion are presented in section five.

2. Literature Review and Theoretical Issues

Through the nineteenth and the first half of the twentieth century, intellectuals were roughly divided between the followers of Malthus and the followers of Marx. Crudely stated, Malthusians believed that high rates of population growth condemned societies to more or less permanent states of underdevelopment and that only by breaking the iron linkage of high fertility to poverty could real improvements in standards of living be achieved. Marx, on the other hand, argued that high fertility was a symptom, not a cause, of poverty and said that only by bringing about a radical transformation in the underlying causes of poverty would living standards rise and birth rates begin to fall. However, since World War II, there have been three broad stages of economic thinking on the relationship between rapid population growth and economic development. In the first stage, which followed the

post war discovery by demographers of extremely rapidly expanding populations in many parts of the developing world, the work of scholars such as Coale and Hoover (1958), Myrdal (1968) and Fogel (1994a) came to be widely accepted. It was decidedly neo-Malthusian, arguing that only by bringing rapid population growth under control could countries hope to achieve improved economic development and high standards of living. While this work hardly represented a consensus among development economists, it did capture the imagination of policymakers, particularly in the richer countries, and contributed to the formation of the modern 'population movement' as it has been known since the 1960s. This movement took as a given fact that rapid population growth harmed the prospects for development and that strong policies to reduce population growth rates were an essential precondition of sustained economic development (Malmberg and Lindh, 2000)

The second stage, which can be dated from around 1986, was what Kelley called the 'revisionist' period (Kelley, 2001). The exemplary work of that period was the 1986 US National Research Council (NRC) publication titled, '*Population growth and economic development: policy questions*'. The work of an expert committee, the 1986 NRC report, concluded that as one of its authors, Birdsall (1988) puts it, 'rapid population growth can slow development, but only under specific circumstances and generally with limited or weak effects'. This was a return to mainstream neo-classical economics, which had always viewed Malthus's views as one-dimensional and simplistic, and which generally expressed skepticism about the strength of the relationship between high fertility and economic development. In a way, the NRC report broke the back of the population movement and ushered in a period of uncertainty about the priority that should be given to population policies, as well as about what the content of policy should be. It is fair to say that the NRC report fits nicely with the ideological predispositions of the Reagan Administration in the USA, which in 1984 had announced at the International Conference on Population at Mexico City that 'population growth is in and of itself neither good nor bad; it is a neutral phenomenon'. The NRC report also reinforced the views of feminist and human rights critics of the population policies of the 1960s–1980s who successfully lobbied for wholesale changes in orientation away from population control and towards a rights-based approach, culminating in the reproductive health and rights agenda that emerged from the International Conference on Population and Development at Cairo in 1994 (Sen, 1994).

This brings us to the third, and current, stage of economic thinking on population and economic development. A new group of development economists decided to look at the impact, not only of reducing population growth rates, but also of changing age structures on economic outcomes (Bloom and Canning, 2001). They opined that rapidly declining fertility is accompanied by changes in the ratio between the economically active population and dependent population. As fertility falls, a larger proportion of the population is in the age range 15–65, compared with the under 15 and over 65 categories. This one-time 'demographic bonus' ought to be associated with increased economic output at the same time that social services requirements for those not yet economically active (for example, for education and health care) decline. Thus, assuming countries also pursue sensible pro-development economic policies, the demographic bonus ought to translate into a jump in income *per capita.* Applying the model to the Asian Tigers (Korea, Singapore, Taiwan and Thailand), these economists found that the data fit the model extremely well. Countries that incorporated strong and effective population policies within the broader context of social and economic development policies were able to cash in very profitably on the demographic bonus. So, by looking at a changing age structure in addition to declining fertility, economists were now able to discern a highly plausible causal connection between demographic change and economic development - a connection that was much more difficult to see in the less sophisticated analysis of the 1986 NRC study and the prior revisionist research on which it reported (Bloom, 1999; Bloom and Sachs, 1998). This latest school in the ongoing saga of macroeconomic thinking on population - economic development interactions does not by any means represent a new consensus. Many economists remain skeptical about the demographic bonus, or 'window of opportunity', as it is also sometimes known. But as the research accumulates, more and more policymakers are paying attention to it and forming their own ideas in accordance with the findings.

This study is based on the demographic transition theory. In much of the developing world, a demographic transition is under way, accelerating with the declines in mortality that began around the end of the Second World War. Improvements in medicine and public health, including the introduction of antibiotics such as penicillin, treatments for diseases such as tuberculosis and diarrhea, and the use of DDT, which helps control malaria, have contained or eradicated diseases that once killed millions of people. This was accompanied by improved sanitation, nutrition, and the wider practice of healthier behaviours. All this gradually led to higher life expectancies, by as much as twenty years in some countries, and naturally to population growth. Yet despite higher life expectancies, these countries had populations that were, on average, growing younger. This is because mortality declines were not evenly distributed across the population. Infectious diseases are particularly ruthless

killers of the young, so their control had the most powerful impact on the mortality of infants and children which fell earlier and more quickly than mortality at other ages. The larger surviving youth cohorts served to drive down the average age of populations. The mortality decline which began the demographic transition has been succeeded by equally dramatic reductions in fertility. Fertility decisions seem to respond strongly to changes in child mortality as parents realize that if fewer children are likely to die in childhood, they can give birth to fewer children to attain their desired number of offspring. This desire to harness in fertility is reflected in trends in the use of contraceptives. Worldwide, more than half of couples now use contraception, compared with 10 percent in the 1960s (Bloom and Williamson, 1998).

Other changes have reinforced the trend towards lowered fertility, as it becomes advantageous to have smaller families. If children have a higher chance of survival and a long life expectancy, it is wise to invest intensively in them. A major form of investment is education - an investment that becomes more tempting when economic changes are likely to increase the potential returns on education. However, this requires a long-term commitment. In a rural society, children typically start working on the land quite early and become economically productive at a young age. Educating children limits their productivity during childhood (they are at school rather than working). However, with increasing urbanization, children are less likely to be economically productive, while, in a labour market that places a greater premium on skills, education makes a greater difference to their future productivity. Thus, urbanization raises the incentive of parents to educate their children at the same time as it reduces the opportunity cost of education in terms of forgone labour income. Education is expensive. It therefore becomes more likely that couples will choose to invest greater resources in fewer children. A greater emphasis on education will inevitably lead to more educated women. This reinforces the likelihood that families will become smaller: women's time becomes more valuable and they are less likely to want to spend so much of their adult life bearing and raising children. For many reasons, then, smaller families make increasingly sound economic sense once the demographic transition gets underway (Willis, 1994).

Table 1: Mobile and Fixed-line Telephone Subscribers (per 100 people) in selected Developed and SSA countries

S/N	Country	2002	2004	2008	2012
Selected Developed Countries					
1.	Canada	20.1	30.4	41.1	46.5
2.	France	19.6	26.7	38.3	41.2
3.	Germany	21.2	31.6	42.3	47.8
4.	Italy	20.6	30.1	36.3	42.8
5.	Japan	19.8	26.2	38.5	47.2
6.	Korea, Rep.	18.7	25.4	33.7	39.1
7.	Netherlands	20.8	30.1	39.7	41.4
8.	Spain	22.1	30.3	39.7	42.6
9.	United Kingdom	21.7	30.6	42.1	50.3
10.	United States of America	23.3	32.8	43.6	55.4
Selected SSA Countries					
11.	Botswana	13.7	14.2	19.8	25.9
12.	Burundi	9.6	10.1	14.2	15.3
13.	Cameroon	9.1	11.1	13.5	16.2
14.	Cote d'Ivoire	8.7	12.4	19.7	27.6
15.	Gabon	7.9	11.4	19.6	23.2
16.	Gambia	11.2	17.1	22.4	31.8
17.	Ghana	10.3	14.8	21.7	31.3
18.	Kenya	8.9	13.1	20.6	28.7
19.	Nigeria	10.4	15.2	22.3	32.8
20.	Senegal	9.2	13.5	20.1	27.2

Source: World Development Indicators, 2013.

A glossary look at the sub-Sahara African sub-region reveal that the subscription of telecommunication line is still inadequate when you compare it in terms of the population of the persons making use of these telephone lines as well as when compared to what obtains in the developed countries of the world. This comparison is what Table 1 sets out to examine via the data for the mobile and fixed-line telephone subscribers (per 100 people) in selected developed and sub-Sahara African (developing) countries. The period under review in Table 1 revealed that in the developed countries, the number of mobile and fixed-line telephone subscribers (per 100 people) witnessed a tremendous increase unlike in the sub-Saharan countries where the increment is slow and gradual.

3. Methodology

This study made use of panel data, that is, both time series and cross-sectional data. The model in this study was estimated using the Least Squares Dummy Variable (LSDV) econometric technique. This study made use of twenty-five SSA countries and a time period between 1988 and 2012; which means that we have both time series and cross-sectional data. The OLS technique cannot be used to estimate combined time series and cross-sectional data. Therefore, there is a need to use an appropriate technique that takes care of panel data, hence the use of the LSDV technique. The rationale for selecting these twenty-five SSA countries and the time frame stem from the fact that these countries had witnessed rapid population growth rate from 1988 till date (see the list of the selected SSA countries in the Appendix). The data was analysed with the use of STATA 11.0 software package. This is based on the ability of the software to handle LSDV and various test statistics that the study is interested in. Panel Data is adopted in this study because of the following reasons: (i) the technique of panel data estimation takes into account heterogeneity explicitly by allowing individual-specific variables; (ii) by combining time series and cross sectional observations, panel data gives more variability, more informative data, less collinearity among variables, more degree of freedom and hence more efficient results are produced; (iii) panel data is better suitable for studying the dynamics of change; and (iv) panel data can better perceive and compute effects that simply cannot be observed in pure time-series or pure cross-section data (Gujarati and Porter, 2009).

The model in this study is specified as:

$$GDP_k = f(GKAP, LAB, GPOP, MOBL, HDI) \quad (1)$$

where; GDP_k is GDP per capita; GKAP is Gross Fixed Capital Formation (a measure of the stock of capital); GPOP is the growth rate of population; MOBL is telecommunication (proxied by the mobile and fixed-line telephone subscribers per 100 people) and HDI is Human Development Index (a measure of growth in human capital).

Expressing equation (1) in panel data form gives:

$$GDP_k = \alpha_{0i} + \underset{(+)}{\alpha_{1i}GKAP_{it}} + \underset{(+)}{\alpha_{2i}LAB_{it}} + \underset{(+)}{\alpha_{3i}GPOP_{it}} + \underset{(+)}{\alpha_{4i}MOBL_{it}} + \underset{(+)}{\alpha_{5i}HDI_{it}} + \varepsilon_{it} \quad (2)$$

where; i = 1, 2… 25 (countries); t = 1, 2… 25 (years). ε is the error term, i is i^{th} country and t is the time period for the variables we defined above. The intercept term carrying a subscript i suggests that the intercepts of the selected countries may be different. The α_1… α_5 are the coefficients of the explanatory variables. α_0 is the intercept. The signs below the variables in brackets indicate the *apriori* expectations.

Table 2 gives a brief description of the variables used in the model and sources from which the respective data are derived.

Table 2: Description of Variables and their Sources

S/N	Name	Symbol	Definition/Description	Source
1.	GDP per capita.	GDP_k	This refers to the total Gross Domestic Product (GDP) divided by total population. It is used as an economic indicator of level of living and development.	World Development Indicators (WDI)
2.	Growth rate of population.	GPOP	Population refers to the total number of persons living in a country at a particular time. The growth rate of population is the percentage rate at which the population increases per annum.	WDI
3.	Human Development Index.	HDI	An index measuring national social development. Based on measures of life expectancy at birth, educational attainment, literacy and adjusted real per capita income.	Human Development Reports (HDR –various issues)
4.	Gross Fixed Capital Formation.	GKAP	Capital invested on fixed assets, infrastructural and social amenities in an economy.	WDI
5.	Proportion of Labour Force employed.	LAB	This is the proportion of the working-age population that is employed. That is, employment to population ratio.	WDI
6.	Telecommunication	MOBL	This refers to the amount of physical and financial capital expended on communication so as to aid interaction among people and boost trading activities. This is proxied by mobile and fixed-line telephone subscribers (per 100 people).	WDI

Source: Authors' Compilation, 2014

4. Data Analysis and Discussion

The underlying assumption of time series data is that it is stationary. Thus, it is expected that economic variables are stationary in nature. The unit root test is used to test the nature of time series to determine whether they are stationary or non-stationary. If a time series is stationary, it means that its mean, variance and auto covariance are the same at the very point they are measured. That is, they are time invariant. But if the mean, variance and auto covariance of a time series are not the same at any point they are measured, the time series is non-stationary. This is a unit root problem. This implies that the study of the behaviour of that time series is only possible for the time period under consideration. It cannot be generalized to other time periods. Such time series may be of little value for forecasting. The stationarity of the time series is important because correlation could persist in non-stationary time series even if the sample is very large and may result in what is called 'spurious or nonsense' regression (Yule, 1989; Wei, 2006). Thus, in order not to have spurious results, this study carried out panel unit root tests.

The panel unit test can be carried out on a pooled data when two conditions are met; first, the time series and cross-sectional observations must be more than fifteen years each and second, the panel must be balanced, that is, there should not be any missing data. These two conditions are met by this study. There are twenty-five countries selected and the time period is twenty-five years; while the data used is a balanced one. Panel unit root test is the panel data (both time series and cross-sectional data) version of the time-series unit root test. The advantages of using panel unit root test are; (i) the power of a panel unit root test is significantly greater compared to the low power of the standard time-series unit root test in finite samples against alternative

hypotheses with highly persistent deviations from equilibrium; and (iii) the asymptotic distribution of a panel unit root test is standard normal, in contrast to individual time series unit root test (Wei, 2006).

There are different methods used to test the panel unit root but this study made use of the non-parametric Fisher-type test which uses the Augmented Dickey Fuller (ADF) test. This method is used because the ADF test conducts unit root tests for each time series individually, and then combines the p-values from these tests to produce an overall test. The ADF test combines information based on individual unit root tests and allow for a heterogeneous alternative hypothesis where the probability values can vary across countries. It is also a test that is conducted by combining the significance levels of the different tests. The null and alternative hypotheses are formulated as:

H_0: All panels contain unit roots.

H_1: At least one panel is stationary.

The rule of thumb for decision making under panel unit root test involves the rejection of the null hypothesis at the 1 percent statistical significance level, this implies that all panel series in the panel data set do not contain a unit root; therefore, at least one panel is stationary. This automatically implies the acceptance of the alternative hypothesis which means that at least one panel is stationary. The results of the panel unit test are presented in Table 3. The implication of this is that the variables are stationary which means that the results obtained from this study is not only possible for the present time period but can also be generalized for other time periods. In addition, this means that the results obtained from this study are not spurious.

Table 3: Augmented Dickey Fuller (ADF) Unit Root Test Results at Levels

Variables	Chi-squared Statistic	Remark
PCI	178.02*** (0.0001)	Stationary
GKAP	175.01*** (0.0002)	Stationary
LAB	152.09*** (0.0044)	Stationary
GPOP	122.43*** (0.0076)	Stationary
MOBL	113.02*** (0.0003)	Stationary
HDI	161.09*** (0.0004)	Stationary
Number of panels 25 Number of periods 25		

Source: Estimated by the Author. Probability values are displayed in parentheses beside the chi-squared coefficients. **Note:** *** - significant at 1 percent, ** - significant at 5 percent.

Equation (3) was estimated to obtain the results shown in Table 4. The adjusted R^2 measures the percentage variation of the dependent variable explained by the explanatory variables. The results show that the adjusted R^2 are 0.484, 0.477, 0.479 and 0.487 in the overall, Central Africa, West Africa and East/Southern African sub-regions respectively. This suggests that the explanatory variables in the model explain about 48.4, 47.7, 47.9 and 48.7 percent variations in the dependent variable, GDP_k in the overall sample, Central Africa, West Africa and East/Southern African sub-regions respectively. The F-stat. probability results show that they are 0.0000 (except in West Africa where the F-stat. is 0.003), meaning that it is significant at 1 percent. This implies that the model is robust, that is, all the explanatory variables jointly explain the dependent variable. However, the low adjusted R^2 is not unexpected in cross sectional data. The implication of this is that empirically, East/Southern Africa tends to experience development faster than the other sub-regions, followed by West Africa and then Central Africa. The reasons for this result may be due to the fact that some of the Central African countries have been observed to have higher annual growth rates than some countries in West Africa and East/Southern Africa. For instance, in 2011, the annual growth rates of Botswana, Kenya, Madagascar, South Africa and Swaziland were 9.5, 5.5, 3.1, 16.4 and 2.2 percents respectively; while that of Benin Republic, Ghana, Nigeria, Niger, Cote d'Ivoire, Gabon, Rwanda and Senegal were 1.4, 3.8, 3.6, 1.8, 2.1, 3.2, 3.7 and 5.2 percents for the same period, respectively (Africa Development Indicators, 2011).

The results in Table 4 also reveal that gross fixed capital formation (which was used to capture stock of capital) is statistically significant at 1 percent in the overall and the three sub-regions (that is, Central Africa, West Africa and East/Southern Africa), but it has about 62.0 percent impact on economic development in the East/Southern African sub-region as against 58.2 percent and 57.1 percent impacts on economic development in West Africa

and Central African sub-regions respectively. However, theoretical evidence says that there is a positive relationship between the stock of capital and economic development, that is, as the stock of capital increases, a country becomes more developed. All the results for GKAP show that it is positively related to economic development which supports what theory postulates. The results also reveal that human development index (HDI – a measure of the growth in human capital) is statistically significant at 5 percent in the overall and the three sub-regions and it has the expected positive sign as postulated by theory. However, HDI has about 18.9 percent impact on economic development in the East/Southern African sub-region as against 17.9 percent and 17.8 percent impacts on economic development in West Africa and Central African sub-regions respectively. As regards the growth rate of population (GPOP), it is negatively related with the dependent variable – economic development which violates the positive relationship that theory postulates. It is statistically significant at 1 percent in the Central Africa and East/Southern African sub-regions and 5 percent significant in the overall and West African sub-region. The results show that it has about -25.6 percent impact on economic development in the Central African sub-region as against -40.9 percent and -49.5 percent impacts on economic development in West Africa and East/Southern African sub-regions respectively. The implication of this is that population growth has a negative impact on economic development in the selected SSA countries.

Furthermore, the results in Table 4 reveal that labour is statistically significant at 1 percent in the overall and the three sub-regions. It is also positively related to economic development as postulated by the *apriori* expectation. The results show that it has about 33.3 percent impact on economic development in the East/Southern African sub-region as against 28.6 percent and 26.6 percent impacts on economic development in West Africa and Central African sub-regions respectively. The coefficient estimate of labour implies that it does significantly contribute to economic development in the selected SSA countries. The implication of this is that when labour increases and is efficient, aggregate output increases and hence an improvement in the level of development. As observed, the East/Southern African sub-region had a higher value in terms of magnitude; this supports empirical evidence which showed that the percentages of total labour force in the East/Southern African countries are higher than in West Africa and Central Africa. For example, in 2011, the percentage of total labour force in Kenya, Tanzania, Uganda, Malawi and Lesotho were 46.3, 49.8, 44.5, 45.7 and 44.8 percents respectively; while that of Benin Republic, Ghana, Nigeria, Gabon, Rwanda, Chad, Niger and Senegal were 44.1, 42.3, 36.2, 43.1, 44.2, 42.6, 43.3 and 31.0 percents for the same period, respectively (Africa Development Indicators, 2011). In addition, the East/Southern African countries are predominantly labour-intensive in their production processes.

As regards the telecommunications variable (MOBL), it is negatively related with the dependent variable – economic development which violates the positive relationship that theory postulates. It is statistically significant at 1 percent in the overall and the three sub-regions. The results show that it has about -32.2 percent impact on economic development in the East/Southern African sub-region as against -42.8 percent and -53.6 percent impacts on economic development in West Africa and Central African sub-regions respectively. The implication of this is that infrastructure has a negative impact on economic development in the selected SSA countries. This may be due to the fact that telecommunication facilities are insufficient and are in poor state in the selected SSA countries. Summarily, the results presented in Table 4 showed that the East/Southern African sub-region performed better than the Central and West African sub-regions.

Table 4: Results for the Model

Dependent Variable – Measure of Economic Development (GDP_k)				
	LSDV			
Regressors	ALL	CEAF	WAF	EASAF
GKAP	0.476*** [6.75] (0.000)	0.571*** [3.32] (0.001)	0.582*** [2.84] (0.005)	0.620*** [4.57] (0.000)
LAB	0.304*** [2.99] (0.009)	0.266*** [3.09] (0.003)	0.286*** [3.07] (0.003)	0.333*** [3.02] (0.004)
GPOP	-0.461** [2.07] (0.039)	-0.256*** [2.38] (0.001)	-0.409** [2.62] (0.014)	-0.495*** [4.70] (0.000)
MOBL	-0.611*** [4.75] (0.000)	-0.536*** [2.94] (0.007)	-0.428*** [4.05] (0.002)	-0.322*** [2.97] (0.006)
HDI	0.123** [2.97] (0.017)	0.178** [2.51] (0.015)	0.179** [2.37] (0.015)	0.189** [2.44] (0.018)
CONSTANT	0.069*** [2.99] (0.008)	0.606** [2.49] (0.014)	0.585** [2.48] (0.017)	0.724** [2.58] (0.016)
R^2	0.530	0.544	0.548	0.584
Adjusted R^2	0.484	0.477	0.479	0.487
F-stat	5.02 (0.000)	4.44 (0.000)	2.42 (0.003)	5.33 (0.000)
Country Dummy	Yes	Yes	Yes	Yes
Countries	25	8	8	9
Number of Observations	613	181	195	217

Source: Estimated by the Authors. **Notes:** Variables are as previously defined. Absolute *t* statistics are displayed in parentheses beside the coefficients while probability values are in brackets. LSDV- Least Square Dummy Variable. CEAF – Central African sub-region, WAF – West African sub-region, EASAF – East and Southern African sub-region.* - significant at 10 percent; ** - significant at 5 percent; *** - significant at 1 percent.

5. Summary of Findings, Recommendations and Conclusion

This section presents the summary of the major findings of the study, the recommendations made and the conclusion of the study.

5.1 Summary of Findings

From the results presented and discussed in section four, the following are the findings and policy implications:

1. The study found that population growth had a significant but negative impact on economic development in the selected SSA countries. Though this violates the *apriori* expectation that postulates a positive relationship. The implication of this result is that the growth in population in SSA in particular and Africa in general is not having a favourable impact on the development of the sub-region and the continent as a whole.
2. The study also found that the growth in human capital had a significant positive impact on economic development in the selected SSA countries. This supports theoretical assertion of a positive relationship between human capital and economic development. Also, human capital growth is believed to be important in the determination of the quality of well-being (Siba, 2008). The implication of this finding is that though human capital plays a vital role in improving the level of economic development; the story among the sampled SSA countries used in this study seems to be different empirically; in that the impact of human capital is not that noticeable on the development of SSA countries.

3. The result of the measure of stock of capital – gross fixed capital formation showed that it has a statistically significant positive impact on economic development in the selected SSA countries used in this study. This supports theoretical assertion which postulates a significant and positive influence of capital on economic development. The implication of this result is that when there is a fall in capital which results in a fall in investment in these SSA countries, this result in the slow pace of development in these countries over the years.
4. The result of this study also revealed that there is a significant negative impact of telecommunications on economic development. Though, the impact of infrastructure on economic development ought to be positive. The implication of this result is that telecommunication facilities are not sufficient when compared with the population that make use of the facilities coupled with the fact that some of these telecommunication facilities are in poor states in these selected SSA countries.

5.2 Recommendations

1. Since human capital plays a crucial role in boosting economic development in SSA countries, the study strongly recommends that the governments of these SSA countries should find ways that will be geared towards improving the stock of human capital in the SSA sub-region. Some of these include the training and retraining of experts such as lawyers, economists, accountants, among others, in SSA countries and their respective ministries such as trade, justice, commerce and industry. This is because a well-informed and trained crop of persons that control policy formulation and implementation in these countries are essential. This is most crucial in this 21st century era which is mostly knowledge-driven. Hence, having and engaging individuals in the sub-region that are conversant with the rapidly changing policy environments and the global issues would be very needful for the sub-region's trade relations.

2. The governments of these SSA countries should put in place measures to control population explosion via family planning and other measures that will help reduce the rate at which the population grows. When this is done, the government will be able to provide for the population adequately.

3. The government should provide telecommunication facilities adequately for the citizens of these SSA countries. The facilities in poor state should be repaired so that the people in the country can have a good living condition.

4. The government should invest in economic projects; this will increase aggregate savings which will in turn increase the level of the stock of capital.

5.3 Conclusion

This study examined the impact of population change and infrastructure usage on economic development in selected twenty-five SSA countries. In order to harness development in the SSA sub-region in particular and Africa in general, as the demographic transition progresses, the financing of infrastructural facilities has to be taken as important in order to improve on the well-being of the citizens of the countries. Again, many developing countries will need to move towards systems that link an individual's benefits to his/her contributions and thus limit inequitable inter-generational transfers. Public-private partnerships are likely to be needed in many areas of social policy, as governments alone will be unable to cope with vast demographic changes, and markets alone will leave some areas unattended to. Such partnerships provide innovative ways for the public and private sectors to share costs and administrative duties associated with the provision of infrastructural facilities.

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Appendix

Table A1: List of Countries and their Identifier (id)

id	Central Africa	id	East and Southern Africa	id	West Africa
1	Angola	3	Botswana	2	Benin Republic
4	Burundi	10	Djibouti	6	Cape Verde
5	Cameroon	15	Kenya	9	Cote d'Ivoire
7	Chad	16	Lesotho	13	Gambia
8	Congo	17	Madagascar	14	Ghana
11	Equatorial Guinea	21	South Africa	18	Niger
12	Gabon	22	Sudan	19	Nigeria
20	Rwanda	23	Swaziland	25	Togo
		24	Tanzania		

Source: UNCTAD (2009) Handbook of Statistics; WTO (2009) International Trade Statistics

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