# The Augmented Solow Economic Growth Model

The augmented Solow growth model was postulated by Mankiw et al. (1992), it is basically a framework for understanding various growth patterns that occur. According to the augmented SOLOW growth model, assuming that diminishing returns exist for both human and physical capital, growth of the country's population, the saving rates and most importantly, progression of technology (in this cases, telecommunication technology); the growth of the country's economy, in the long run, is greatly externally dependent on the advancements in technology and that adaption to stable steady-state growth can be attained through internal changes with regards to the accumulation of factors. According to this model, economic diversification to information and technology would greatly facilitate economic growth. This augmented model by Mankiw et al. (1992) has been very useful as it has been employed in different research carried out over time. According to Mankiw et al. (1992), by analysis of the variables: increase in population, capital investment rates (human and physical), and technological advancement, a thorough understanding and explanation of the differences in Per capita income across countries can be realized. The model was based on a 25-year analysis of countries from 1960 to 1985.

A particular question was asked by Hoeffler (2002) on whether or not this augmented Solow model is applicable to explain the economic growth as a result of advancement in technology. Hoeffler (2002) analysed 98 different countries over 30 years from 1960 to 1990, Hoeffler (2002) carried out a comparison of several methods of estimation including ordinary least square method, instrumental variable method, first differences generalized method of moments, system generalized method of moments, amongst others. It was discovered by Hoeffler (2002) that system generalized method of moments (GMM) is best suited for this augmented model. Upon discovery, Hoeffler (2002) redressed the residuals gotten from the system generalized methods of moments estimation, the coefficient was discovered to be insignificant. This finding inferred that this augmented model can totally account for low rates of growth in Africa when unobservable effects peculiar to particular countries and regressors' endogeneity is controlled when utilizing system generalized methods of moments method. A study by Islam (1995) was also conducted using a panel data approach of the augmented Solow model that took the process of growth in short intervals into consideration, to analyse growth across countries. Islam (1995) discovered that differences in technical efficiency play a huge role in differences in economic development across many countries. The study discovered that higher levels of technological expertise translate to higher levels of per capita income (Islam, 1995). According to Klenow and Rodriguez-Clare (1997), a large percentage of the differences in economic output across countries are majorly due to the disparities in technological advancement. A study by Hall and Jones (1999) discovered great differences in Solow residual levels across different countries, their report, therefore, reiterated how important the governmental policies and institutions are in influencing the accumulation of capital, technological development, output level and general economic growth. Gundlach (2007) sampled the work by Caselli et al. (1996), in his research, he realized that the cross-country differences in economic output and growth are explained by the disparities in technology. Following the findings of these studies, if Nigeria embarks on economic diversity and takes the telecommunications technology route, there would be an increase in per capita income, and therefore increase in economic growth.

The Cobb-Douglas production function would be used to confirm the postulations of Solow's augmented growth theory. The function was developed in the year 1928 by Charle Cobb who was a mathematician and Paul Douglas who was an economist (Cobb and Douglas, 1928). This function is generally used to model the changes that occur between capital input, the services of labour, and changes in technology (Cobb and Douglas, 1928). In essence, the function implies that the elasticity of change or substitution of these factors equals one. The production function is shown below:

Q = f(K, L) = AK?L?

In the above equation, the Gross domestic product (GDP), which is essentially the monetary value of products (especially within one year) is represented by Q, the Tfp (Total factor productivity) or the productivity as a result of the technology available to the country is represented by A, the grand fixed assets investments (cost of equipment, buildings and machinery) otherwise referred to as the investment capital input is represented by K, and the labour input quantity (the total number of hours or people working in a calendar year) is represented by L. ? is the capital-output elasticity while ? is the labour output elasticity (Cobb and Douglas, 1928). However, a limitation of the Cobb-Douglas production function as explained by (Liao, Wu and Xu, 2010) is that the function makes use of two-factor input in its explanation of production