Assessing the Key Drivers of Potential Gross Domestic Product: A Production Function Approach

Dennis Opiyo Olila

University of Nairobi

Department of Agricultural Economics,

P.O.BOX 29053-00625, NAIROBI

+254720 633 940

oliladennis@gmail.com, denis.olila@treasury.go.ke

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Abstract

Kenya is an emerging economy with agriculture playing a fundamental role in economic development. The country's long-term goal is rooted in vision 2030 that envisages an economic growth of 10 percent. Moreover, the vision places a high premium on stable macroeconomic environment. Understanding economy's level of output requires understanding of aggregate demand and supply. Empirical evidence shows that potential Gross Domestic Product (GDP) is perhaps the most important indicator of economic activity in a country. Moreover, over the medium term, the ability of a country to produce goods mainly depends on the physical capital, employment, and total factor productivity (TFP). However, in the Kenyan context, there exists an empirical dearth in knowledge on the value of potential GDP and its key drivers. The current study therefore fills the aforementioned knowledge gap by empirical decomposition of a Cobb Douglas Production function into TFP, capital stock, and labour attributes. The key drivers of potential GDP was identified using the growth accounting approach. The study used national accounts secondary data. Study findings show that labour is the major contributor to potential GDP at 6.46 percent as compared to 1.27 percent of capital. The study therefore provides important policy insights on the employment of more units of labour as compared to capital. However, a balance in the employment of the two factors is important since a well-functioning supply side requires a balance between the two. It is envisaged that this will drive the economy along a sustainable path

1.0 Introduction

Agriculture is the key driver of economic growth and development in Kenya. Odhiambo *et al*. (2004) posits that agricultural sector performance directly mirrors that of the economy. According to GoK (2014), the sector currently contributes 24.5 percent to the GDP. Moreover, the sector contributes approximately 27 percent to the GDP through linkages with manufacturing, distribution and other service related sectors. It further accounts for 65 percent of Kenya's' total exports, 18 percent and 60 percent of the formal and total employment respectively. Most importantly, agriculture falls under the economic pillar of Kenya's vision 2030 aimed at delivering 10 percent economic growth.

Kenya's economy is still operating below its potential (World Bank, 2013). The projections for economic growth are 5.7 and 6 percent respectively for the years 2013 and 2014. In spite of this the economy is still vulnerable to external shocks placing the significant achievement so far in jeopardy. One of the sectors that is significantly affected is the agricultural. Empirical information reveals that over 80 percent of Kenyan population most of who fall under the confines of poverty trap derives their livelihood from agriculture (Odhiambo *et al.,* 2004).

According to Kakarlapudi (2007), agricultural growth performance has become serious issue of concern for both academicians and policy makers as it is subject to various endogenous and exogenous shocks. As a result, declining agricultural growth is a as a major contributor of poverty in Kenya. According to Poverty Reduction Strategy Paper (PRSP), declining agricultural productivity has negative impacts on food security, employment and low income (GoK, 2001).

1.2 Statement of economic research problem

In Kenya, agricultural sources of growth have been changing since independence. Even though valid estimates exist on the contribution of the sector to the overall economy, limited information exists on the actual value of potential GDP and its key drivers. Potential GDP refers to the highest level of output that is sustainable over the long-term. There are three justifications for assessing potential output (GDP) and its key drivers. First is to evaluate effects of aggregate demand i.e. if aggregate demand is greater than non-inflationary level of aggregate supply, then wage and price pressures manifests and this call for tighter fiscal and monetary policies.

Second, it is important to understand the long-term prospects for a country. For example, it enables one to know whether a less developed country is converging with its richer neighbors or not. Finally, assessing potential GDP and its drivers is relevant in doing medium term projections for a particular country.

1.3 Objective of the study

The main objective of the study was to evaluate potential GDP and its key drivers. The specific objective of this study was to estimate the potential GDP and its key drivers. The study hypothesized that there are no known values of the key drivers of potential GDP.

2.0 Literature review

The classical study by Minhas and Vaidyanathan (1965) was the first to decompose agricultural growth. The change in agricultural growth was equated to the following four factors: area, yield, cropping pattern and the interactions between the yield and cropping pattern. Becket (2009) decomposed Malaysian production structure using input and output approach. The study used Input Output tables for the Malaysian economy 1983 – 2000. The results showed that there were similarities over in the national structure of production patterns of growth processes.

Kakarlpundi (2007) carried out a decomposition analysis of agricultural growth. The study also systematically reviewed the past literatures. Findings of the study revealed that the sources of agricultural growth varied according to the studies undertaken. Further, Sagar (1977) did a study that expanded decomposition into seven component version i.e., decomposing agricultural output at prevalent prices into three pure components comprising of area, yield, price, and their interaction.

3.0 Methodology

3.1 Data collection

Secondary data used to calculate Kenya's potential output and its key drivers was retrieved from the International Monetary Fund (IMF) data base for 1980 to 2012. Analysis was done in excel using growth accounting method. Potential GDP is defines as the level of output that can be achieved if all factors of production are fully employed. It is perhaps the most indicator of economic activity in a country. In the medium term, the ability of a country to produce goods depends on the following three main factors: physical capital, employment, and TFP.

3.2 Model estimation

The study estimates potential output and its key drivers using growth accounting method. The specification of a two factor Cobb-Douglas production function is as follows:

$$Y_t = A_t^* K_t^{\alpha} L_t^{1-\alpha} \quad \text{.......... (1)}$$

Where: Y, A, K and L are potential output, TFP, capital and labour respectively. It should be noted that most studies on productivity analysis normally use constant returns to scale agricultural production relationship with capital and labour as the two key inputs to production (Mundllak *et al.,* 2002). In order to estimate the shares by both K and L to the potential GDP, equation (1) above was linearized by taking the natural logarithm of the equation as:

$$LnY_t^* = LnA_t^* + \alpha LnK_t^* + (1-\alpha)Ln_t^* \quad \text{.......... (2)}$$

Where:

LnY_t^* = Potential output

LnA_t^* = Total Factor Productivity (TFP)

αLnK_t^* = Capital share in national income

$(1-\alpha)Ln_t^*$ = Labour share in national income

The calculation of potential GDP begins with the calculation of the capital stock. The dynamics of capital stock equation is formulated as:

$$K_t = I_t + (1-\partial)K_{t-1} \quad \text{(3)}$$

Since, the value of annual GDP is known, it follows that the ratio of investment to GDP is given by $\frac{I_t}{Y_t}$ (4)

From equation (4) above, investment is deduced. However, a starting capital stock, K_0 is needed. An initial capital/output ratio ranging from 3 – 4 (case of developing countries) is assumed.

$$\frac{K_0}{Y_0} \quad \text{(5)}$$

Data on the country's population, working population and employment was retrieved from the International Labour Organization (ILO) data bases. This facilitated the estimation the participation of both male and female in the labour force. Moreover, natural rate of unemployment was determined.

Finally, the TFP is not measurable. As such, it can only be estimated as residual of the production function:

$$A_t = \left[\frac{Y_t}{L_t^{1-\alpha} \cdot K_t^{\alpha}}\right] \quad \text{(6)}$$

Where Y is observed output, L is the number employed (including self-employed) and K is capital. The TFP measures the synergy and utilization of inputs. In terms of logarithm, the TFP is estimated as:

$$LnA_t = LnY_t - \alpha LnK_t - (1-\alpha)LnL_t \quad \text{(7)}$$

Labour share $(1-\alpha)$ is calculated using total labour cost and the number of employed people and gross value added:

$$(1-\alpha_t) = \frac{tlc_t \cdot L_t}{gva_t} \quad \text{(8)}$$

α is calculated as average of α_t and is kept constant.

4.0 Results and Discussion

The results of data analysis are presented in tables 1, 2 and 3. Tables 1 and 2 presents results of potential GDP and its key determinants while table 3 presents a summary of statistics of the key drivers of potential GDP. During the period 1980 – 1989, TFP has remained nearly stagnant. Empirical literature holds different views on TFP. The first school of thought holds that changes in TFP measures the rate of technical change (Young, 1992). The second school of thought believe that TPF only measures only the free lunches of technical change mainly associated with externalities and scale effects (Jorgenson, 1995). In terms of the two key production inputs, results denote that labour contributes significantly to the potential GDP. This was plausibly expected since in most developing countries, labour input is in abundance as compared to capital.

Table 1: Potential GDP and it drivers: 1980-1989

			Growth rates					Contributions to GDP		
Year	**TFP**	**Y**	**TFT**	**K**	**Populatio**	**WAP**	**L**	**TFP**	**K**	**L**
1980	8.55									
1981	8.34	4.10%	-2.42%	0.80%	3.89%	3.89%	11.74%	-2.42%	0.36%	6.46%
1982	8.243	5.05%	-1.16%	1.33%	3.90%	3.92%	10.51%	-1.16%	0.60%	5.78%
1983	7.933	1.59%	-3.77%	0.95%	3.88%	3.95%	9.51%	-3.77%	0.43%	5.23%
1984	7.668	1.60%	-3.34%	0.89%	3.84%	3.97%	8.68%	-3.34%	0.40%	4.78%
1985	7.631	4.07%	-0.48%	0.55%	3.79%	4.00%	7.99%	-0.48%	0.25%	4.39%
1986	7.764	6.98%	1.74%	2.47%	3.73%	4.00%	7.40%	1.74%	1.11%	4.07%
1987	7.851	5.81%	1.11%	1.97%	3.66%	4.00%	6.89%	1.11%	0.89%	3.79%
1988	7.959	6.09%	1.39%	2.47%	3.59%	4.04%	6.44%	1.39%	1.11%	3.54%
1989	7.957	4.55%	-0.03%	2.83%	3.52%	4.12%	6.05%	-0.03%	1.27%	3.33%

Table 2: Potential GDP and it drivers: 1990-1999

			Growth rates					Contributions to GDP		
Year	TFP	Y	TFT	K	Populatio	WAP	L	TFP	K	L
1990	7.85	0.04	-1.38%	1.13%	3.83%	4.23%	-1.38%	-1.38%	0.51%	-0.76%
1991	7.671	1.34%	-2.23%	2.88%	3.37%	4.33%	-2.23%	-2.23%	1.30%	-1.23%
1992	7.35	-1.08%	-4.19%	1.87%	3.30%	4.39%	-4.19%	-4.19%	0.84%	-2.30%
1993	7.18	-0.09%	-2.32%	-0.21%	3.20%	4.35%	-2.32%	-2.32%	-0.09%	-1.27%
1994	7.187	2.53%	0.09%	0.31%	3.08%	4.21%	0.09%	0.09%	0.14%	0.05%
1995	7.34	4.29%	2.14%	-0.15%	2.94%	4.00%	2.14%	2.14%	-0.07%	1.18%
1996	7.481	4.01%	1.92%	0.00%	2.80%	3.79%	1.92%	1.92%	0.00%	1.06%
1997	7.373	0.22%	-1.45%	-0.57%	2.69%	3.60%	-1.45%	-1.45%	-0.26%	-0.80%
1998	7.484	3.33%	1.51%	-0.21%	2.62%	3.48%	1.51%	1.51%	-0.09%	0.83%
1999	7.534	2.41%	0.66%	-0.28%	2.61%	3.42%	0.66%	0.66%	-0.13%	0.36%

It is interesting to note that the results of tables 1 and 2 show that the Working Age Population (WAP) is directly proportional to the contribution of employment to the potential GDP. However, despite labour being a major driver in GDP contribution, it is evident that its share to GDP has been declining. This has an implication on the rising unemployment rates currently witnessed in the country. Finally, table 3 gives a summary of the average growth rates and the contribution of TFP, K, and L to the potential GDP during various periods.

Table 3: Average growth rates and contributions to GDP

Year	Average growth rates					Average contributions to GDP			
	TFP	K	Population	WAP	L	TFP	K	Employment	Y
1981-2012	-0.01%	1.42%	3.14%	3.65%	3.55%	-0.01%	0.64%	1.96%	2.58%
1981-1989	-0.77%	1.59%	3.76%	3.99%	8.36%	0.09%	0.70%	1.80%	2.58%
1990-1999	-0.52%	0.48%	3.05%	3.98%	-0.52%	0.15%	0.74%	1.67%	2.56%
2000-2012	1.03%	2.34%	2.71%	3.07%	3.33%	0.32%	0.78%	1.55%	2.65%
2005-2012	1.42%	3.38%	2.72%	2.88%	3.28%	0.48%	0.81%	1.46%	2.75%

In terms of the average growth, the TFP has shown a fluctuating growth rate between the various periods. However, significant growth rates were witnessed in the year 2000 – 2012. The average growth rates of capital stock have been on the rise with a little stagnation during the year 1990-1999. The period 2005-2012 saw a significant growth in TFP, K, and potential output. This could be explained by good fiscal and monetary policies resulting in a stable macroeconomic environment witnessed in Kenya. Finally, in terms of the average contribution to the GDP, findings reveal that employment (L) is the key driver to the GDP.

However, a well-functioning supply side requires that the potential output is not driven solely by one factor as has been witnessed in this case. This calls for policies that encourage employment among the population. Therefore, it can be concluded that L input plays a significant role in driving the GDP of Kenya.

5.0 Conclusions and policy recommendations

The study attempted to decompose the production function into its various components namely potential GDP, capital stock and labour. This was important in two main aspects: designing of appropriate policies to address the challenges facing the sector and identifying which sectors to investment. Among the aforementioned factors, it has established that labour is the Key driver to Kenya's potential GDP.

In a well-functioning economy, the potential output ought to be driven by both factors of production without one dominating. This is contrary to the study findings that labour input was the overriding factor. Hence, the study recommends that more capital be employed in the production process with an aim of balancing out the two main drivers of GDP namely capital and labour. Further, the study has established a redundant TPF in terms of growth and even contribution to GDP. This declining trend in technology use calls for a paradigm shift in advancing technology in agricultural production.

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