Analysis of the Structure of the Ghanaian Economy: Using Input-Output Modeling Techniques

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Abstract

This study seeks to analyze the structure of the Ghanaian Economy after the rebasing of Gross Domestic Product in 2010 using Input-Output modeling techniques. The scope of analysis include; the contribution of sectors to GDP, the shares of sectors in wages and salaries, sectoral interdependence, economic diversity and the multiplier impact of final demand policy on the economy in terms of output and income.

The study finds that Agriculture has been overtaken by the services sector in terms of contribution to GDP though the sector still employs a larger proportion of the labor force. It also finds that though exports portfolio has increased as a result of the addition of oil as a commodity, the economy of Ghana is still not diversified.

The study also discovers that inter-sectoral linkages are low between and among various key sectors within the economy. The Manufacturing sector which is vital for providing the needed backward linkage for output of Agriculture is crumbling. The Mining sector has virtually non-existent forward linkage with other sectors within the economy. Its backward linkage is also negligible as most indigenous enterprises are often not able to meet the standards of providing services within the Mining production value chain.

Key words

Structural transformation, input-output modeling, Ghanaian economy, economic diversification

1. Introduction

In spite of investments after independence in industrialization, infrastructure and series of reforms, Ghana has still not registered any appreciable structural transformation and diversification of the economy to deliver high output, employment and poverty reduction. This is against the backdrop that she has signed several human rights obligations to which she must respond. The country’s inability to meet these rights obligations is due largely to the nature and character of her integration in the international system where she is assigned the role of an exporter of primary products and a consumer of imported manufactured goods and services through over liberalization of the economy.
Vast literature on input-output analysis firmly demonstrates the suitability of such models in the analysis of economic impact of policies, inter-industry dependencies, and in national development planning at all levels of an economy. Since the pioneering work of Prof. Wassily Leontief, input-output analysis has experienced extensive growth in its application to economic issues. The significance of such models and their absence in the economy served as a drive for an in-depth quantitative analysis. The model analyses the structure of the economy in terms of sectoral contribution to gross domestic product, employment and labor shares, final demand impacts of exogenous shocks, inter-sectoral linkages and economic diversity.

Efforts at altering the structure of Ghana’s economy can be traced back to the colonial era. Szereszewski (1965) points out that in 1891, the Ghanaian economy had structural characteristics similar to many other pre-colonial economies. There was dominance of resources in the traditional sector, controlled by food production on a subsistence basis. The other sectors were mining and trade which were concentrated along the coast. In terms of international trade, agriculture dominated exports by 75 percent.

The economy at the time of independence portrayed a structure similar to the basic characteristics that had been established during the first ten years of the 20th century. It was dominated by agricultural production organized mainly on the basis of peasant mode of production. Agriculture contributed more than half of domestic production (52 percent) and employed about 60 percent of the labor force. Because of the early introduction of cash crop production, there was a high degree of market penetration and, thus, pure subsistence accounted for only 17 percent of GDP in 1960 (Baah-Nuakoh, 1997).

Baah-Nuakoh (1997) indicates that Ghana’s economy experienced an accelerated transformation between 1901 and 1911. The composition of exports underwent significant transformation during the period. Two commodities dominated the export trade in 1911. These were gold and cocoa, accounting for 76 per cent of total export. The contribution of cocoa over this period explains the future dependence of the latter commodity.

Within agriculture, cocoa was the main export crop and accounted for about 13 per cent of domestic product and earned between 50 and 60 per cent of foreign exchange. The
manufacturing sector was still small as it garnered only 4 percent of GDP and had only 9 per cent of total employment.

An important attribute of Ghana’s economy at the time of independence was a general lack of interdependence, albeit the small industrial sector exhibited some level of interdependence with other sectors. Based on a 1960 input-output table, Szereszewski reveals the extent of linkages in the domestic economy. He points out that only 5 percent of agricultural output was used as inputs by other sectors; 93 percent went into final consumption. Five percent of cocoa production was used as inputs, 78 percent went to exports. Ninety-nine percent of mining output was exported.

A dramatic change in Ghana’s match towards economic transformation occurred in the eighties when Ghana adopted the IMF/World Bank Structural Adjustment Programme (SAP). This policy framework was adopted to stem the socioeconomic backwardness that confronted the country just decades after independence. According to Sowa (2002), the causes of the decline in Ghana’s economy have been attributed to structural weaknesses, external shocks – particularly, declines in the terms of trade, economic mismanagement, and political instability.

2. Objective and Methodology

The main objective of this study therefore is to describe the current structure of the economy, various policy scenarios and their impact on income, poverty and inequality. Alternative policies for inclusive economic growth and development will also be proposed.

Techniques from Input-Output modeling were employed to describe the structure quantitatively. In constructing the Input-Output model, the national Supply and Use table was used to generate transactions. The transactions table assumed eleven (11) sectors in the economy: Agriculture, Mining and Quarrying, Manufacturing, Electricity and Water, Construction, Distribution and Catering, Transport and Communication, Business and Finance, Public Administration, Education and Health and Other Community Services. A balanced Input-Output table was then developed from the transactions table and used in the construction of the Input-Output model.
Input coefficients were derived from the Input-Output tables which are assumed stable given the structure and nature of the economy.

3. Results

3.1 The Share of Productive Sectors in Gross Domestic Product

Figure 1 shows that the services sector has the highest share of GDP in Ghana of about 47%. Industry has the second highest contribution with a percentage of 29%. The Agricultural sector which previously contributed the highest share now has the lowest contribution thus explaining the current structural changes within the Economy. Notwithstanding, the Agricultural sector still has the highest share of the labor force within the economy and policies hinging on bridging the inequality gap must largely focus on this sector since such a policy will have greater immediate or short-term impact. Recent trends however show that the Agricultural sector has not only declined in its share of GDP but most worryingly experienced decline in its overall performance. With food security, rising unemployment, inequality, poverty and social exclusion raging as issues of concern, massive investment is required to revive the fortunes of the sector.

The Industrial sector has not received the necessary state support in terms of infrastructure and fiscal policies to ensure its efficient operation. Saddled by setbacks such as lack of credit facilities, energy crises and threats from cheap imports, the industrial sector has witnessed an under par performance over the years. It is therefore not surprising to find a major percentage of exports being raw materials.

The services sector which is now the fastest growing sector in the Ghana and also contributes the highest to Gross Domestic Product is largely propelled by developments in the banking and telecommunications sectors. Economic growth which is driven by these sectors will certainly not be inclusive since the sector employs very small percentage of the poor population.
3.2 Share of Intermediate Input Use by Sector.

Figure 2 shows that though the Industrial sector has the second contribution to GDP, it has the highest share in terms of intermediate inputs used of about 44% within the economy. Inputs are calculated by summing up the total cost of intermediate raw materials as well as the cost of labor and capital. The Services Sector has the second highest share of inputs used with the Agricultural sector having the least share. The share of the Agricultural sector is accounted for by the nature of inputs used which are basically raw materials, simple farm tools and cheap labor.

The Services sector is dominated by a mix of both Ghanaian own enterprises and multinational companies. This sector performs creditably to an extent making use of local content which promotes employment and other opportunities for poverty reduction. The Industrial sector is however dominated by few large foreign own enterprises which tend to exploit the excess labor force within the economy by paying wages below the minimum wage. Indigenous enterprises which are classified under industry basically import all manufactured goods and repackage for distribution. There are therefore also low opportunities in terms of jobs and local content. The details are depicted in Figure 2 below.
3.3 Sector Shares in Wages and Salaries

Figure 3 shows that within the Ghanaian Economy, most wages are paid within the Services sector. The agricultural sector has a share of barely 1% in total wages. The industrial sector has a share of 14% with the services sector which is the fastest growing sector having a share of 85%. The share of Agriculture in wages is largely attributed to the subsistence nature of activities within the sector. It is also accounted for by the raw nature of products, product homogeneity and high level of competition. The sector also has the highest share of low skilled labor as compared to the industrial and services sectors.

The Services sector has the highest share of wages as a result of the type of labor used. This sector has the highest share of skilled labor and the lowest share of low skilled labor. The industrial sector also has a proportion of its labor force belonging to the categories of medium skilled labor and high skilled labor thus accounting for its 14% share of wages.

Policies on poverty reduction should focus on the Agricultural sector since it employs the highest percentage of the population. Investing in Agriculture will improve output, create more decent
jobs and increase the levels of income of the sector. It will be easier within the short-term to reduce the level of poverty within the economy by raising income levels within the Agricultural sector through investment in value addition activities. Growth in other sectors could skew development and widen the income gap but prioritizing Agriculture will reduce poverty levels as well as reducing inequality. Figure 3 illustrates the details below.

**Figure 3 SECTOR SHARES IN WAGES AND SALARIES**

![Sector Share in Wages and Salaries](image)

Source: Author generated from National Supply and Use Tables, GSS

### 3.4 Final Demand Impact and Policy Scenarios

Final demand impact describes the changes that occur as a result of a given shock or investment within the economy. For Example, final demand change calculates the magnitude of impact of a GHC 1 investment on variables such as income, employment, output etc. This is based on the assumption that there is under capacity production and consumption. Final demand change is assumed to be from government expenditure ie $\Delta G$.
### 3.4.1 Income

Figure 4 shows the impact of GHC 1 investment on the levels of incomes in the economy by sector. It is observed that the impact is greatest in the Public Administration sector with GHC 3.49. Education and Health have the second highest impact of about GHC 1.86. The lowest income effect from such investment occurs in the Agricultural sector with an income effect of GHC 0.04.

![Figure 4 IMPACT OF GHC 1 INVESTMENT ON INCOME BY SECTOR](image)

Source: Author generated from National Supply and Use Tables, GSS

### 3.4.2 Output

Figure 5 shows that investing a GHC 1 in the economy will generate output in all sectors but at different levels. Output in the Manufacturing sector responds more to such investment with a change of GHC 4.10. Agriculture has the second highest impact of GHC 2.01. Other community services sector has the lowest output response with a value of GHC 1.
3.4.3 Imports

The extent to which a GHC 1 investment affects imports is illustrated in Figure 6. It is observed that the impact is greatest in the Manufacturing sector, GHC 14.37 and this is accounted for by the fact that most consumed manufactured goods in Ghana are imported. The Mining sector is one other sector that imports basically all its inputs thus also exhibiting high import response to such investment in the economy GHC 9.82. The Public Administration sector where basically services are acquired from domestic sources has very low import impact of about GHC 0.10.
3.4.4 Exports

Figure 7 shows that GHC 1 investment in the economy will yield more exports in the Mining and Quarrying sector of about GHC 16.08. This is largely attributed to the high volume of mineral exports and the relatively high international market prices of solid minerals such as Gold, Diamond etc. The Manufacturing sector has the second highest share demand impact of about GHC 3.87 and this basically constitutes exports of raw materials and semi-finished products. The Education and Health Sector as well as other community services which are not exported have the lowest impact of GHC 0.06 respectively.
3.5 Economic Diversity

It is widely held that a diversified economy is less sensitive to the ups and downs associated with any particular industry because risk is spread more evenly across a number of industries. With diversification, even if some industries are suffering, other stronger industries will help the economy maintain healthy growth. The presence of many industries would be expected to offer opportunities for employment in growing sectors to compensate for employment losses in declining sectors. The level of diversity in the Ghanaian economy is however very low as the economy depends heavily on a narrow range of exports. The Hirschman-Herfindhal index (HHI) was used in calculating the level of economic diversity and below is the results.

Source: Author generated from National Supply and Use Tables, GSS
Table 1 LEVEL OF ECONOMIC DIVERSITY IN GHANA

<table>
<thead>
<tr>
<th>Sector</th>
<th>Output</th>
<th>Output Share</th>
<th>Squared Output Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>18,411.160</td>
<td>0.242</td>
<td>0.059</td>
</tr>
<tr>
<td>Mining And Quarrying</td>
<td>1,952.532</td>
<td>0.026</td>
<td>0.001</td>
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<tr>
<td>Manufacturing</td>
<td>11,273.581</td>
<td>0.148</td>
<td>0.022</td>
</tr>
<tr>
<td>Electricity, Gas And Water Supply</td>
<td>2,774.629</td>
<td>0.036</td>
<td>0.001</td>
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<tr>
<td>Construction</td>
<td>6,350.949</td>
<td>0.083</td>
<td>0.007</td>
</tr>
<tr>
<td>Distribution and catering</td>
<td>11,827.290</td>
<td>0.155</td>
<td>0.024</td>
</tr>
<tr>
<td>Transport, Storage And Communications</td>
<td>9,107.904</td>
<td>0.120</td>
<td>0.014</td>
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<tr>
<td>Finance and business</td>
<td>4,286.220</td>
<td>0.056</td>
<td>0.003</td>
</tr>
<tr>
<td>Public Administration And Defence; Compulsory Social Security</td>
<td>4,060.069</td>
<td>0.053</td>
<td>0.003</td>
</tr>
<tr>
<td>Education, health and social work</td>
<td>3,741.405</td>
<td>0.049</td>
<td>0.002</td>
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<tr>
<td>Other Community, Social And Personal Service Activities</td>
<td>2,300.363</td>
<td>0.030</td>
<td>0.001</td>
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<tr>
<td>Total</td>
<td>76,086.103</td>
<td></td>
<td>0.137</td>
</tr>
</tbody>
</table>

Source: Author generated from National Supply and Use Tables, GSS

**Interpretation of HHI**

An HHI above 0.25 indicates high concentration of industries within an economy

An HHI between 0.15 -0.25 indicates moderate concentration

An HHI below 0.15 indicates low concentration

An HHI below 0.01 indicates highly unconcentrated economy

The concentration ratio indicates whether an economy is comprised of a few large firms or many small firms. In the case of low concentration ratio such as observed in table 1, the economy is comprised of many small firms with high level of competition.

### 3.6 Inter-Sectoral Linkages: Forward and Backward Linkages

#### 3.6.1 Forward and Backward Linkages

A forward production linkage entails the supply of inputs to upstream industries. This implies that the more important a sector is for upstream industries, the stronger its forward linkages will
be. Backward production linkages are the demand for additional inputs used by producers to supply additional goods or services. The more input intensive a sector’s production technology is, the stronger its backward linkages are. In the input-output model, sectoral backward linkages are the same as the output multipliers.

Figure 8 shows that three sectors within the economy: Mining and Quarrying, Manufacturing and Electricity and Water have very strong both backward and forward linkages hence such sectors are considered key in their contribution to national development. A sector is considered key if both its backward and forward linkages are greater or equal to one. The Agricultural sector is seen to have a very strong forward linkage where it supplies most of its output to other sectors to be used as inputs or for final consumption. Mining and Quarrying, Manufacturing, Electricity and Water, Distribution and Catering as well as Business and Finance all have strong forward linkages where their outputs are distributed to other sectors as inputs. In terms of backward linkages, the Mining and Quarrying sector, Manufacturing, Electricity and Water, Construction, Distribution and Catering all have very strong linkages with other sectors which is conducive and necessary for economic development.

Sectors such as Public Administration, Education and health as well as Community social services have very low linkages both forward and backward. It is therefore imperative to improve the inter-sectoral relationships among all sectors within the economy to boost employment opportunities, output and income. The high forward linkage by the Mining and Quarrying sector is largely accounted for quarrying activities and output.

The Mining sector is very key in the development of the economy as a result of its high contribution to gross foreign exchange earnings. The reality on the ground however shows that the sector imports basically all its inputs used for production including services which creates very few opportunities for Ghanaians and indigenous enterprises. Due to the highly underdeveloped industrial sector, output of the sector is not sold within the economy but exported in their raw state thus attracting lower. The industrial sector must therefore be strengthened to take advantage of the opportunities available in terms of forward linkages to promote economic growth and development.
4.0 Discussion

4.1 Poverty Reduction

The study shows that a large proportion of the labor force is employed in the Agricultural sector with the sector having the lowest share of wages and salaries. This therefore means that to reduce poverty to the lowest level while ensuring inclusive development and equity in the distribution of national resources, government investment should focus on improving productivity within the agricultural sector which will raise output and incomes. The size of the economy has expanded as a result of the commercial exploration of the oil and gas resources. Economic growth is certainly high and at unprecedented levels in the history of the country but it is skewed towards few rich Ghanaians. Oil inclusive growth will only be socially inclusive if revenues from the
sector are invested in areas where a larger percentage of the poor is located in this case Agriculture.

4.2 Economic Diversity
The discovery and subsequent commercial exploration of oil has improved the export portfolio of the country thus improving the level of diversity. The economy however is still vulnerable to external shocks and fluctuations in international commodity market prices. A huge potential still remains untapped in terms of maximizing exports through value additions to products from the Agricultural and Mining Sectors. The Herfindhal index used in this study describes the Ghanaian Economy as having a low concentration ratio implying that the economy is dominated by many small firms which are competing in terms of resources and output. High competition among the sectors in the economy is conducive for growth and development but the capacity of these sectors to meet domestic and international demand remains a matter of concern.

4.3 Improving Industrial Clusters and Inter-sectoral Linkages
The study shows that only three sectors within the economy are key in terms of both backward and forward linkages. These sectors include Mining and Quarrying, Manufacturing as well as Electricity and Water. All other sectors either fulfill strong backward or forward linkages criteria. Important sectors such as construction, Distribution and Catering, Transport and Communication, Business and Finance, Public Administration as well as Education and Health have strong forward linkages but massive investment is required to improve such linkages since there still exists a gap in such sectoral interdependence. There is the need for improvement in productivity within the Public Administration sector. Conducive environment must also be created to enhance the relationship between the real sectors and the Business and Finance sector.

4.4 Maximizing Local Content
Manufacturing and Mining have very high import propensities as basically a high percentage of inputs both raw materials and services are imported for production. This development has reduced the amount of opportunities available for local enterprises to participate as high capital requirement has rendered such indigenous enterprises incapable of competing in production. It is imperative for government to ensure a local content policy which creates opportunities within the production chain for the local industries.
These sectors do not only import inputs but finished products as well. The domestic market in Ghana is flooded by cheap imported manufactured goods. This situation is largely due to the high cost of manufacturing which includes high cost of credit facilities and utilities as well as the unreliable supply of power leading to uncompetitive prices of locally manufactured products. The capacity of domestic/indigenous firms should be built to take advantage of local content opportunities within the Mining and Manufacturing sectors.

An enabling environment should be created to enhance the development of the Manufacturing sector which will serve as a basis for the production of import substitutes by implementing policies that will reduce the cost of accessing credit from financial institutions as well as providing constant, reliable and affordable power supply for production.

4.5 Increasing Exports
The Mining sector has the highest export multiplier in the economy as a result of its contribution to overall foreign exchange earnings. Exports from this sector are however in their raw and unprocessed state thus attracting lower prices than would earn potentially if value is added. This therefore calls for the need to develop the industrial sector to a capacity where such mineral resources could be processed into finished products before exporting. Development of the industrial sector will not only enhance the country’s foreign exchange earnings but will also create more opportunities in terms of employment and income.

5.0 Conclusion
The study shows that there exists a great similarity between the current system and the colonial and economic model and therefore stress the need for structural changes in the economy. In particular, it finds the need for diversification of the country’s product mix, with a view to carving out new niches beyond the prevailing system, capable of producing the desired economic transformation.

Even though some form of growth is imposed on the economy because of the transition to a more urbanized and services-dominated economy, we are concerned with the nature of this growth, especially whether it is pro-poor, inclusive and sustainable as well as how the benefits of such growth is distributed. Factors driving Ghana and other African countries’ economic
transition include: the population dynamics, decreasing role of the agricultural sector without improved productivity of the manufacturing sector, rural-urban migration and the ceding of space in labor-intensive and low skilled manufactures by the newly industrializing countries.

The economy will not witness any appreciable level of economic transformation if the manufacturing sector and for that matter industry is not developed to process all the raw materials stemming from the real sectors of production.

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