The Effect of Economic Sectors on the National Income of West African Economies from 2010 to 2019: A Multiple Regression Analysis

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A Multiple Regression Analysis

By

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Abstract:

The purpose of this paper is to explain the effect that economic sectors exert on the national income of West African countries during the last decade. Since the post-colonial era, agriculture has been the primary and the predominant sector of West African economies. However, since the late 1990s and early 2000s, through various observational data, we could perceive that the manufacturing and services sectors began to bring a broader contribution to the economic production of West African countries. Through the use of a multiple regression analysis, this paper aims to explain the correlation and impact that each of these sectors exercises on the national income of the sixteen countries that encapsulate the West African region.

Keywords: Econometrics, Economic Growth, Statistical Modeling, Development Economics, Macroeconomics, Aggregate Production

1. INTRODUCTION

Agriculture, for what we know, has been the primary source of the national income and economic growth in many societies around the world; and Africa is no exception. Before the Industrial Revolution, Western Europe and the United States were essentially agricultural societies. Agriculture was the economic sector that principally determined the national income of their societies. Nonetheless, before the Industrial Revolution, life expectancy was relatively low, and the living standard of the masses was drastically below the basic level of subsistence.[1] The Industrial Revolution created two additional sectors within an economy: the manufacturing and the service sectors. The manufacturing sector amply contributed to the development of technological progress and the service sector contributed to the amelioration of the living standard of the masses.[2] As we could observe in figures 1 and 2, the Industrial Revolution increased employment and labor productivity in the manufacturing and services sectors and decreased that of agriculture. Interestingly, employment in the manufacturing sector declined throughout the twentieth century as technological progress continues to thrive.

Employment by Sector as share of total employment in United Kingdom from 1840 to 2000

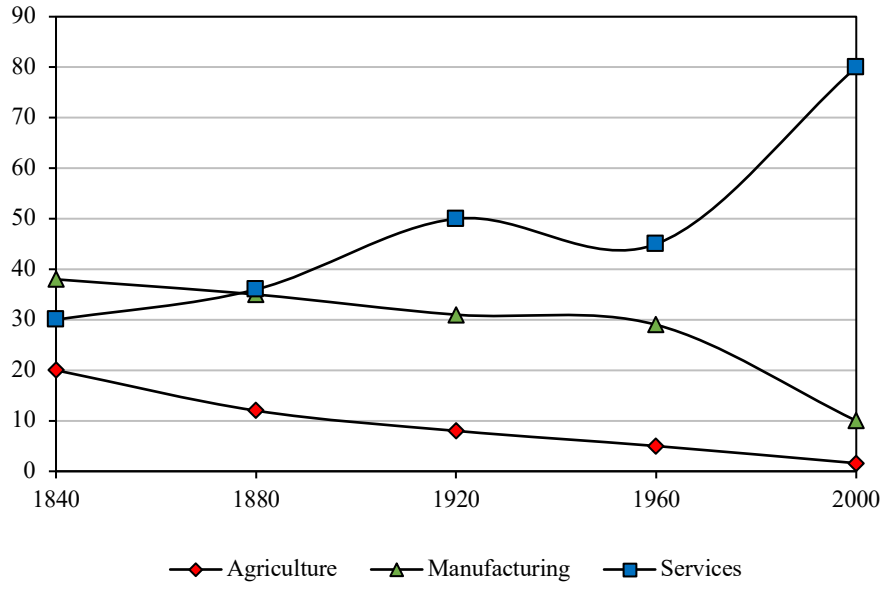

Figure 1. Source: Office of Statistics

[1] Feinstein, Charles, "Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution." *Journal of Economic History.* (1998). 58 (3):625-58. Doi: 1017/s0022050700021100.
[2] Landes, David. *The Wealth and Poverty of Nations.* W.W. Norton & Company. ISBN 978-0-393-31888-3

Employment by sector as share of total employment in the United States from 1840 to 2000

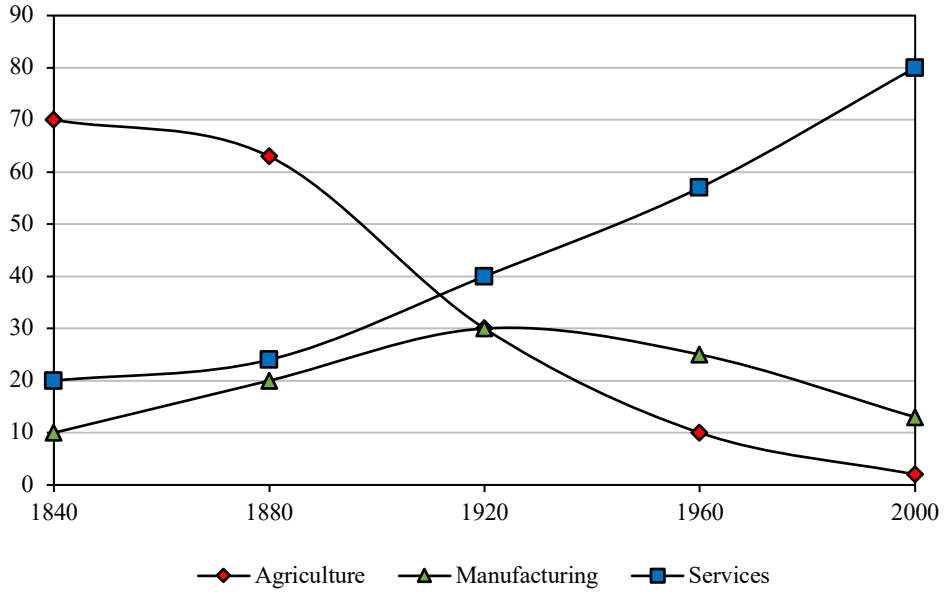

Figure 2. Source: U.S. Bureau of Labor Statistics

The manufacturing sector indeed was the main sector which enabled that transition to occur because the development of technology primarily took place in factories in most developed countries. However, in the rest of the world, the output of the manufacturing sector declined over time from 1750 and 1900. Figure 3 shows the total world output by region.

Share of Total Manufacturing Output (%)

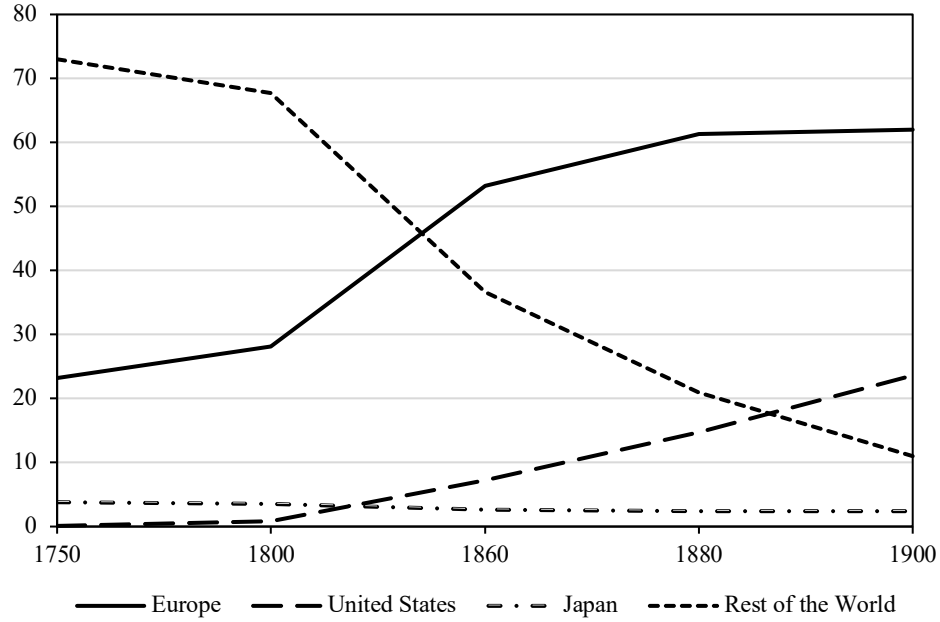

Figure 3. Source: The Rise and Fall of Great Powers (1987)

It has been argued that the decline in manufacturing output in the rest of the world is based on the exploitation of natural resources by Western powers. Whether this assertion establishes causation or not, it is nevertheless clear that there is a correlation. As western countries industrialized themselves by heavily relying on the production of the manufacturing sector, the countries that make up the rest of the world began to rely heavily on agriculture as the primary resource for their economic production. This then may explain why Africa, generally speaking, has been for a very long time, an agricultural society.

It is undeniable that Africa is mostly an agricultural society, especially countries in West Africa. During the post-colonial era, West African countries relied on agriculture as the primary and main economic source of production. From 1960 to 1990, the national income of West African countries was mainly based on agricultural output. In 1980, West Africa alone produced 26 percent of total food production in Africa.[3] By 2010, West Africa alone produced 33 percent of the total food production, which is more than any other subregion in Africa. Figure 4 illustrates the agricultural output that West Africa contributes to the total food production of the continent.

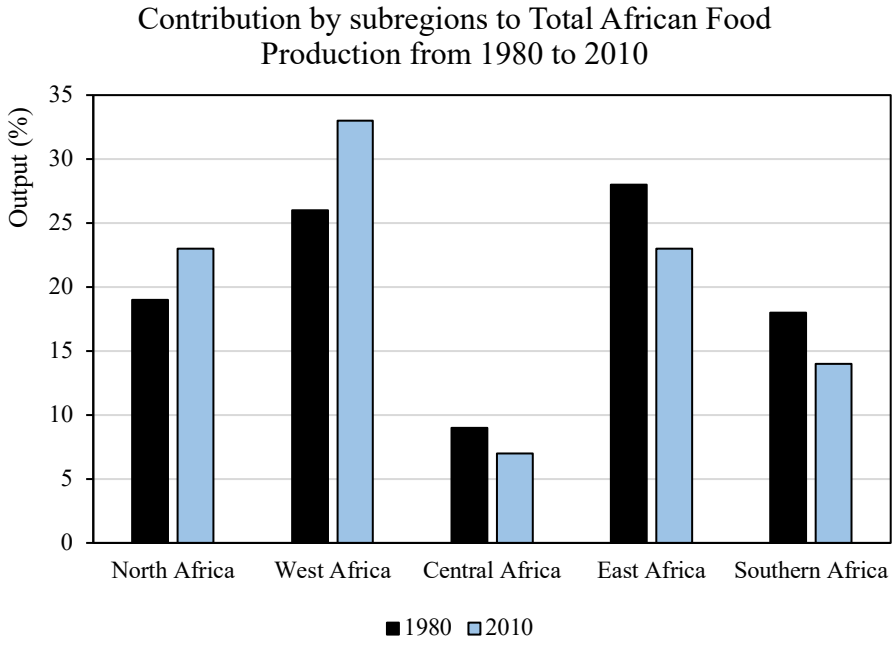

Figure 4. Source: Food and Agriculture Organization

As we could see, West Africa and North Africa are the only two regions where their contribution to total African food production has increased significantly while it has decreased in the other subregions. But the question we should ask ourselves is the following: what is the real impact of the agricultural sector on the national income of West African economies? Agriculture is, of course, not the only sector that contributes to the national income of West African countries, but it is for sure the one that has the most employment. As a matter of fact, according to the OECD data, 66 percent of total employment in West Africa is in the food economy, and 78 percent of the

[3] Mayaki, Ibrahim, Assane, "African Agricultural Paths" *Agriculture in Africa: Transformation and Outlook* New Partnership for Africa's Development (NEPAD). pp-1-76.

66 percent of food economy jobs are still in agriculture.[4] We can see that agriculture is indeed a very much relevant sector in the economy of West African countries. Our analysis is not to solely evaluate the impact of the output of agriculture on the national income of West African countries during the previous decade (2010-2019), but to also assess the impact of the manufacturing and service sectors as well on those economies and to see which of the three does contribute the most to the national income of West African economies. To assess the impact of the three sectors on the national income of West African countries, we aimed to use a multiple linear regression model to determine their impact on the national income.

2. METHODOLOGY

As was aforementioned at the end of the introduction, the purpose of our analysis is to evaluate the impact that the economic sectors of West African countries exert on their national income. The methodology to complete that task is, first and foremost, to collect the data.

Our raw empirical data will consist of five datasets. The first dataset represents the average of the national income of each West African country from 2010 to 2019. This dataset is our dependent variable. The second dataset represents the average of the output of the agricultural sector for each West African country from 2010 to 2019. This dataset will embody our first explanatory variable to the national income of West African countries. The third dataset represents the average of the output of the manufacturing sector for each West African country from 2010 to 2019. This dataset will characterize our second explanatory variable to the national income. The fourth dataset reflects the average of the output of the service sector for each West African country from 2010 to 2019. This dataset will symbolize our third explanatory variable to the national income. The fifth dataset epitomizes the correlation between all of our variables. It is the data that we will mainly use and rely on to make our assumptions, test these assumptions, evaluate the results, and draw conclusions from it.

[4] Allen, T., P. Heinrigs and I. Heo. "Agriculture, food and jobs in West Africa" *West African Papers,* (2018). No 14, OECD Publishing, Paris.

3. THE DATA

Data 1: Average of the National Income of West African Countries from 2010 to 2019 (Billions of U.S. Dollars)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Ghana	32.2	39.34	41.27	62.41	53.66	48.57	55.01	59	65.56	66.98	52.4
Nigeria	363.36	410.34	458.34	459.38	514.97	568.5	494.58	404.65	375.75	398.16	444.803
Côte d'Ivoire	24.91	25.42	26.79	31.27	35.36	45.81	47.96	51.88	57.73	58.79	40.592
Senegal	16.23	17.9	17.82	18.96	19.8	17.78	19.04	21	23.23	23.57	19.533
Liberia	2	2.4	2.72	3.07	3.14	3.18	3.27	3.29	3.26	3.07	2.94
Mali	10.69	13	12.44	13.24	14.36	13.11	14.02	15.38	17.17	17.51	14.092
Burkina Faso	10.11	12.08	12.56	13.44	13.94	11.83	12.82	14.17	16.2	15.75	13.29
Togo	3.43	3.87	3.87	4.32	4.57	4.18	4.49	4.82	5.35	5.46	4.436
Benin	9.54	10.69	11.14	12.52	13.29	11.39	11.82	12.7	14.25	14.39	12.173
Guinea	6.85	6.79	7.63	8.38	8.78	8.79	8.6	10.34	12.21	13.58	9.195
Guinea-Bissau	0.85	1.1	0.99	1.05	1.05	1.05	1.18	1.35	1.46	1.34	1.142
Sierra Leone	2.58	2.94	3.8	4.92	5.02	4.22	3.68	3.74	4.09	3.94	3.893
Niger	7.79	8.7	9.37	10.16	10.82	9.67	10.29	11.17	12.83	12.93	10.373
Cape Verde	1.66	1.87	1.74	1.85	1.86	1.6	1.66	1.77	1.97	1.98	1.796
Gambia	1.54	1.41	1.42	1.38	1.23	1.36	1.47	1.5	1.63	1.76	1.47
Mauritania	5.63	6.77	6.73	7.22	6.59	6.16	6.4	6.76	7.05	7.59	6.69

Table 1. Source: World Bank Data, Author's computation

Data 2: Average of the Output of the Agricultural Sector of West African countries from 2010 to 2019 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Ghana	28.04	23.66	22.13	20.45	20	20.25	20.98	19.7	18.27	17.31	21.079
Nigeria	23.89	22.23	21.86	20.76	19.99	20.63	20.98	20.85	21.2	21.91	21.43
Côte d'Ivoire	24.53	26.69	22.19	10.98	21.05	18.36	19.74	18.74	17.47	15.69	19.544
Senegal	15.84	12.88	13.97	13.69	13.37	14.28	14.21	14.98	15.02	14.79	14.303
Liberia	35.92	35.87	35.81	36.02	35.42	35.19	34.82	34	33.99	33.9	35.094
Mali	33.02	34.56	38.11	36.75	37.46	37.72	37.42	37.41	37.39	37.32	36.716
Burkina Faso	24.14	23.04	23.76	23.64	23.69	22.63	21.73	21.34	20.42	20.3	22.469
Togo	34.26	33.86	33.11	32.96	33.26	34.07	29.72	28.1	26.89	26.09	31.232
Benin	25.84	25.8	25.77	25.28	25.62	26.39	27.75	28.49	28.09	26.88	26.591
Guinea	20.12	20.03	19.92	19.79	19.63	19.41	19.65	19.8	20.04	20.08	19.847
Guinea-Bissau	55.93	55.86	55.7	54.82	53.51	52.94	50	50	49.97	49.66	52.839
Sierra Leone	54.2	52.2	51.5	51.43	51.29	50.98	50.73	50.83	50.92	51.07	51.515
Niger	36.28	34.09	34.06	32.6	33.7	32.61	35.88	36.01	38.44	38.18	35.185
Cape Verde	7.99	7.84	8.45	8.29	8.02	8.74	8	6.74	5.29	4.8	7.416
Gambia	35.19	27.2	27.39	26.22	22.46	22.21	21.86	21	19.87	16.79	24.019
Mauritania	17.36	15.06	14.9	14.86	14.42	13.97	13.9	13.99	14.5	14.74	14.77

Table 2. Source: World Bank Data, Author's computation

Data 3: Average of the Output of the Manufacturing Sector of West African countries from 2010 to 2019 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Ghana	18.01	23.86	27.14	34.86	34.59	31.68	28.23	30.39	31.53	31.99	29.228
Nigeria	25.32	28.28	27.07	25.54	24.64	10.16	18.17	22.32	25.73	27.38	23.461
Côte D'Ivoire	22.41	24.2	24.03	25.95	27.41	19.53	19.09	20.46	21.86	23.18	22.812
Senegal	21.56	23.09	22.79	24.1	23.15	23.59	23.34	23.28	24.18	24.38	23.346
Liberia	10.99	11.27	11.19	12.95	14.14	15.09	15.72	13.8	12.96	11.99	13.01
Mali	22.73	20.65	19.87	17.18	18.53	17.6	17.89	18.83	20.11	20.84	19.423
Burkina Faso	26.06	28.37	26.87	24.1	24.93	24.35	24.95	24.87	22.72	22.36	24.958
Togo	26.3	25.92	25.62	24.73	23.46	22.5	23.67	21.6	21.53	20.33	23.566
Benin	18.01	18.14	16.96	17.24	16.41	16.39	15.7	15.11	14.65	16.31	16.492
Guinea	33.98	29.16	30.97	27.98	26.43	29.58	31.08	32.1	32.07	32.4	30.575
Guinea-Bissau	29.77	30.44	31	31.24	32.63	26.5	27.68	28.11	30.29	31.02	29.868
Sierra Leone	13.97	14.87	14.9	15.92	16.23	16.43	17.86	19.22	16.82	13.07	15.929
Niger	21.18	20.98	25.09	24.59	22.4	21.59	19.91	20.25	18.07	18.44	21.25
Cape Verde	18.15	17.76	17	17.52	18.73	18.12	17.13	18.19	19.28	19.61	18.149
Gambia	9.83	11.51	11.96	11.89	13.21	17.14	20.94	17.89	15.57	16.35	14.629
Mauritania	44.2	43.6	48	49.12	49.36	50.5	48.66	47.96	46.97	45.5	47.387

Table 3. Source: World Bank Data, Author's computation

Data 4: Average of the Output of the Services Sector of West African countries from 2010 to 2019 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Ghana	47.94	48.18	45.84	47.58	39.15	36.11	39.54	43.09	43.01	44.14	43.458
Nigeria	50.79	49.24	50.19	52.37	54.15	58.12	59.79	55.8	52.02	49.73	53.22
Côte d'Ivoire	53.06	49.11	53.78	53.07	51.54	54.72	54.33	53.36	53.57	53.88	53.042
Senegal	52.75	54.05	53.65	52.94	53.61	51.44	51.97	52.17	52.01	51.44	52.603
Liberia	53.92	54.13	53.76	53.98	51.22	50.77	49.75	52.2	51.93	51.18	52.284
Mali	35.45	36.73	34.22	38.27	37.27	37.31	35.66	34.86	33.75	33.12	35.664
Burkina Faso	42.12	40.56	40.32	41.56	42.5	44.08	43.83	43.48	41.75	43.96	42.416
Togo	54.5	54.7	52.8	51.36	49.22	48.73	49.59	50.3	53.24	52.18	51.662
Benin	44.05	46.98	48.87	49.42	49.53	49.24	48.2	48.4	48.76	48.03	48.148
Guinea	45.05	45.64	47.08	49.54	50.55	50.42	50.31	48.1	47.97	48.5	48.316
Guinea-Bissau	15.6	15.4	13.2	12.95	12.75	13.6	13.7	11.97	11.86	11.76	13.279
Sierra Leone	30.7	30.9	33.6	33.71	32.91	32.7	32.27	31.9	31.97	32.06	32.272
Niger	38.3	36.41	37.97	35.99	37.95	39.28	38.93	38.56	37.84	38.07	37.93
Cape Verde	60.19	61.16	60.6	62.16	61.83	61.23	61.79	61.24	60.9	61.39	61.249
Gambia	51.1	49.2	54.9	54.45	55.13	56.44	51.89	48.8	53.43	58.52	53.386
Mauritania	35.6	34.8	37.1	37.8	38.76	38.84	40.21	43.43	36.3	39.7	38.254

Table 4. Source: World Bank Data, Author's computation

Data 5: Correlative Data

Country	National Income (Y)	Agriculture (X1)	Manufacturing (X2)	Services (X3)
Ghana	52.4	21.079	29.228	43.458
Nigeria	444.8	21.43	23.461	53.22
Côte d'Ivoire	40.59	19.544	22.812	53.042
Senegal	19.53	14.303	23.346	52.603
Liberia	2.94	35.094	13.01	52.284
Mali	14.092	36.716	19.423	35.664
Burkina Faso	13.29	22.469	24.958	42.416
Togo	4.436	31.232	23.566	51.662
Benin	12.17	26.591	16.492	48.148
Guinea	9.195	19.847	30.575	48.316
Guinea-Bissau	1.14	55.839	29.868	13.279
Sierra Leone	3.893	51.515	15.929	32.272
Niger	10.373	35.815	21.25	37.93
Cape Verde	1.796	7.416	18.149	61.249
Gambia	1.47	24.019	14.629	53.386
Mauritania	6.69	14.77	47.387	38.254

Table 5. Source: Author's computation

4. THEORETICAL FRAMEWORK

Our observation of the data allows us to formulate three major assumptions. (1) Agricultural output contributes more to the national income of the least developed countries than that of the most advanced ones in West Africa. (2) The output of the service sector is higher in the most advanced West African countries, which increases their national income than in the least developed countries because many people have been leaving the agricultural sector to work in the service sector. (3) The national income of the least developed countries in West Africa is low despite the major contribution of agriculture to their economies because of the lack of technological progress in the manufacturing and services sectors.

5. MODEL

The model of our analysis is indeed based on a multiple linear regression with three explanatory variables and one dependent variable. The equation of the model could be written as the following:

$$Y_{\text{National Income}} = \beta_0 + \beta_1 X(\text{Agriculture}) + \beta_2 X(\text{Manufacturing}) + \beta_3 X(\text{Services}) + \varepsilon$$

The inputs of our linear regression model give us the following summary output of our computed variables.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.27169982
R Square	0.07382079
Adjusted R Square	-0.157724
Standard Error	117.186782
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	13134.7613	4378.25375	0.31881862	0.81163747
Residual	12	164792.902	13732.7419		
Total	15	177927.664			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-401.40071	623.088741	-0.6442111	0.53155956	-1758.9945	956.193034	-1758.9945	956.193034
Agriculture (X1)	3.2072936	6.23667973	0.514263	0.6164068	-10.381264	16.7958514	-10.381264	16.7958514
Manufacturing (X2)	4.0969985	6.58051169	0.62259573	0.54519991	-10.240705	18.4347018	-10.240705	18.4347018
Services (X3)	5.75143837	7.27730857	0.79032493	0.44467628	-10.104455	21.6073316	-10.104455	21.6073316

6. EMPIRICAL EVIDENCE AND DISCUSSION

After testing our model, we have obtained three regressions for each of the explanatory variables tested against the dependent variable. Let us start interpreting the results of our first linear regression.

Regression 1: Agricultural Output correlated to National Income

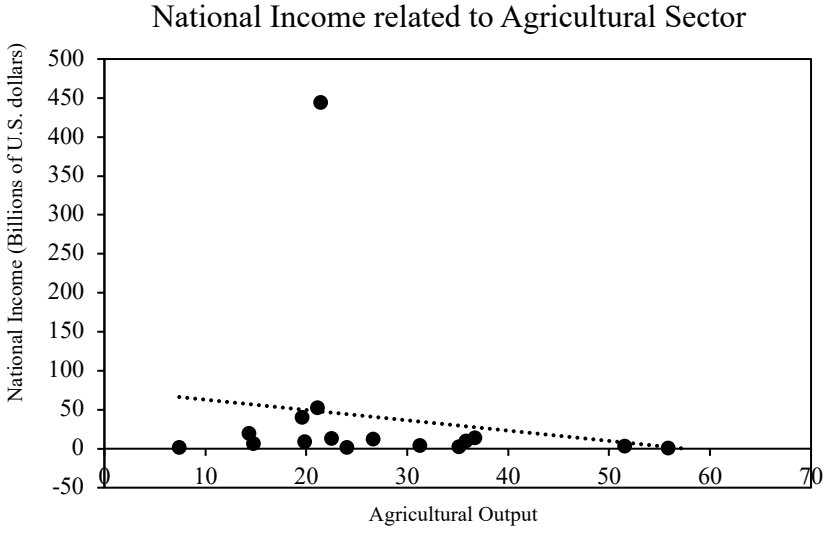

Figure 5

The results of the first regression indicate to us that since 2010, agricultural output has been in decline in many West African countries. As a matter of fact, Gambia, Niger, Mali, Sierra Leone,

Guinea-Bissau, and Liberia are among the countries that have the lowest national incomes within our model and one of the highest agricultural outputs ($X_1 > 30\%$ of GDP). But countries such as Nigeria, Côte d'Ivoire, or Ghana have an agricultural output averaging 20 percent of their GDP and a high national income ($Y \geq \$40$ billion). It is clear that low-income West African countries grow economically less rapidly than their high-income counterparts despite a strong reliance on agricultural activities and production. Agriculture has played a huge role in the economic development of most African countries, particularly in those of West Africa since the colonial and post-colonial era.

In the 1950s, development efforts focused on industrialization and urbanization that were seen as driving growth through manufacturing that would at least, initially be more productive in the use of labor and capital than agriculture.[5] Demand for agricultural products would grow in response to rising incomes in urban areas, while technology to raise productivity, it was thought at the time, could readily be transferred from industrialized countries.[6] The expectation that agriculture would grow with higher productivity, with little additional stimulus other than demand, prove optimistic in some countries such as the ones aforementioned—agricultural growth was often slower than expected and hindered overall growth. This perception is indeed valid though, especially since the 1990s. Agricultural growth is generally slower than the other form of growth, especially in low-income countries like Liberia or Sierra Leone because there is a substantial lack of technology to increase labor productivity.[7] It does not mean that agriculture is irrelevant to the economic development and the national income of a country. On the contrary, agriculture remains an important factor in reducing poverty in low-income countries. However, it implies that to rely on agriculture as the primary resource to create economic growth, is a process that would, in fact, slow the economic growth of a country.[8] Burkina Faso has done substantial economic progress lately although it mostly remains an agricultural society. As the data could show in figure 6, nearly 50 percent of total employment was employed in agriculture in 2010. This number has decreased by half to 25 percent at the end of the decade in 2019. Although Burkina Faso is predominantly an agricultural society, employment in its agricultural sector has declined considerably over the past decade because the other two sectors, which are the more developed than the agricultural sector, offered more economic opportunities as well as higher incomes, which were both an incentive for workers to leave the agricultural sector. As we could observe on this graph in figure 7, income per capita overall increased in Burkina Faso despite a drastic fall of about $139 between 2014 and 2015.

[5] Wiggins, Steve. "2. Agriculture and Growth" *Agriculture and Growth in Low-Income Countries.* (2013). pp. 1-20 Growth Research Programme.
[6] Ibid. p. 4
[7] Christiaensen, L., Demery, L. and Kuhl, J. *The Evolving Role of Agriculture in Poverty Reduction. An Empirical Perspective.* (2010). Working Paper, No 2010/36, Helsinki: UNU Wider.
[8] Davis, K. E. "Extension in Sub-Saharan Africa: Overview and Assessment of Past and Current Models, and Future Prospects." *Journal of International Agriculture and Extension Education,* 15 (3):15-28.

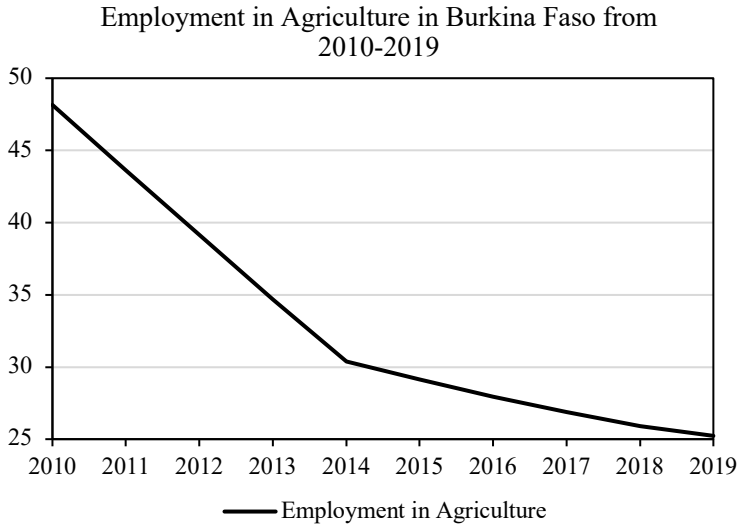

Figure 6. Source: International Labor Organization

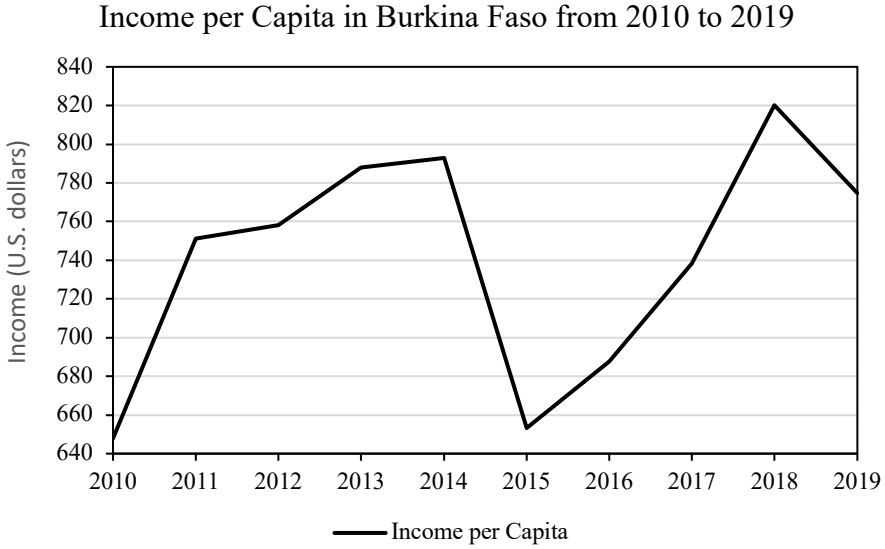

Figure 7. Source: African Development Bank

Burkina Faso is, of course, one example among other countries within our model that we chose to elaborate in order to epitomize the decline of the agricultural output upon the national income of West African countries. Senegal is following the same pattern as Burkina Faso. Primarily an agricultural society, Senegal has made major structural adjustments within its economic sectors as well. Like in Burkina Faso, employment in the agricultural sector has been in decline as well in Senegal. Agriculture has been contributing less and less to the national income of Senegal while the other two sectors have made a significant impact on the improvement of the living standard in Senegal.

Regression 2: Manufacturing Output correlated to National Income

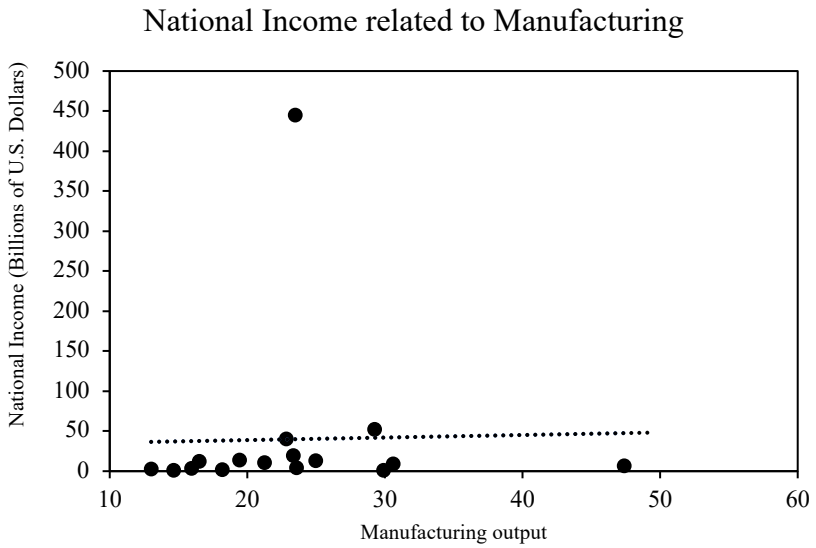

Figure 8

There has been a positive correlation between the output of the manufacturing industry and the national income of West African countries. However, this positive correlation is not absolute. In fact, this positive correlation mostly feeble. The regression shows us that the output of the manufacturing sector has been more or less stagnant on the national income of West African economies. As it was elaborated in the introduction of our analysis, the manufacturing sector has been the catalyst for the economic development and structural adjustments of developed countries such as Western Europe, the United States, Canada, and Japan. But for West Africa, the manufacturing sector, although it has helped improving the economic development of many African countries, it has not made a definitive contribution by increasing substantially the national income of the majority of West African countries.

It is undeniable that modern industry significantly contributes to the accumulation of physical and human capital.[9] Indeed, it provides well-paid jobs for a large number of unskilled or uneducated workers—particularly those who are not integrated into the formal economy—which increases household income and hence, domestic demand.[10] Moreover, a strong manufacturing argued that to improve a country's external account balance by decreasing imports and diversifying exports, thereby increasing resilience to external shocks as compared to reliance on primary commodities.[11] Though African manufacturing grew in the immediate post-independence period, largely shaped by state-led and protectionist policies, by the mid-1980s, a series of external shocks—including oil price increases, commodity price decreases, real interest rates rise, withering public coffers, and the limitations of domestic markets—were major factors in the

[9] Signé, Landry, "2. Evolution of Manufacturing and Industrialization in Africa: Facts and Trends" *The Potential of Manufacturing and Industrialization in Africa: Trends, Opportunities and Strategies.* (2018). Africa Growth Initiative. Brookings Institute. pp. 1-36.
[10] Ibid. p. 3
[11] Ibid. p. 3

industrial sector declined in the region.[12] Though structural adjustment reforms like privatization of state-owned enterprises and trade liberalization along with foreign aid restarted West African manufacturing in the 1990s, increased competition from foreign products.[13] However, by 2006, the share of manufacturing in GDP had declined to roughly 10 percent before it regains its momentum again in the early 2010s.[14] As we could see in figure 9, the value added by the manufacturing sector in the economy of most African countries declined overall. This decline considerably affected the national income of most West African countries.

Figure 9. Source: World Bank Data

There are, in fact, two reasons which could justify the decline of the added value of the manufacturing industry on the national income of Sub-Saharan African countries and its stagnation in those of West Africa. The first reason is the decline in employment in that sector as well. Although the manufacturing sector has provided substantial value to the national income of West African countries, many people are still leaving the industry because wages became lower.[15] Second, economic opportunities also became scarcer.[16] Labor markets in poor counties reward schooling, experience, and other individual skills.[17] The idea that employment relationships result from a sorting process goes back a long way—one possible reason for sorting is that the returns to skills are heterogenous across jobs.[18] As a matter of fact, skills acquired through higher education raise productivity more in certain tasks than in others, and sorting of workers across jobs has

[12] Ibid. p. 3
[13] Ibid. p. 4
[14] Ibid. p. 4
[15] Fafchamps. Marcel; Söderbom, Mäns; Benhassine, Najy. *Wage Gaps and Job Sorting in African Manufacturing.* (2008). Working paper. ERSC Global Poverty Research Group. pp.1-42.
[16] Ibid. p. 2
[17] Ibid. p. 2
[18] Ibid. p. 2

generally resulted in highly educated individuals performing the task that pays the most.[19] Since the level of education is less advanced in the manufacturing sector than in the service sector, incentives for higher wages are reduced because wages and labor productivity increase based on the level of the education of the individual performing the task.

In West Africa, the manufacturing sector has mainly stagnated rather than thoroughly augmented throughout the last decade because West African countries do not really transform their own commodities and natural resources. The lack of transformation of those resources precludes the generation of new jobs in the sector. As a result, more workers are seeking job-opportunities in other sectors of the economy, and mainly in the service sector. It does, by no way, mean that the added value of the manufacturing sector does not contribute to the national income of West African countries. It does but its contribution to their GDP is not significant since employment is shrinking in that sector. It is logically clear to everyone, including those without doctoral degrees, that of an economic sector to perform efficiently and to produce significant output, employment in that sector must be reasonably high. The reason why employment in the manufacturing sector remains nonetheless relevant to some extent to the GDP of West Africa is that it plays a crucial role in the economic growth of Nigeria and Ghana which are two of the most advanced countries in the subregion. Figure 10 indeed epitomizes the increase in employment in the manufacturing sector of these two countries. Let us not forget that Nigeria and Ghana alone do produce over two-thirds of the whole income of West Africa. Without the rise of employment in the manufacturing sector of these two countries, manufacturing output would have had a negative impact on the GDP of West Africa overall.

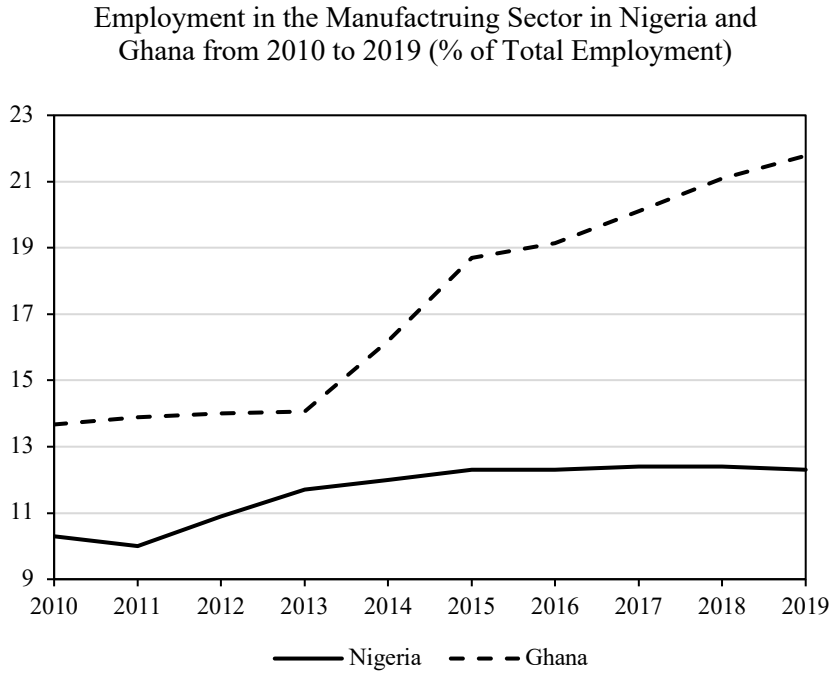

Figure 10. Source: International Labor Organization

[19] Ibid. p. 2

Regression 3: Services Output correlated to National Income

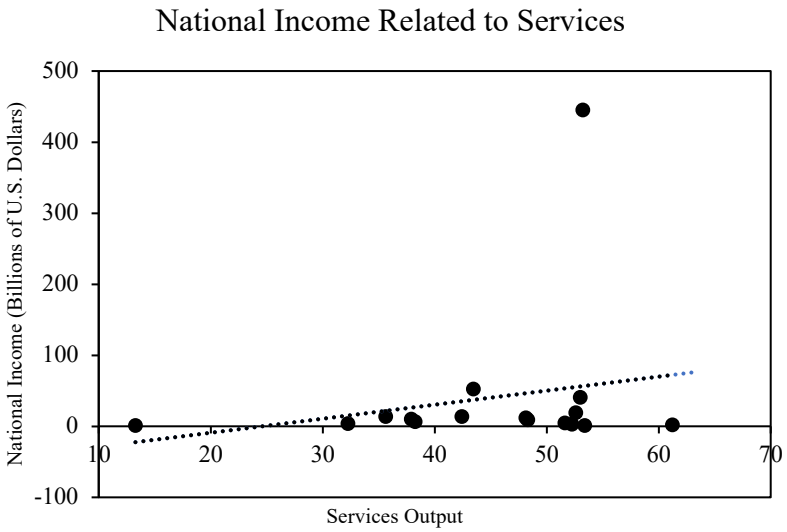

Figure 11

The third regression of our model clearly shows an overwhelmingly positive correlation between the output of the services sector and the increase of the national income of West African countries. The services sector's share in the economy of West African countries is the largest in most of those countries.[20] As we could see in figure 12, based on our correlative data, Cape Verde, Nigeria, Côte d'Ivoire, and Gambia have the highest contributions of the service sector to their national income in West Africa.

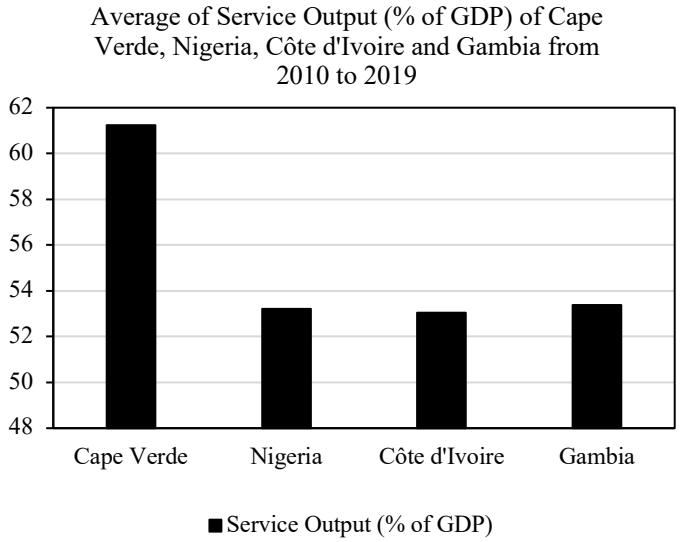

Figure 12. Source: Author's computation from the correlative data of table 5

[20] Board of Directors, "Executive Summary" *West Africa Economic Outlook 2018*. (2018). African Development Bank Group. pp.1-50. ISBN: 978-9938-882-67-4. Data Report.

Nigeria and Côte d'Ivoire are among the countries that have the highest national incomes in West Africa while Cape Verde and Gambia are the ones that have the lowest ones. It does not subsequently imply that because Cape Verde and Gambia have one of the lowest national incomes of the subregion, therefore there are less advanced. As a matter of fact, Cape Verde is the most advanced country in West Africa according to the Human Development Index with a human development index (0.651 > 0.5) considerably above the normal trend which is estimated at 0.5 index-points. while Nigeria, despite its colossal population, remains within the lowest quintile of the human development index in the whole African continent.[21] Cape Verde is a very small island in the Atlantic Ocean, on the far west of Senegal with a population of fewer than 1 million people according to the World Bank. Consequently, since Cape Verde has a population of 500,000 inhabitants and an average national income of about $1.8 billion from 2010 to 2019, we can say that the national income of Cape Verde is clearly not low but proportional to its population size. Gambia, however, despite its high services sector's output to its economy, remains among the least advanced countries in West Africa. It has a low human development index compared to the normal trend (0.466 < 0.5)[22] and a population above 2 million inhabitants. For a population of 2 million inhabitants and an average national income of $1.7 billion from 2010 to 2019, Gambia's national income is definitely lower because the sum of goods and services produced is below what its population can actually produce.

Demand in the economies of West African countries comes primarily—70 percent on average—from private consumption,[23] which is mainly produced by the service sector. As we initially elucidated in the first regression of our analysis, many workers left the agricultural sector to seek employment in the service sector. As a result, output in the agricultural sector declined while it increased in the services sector. Ghana is the perfect example to epitomize this argument. Although Ghana may not have the highest services output, its service output has increased over the years due to an increase in employment in the sector as figure 13 could illustrate.

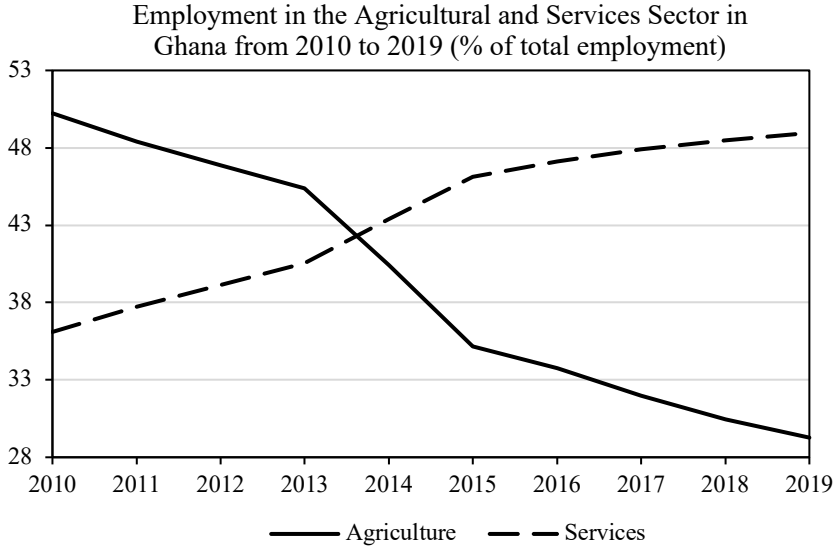

Figure 13. Source: International Labor Organization

[21] *Human Development Index.* 2019
[22] Ibid.
[23] *West Africa Economic Outlook 2018.* p. 1

Employment in the service sector began to increase because more people have had access to education. This improved access to education subsequently enabled workers to gain the skills they need to get better job opportunities with higher pay. As it was previously expounded in the analysis of the second regression, the higher is the level of education, the higher is the wage, and the higher is the labor productivity. Figure 14 shows the income per capita in Ghana from 2010 to 2019.

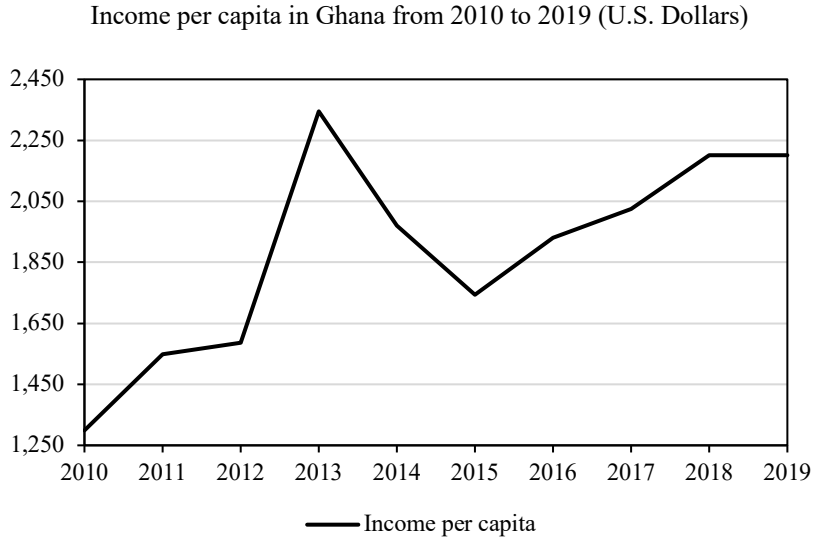

Figure 14. Source: World Bank

West Africa's labor force participation rate is high, and its unemployment is rate low.[24] The reason why the labor force in West Africa significantly increases is because of the structural adjustment that occurred which led to the creation of more job opportunities in the service sectors. The labor market is almost entirely informal, which means that most jobs in the labor market are provided by the service sector.[25] Interestingly most of the jobs created in the service sector are mainly self-employment jobs or entrepreneurial jobs since demand in that sector increased because consumption increased within the latest years. Demand requires proper channeling to support entrepreneurship in the region.[26] During the last two years of the previous decade, imports outweigh exports.[27] The problem with having imports exceeding exports is that it disincentivizes entrepreneurs from creating innovating goods and services that would create more jobs within the sector. Overall though, the service sector has demonstrated to be the main driving force of economic growth in West Africa. It has been the most contributing sector of all three to the national income of West African economies and will continue to be so since digitalization is considerably augmenting in the consumer's daily lives.

[24] Ibid. p. 1
[25] Ibid. p. 1
[26] Ibid. p. 4
[27] Ibid. p. 4

7. CONCLUSION

The results of our multiple regression have allowed us to understand and analyze the impact that the economic sectors exert on the national income of West African countries. It is consequently clear that major structural transformations and adjustments occurred within the last decade. The most blatant of these structural changes was the considerable decline of agricultural output and the rise of the output of the service sector. Although West African societies are still primarily agricultural, they, nonetheless, fathomed that the development of technological progress and the digitalization of goods and services were the most needed tools to improve their living standard. The countries that have mainly relied on agricultural output to develop their economies are still backward while those that favored the output of the service and manufacturing sectors are more advanced. In this new decade (2020-2030), it is clear that agricultural output will continue to decline because the use of technology will keep increasing over time to the point that the digitalization of employment will become the main way to obtain employment; which implies that employment in the service sector will skyrocket.

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21. *Human Development Index.* 2019

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23. *West Africa Economic Outlook 2018.* p. 1

24. Ibid. p. 1

25. Ibid. p. 1

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27. Ibid. p. 4