African Institute for Mathematical Sciences, Ghana.

Crop Production In Some African Countries

Ahmed Ayad

Lois Aku Selase Keh

Pearl Osei

Samuel Angmor Mensah

Solomon Tettey Kwao

October 7, 2014

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1 Introduction

Agriculture is "the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products" according to the Merriam-Webster dictionary.

Agriculture has suddenly received attention in recent years among policy makers, NGO's (especially those focused on Sub-Saharan Africa). Though Sub-Saharan Africa has the potential of becoming an agricultural powerhouse, crop yields for most of the regions are just a fraction of those in the rest of the world.

Experts say; in the late 1960's, most Sub-Saharan African countries were net food exporters buta as of 2002. Sub-Saharan Africa imported 19 million tons of food a year. Although Africa's total factor productivity in agriculture is estimated to have increased in recent years, its production per capita remains essentially unchanged. In this report, we limit our study to selected African countries.

1.1 Definitions

1. **Agricultural land:**
   This refers to the land devoted to agriculture, the systematic and controlled use of other forms of life,particularly the rearing of livestock and production of crops to produce food for humans. It is generally synonymous with farmland or cropland [3].

2. **Import Dependency Ratio:**
   This refers to the extent of dependency on importation in relation to domestic consumption[2].

2 Objectives

At the end of this report,the following will be seen:

1. To investigate the percentage of land area that is invested into agriculture in some selected African countries.

2. To investigate the relationship between agricultural land and crop production.

3. To investigate the relationship between the rate of crop production and the import dependency ratio.

3 Data Source

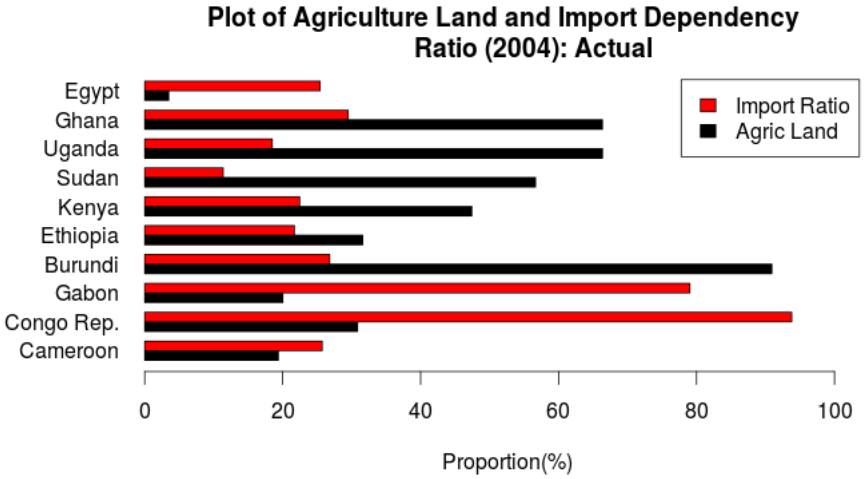
Secondary data was collected from www.opendataforafrica.org for the exploratory analysis and for the various tests that will be seen in this report.

Data was also collected from students of the African Institue for Mathematical Sciences, Ghana. This task was completed by administering questionnaires via email(google forms).

4 Exploratory Analysis

4.1 Proportion of Agric land versus Import Dependency Ratio

The plot below shows the percentage of land that is invested into agriculture in selected African countries according to the secondary data that was acquired.

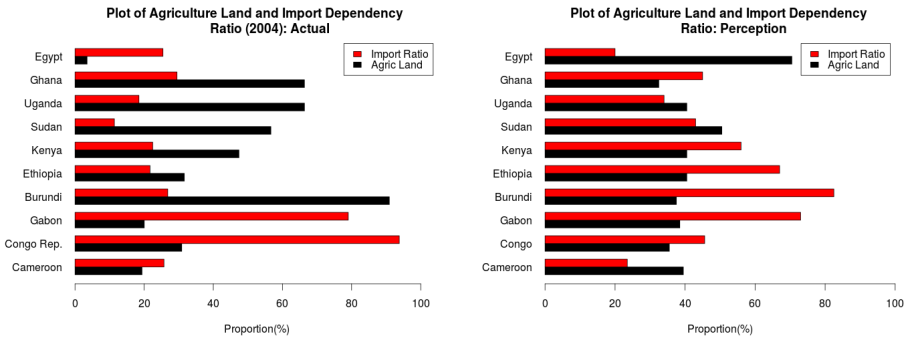


The plot shown above compares the differences between how much land area is used for crop production and how much a specific country depends on importation. it is observed that if the land area is large,then a country will have small dependency ratio and a country such as Congo Republic with a small land area for production tends to depend more on importation for domestic consumption.

However, since the total land area of the countries are not equal, we could not compare in terms of production, which country tends to depend more on importation than the other

4.2 Comparison of Actual and Perception Data

1. This is a comparison of a plot of agriculture land and import dependency ratio of actual data and perception data.

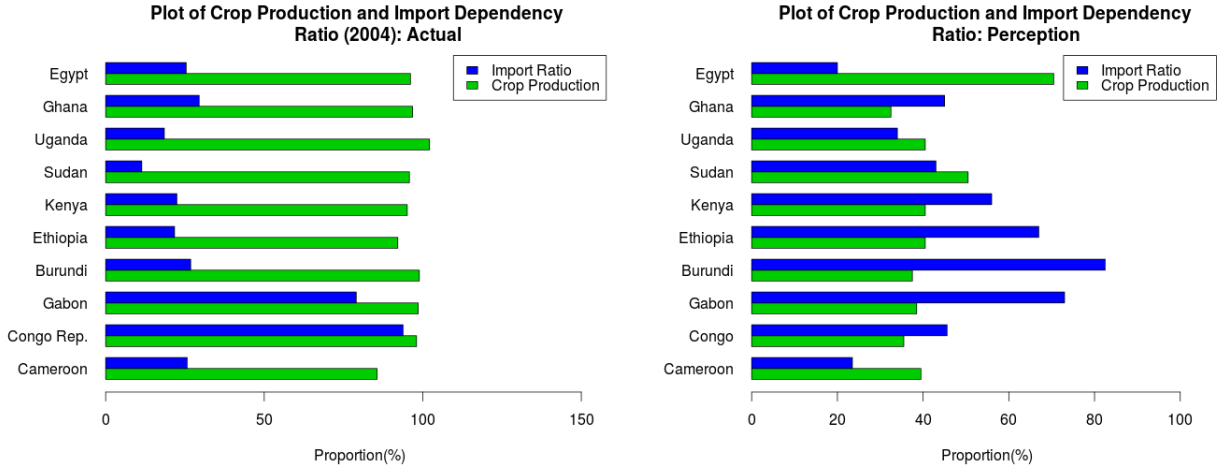


From the perception data, land used for agriculture within a country like Egypt is of a higher proportion compared to the actual data. This could be on the notion that,individuals from the class considered the size of the land, thinking that a large area of land could influence a greater proportion of agriculture.

The actual data for land use in Egypt which is about 3.5% could be explained by the fact that most of the land in Egypt is in a desert region.

The actual data is from year 2004 and the perception data is collected in 2014. Looking at the differences in values for some of the countries,can we conclude that the perception data is a true reflection of what is happening in terms of agricultural land proportion and import dependency ratio? No, we cannot conclude that the perception data is the actual representation of what is happening in the selected country in terms of the above listed variables.

2. It has been established from the previous plot that, relative to agricultural land, a country will import more if the agric land is small.



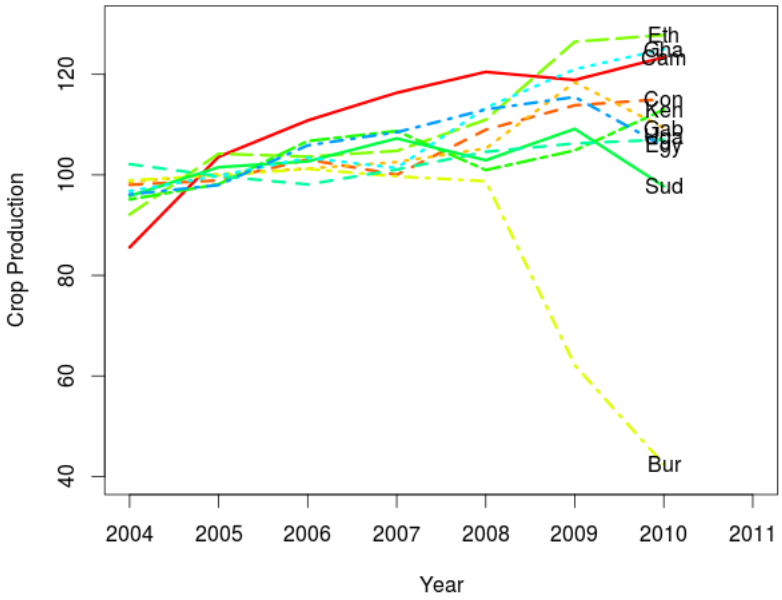
Now the question is; how much of crops does a country produce and how well does it explain its importation?. The plots above explain the question posed, that is,the plot for the actual data (obtained from `www.opendataforafrica.org`) and a perception data(obtained from AIMS-Ghana Students).
From the plot of the actual data, it is observed as at 2004, all the African countries used in this work, produced more crops than what they imported.

A country like Congo Republic for instance has the highest importation ratio and yet produces more crops than it imports per observation.

However, the perception data shows some changes in crop production. Also,it is observed that Uganda imports more than it produces, but the actual data gives Uganda a different representation.

It cannot be concluded that things have changed over the years based on the perception data. This is because the size of the perception data is small and cannot represent the entire population.

4.3 Trendlines of Crop Production

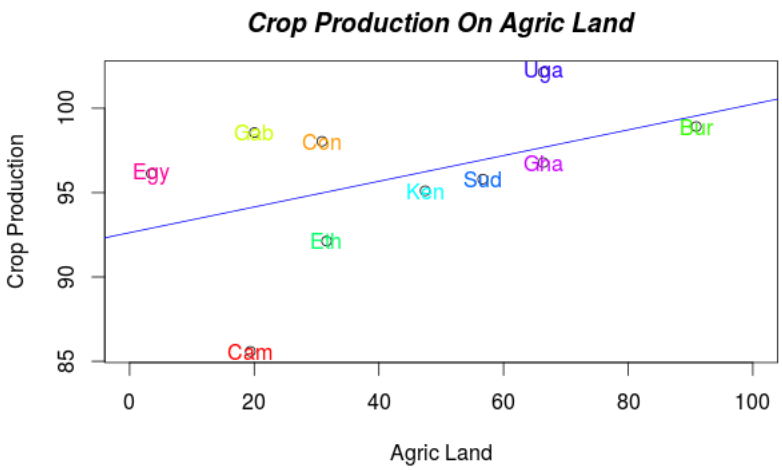


It is observed that there is a steady increase in the trend of crop production across most of the selected countries from 2004 to 2010 except Burundi, which had a sharp decline in crop production.

There are some factors that could have caused this sharp decline, the data collected cannot explain this because is that of 2004. Nevertheless,from other studies, we came to the knowledge that, continuous rains destroyed most of their crops within the period 2008 and 2009 affecting crop production in the year 2010.

5 Confirmatory Analysis(Based on Actual Data)

5.1 Crop Production Vrs Agricultural Land



Up to this point the report has shown how the import dependency ratio relates to agricultural land and also crop production. However, to determine if the availability of agricultural land actually explains the differences in crop production, the above regression will be used.

From the above regression, it can be observed that there is a positive relationship between the agricultural land and and crop production. However, there are inconsistencies when individual countries are considered.

Uganda uses about 65% of land for agriculture and compared to the base index of 100 as at the year 2000 according the secondary data collected, it can be observed that there has been an increase in crop production.

On the other hand, a country such as Burundi has about 90% land for agriculture and yet there is a reduction in crop production when compared to the base index of 100.

We further study the relationship by performing a 't-test' on the data by using an optimal progamme - R.

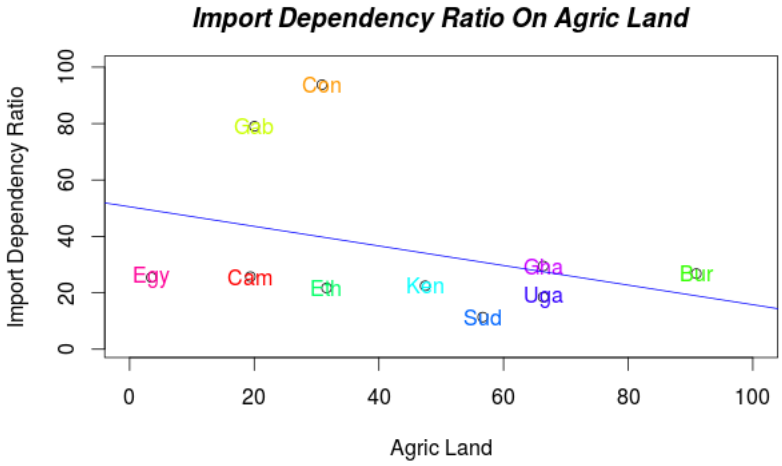
```
Residuals:
    Min      1Q  Median      3Q     Max
-8.5068 -1.1336 -0.7616  3.1996  4.4634

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)      92.62069    2.64068   35.08 4.78e-10 ***
agric$agric_land  0.07618    0.05252    1.45    0.185
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.241 on 8 degrees of freedom
Multiple R-squared:  0.2082,Adjusted R-squared:  0.1092
F-statistic: 2.103 on 1 and 8 DF,  p-value: 0.185
```

A test further shows that there is no evidence to say that the availability of land affects crop production since the p-value is 0.185 which is greater than the α value of 0.05. this shows that agricultural land only shows about 11% of variability in crop production.

5.2 Import Dependency Ratio Versus Agric land



A comparison between import dependency ratio and agricultural land shows a negative relation. That is, the plot shows that as the agricultural land increases, countries tend to depend less on importation. There are however some countries that depend more on importation but also have a significant amount of agricultural land. An example is Gabon.

We further study the relationship by performing a 't-test' on the data by using an optimal progamme - R.

```
Residuals:
   Min     1Q Median     3Q    Max
-23.83 -17.96 -10.24   6.45  54.04

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)       50.4763    17.1212   2.948   0.0185 *
agric$agric_land  -0.3472     0.3405  -1.020   0.3378
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 27.49 on 8 degrees of freedom
Multiple R-squared:  0.115,Adjusted R-squared:  0.004359
F-statistic: 1.039 on 1 and 8 DF,  p-value: 0.3378
```

A test shows there is no much evidence to say that the agricultural land affects import dependency ratio. A significance level of 5% gives a p-value of 0.3378 and adjusted R-Squared of 0.0044. This means, agricultural land only shows 0.4% variability on import dependency ratio.

6 Limitations

1. Since The data was a secondary data, omissions in the data and this can lead to an incomplete representation of some of the selected countries.

2. Perception data was taken when students were busy with assignments and this might lead to collection of wrong information.

3. The sample size for the perception data was small hence could not represent the whole students popultion.

7 Conclusion

This work shows that as at 2004 , even though all the selected African countries had some percentage of their total land area for agricultural purposes, the size of the land did not have any effect on their crop production, neither did it have an effect on the import dependency ratio. Considering the trendline and some good initiatives in the Agricultural sector of most African countries it can be assumed that crop production in Africa is receiving some form of improvement over time.

References

[1] Open Data for Africa. (http://www.opendataforafrica.org)

[2] Philippine Food Security Information System. (http://www.philfsis.psa.gov.ph/index.php/id/meta/IDR)

[3] Wikipedia. (http://en.wikipedia.org/wiki/Agricultural_land)

[4] Brookings. (http://www.brooking.edu/research/papers/africa-agriculture-challenge-mcarthur)

[5] Council on Foreign Relations. (http://www.cfr.org/sub-saharan/african-agriculture/p16352

8 Appendix

- Ahmed Ayad : Data collection and arrangement
- Lois Aku Selase Keh : Write up of report and structure, regression analysis
- Pearl Osei:Arrangement of data and plotting
- Samuel Angmor Mensah: Creating of plots and its study, information gathering to explain data(actual)
- Solomon Tettey Kwao: Regression analysis, information gathering to answer trends (actual)