Visualization of Year 2015 Flooding Impact on Southern Malawi

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Introduction

- Malawi is a Southeastern African country.
- It is bordered by Zambia to the west, Tanzania to the north and northeast, and Mozambique surrounding on the east, south and southwest.
- Malawi spans over 118,484 km^2 (45,747 sq miles) and has an estimated population of 18,143,217 (as of July 2018).
- It is divided into 3 regions and subdivided into 28 districts.
- Lake Malawi takes up about a third of Malawi's area.
- Its official languages are English and Chewa.

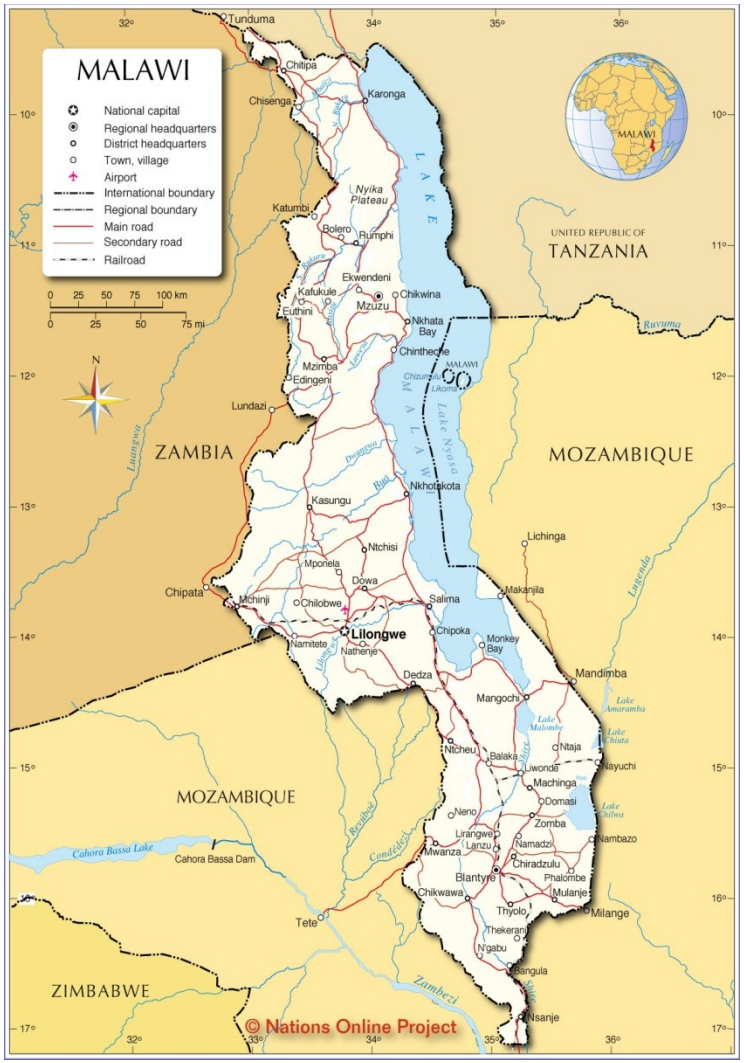


Figure 1: Map of Malawi with her surrounding countries

Text Source: Wikipedia
Map Source: https://www.nationsonline.org/oneworld/map/malawi_map.htm

Malawi 2015 flood description

- Some African countries were struck with severe floods caused by sustained heavy rains between January and March 2015, particularly Mozambique and Malawi.
- According to UNICEF, in Malawi, about 276 people were killed or missing, while 645 people had been injured and 230,000 people were displaced .
- This led to destruction of roads, villages being obliterated, homes being swept away and livestock killed.
- Hence, it further led to a food crisis that affected approximately 2.8 million Malawians as most people survive from subsistence farming.
- Summarily, the 3 Malawi regions were affected(Northern, Central and Southern regions), but the southern region was the most affected.

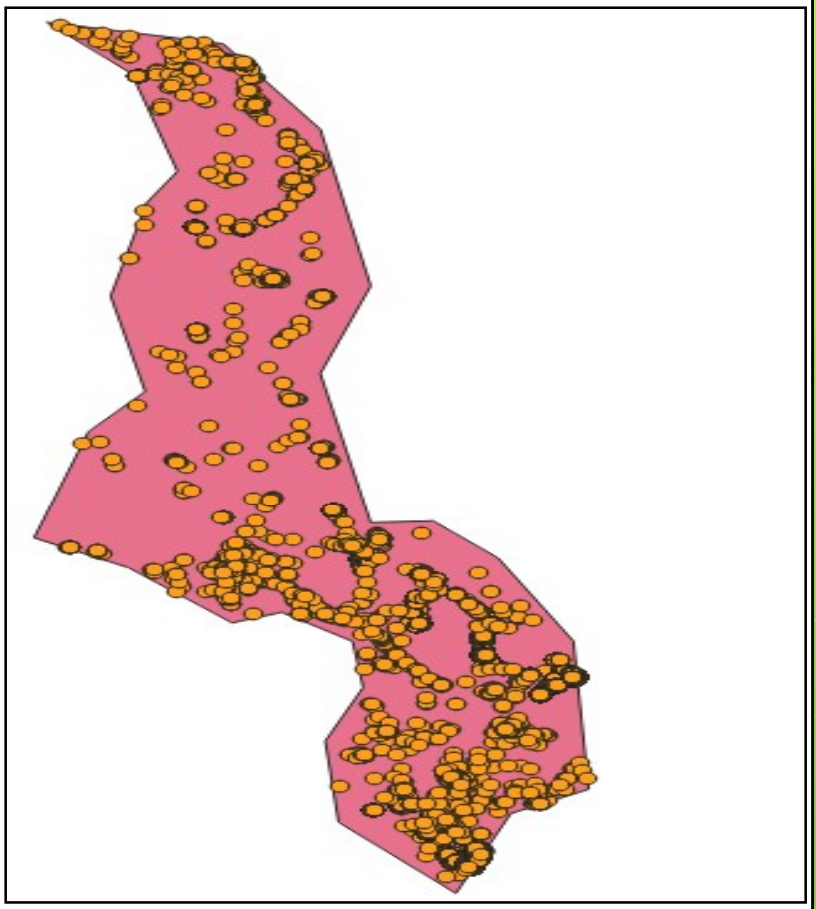


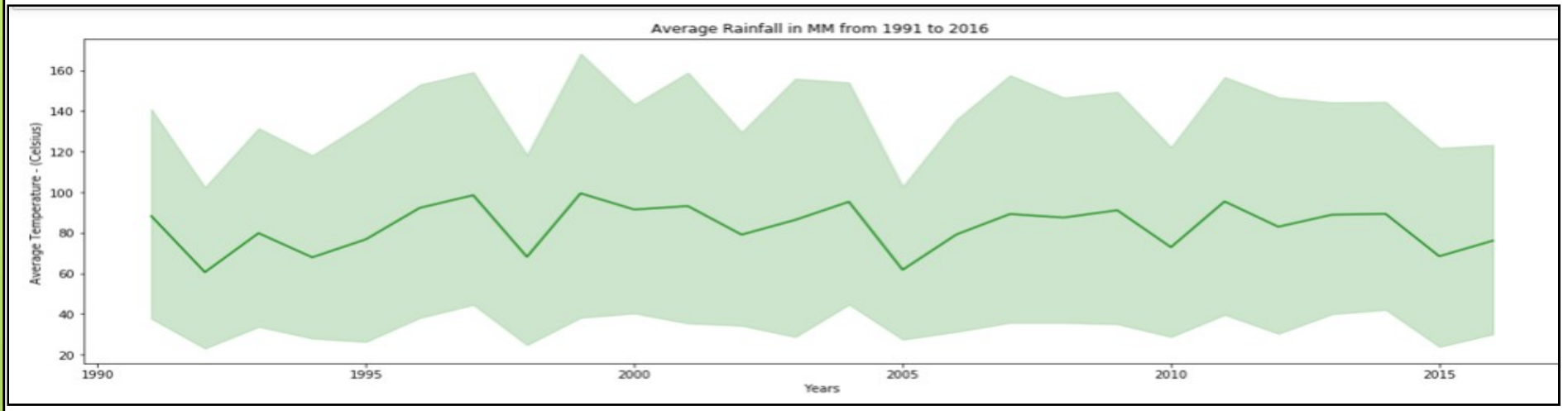
Figure 2: Map of Malawi showing the flood intensity in 2015.
The effect is highly concentrated in the southern region

Malawi 2015 Flooding Effects

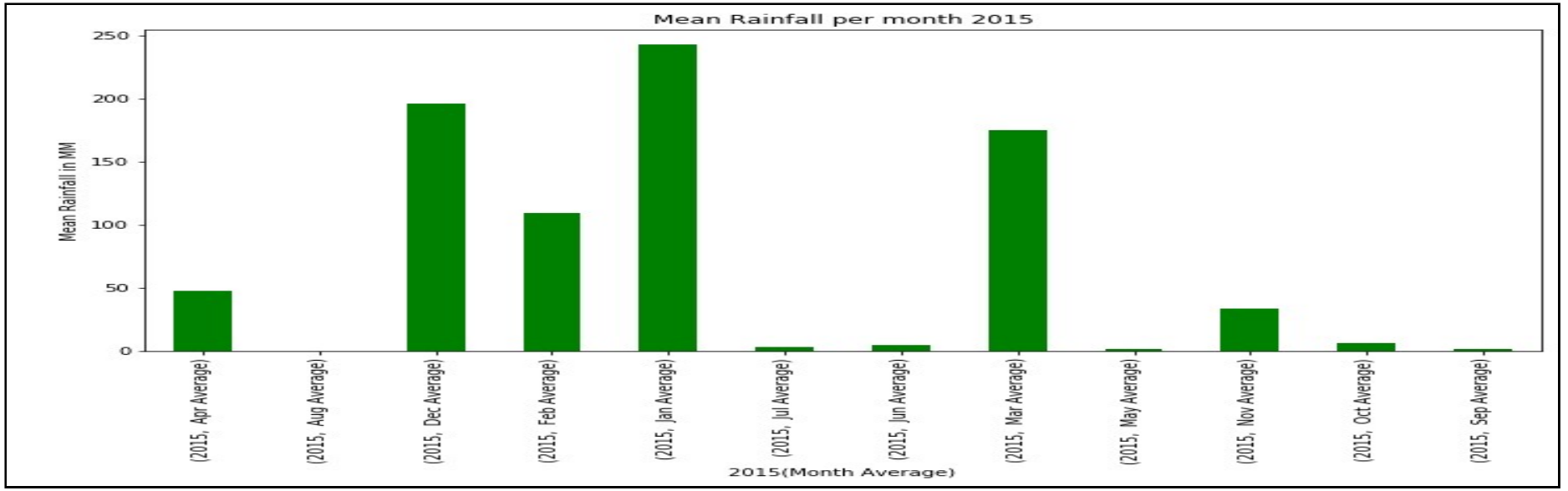
The Malawi 2015 flooding effects will be described and visualized under the following sections:

- Hike in Food Prices
- Malawi Health care sites
- Food Security
- Flood Extent
- Demographic/Health factors
- Socio-Economic/Population factors
- Trends Monitoring

Malawi Weather (Mean Rainfall)

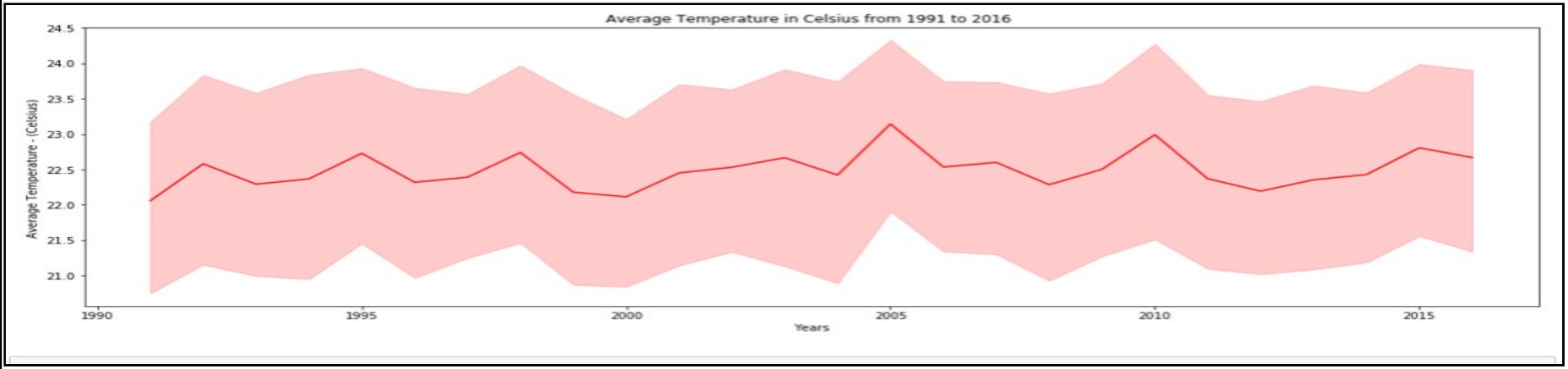


Plot 1: Average/ Mean Rainfall from 1991 to 2016

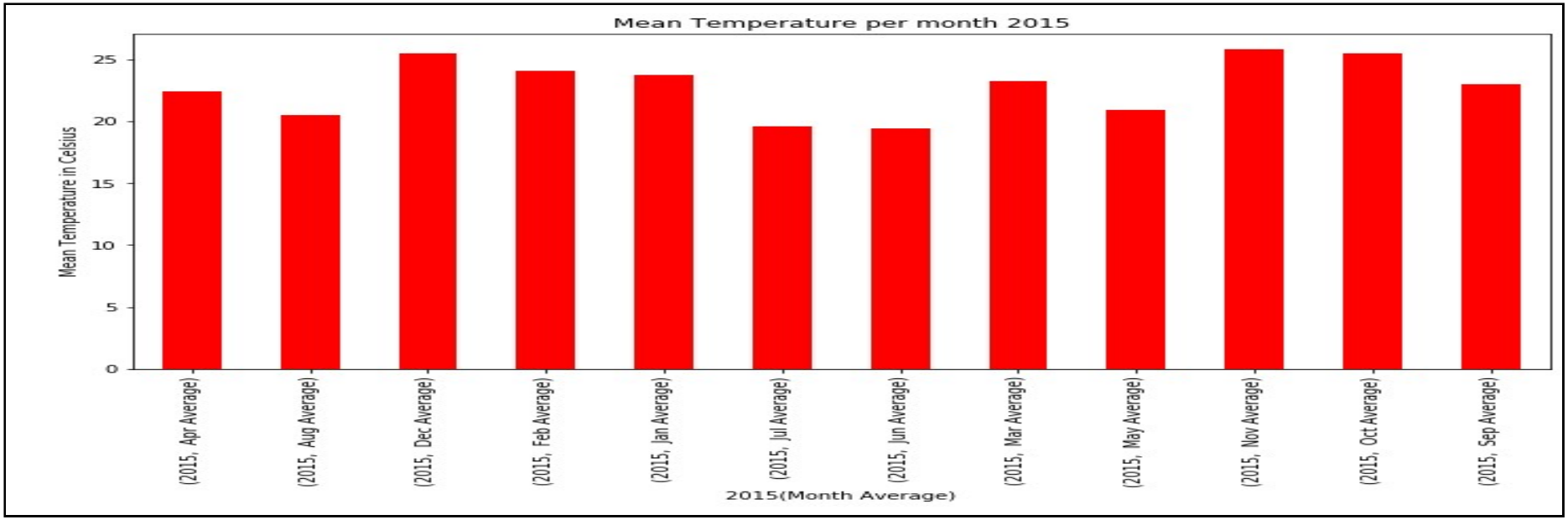


Plot 2: Average/ Mean Rainfall per month in 2015

Malawi Weather (Mean Temperature)



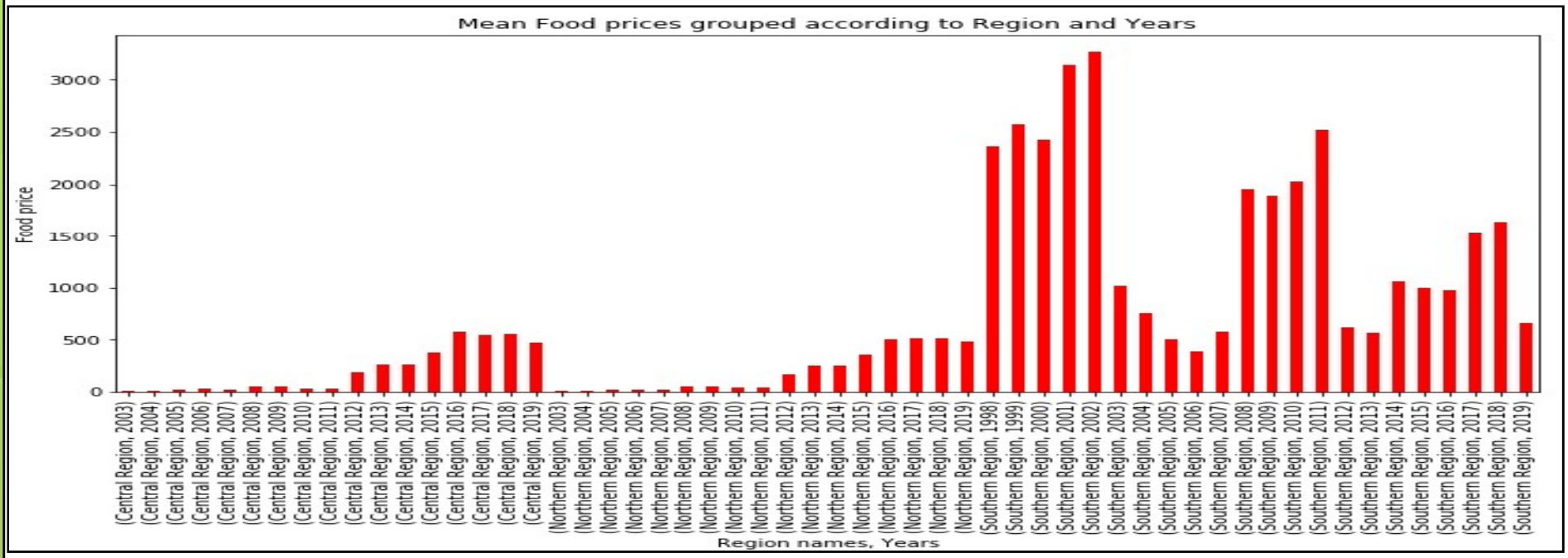
Plot 3: Average/ Mean Temperature from 1991 to 2016



Plot 4: Average/ Mean Temperature per month in 2015

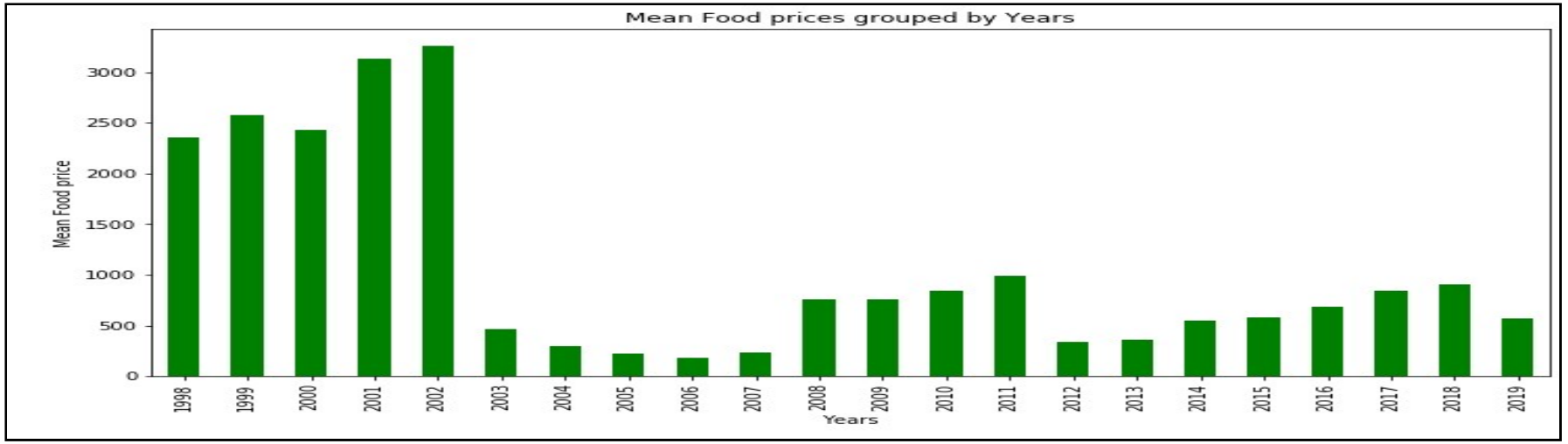
Hike in Food Prices

- It simply means there was a sudden increase in the prices of food items.
- Analysis were done to compare food price changes within years, months and regions to fully understand the effect of the 2015 flooding of food price's hike.



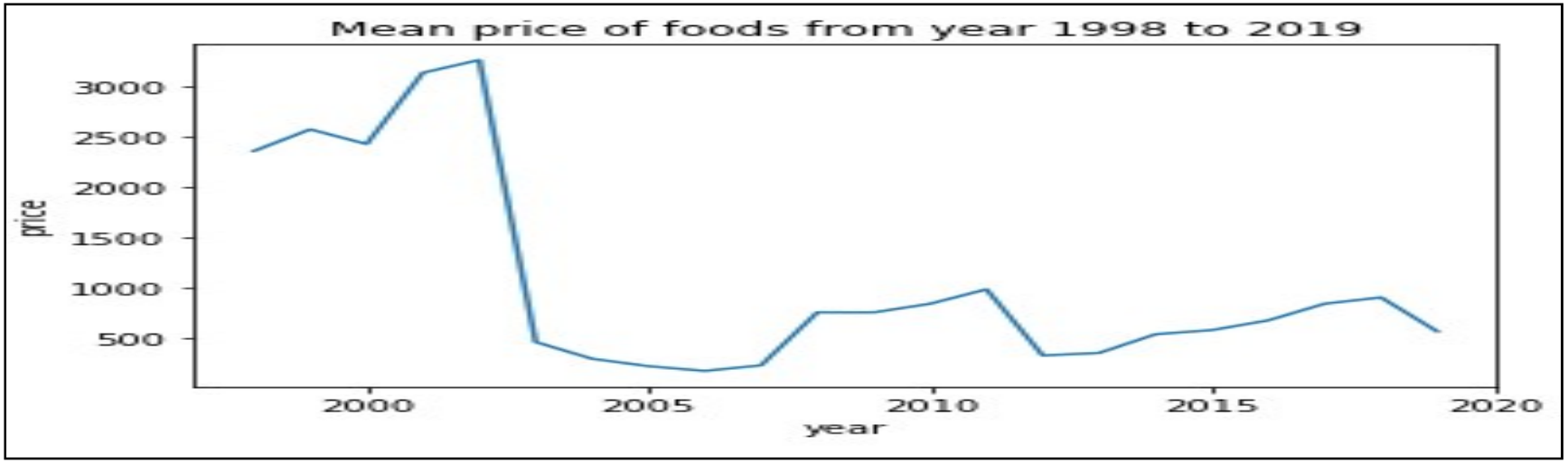
Plot 5: The variation of mean food prices for each region within the years .

- *from 2003 to 2019 for the central region.*
- From 2003 to 2019 for the Northern region.
- From 1998 to 2019 for the Southern region.
- The Southern region is observed to be generally riffed with high mean food prices compared to other regions irrespective of the year.



Plot 6 : Mean food price variation over the years from 1998 to 2019.

-Mean food price is slightly higher in 2015 than 2014, although it increased with subsequent years.

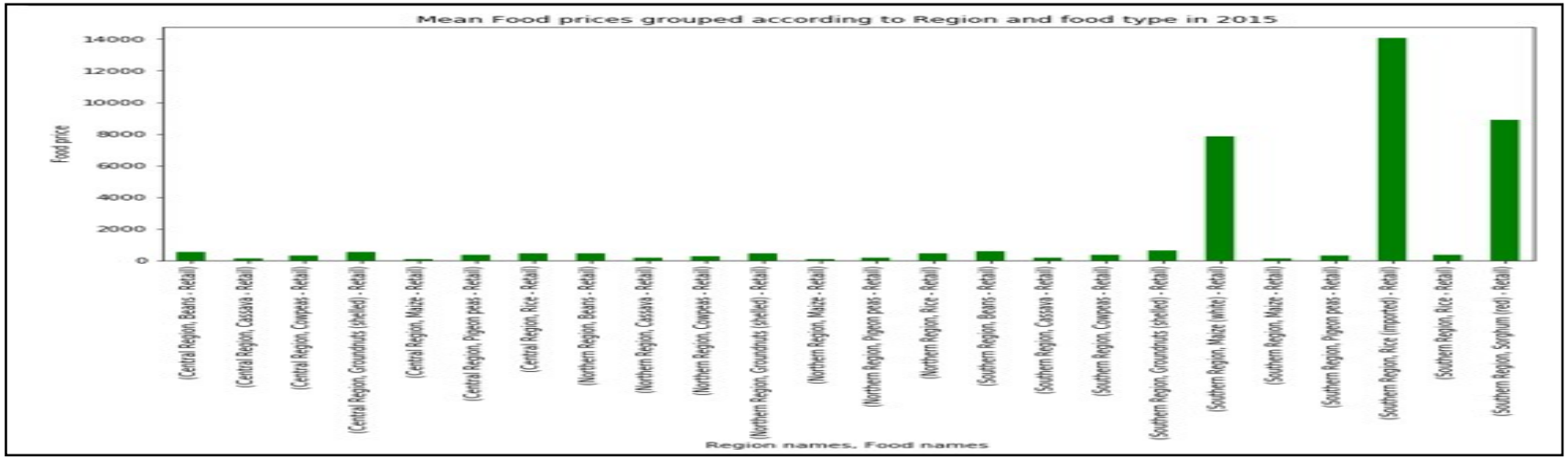


Plot 7: Trend of how mean food price have varied over the years from 1998 to 2019

-Similar to plot 1 above, but this is a trend or line representation.

Plot 8: Mean food price variation over the years from 1998 to 2019 between regions.

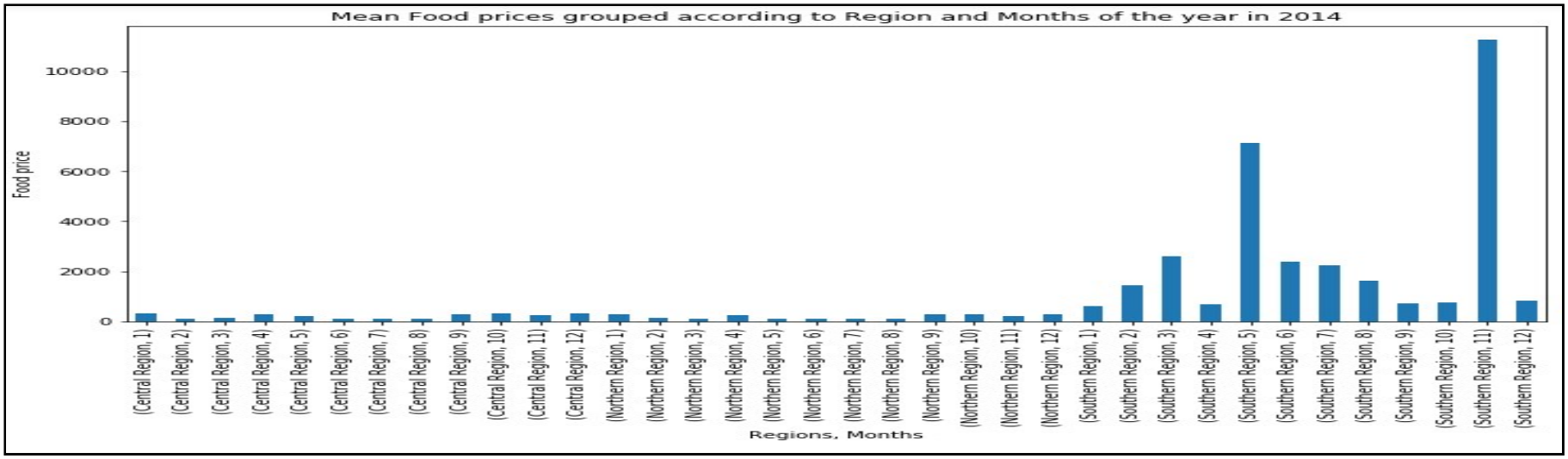
- Mean Food price is clearly higher in the southern region than the other two regions.
- Mean Food price in the year 2015 is quite higher than 2014 for the central and Northern regions.



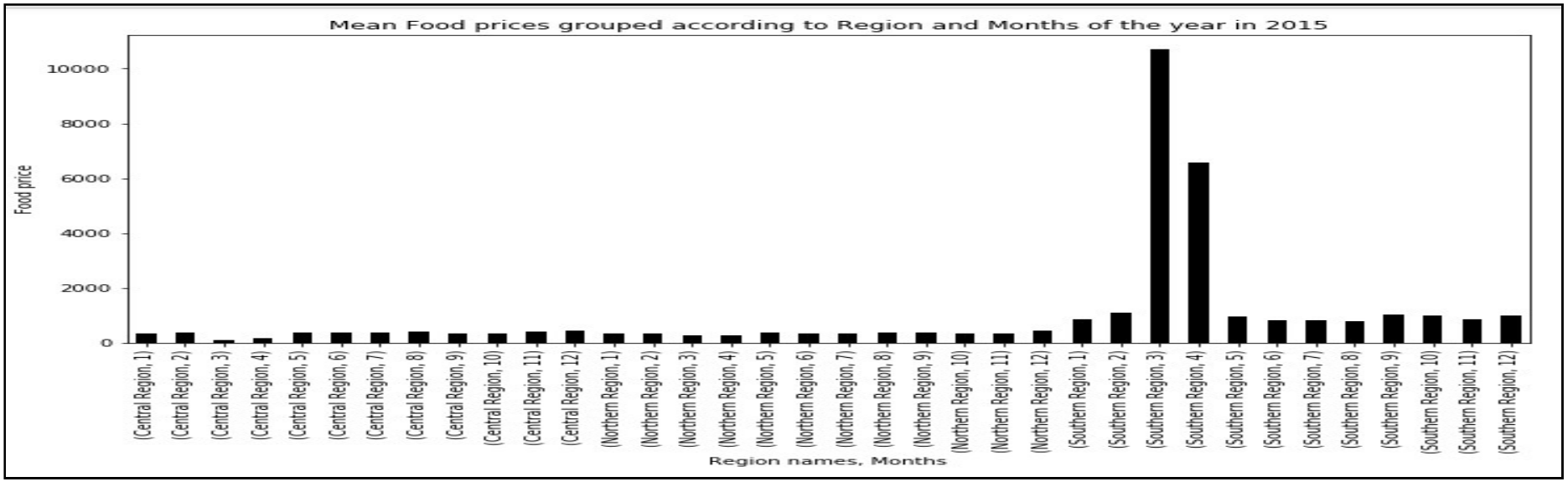
Plot 9: Mean Food price variation of the different major classes of food for each region in 2015.

-The Southern region records the highest food mean price conspicuously for white Maize, imported rice and Sorghum, which are common cereals consumed by the citizens.

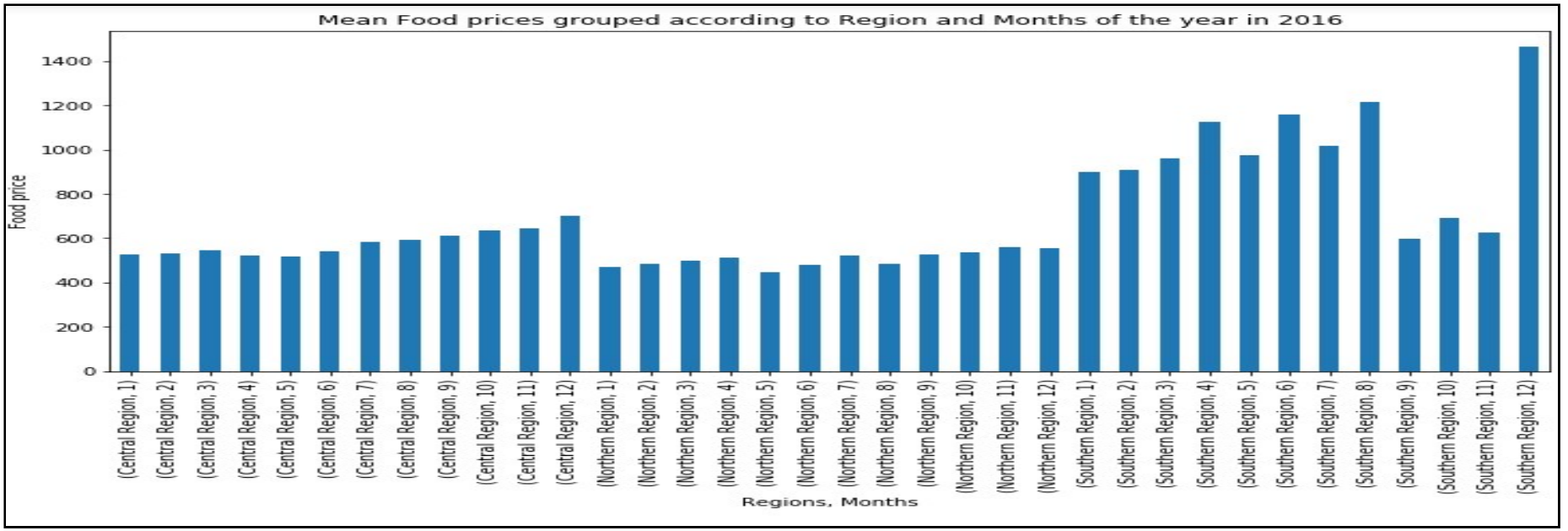
-This could have led to some degree of inconvenience for the people in Southern Malawi



Plot 10: Mean food price grouped according to regions and months of the year for the year 2014



Plot 11 : Mean food price grouped according to regions and months of the year for the year 2015



Plot 12 : Mean food price grouped according to regions and months of the year for the year 2016

Plots 10, 11, 12 : Mean food price grouped according to regions and months of the year for years 2014, 2015, 2016 respectively.

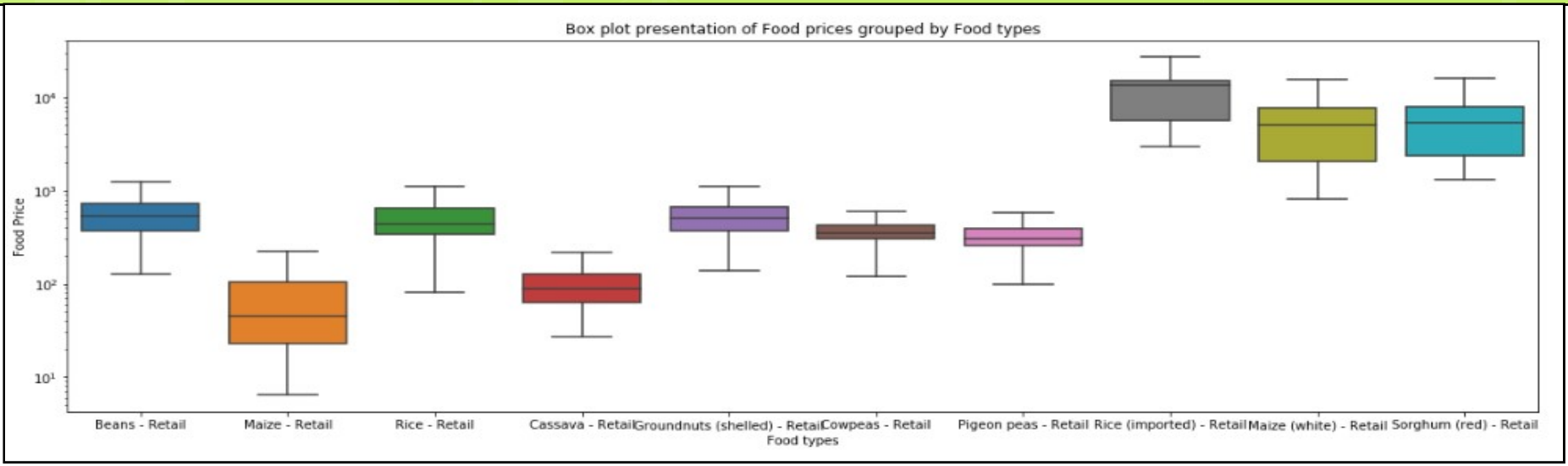
-This comparison was done purposely to compare mean food prices for the immediate years before and after 2015, our year of interest, per region.

-In 2014, food prices were highest in may and November(southern region).

-While in 2015, March and April had the highest food price record(southern region), after effects of the January to march flooding.

-The trend in 2016 was quite regular for each region, but the southern region still showed the highest food prices.

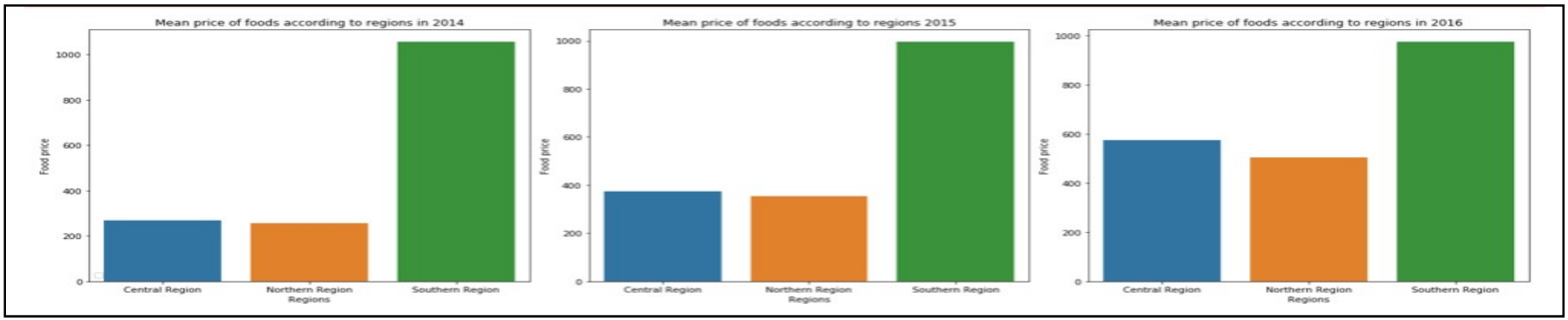
-The plots also buttress the point that food prices are higher in the Southern region than the other two regions.



Plot 13: The basic statistical representation of the prices for each food category.

-The minimum, first quantile(25th percentile), median,(50th percentile), 3rd quantile (75th percentile) and maximum prices are shown.

- Highly priced foods are imported rice, retail white maize and retail red sorghum.



Plot 14: Mean food prices grouped according to regions for years 2014, 2015, 2016.

-Southern region clearly takes the lead in food prices in all three years, before and after the flooding.
-This indicates some sort of high standard of living in the region or expensive food, with or without flooding.

Malawi Health Care Sites Distribution

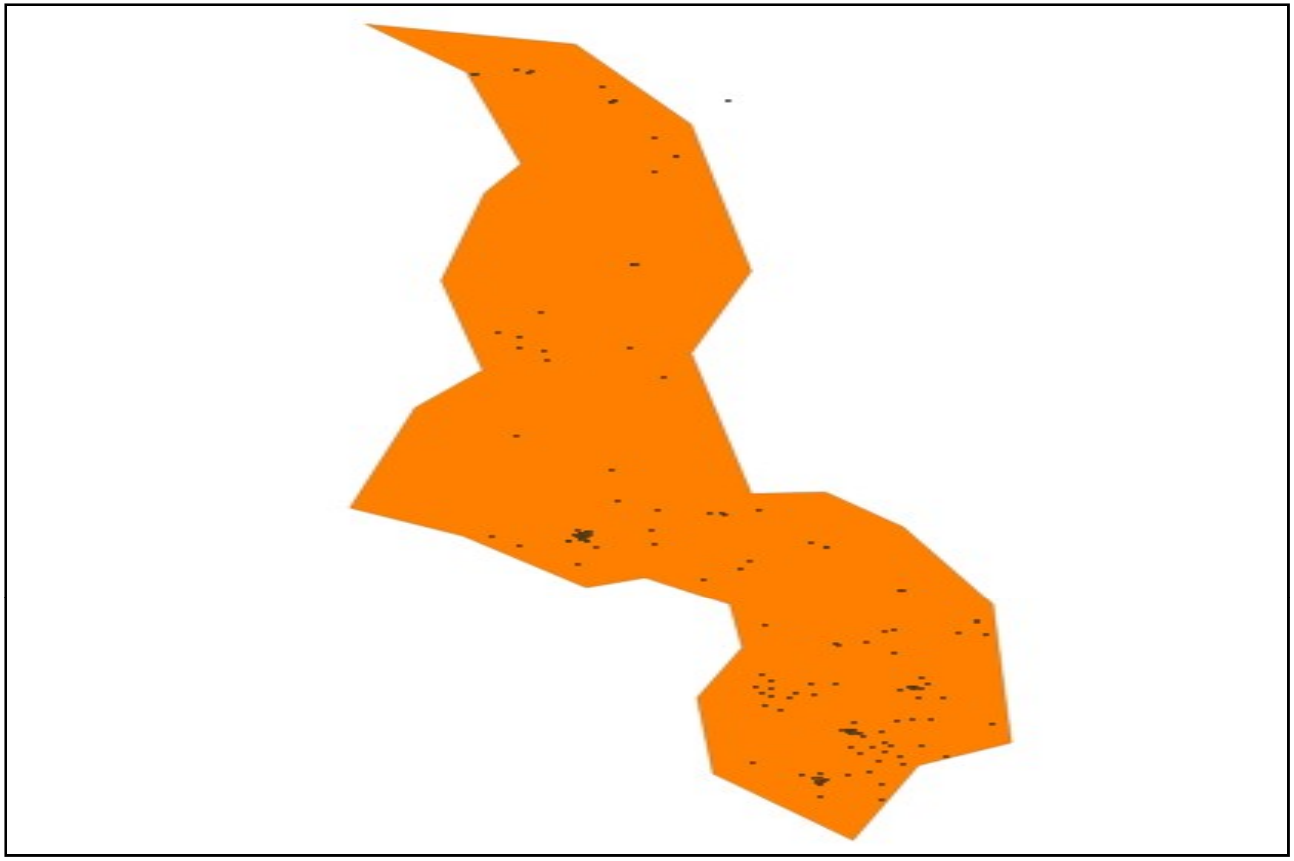


Figure 3 : Health care centers distribution in Malawi based on available data

-It can be observed that health care centers are sparsely populated in the northern and central regions compared to the southern region.

-It is a wake up call for the Malawi government and relevant bodies to ensure healthcare centers are evenly distributed in all parts of the country, well equipped and with adequate medical personnel irrespective of the country's climatic conditions.

-Insufficient healthcare centers or personnel will cause more problems for the displaced population who are in dire need of improved access to health services. Unfortunately, some health centers were destroyed by the flood.

Food Security

- According to the final report of the 1996 World Food Summit, food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

- On the other hand, united States Department of Agriculture(USDA) defined food insecurity, as a situation of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.

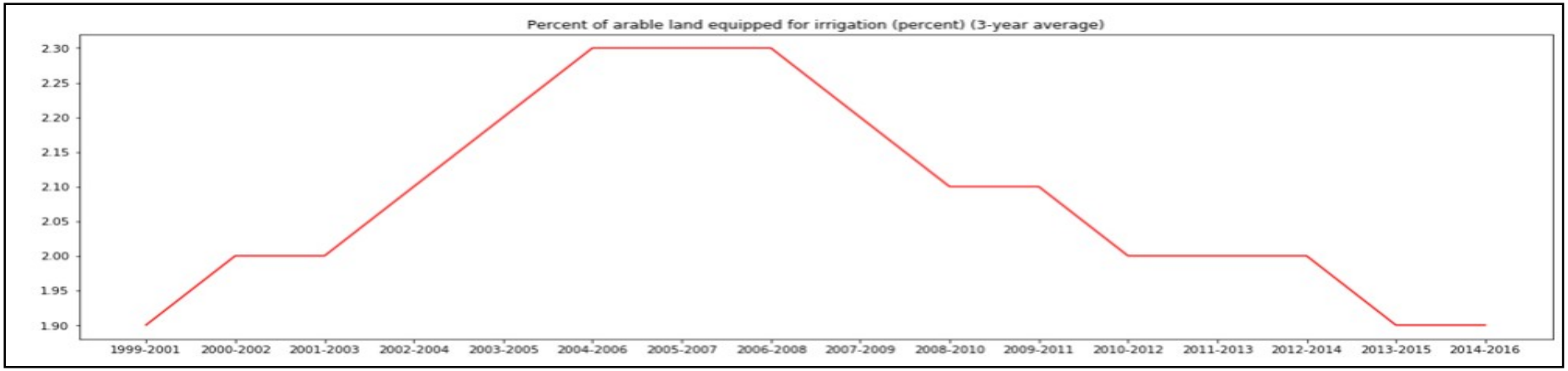
- The four pillars of food security are availability, access(distribution), utilization, and stability.

Causes of food Insecurity

- Global water crisis
- Land degradation
- Climate change(flooding)
- Agricultural diseases
- Politics and Community unrest
- Food waste

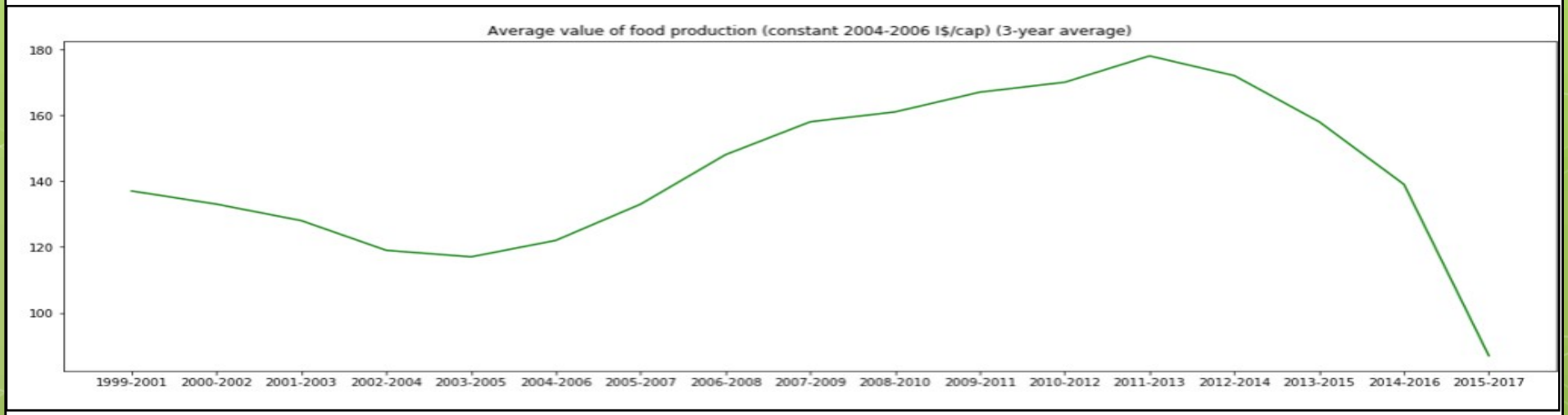
Effects of food insecurity

- According to UNICEF, about 47% of Malawi's children are already stunted, which is caused by under nutrition, so they are particularly vulnerable.
- Stunting/ Malnutrition (can lead to high infant and child mortality).
- Overweight (when fed with diet high in simple carbohydrates or overeating from fear of food scarcity).
- Chronic nutritional deficiencies(can lead to reduced cognitive abilities of children)
- Depression, anxiety and sleep disorders



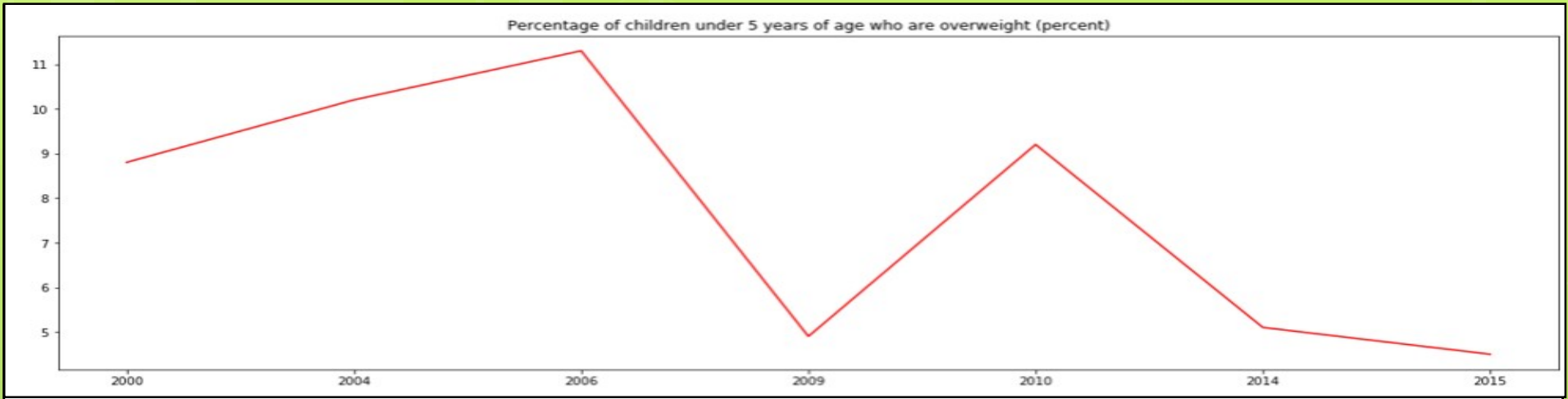
Plot 15: Percent of arable land equipped for irrigation (percent) (3-year average)

-There is a dramatic decrease in the percentage of arable land available for irrigation.



Plot 16: Average value of food production (constant 2004-2006 I$/cap) (3-year average)

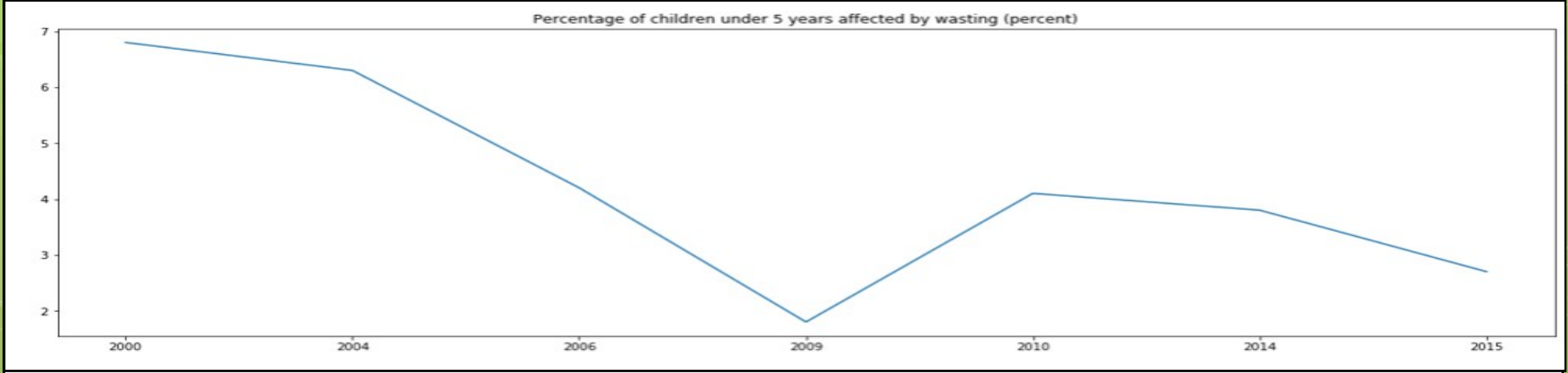
-There is an observable decrease in the average value of food production from 2012 to 2017



Plot 17: Percentage of children under 5 years of age who are overweight (percent)

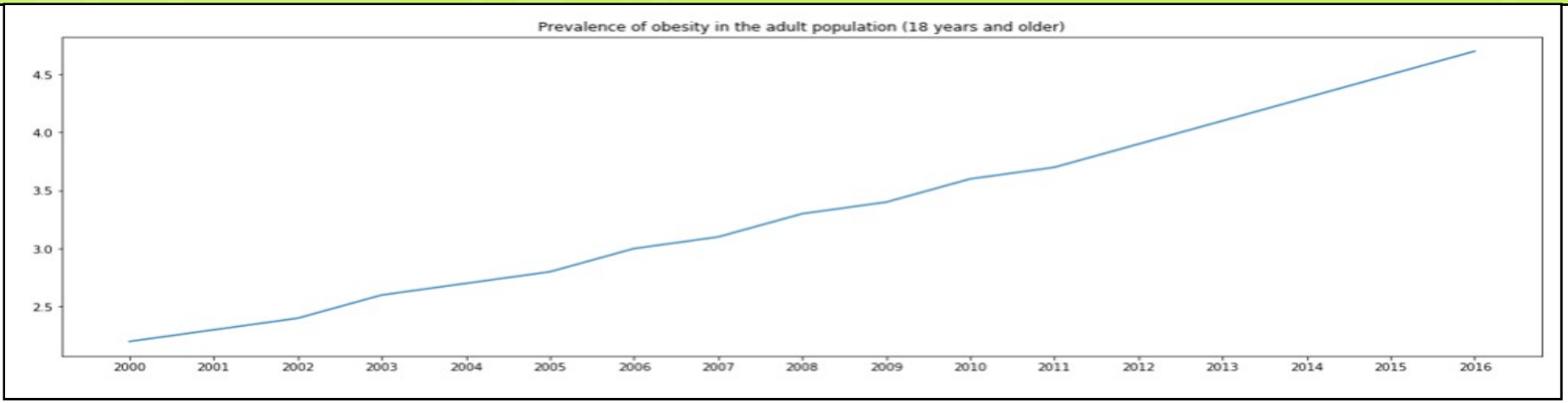
-Overweight in children might be caused by the excessive eating of food rich in simple carbohydrates instead of nutritious foods.

-Its rate of occurrence decreased from 2010



Plot 18: Percentage of children under 5 years affected by wasting (percent)

-Its rate of occurrence has shown some decrement from 2010

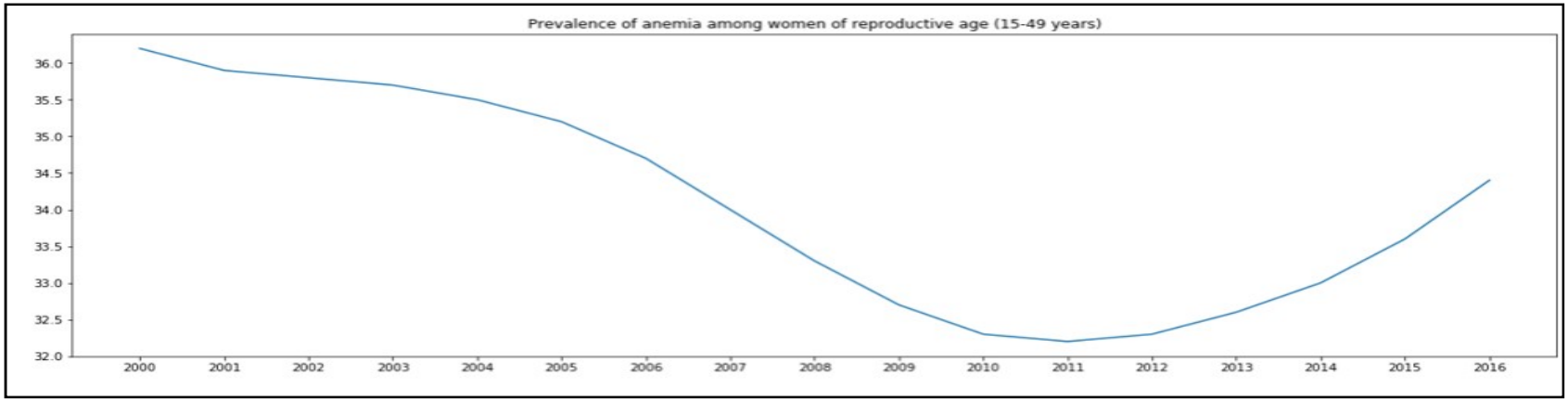


Plot 19: Prevalence of obesity in the adult population (18 years and older)

-Overweight or obesity in adults might be caused by the excessive eating of food rich in simple carbohydrates, junk foods, Overeating, genetics, etc.

-The rate of occurrence has shown a positive trend through the years, which is quite disturbing.

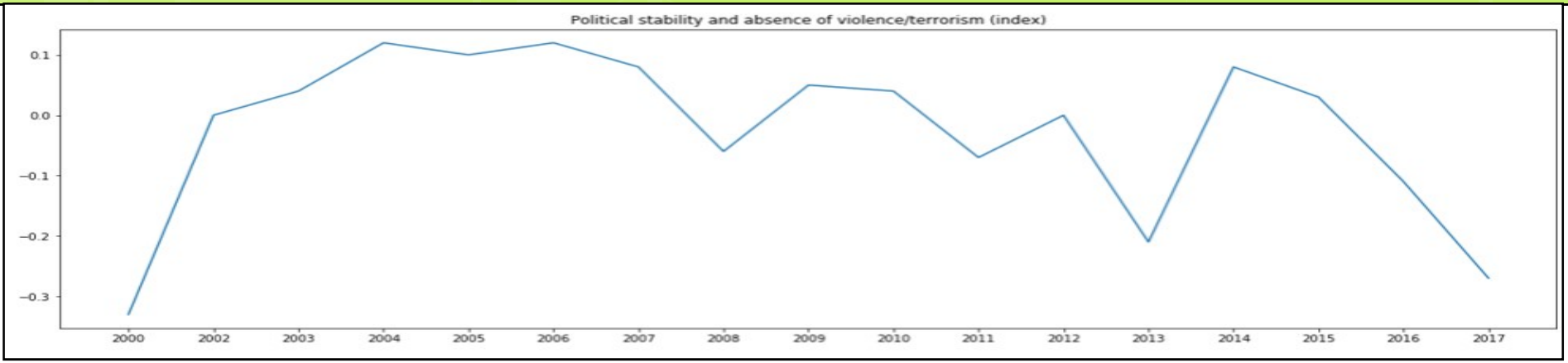
-More investigation might be needed to confirm the exact causes of adult obesity in Malawi.



Plot 20: Prevalence of anemia among women of reproductive age (15-49 years)

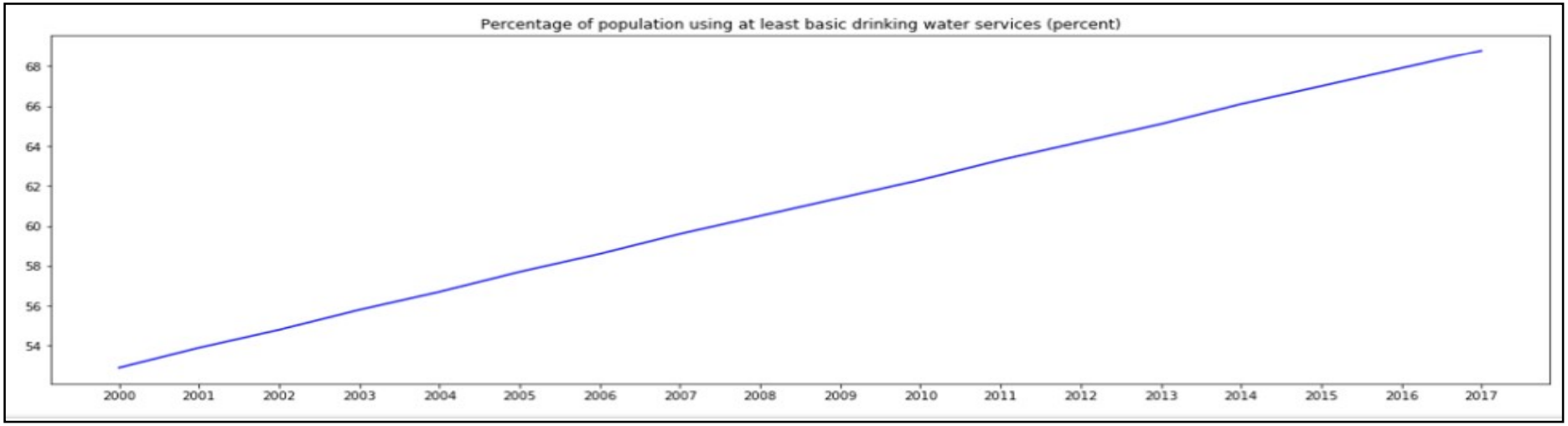
-The commonest cause of anemia is iron deficiency, which can be caused by food insecurity.

-Its prevalence has increased in recent years from 2011, long before the 2015 flooding. This might require more investigation



Plot 21: Political stability and absence of violence/terrorism (index)

-Political stability is seen to decrease steadily in Malawi from 2014 to 2017. This can lead to social/community unrest which in turn leads to food scarcity and unavailability.

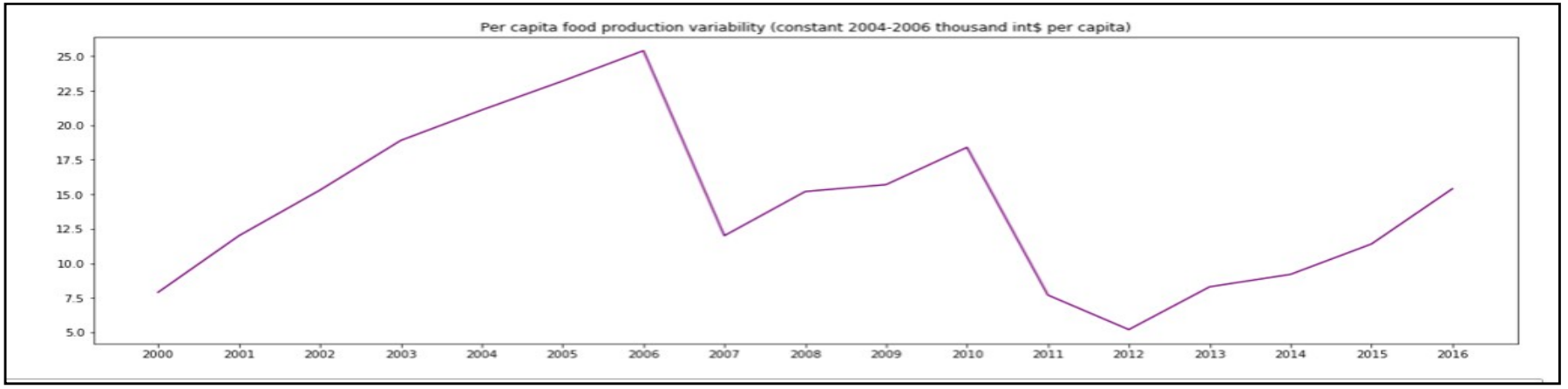


Plot 22: Percentage of population using at least basic drinking water services (percent)

-It's pleasant to know the percentage of the Malawian population with access to basic drinking water has been increasing through the years.

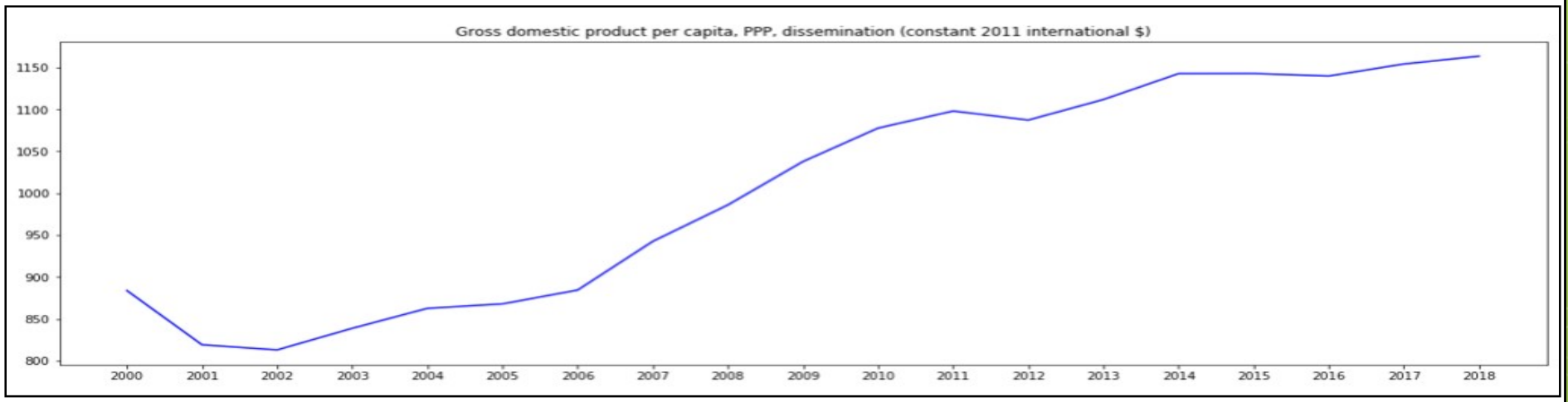
-It will be more pleasant if the total population have access to this important basic facility.

-Unfortunately, water supply may be impacted by the flooding. Lack of clean water supply can lead to disease outbreak for the displaced population.



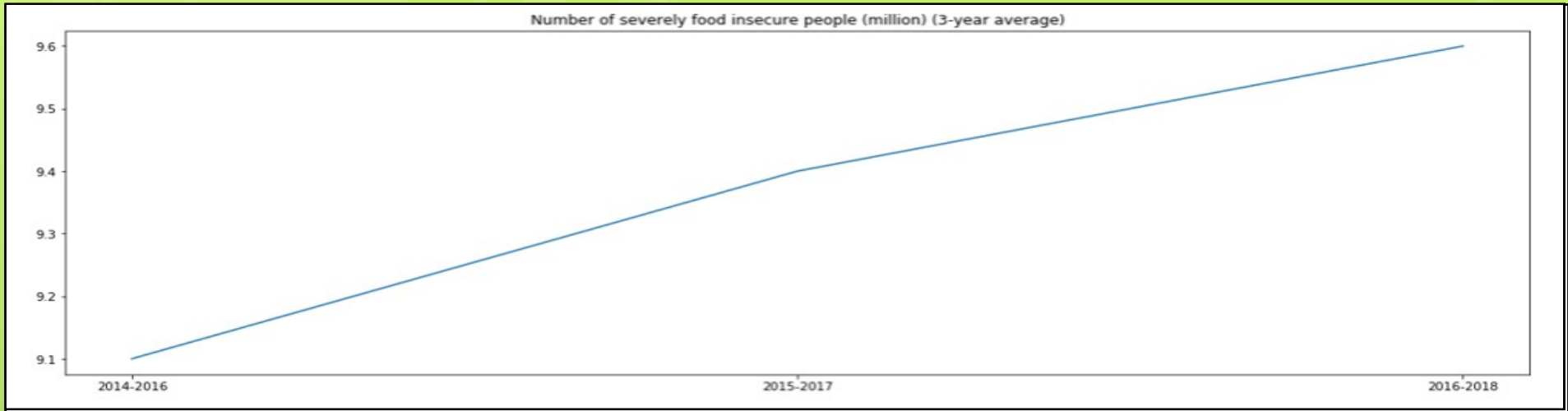
Plot 23: Per capita food production variability (constant 2004-2006 thousand international $ per capita)

-This is the variability of the "food net per capita production value in constant 2004-2006 international $. Although, it has been fluctuating in previous years, it's shown to increase from 2012 to 2016



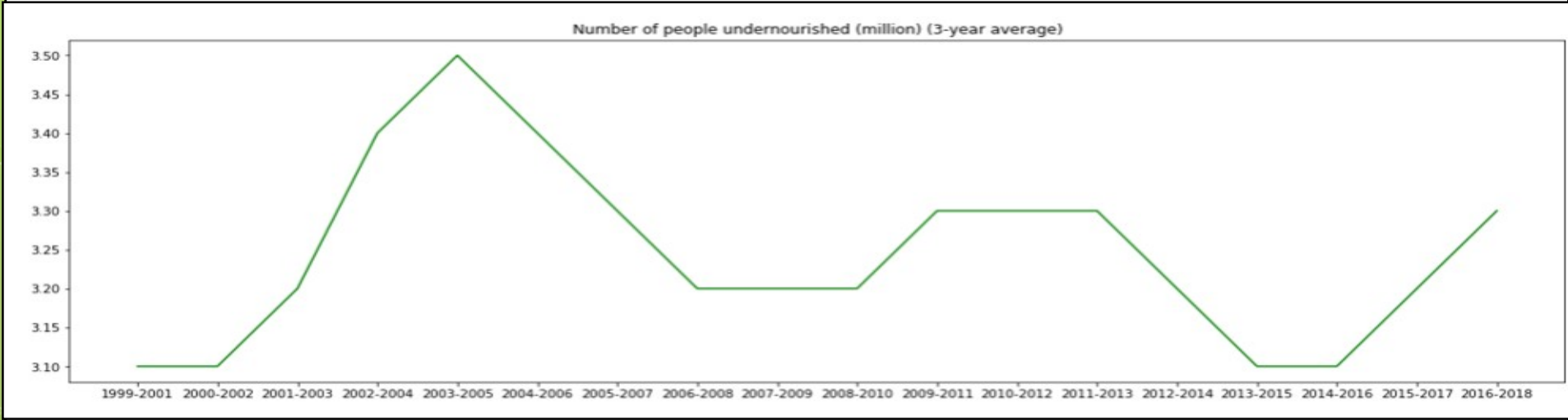
Plot 24: Gross domestic product per capita, PPP, dissemination (constant 2011 international $).

-It increased through the years although small fluctuations do exist



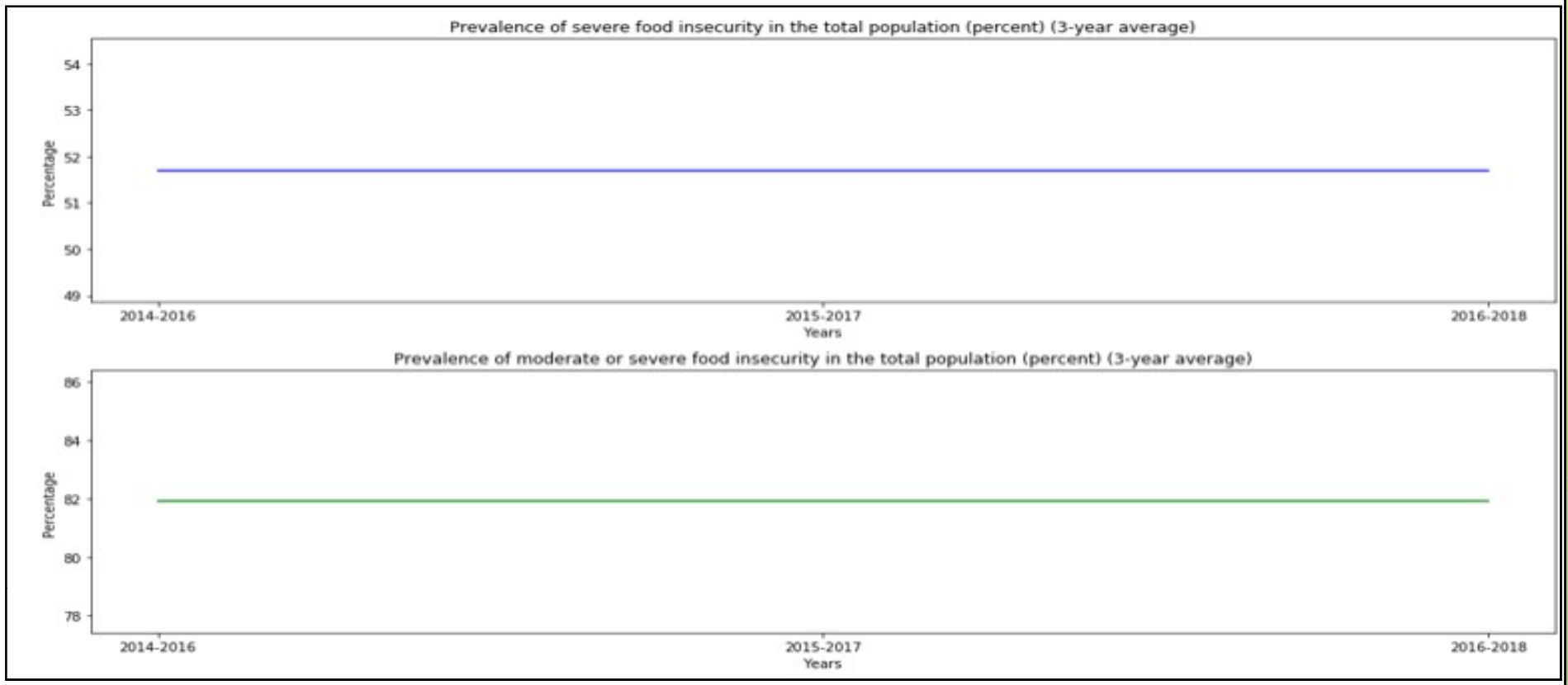
Plot 25: Number of severely food insecure people (million) (3-year average)

-This has unpleasantly increased in the 3-year average , the relevant bodies need to investigate why.



Plot 26: Number of people undernourished (million) (3-year average)

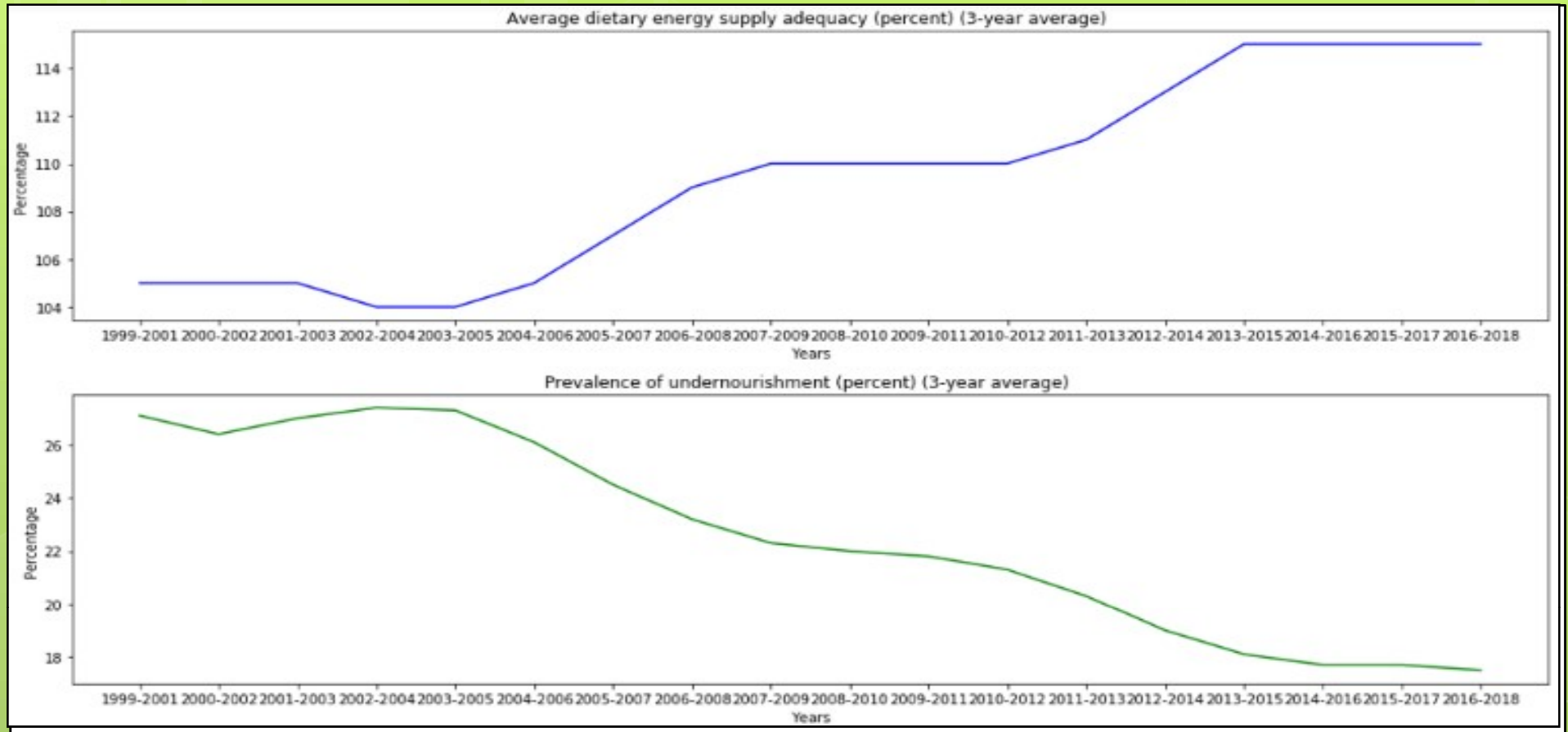
-This has also been increasing from the 2014-2016 average.



Plot 27: Prevalence of severe food insecurity in the total population (percent) (3-year average)

Plot 28: Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average)

-The prevalence of severe food insecurity in the total population (3-year average) is about 52.5% while the prevalence of moderate or severe food insecurity in the total population (3-year average) is about 82%.
-They are both high and are quite constant through the three(3-year) averages.
-More definitely has to be done to address this issues and bring down the prevalence rate.



Plot 29: Average dietary energy supply adequacy (percent) (3-year average)

- This factor is constant for the last four averages. It could increase if more measures are put in place.

Plot 30: Prevalence of undernourishment (percent) (3-year average)

-The rate of undernourishment is shown to be decreasing, more could be done to ensure a further decrease in the rate

Flood Extent

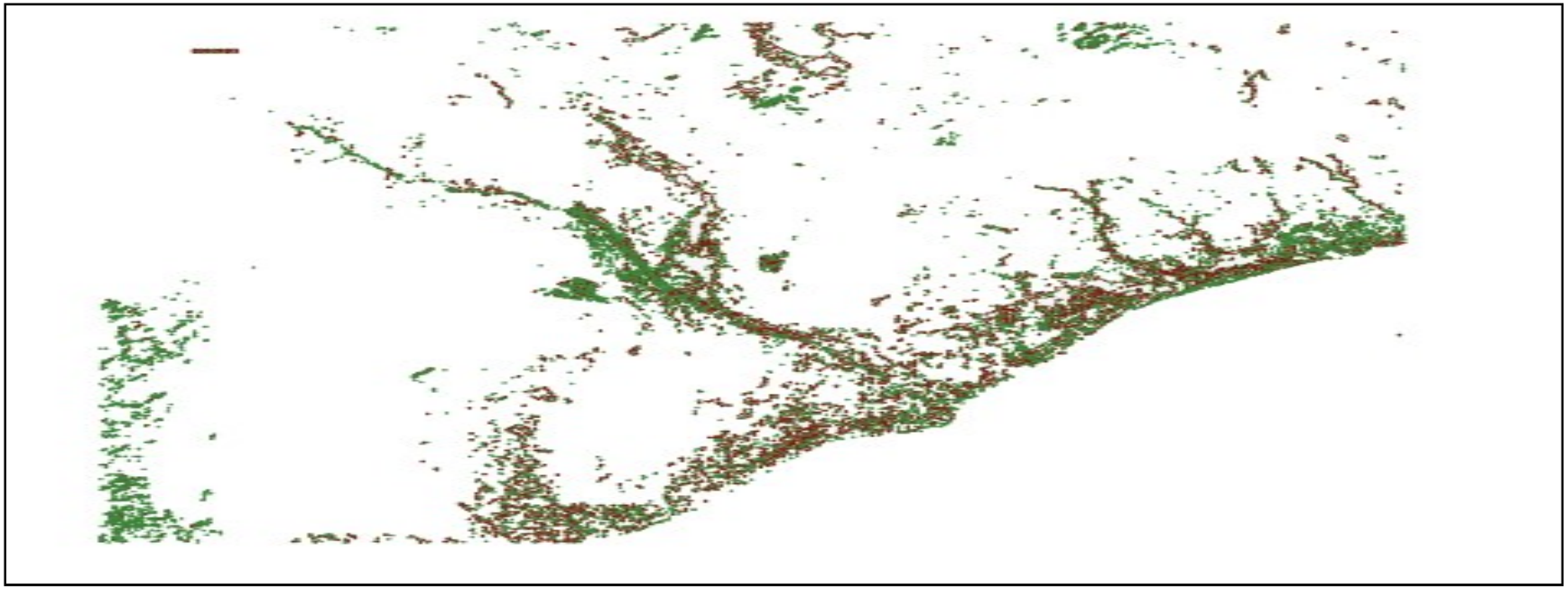


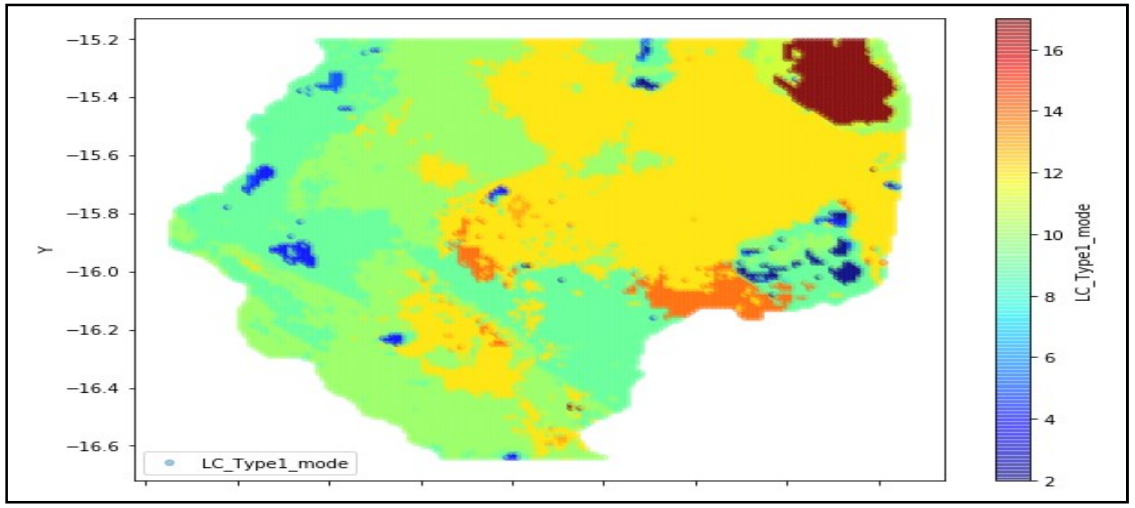
Figure 4: Flood extent map in Southern Malawi and Mozambique, indicated by the darker colour shades.

-Flooding of lands and farmlands, led to loss of lands and properties.

-About 64,000 hectares (158,147 acres) of land in Malawi were damaged.

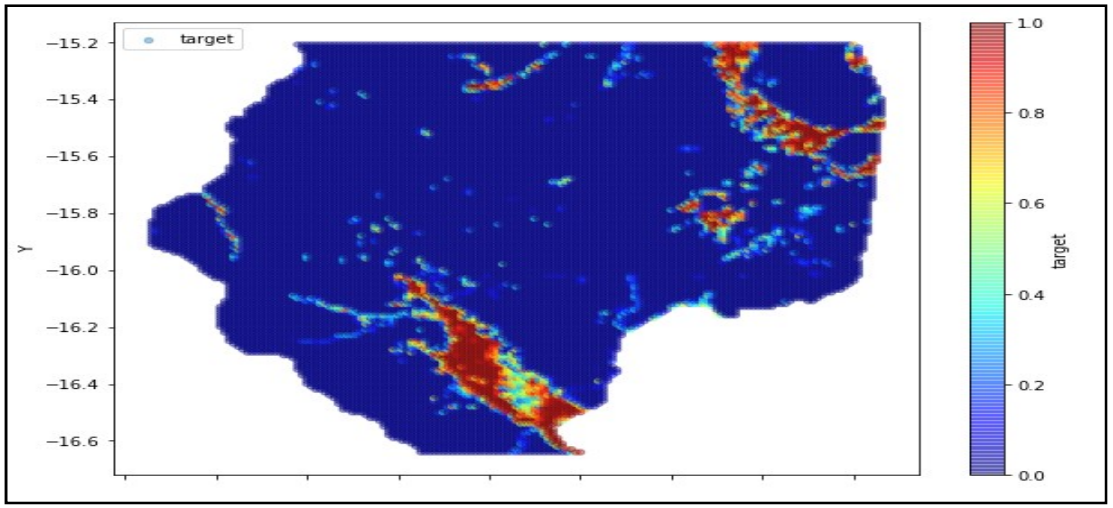
-Overflow of rivers also occurred.

2015 Flood Extent in Southern Malawi



LC_Type1_ mode	Brief Description
2	Evergreen Broadleaf Forests
4	Deciduous Broadleaf Forests
5	Mixed Forests
7	Open Scrublands
8	Woody Savannas
9	Savannas
10	Grasslands
11	Permanent Wetlands
12	Croplands
13	Urban and Built-up Lands
14	Cropland/Natural Vegetation Mosaics
15	Permanent Snow and Ice
17	Water Bodies

Figure 5: A section of Southern Malawi grouped according to land cover type1_mode



Target	Description
1	Total Flooding
0	No flooding

Figure 6: Flooding extent of the section of Southern Malawi described in figure 5 above in fractions.

-It will be observed that the most flooded parts are the land cover type 12(crop lands).

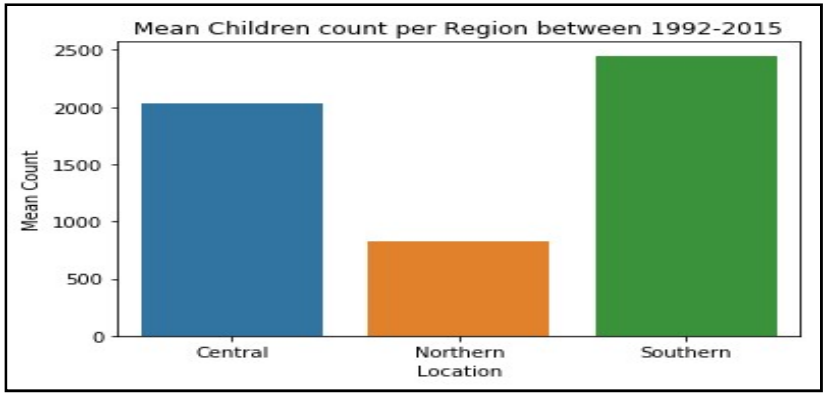
-This emphasizes the point that croplands were severely damaged during the 2015 flooding.

Demographic/Health Factors

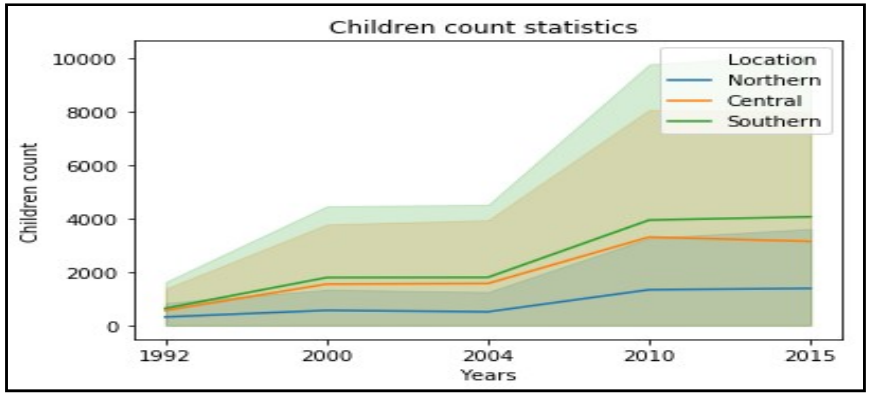
- Demographic factors are socioeconomic characteristics of a population expressed statistically, in the forms such as age, sex, education level, income level, marital status, occupation, religion, birth rate, death rate, average size of a family, average age at marriage.

- Health factors relate to the welfare of the populations in terms of healthcare quality and accessibility.

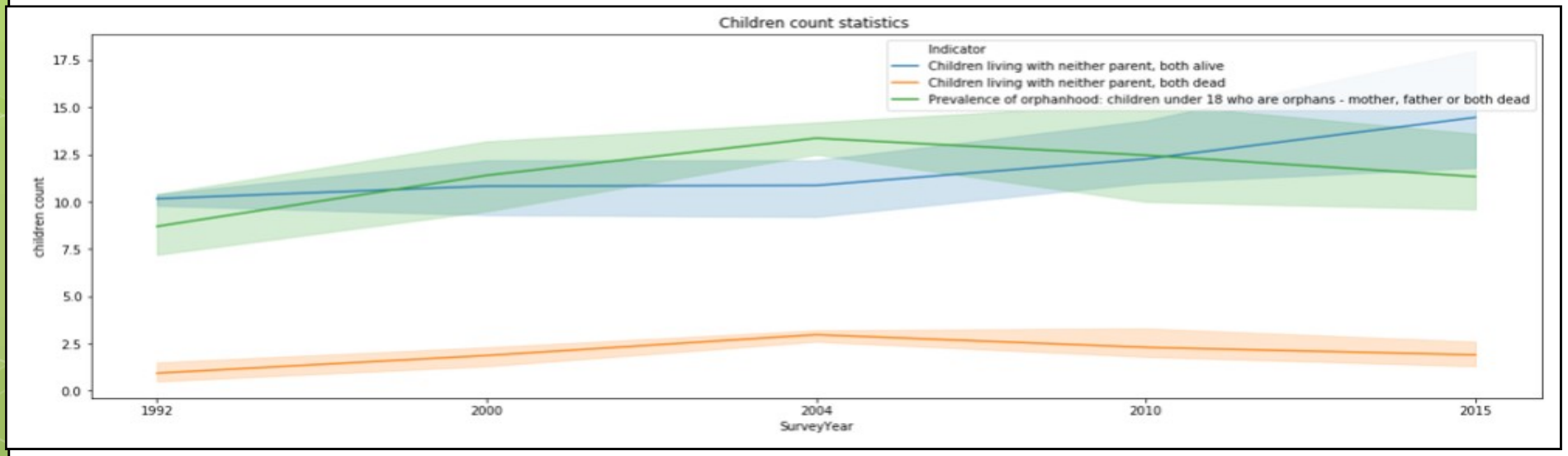
Demographic/Health Factors
(Children's Count Statistics)



Plot 31: Mean Children count for the 3 regions between years 1992 and 2015

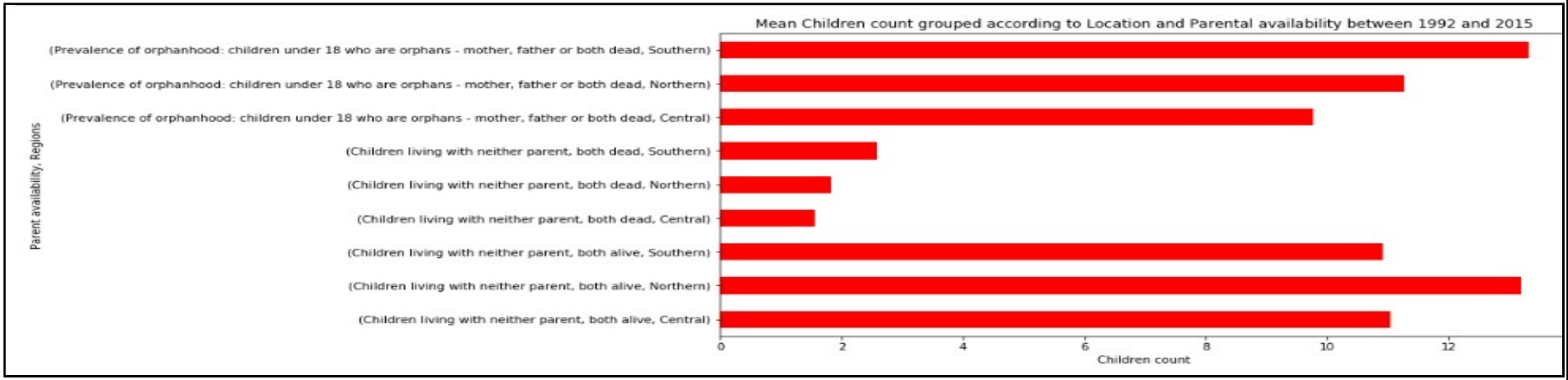


Plot 32: Mean Children count for the 3 regions per year between years 1992 and 2015



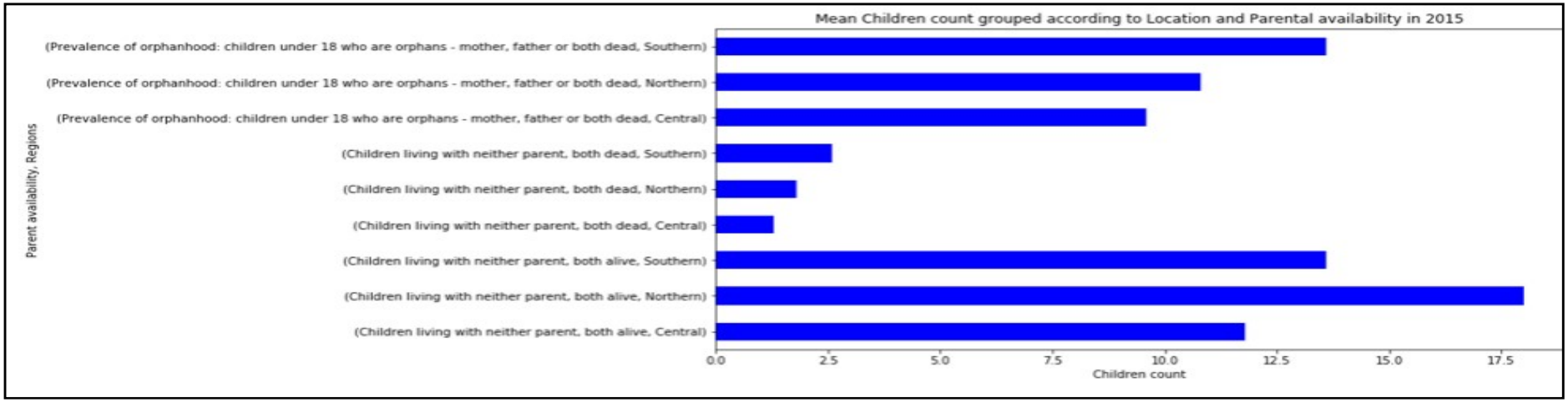
Plot 33: Malawi Children Counts according to Parents being alive or not for different years in thousands.

-It relates to children not living with their parents which might be caused by being orphans or not.



Plot 34: Mean Children count grouped according to Location and Parental availability between 1992 and 2015

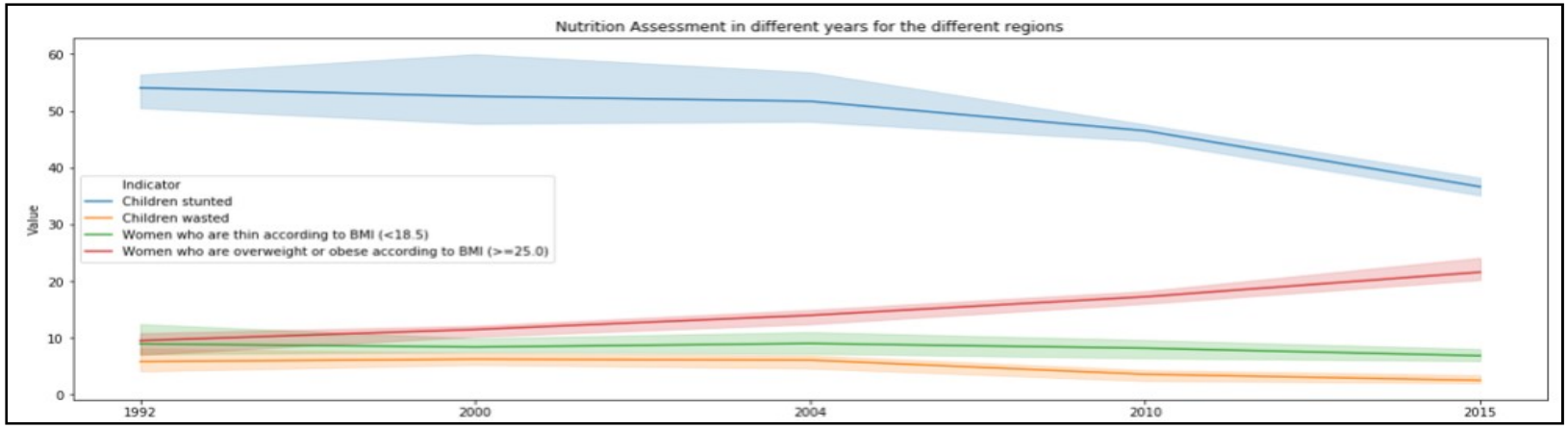
-The southern region is observed to have the highest mean of orphans counts (both parents dead)



Plot 35: Mean Children count grouped according to Location and Parental availability in 2015 (year of interest)

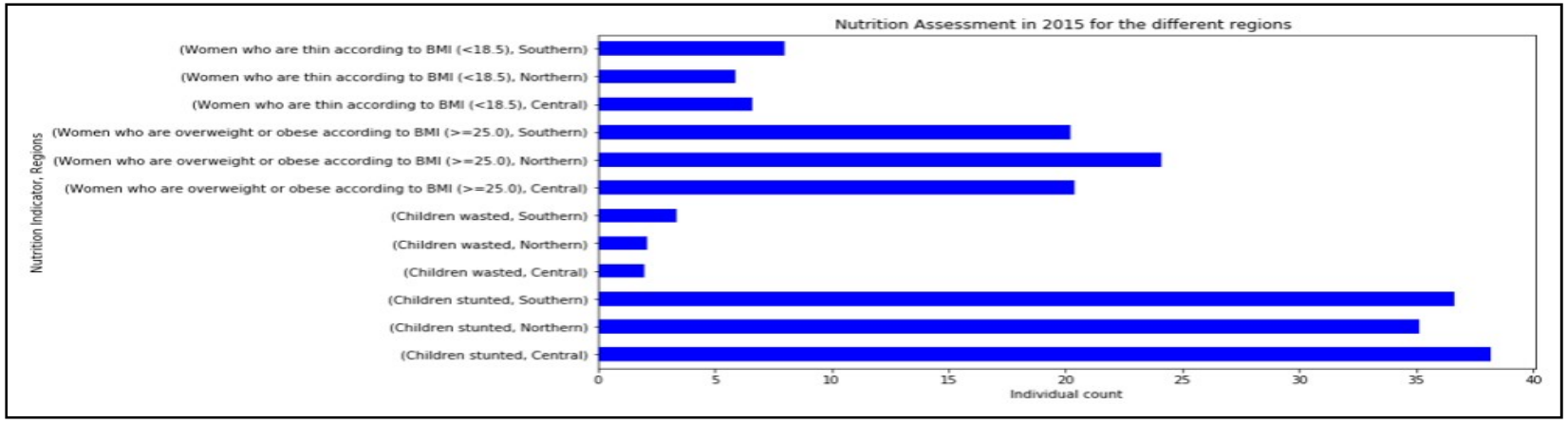
-Also in 2015, the southern region is observed to have the highest mean of orphans count (both parents dead)

Demographic/Health Factors
(Nutrition Assessment)



Plot 36: Nutrition Assessment in different years for the different regions based on different factors

-The plot shows the Nutrition Assessment trend through different years

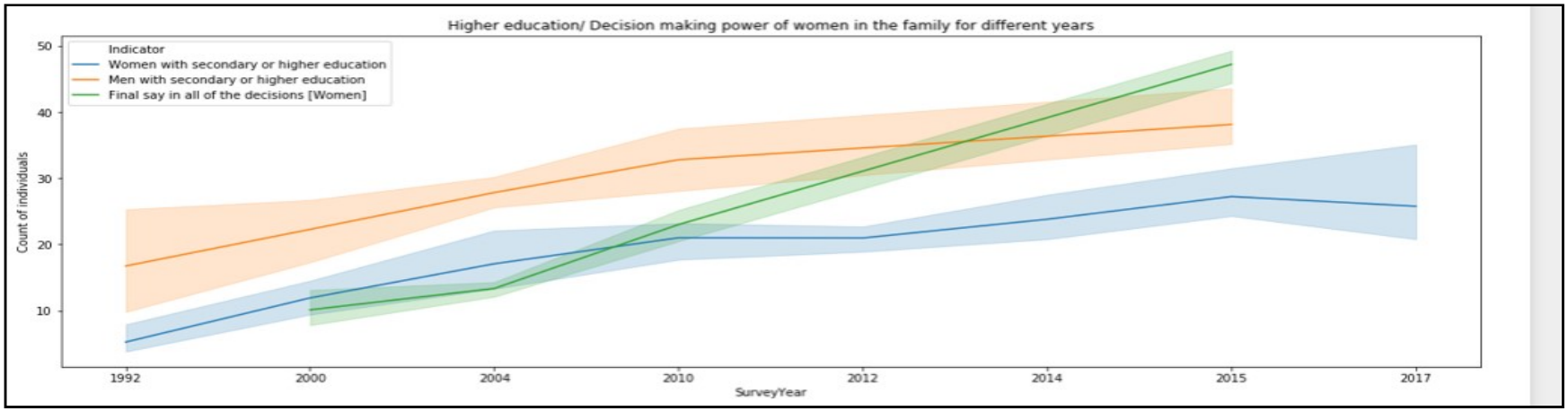


Plot 37: Nutrition Assessment in 2015 for the different regions (year of interest)in percentage

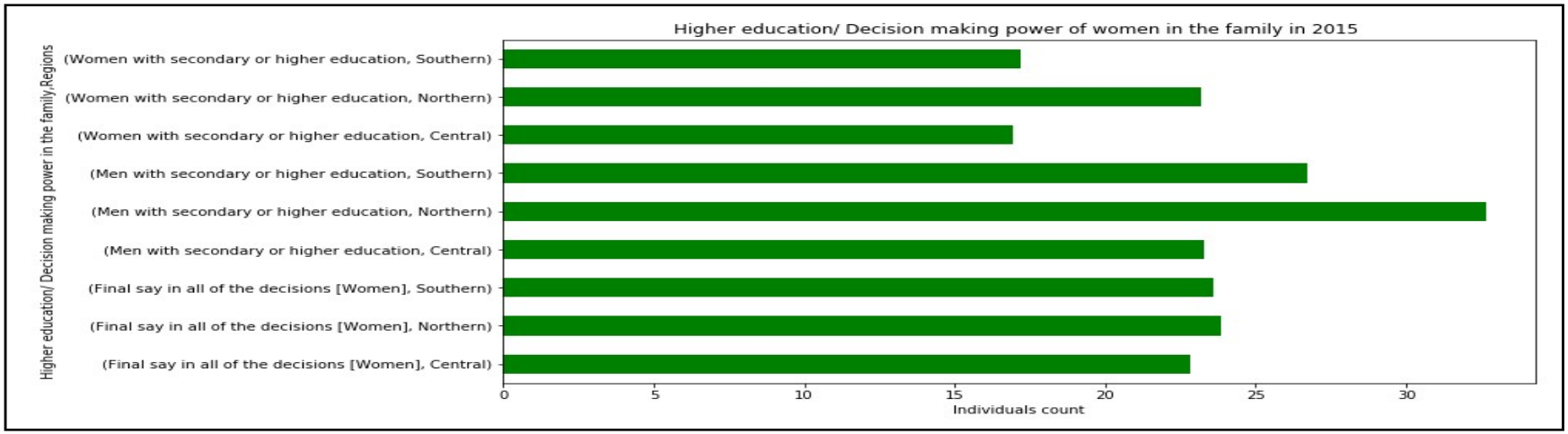
-In 2015, all regions have high count rate of stunted children

- The count rate of overweight women was also high

Demographic/Health Factors
(Higher education/ Decision making power in the family)



Plot 38: Higher education/ Decision making power of women in the family for different years

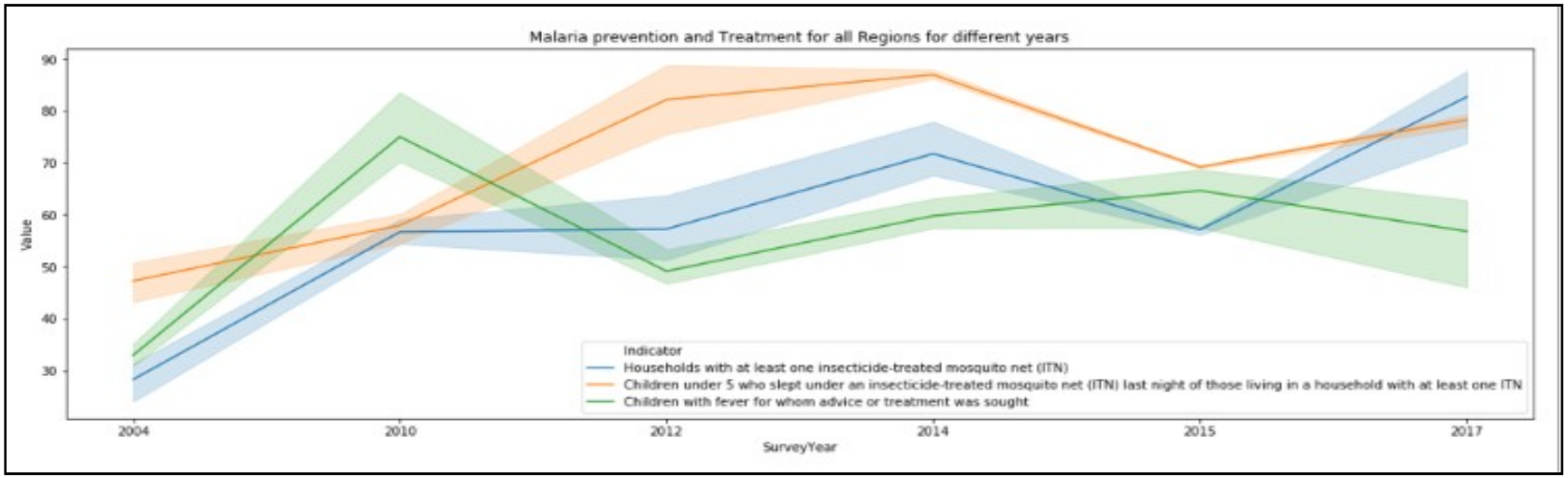


Plot 39: Higher education/ Decision making power of women in the family in 2015(year of interest)

-It can be inferred that more people are educated in the Northern region than the other two regions.
-Although, the rate of women having the final say in the family's decision making was almost the same for the three regions, the northern region is a little more than the other two.

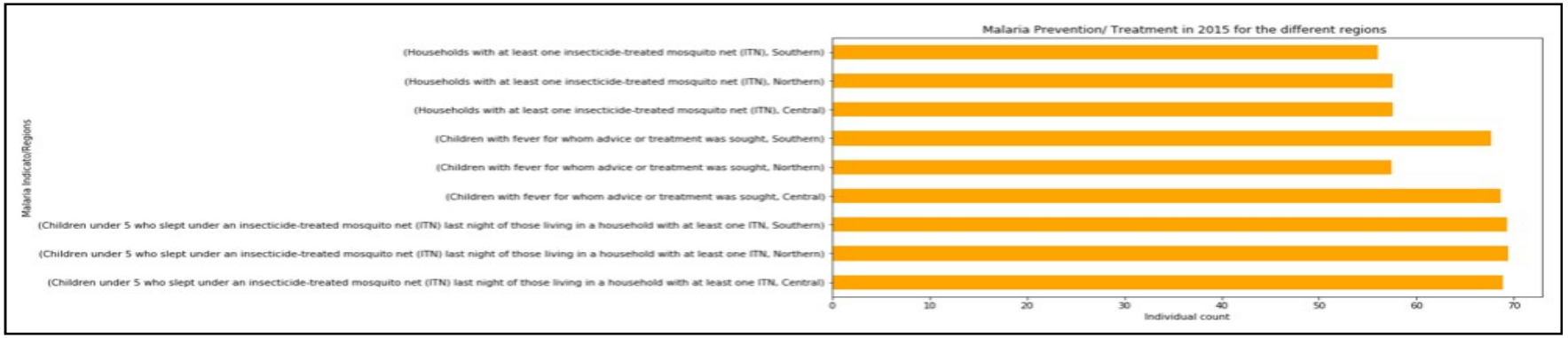
Demographic/Health Factors

(Malaria Prevention and treatment)



Plot 40: Malaria prevention and Treatment for all Regions for different years

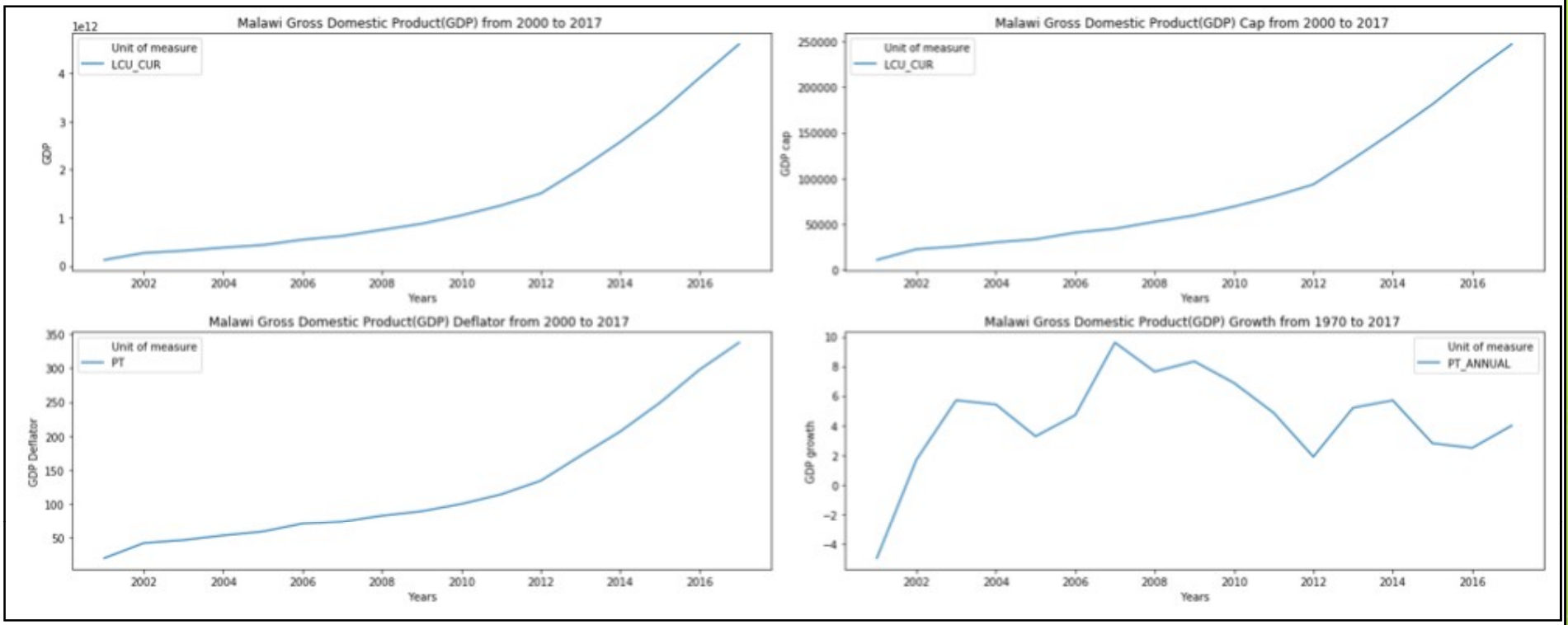
-How well the regions are collectively handling malaria treatment and prevention.



Plot 41: Malaria Prevention/ Treatment in 2015 for the different regions

- The flood might also lead to the outbreak of waterborne diseases such as cholera and diarrhea(drinking of impure water), as well as mosquito vector illnesses (caused by mosquitoes breeding in stagnant water).
- A total of 39 cholera cases were confirmed in Nsanje and Chikwawa districts of the Southern region within a month after the floods (OCHA 25/2/2015).

Socio-Economic/ Population Factors (GDP)

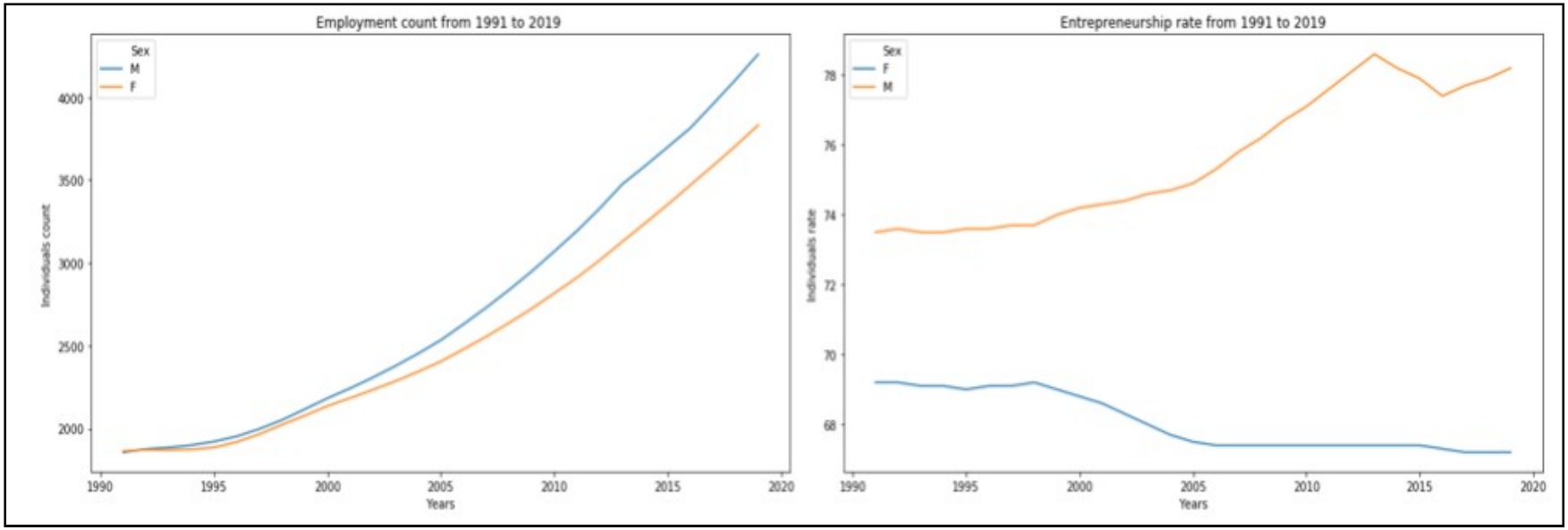


Plot 42 : Gross Domestic Product(GDP) from year 2000 to year 2017 with its related factors; GDP cap, GDP deflation and GDP growth.

-From the series of subplots above, it will be observed that GDP, GDP cap, and GDP deflation shows similar trends all through year 2000 to 2017.

-The 4th subplot shows the Malawi GDP annual growth rate in Percentage. It will be observed that growth rate declined in year 2015, and later rose in 2016. This might be attributed to the huge flooding that occurred that year, but investigation should e carried out to know why.

Socio-Economic/ Population Factors
(Employment)



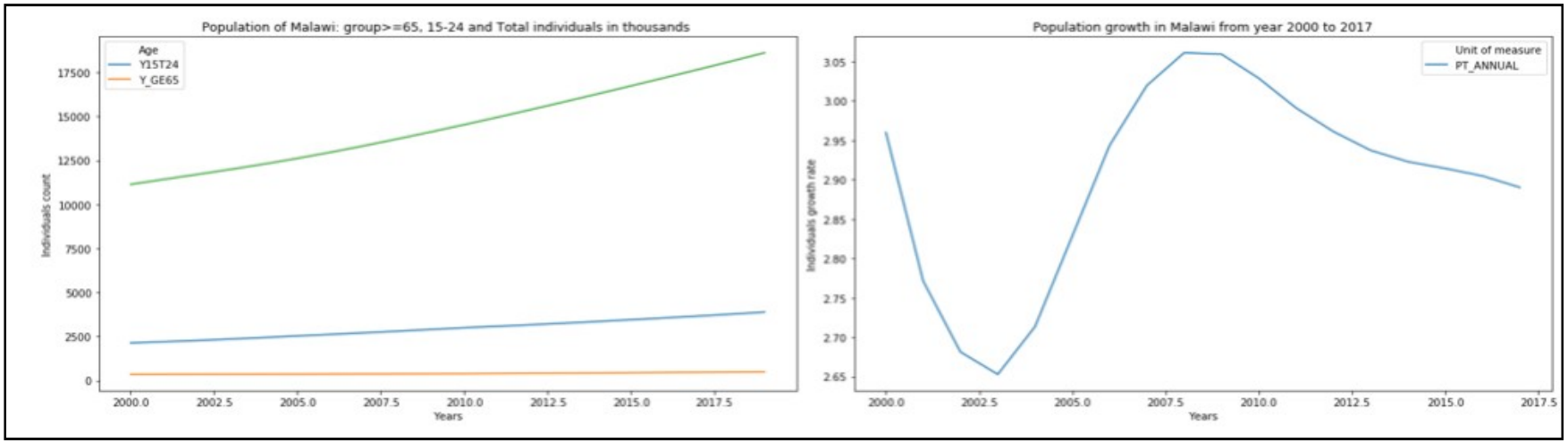
Plot 43: Comparison between Malawi Male and Female genders based on employment(counts) and entrepreneurship(percentage) factors, from year 1990 to 2019.

-The first subplot shows that employment rate has increased over the years and the male gender has higher employment rate than the female counterpart.
-Similarly, there are more male entrepreneurs than females.

-A disturbing trend observed is that there was a sizeable drop in the counts of female entrepreneurs from year 2005 to 2019 while reverse is the case for the male gender. Also, there was a drop in the male entrepreneur counts around year 2014-2015, but the counts increased thereafter.

-Admissive, agricultural production accounts for a good part of Malawi's GDP, hence loss of farmlands and live stocks to the 2015 flooding will impact the means of livelihood of Malawians and the country's GDP negatively.

Socio-Economic/ Population Factors
(Population)



Plot 44: Population count and Population annual growth rate between year 2000 and 2017.

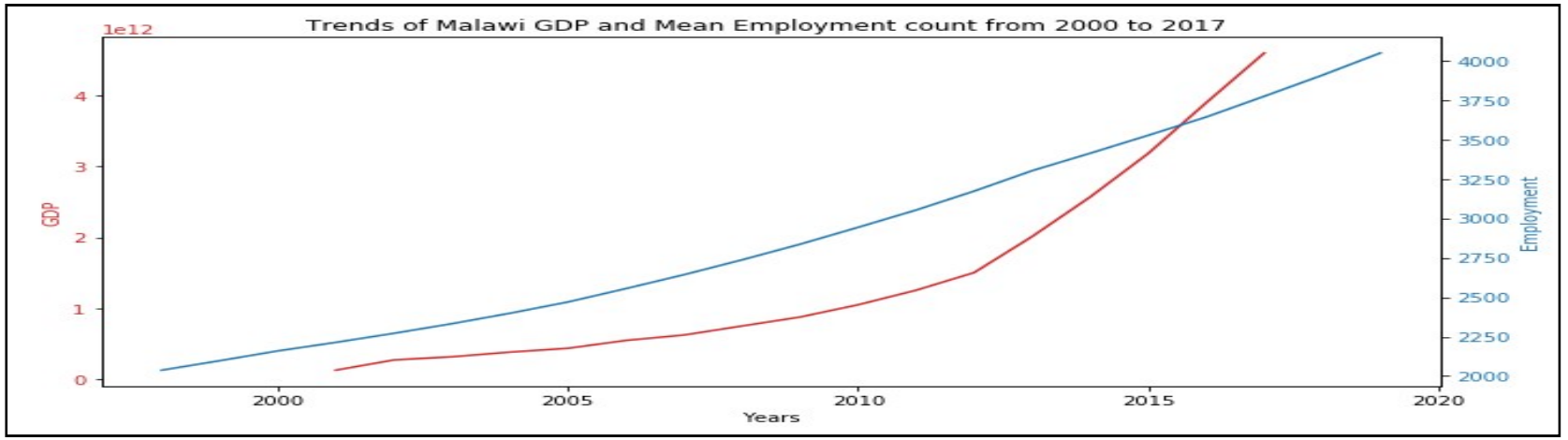
-From the left subplot, expectedly, the population group of age 15-24 is higher than the group of age 65 and older.

-The green curve is the total Malawi population, with an increasing trend through the years.

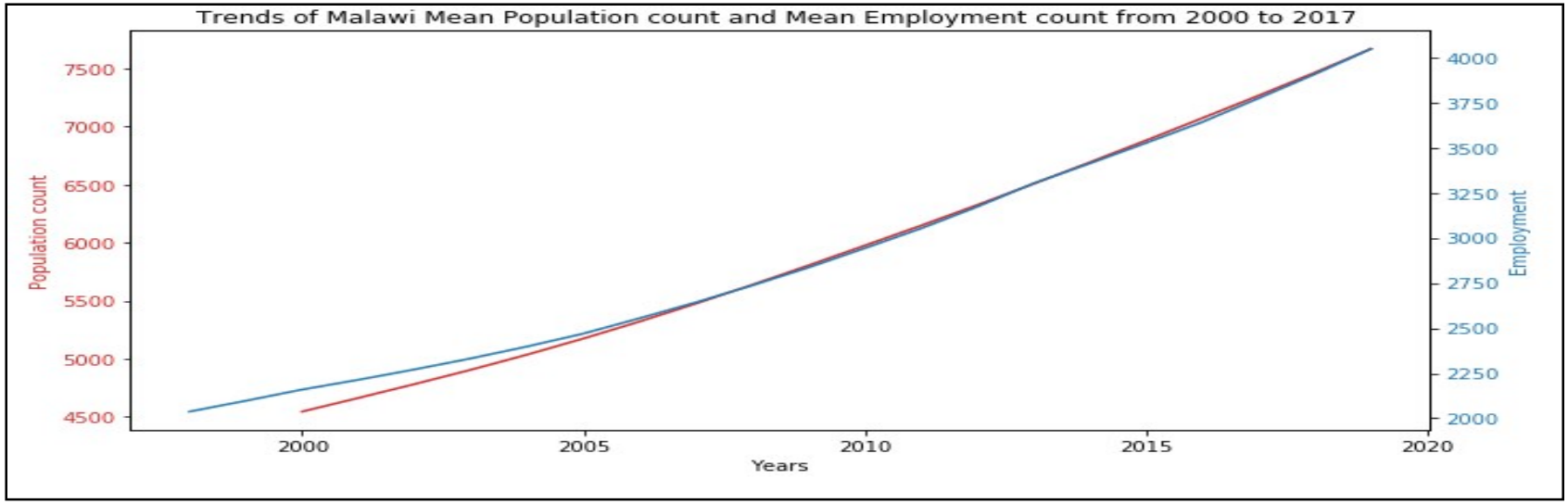
- It can be inferred that the population group of age 0-15 is quite large based on the three curves.
-The right subplot shows the annual growth rate in percentage from year 2000 to 2017.

-There has been a decrease in the growth rate from 2008, after reaching its peak.

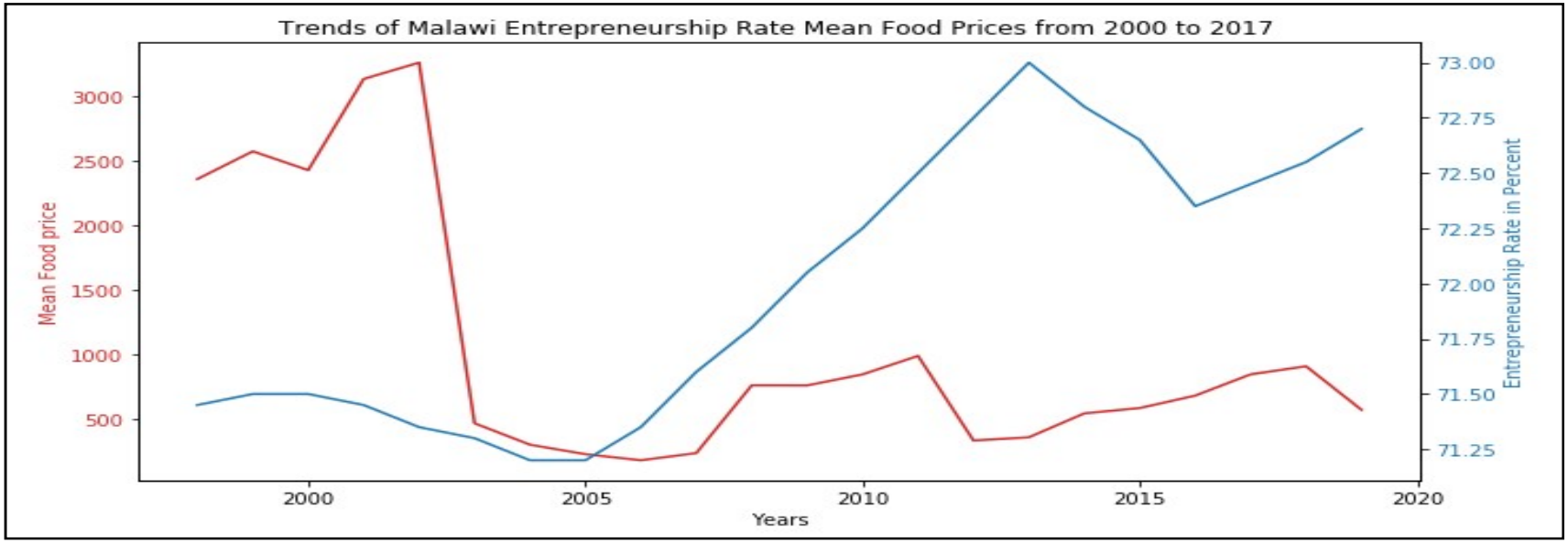
Trends Monitoring of different factors



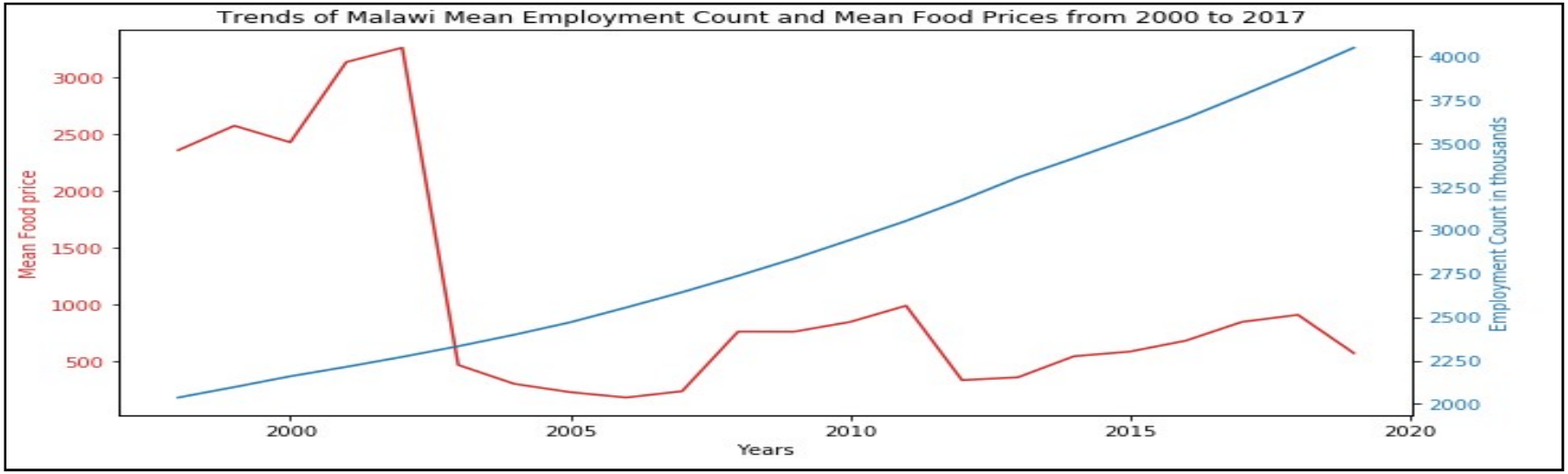
Plot 45:As GDP increases, employment count also increases



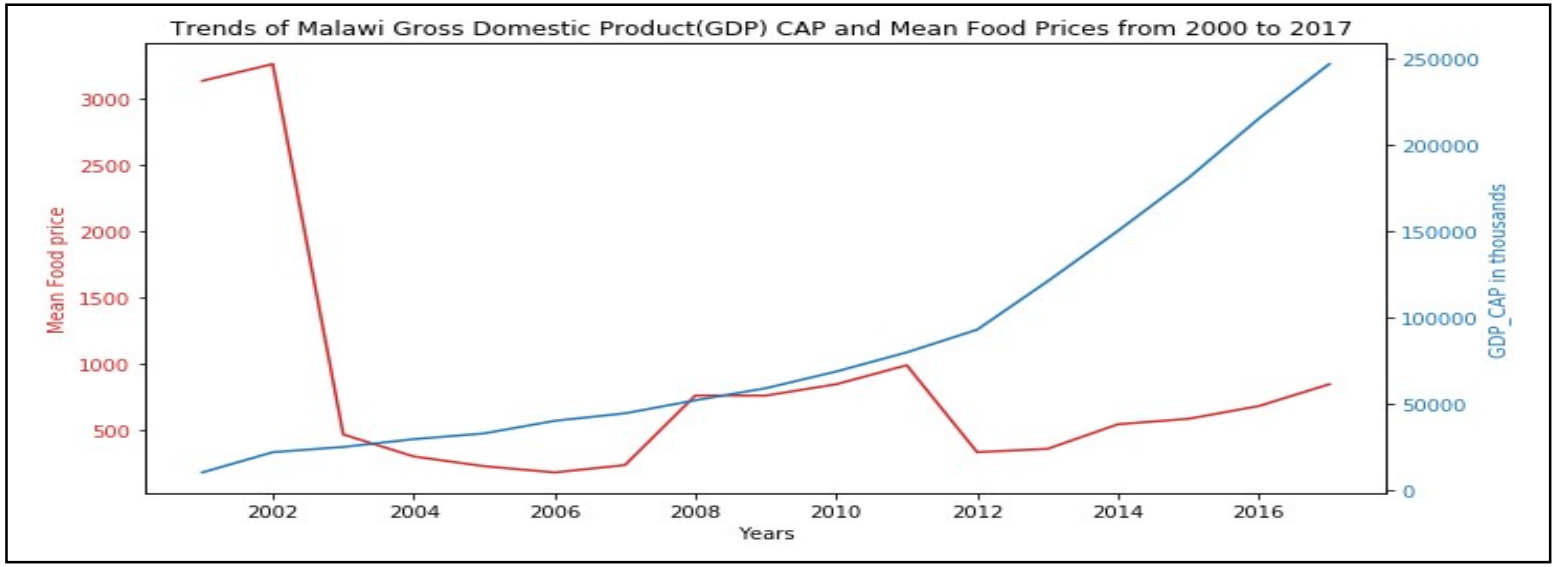
Plot 46:As Population increases, employment count increases closely.



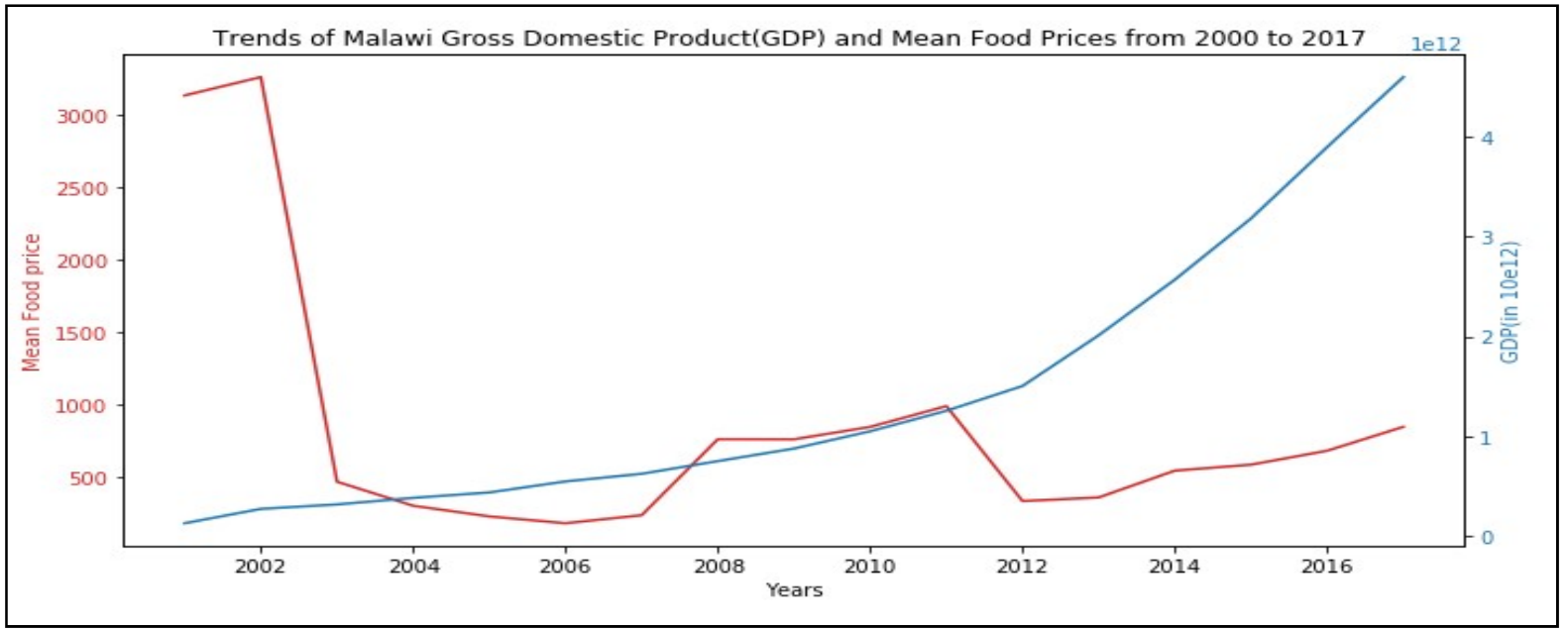
Plot 47:Variation of mean food price with Entrepreneurship rate



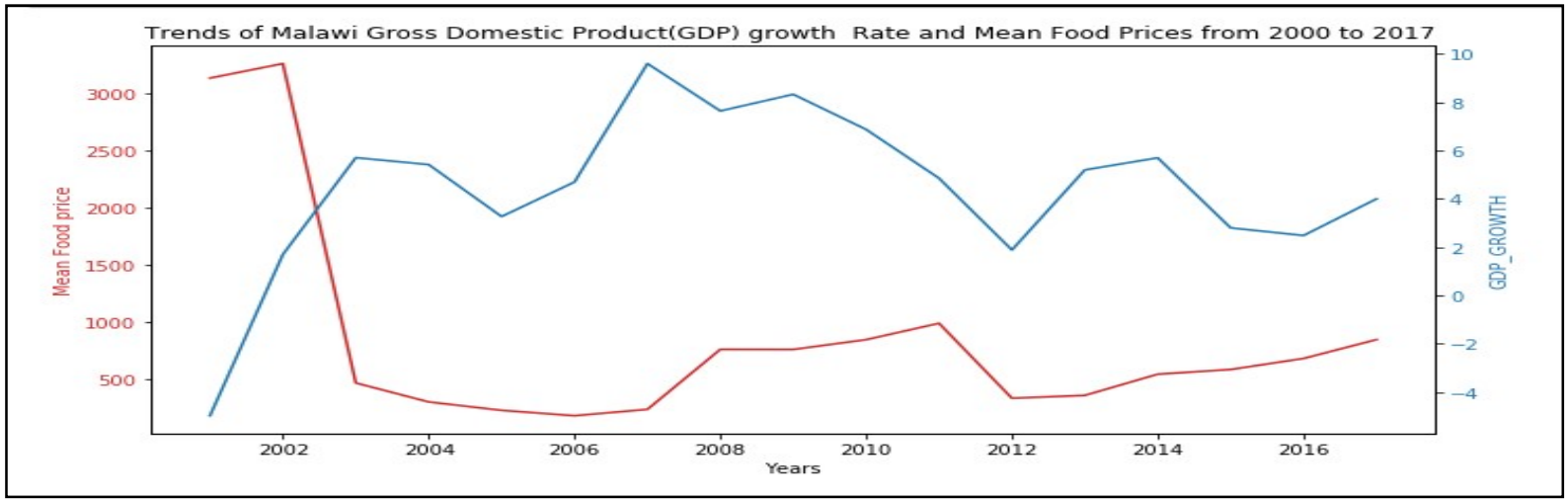
Plot 48: Variation of mean food price with employment count



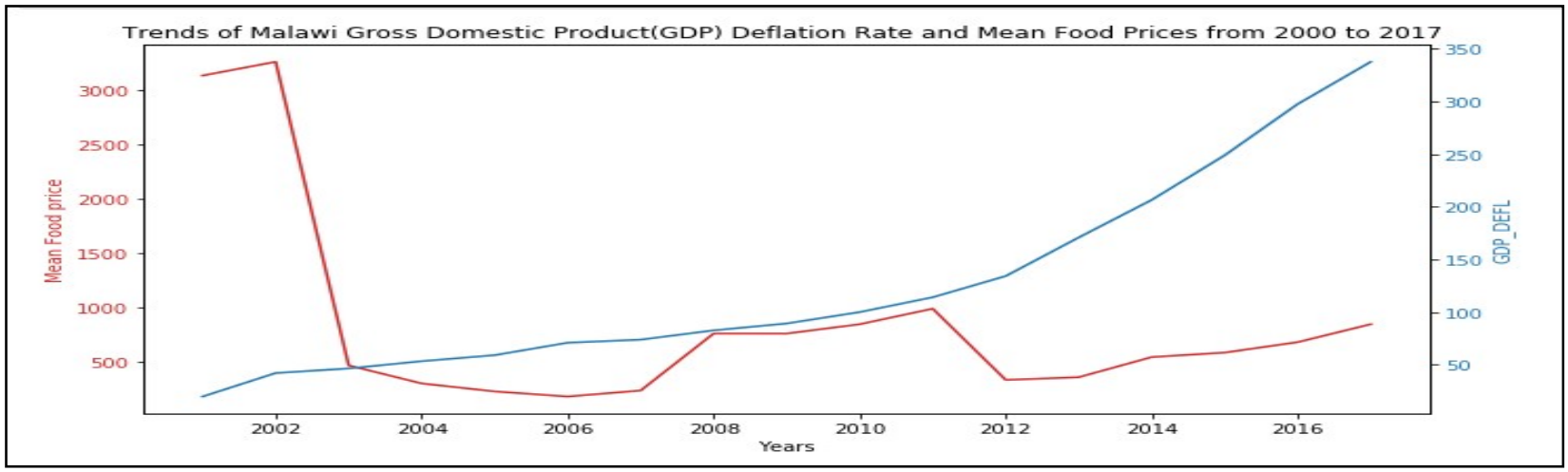
Plot 49: Variation of mean food price with GDP cap



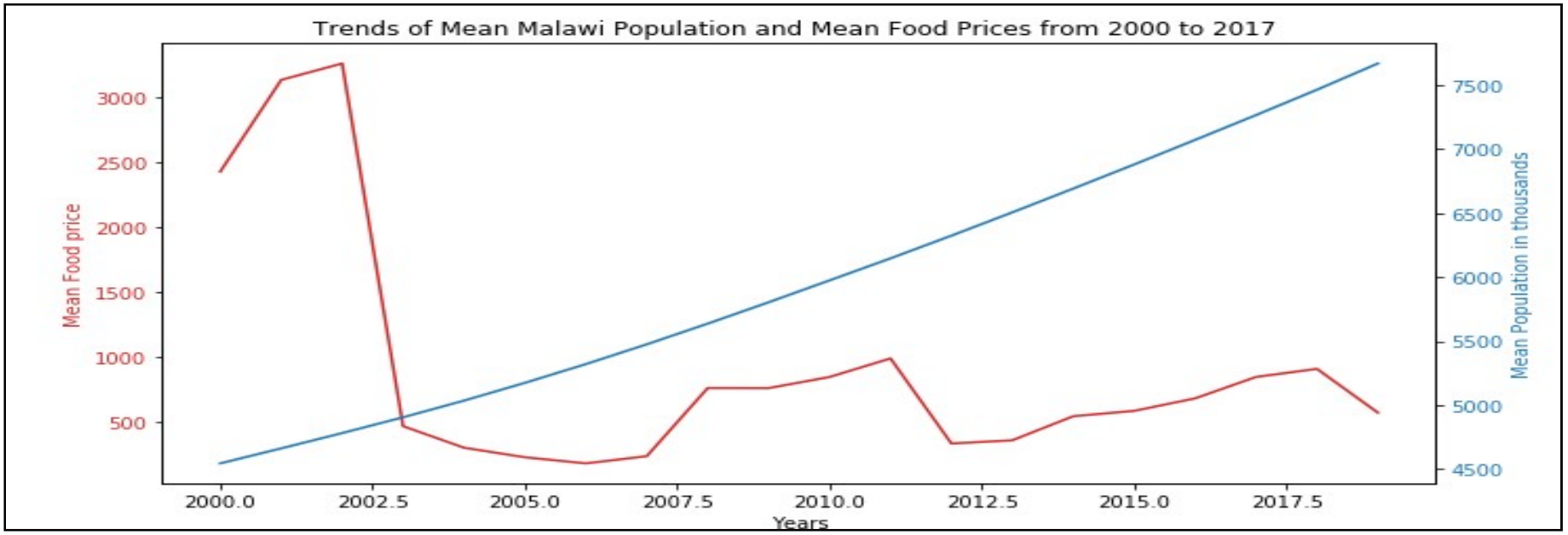
Plot 50:Variation of mean food price with GDP



Plot 51:Variation of mean food price with GDP growth rate

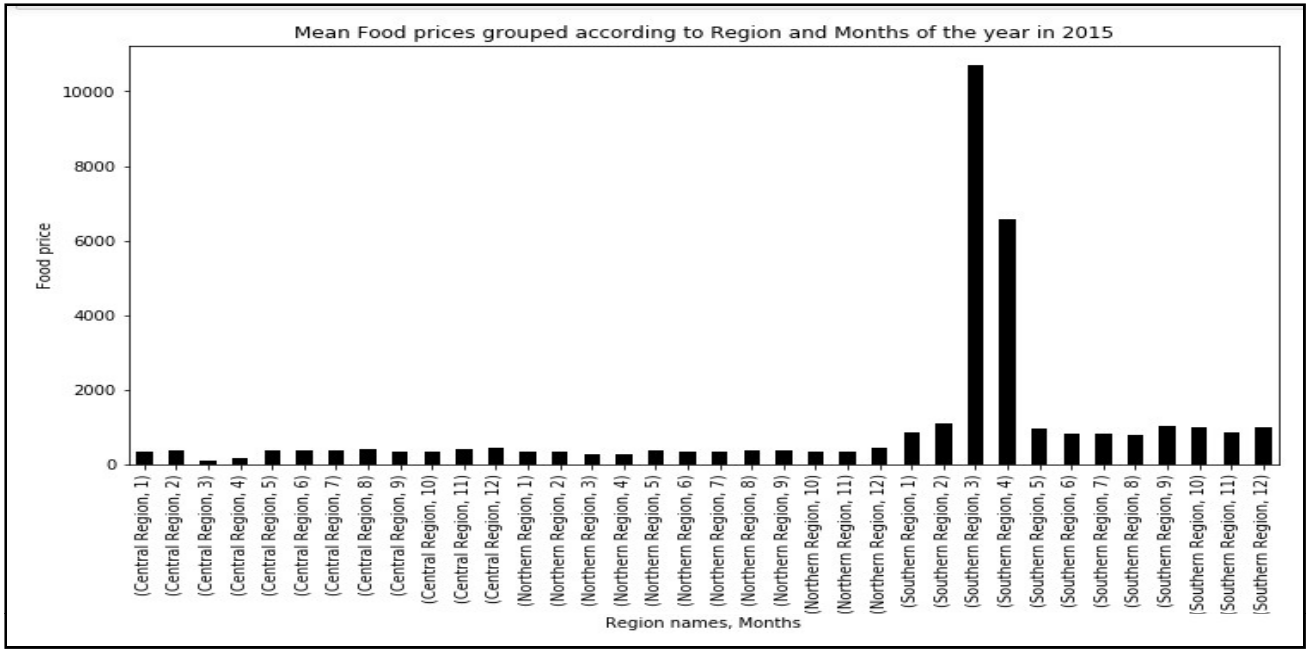


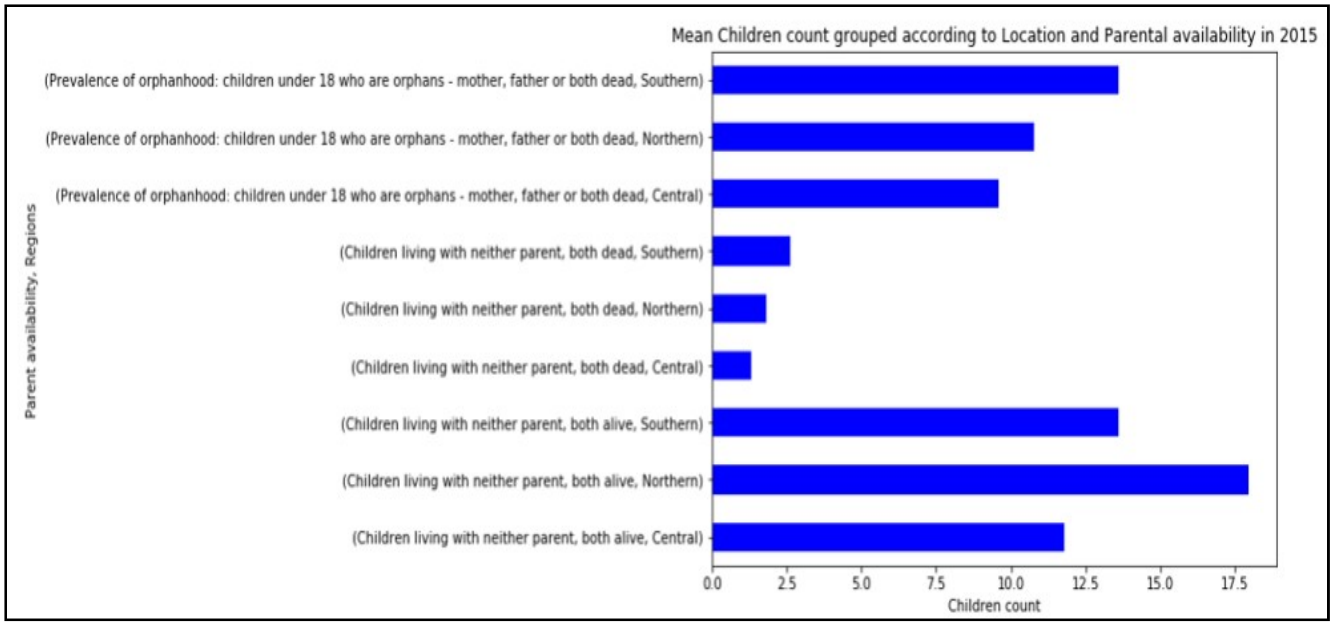
Plot 52: Variation of mean food price with GDP deflation

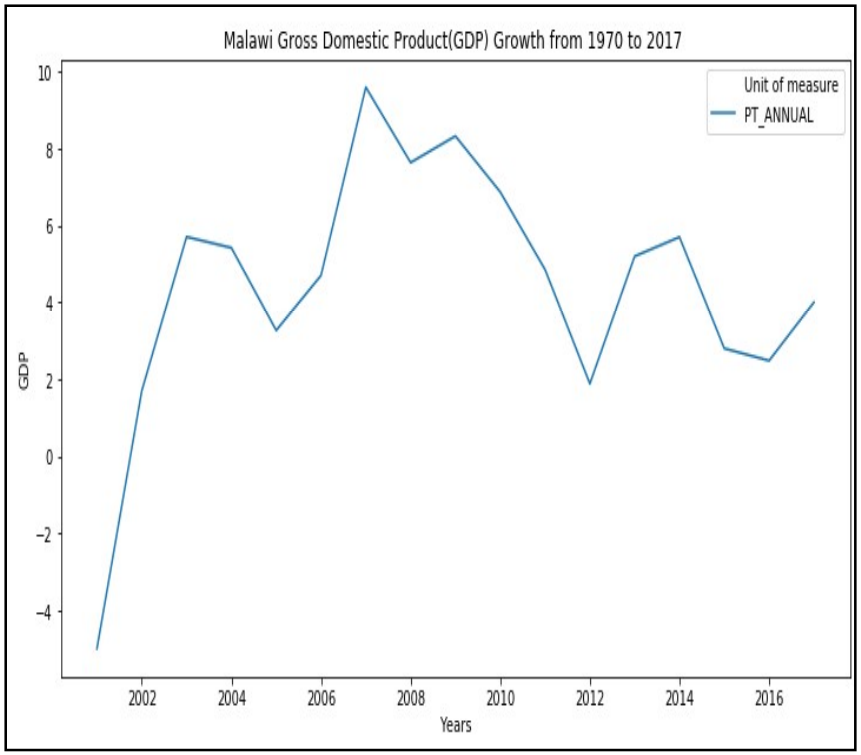


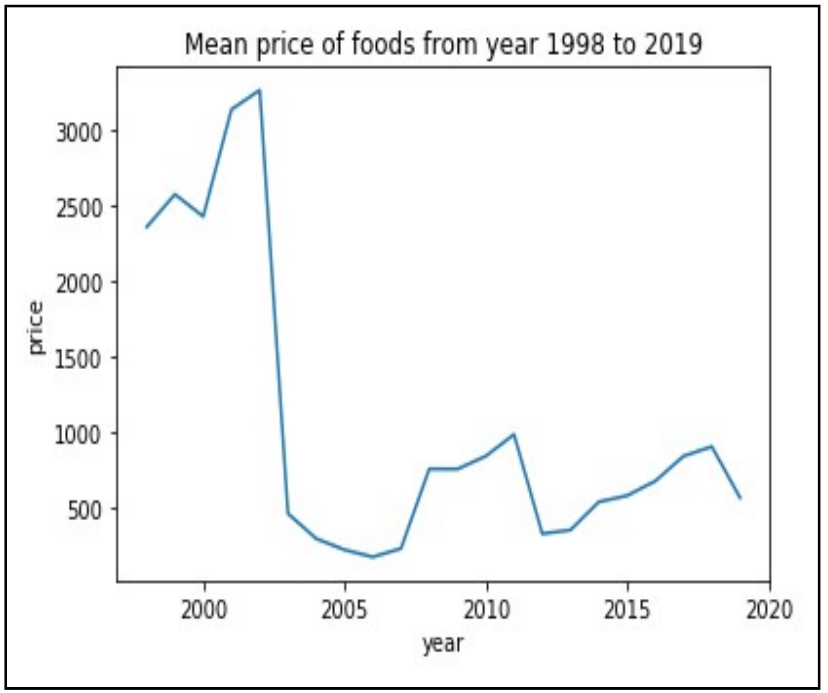
Plot 53: Variation of mean food price with Population

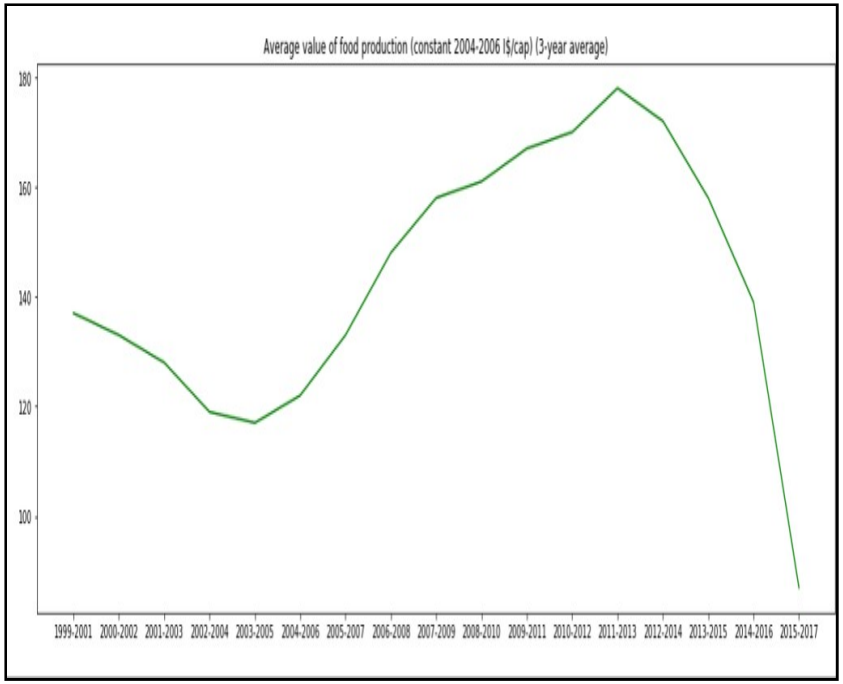
Conclusion Dashboard






Malawi Gross Domestic Product(GDP) Growth from 1970 to 2017
Unit of measure
PT_ANNUAL
GDP
Years
10
8
6
4
2
0
−2
−4
2002
2004
2006
2008
2010
2012
2014
2016


Mean price of foods from year 1998 to 2019
price
year
3000
2500
2000
1500
1000
500
2000
2005
2010
2015
2020


Average value of food production (constant 2004-2006 I$/cap) (3-year average)
180
160
140
120
100
1999-2001
2000-2002
2001-2003
2002-2004
2003-2005
2004-2006
2005-2007
2006-2008
2007-2009
2008-2010
2009-2011
2010-2012
2011-2013
2012-2014
2013-2015
2014-2016
2015-2017

Conclusion/Recap

- Food prices are generally higher in the Southern region than the other two Malawian regions irrespective of the year.
- In 2015, March and April had the highest food price record(mainly in the Southern region), after effects of the January to march flooding.
- There was a dramatic decrease in the average value of food production from 2012 to 2017.
- Many croplands/farmlands were destroyed by the flooding.
- The southern region is observed to have the highest mean of orphans count(both parents dead).
- Although, there are fluctuations in previous years, Gross Domestic Product(GDP) growth rate declined in year 2015, and later rose in 2016.

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- https://data.humdata.org/m/dataset/malawi-floods-2015-flood-extent/ malawi_mozambique_flooding
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- https://data.humdata.org/m/dataset/dhs-data-for-malawi/Subnational Orphans
- https://data.humdata.org/m/dataset/dhs-data-for-malawi/Subnational SDGs
- https://data.humdata.org/m/dataset/dhs-data-for-malawi/ Subnational Select Gender Indicators
- https://data.humdata.org/m/dataset/dhs-data-for-malawi/ Subnational Select Malaria Indicators
- https://data.humdata.org/m/dataset/dhs-data-for-malawi/ Subnational Select Nutrition Indicators
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_gdp
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_gdp_cap
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_gdp_defl
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_gdp_growth
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_ilo_emp
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_ilo_etpr
- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_ilo_emp

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- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_pop
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- https://data.humdata.org/m/dataset/unesco-dsei-malawi/ unesco_mwi_dem_eco_ilo_etpr
- https://data.humdata.org/m/dataset/hotosm_mwi_buildings/ hotosm_mwi_buildings_gpkg
- https://data.humdata.org/m/dataset/hotosm_mwi_buildings/ hotosm_mwi_buildings_polygons_kml
- https://data.humdata.org/m/dataset/hotosm_mwi_buildings/ hotosm_mwi_buildings_polygons_shp
- https://data.humdata.org/m/dataset/hotosm_mwi_buildings/ hotosm_mwi_gmapsupp_img
- https://data.humdata.org/m/dataset/hotosm_mwi_points_of_interest/hotosm_mwi_gmapsupp_img
- https://data.humdata.org/m/dataset/hotosm_mwi_points_of_interest/hotosm_mwi_points_of_interest_points_shp
- https://data.humdata.org/m/dataset/hotosm_mwi_points_of_interest/hotosm_mwi_points_of_interest_polygons_shp
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