

Full Length Research Paper

Food Security and Population Growth in Nigeria

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ABSTRACT: The influence of population growth on food security in Nigeria was investigated using secondary data on population growth and agricultural output from 1981 to 2019. The selection of one independent variable (population growth) is based on the assumption that other independent factors are held constant, and the rate of population growth may affect the variables favourably or adversely, hence affecting food security. Increased population raises food demand, food costs, farm labour, or leads to over-utilization of a country's resources, affecting food security. Regression with Analysis of Variance (ANOVA) results show that there is a substantial association between population growth and food security in Nigeria. It demonstrates that the country's unrestrained population growth significantly raises consumption of agricultural production (food security proxy), resulting in food decrease and affecting national food security. The hypothesis was tested using the t-test of difference between Means of Population Growth and Agricultural Output (food security) in Nigeria. The results revealed a statistical difference between the means of population growth and agricultural output (food security), implying that Nigeria's population is greater than the available agricultural output/commodity, resulting in food insecurity because the mean population growth is far greater than the mean agricultural output. As a result, it was recommended that the government address and control population growth through birth control, family planning education, and strict legislation against polygamy; increase agricultural financing and sustain the pace in order to boost agricultural output and food security; and ensure strict monitoring of allocated agricultural funds for appropriate and adequate disbursement.

Keywords: Population, population growth, agricultural output, food security, Nigeria

INTRODUCTION

The rate at which the world population is expanding, particularly in developing countries, portends a threat to food security. The world population was predicted to be over 2.6 billion people in 1950. In 1987, it was 5 billion, and in 1999, it was 6 billion. The global population was expected to be 7 billion in October 2011. The world's population is estimated to reach 8.5 billion in 2030 and to grow by 2 billion people during the next 30 years, from 7.7 billion in 2019 to 9.7 billion in 2050 and 11.2 billion by 2100. (UN, 2019).

Six of the Earth's seven continents are permanently inhabited on a big scale. Asia has the most people,

followed by Africa. Sixty-one percent of the world's population (4.7 billion) lives in Asia, 17% in Africa (1.3 billion), 10% in Europe (750 million), 8% in Latin America and the Caribbean (650 million), and the remaining 5% in Northern America (370 million) and Oceania (43 million). China (1.44 billion) and India (1.39 billion) continue to be the world's two most populated countries, each with more than one billion people, constituting 19 and 18% of the global population, respectively. India is expected to overtake China as the world's most populated country in 2027, whereas China's population is expected to decline by 31.4 million, or roughly 2.2%, between 2019 and 2050.

(UN Report: World Population Prospects, 2019). Out of the world's 7.7 billion people, two billion are still living in moderate or severe food insecurity because they do not have regular access to food, do not have a sufficient variety of nutritional value, or do not have enough food to feed the entire population. 820 million of the two billion people facing food insecurity are hungry (FAO et al., 2019). Globally, an estimated 690 million (8.9 percent of the world's population) are malnourished.

Since 2014, the number of hungry people has continuously increased and is expected to reach 841.4 (9.8 percent) million by 2030, with Africa accounting for 51.5 percent (433.2 million), the biggest number of undernourished people globally (FAO et al. 2020). Despite the deaths caused by the COVID - 19 pandemic, the world population is currently estimated to be 7.9 billion people (UN, 2022). The United Nations World Food Program (2020) anticipated that 265 million people, a two-fold increase, would endure acute food insecurity by the end of 2020, when the global population was estimated to be 7.8 billion. According to FAO et al. (2021), between 720 and 811 million people worldwide faced hunger in 2020, up to 161 million more than in 2019. In 2020, about 2.37 billion people lacked appropriate food, a rise of 320 million in just one year. No part of the globe has been spared. The high expense of healthy diets, along with continuously high levels of poverty and income inequality, keep good diets out of reach for around 3 billion people worldwide. The increasing cost of nutritious diets was linked to greater levels of moderate or severe food insecurity.

Africa is predicted to account for more than half of global population growth between now and 2050. Africa has the fastest population growth rate of any major region. Sub-Saharan Africa's population is expected to treble by 2050. Even if fertility numbers fall significantly in the near future, Africa's population is expected to grow rapidly. Regardless of the uncertainty surrounding future fertility trends in Africa, the large number of young people on the continent who will reach adulthood and have children of their own ensures that the region will play a critical role in shaping the size and distribution of the world's population over the coming decades (UN, 2019). Nigeria is the most populated country in Africa, ranking seventh in terms of population (including dependencies). Nigeria's present population is expected to be 215 million, accounting for 2.64 percent of the total global population, with a predicted population of 401.31 million by 2050. (UN, 2022). In most places of Africa, population growth and food security have an inverse connection. Despite Africa's rapid population increase, particularly in Nigeria, the continent remains afflicted by hunger and food insecurity. According to FAO et al. (2019), hunger in Africa deteriorated between 2014-2018 after a lengthy period of progress, as assessed by the prevalence of

undernourishment. In 2017-2018, this tendency slowed. Currently, 256 million Africans, or 20% of the population, are malnourished. There are 239 million in Sub-Saharan Africa and 17 in Northern Africa. In addition to the 277 million people in Africa who are severely food insecure, the measure of moderate or severe food insecurity shows that there are 399 million people who are moderately food insecure, i.e. they did not have regular access to nutritious and sufficient food, even if they were not necessarily suffering from hunger. 87 percent of these people live in Sub-Saharan Africa (FAO et al., 2019). In 2020, one in every five individuals (21 percent of the population) in Africa faced hunger, more than double the level in any other continent. This marks a three-point improvement in one year (FAO et al., 2021).

Food insecurity in Nigeria is currently at an alarming level, necessitating prompt action. Chronic and hidden hunger, extreme poverty, corruption, conflict occurrences (insurgency in the North East), and unfavourable climate change have all contributed to the country's precarious position of acute food insecurity. Chronic and seasonal food insecurity exists throughout the country, exacerbated by high food costs, the impact of insurgency-related warfare (particularly in the Northeast), armed banditry, community, pastoralist/farmer crisis, kidnapping, and cattle rustling (Ayinde et al., 2020). Furthermore, the country's rapid population expansion has had a significant impact on food security, which has been exacerbated by inadequate agricultural financing. According to Onime (2019), rapid population growth, particularly in countries with underdeveloped agricultural sectors, causes food shortages, food price inflation, and income strain by increasing government recurrent and social expenditure because substantial resources must be devoted to providing basic food and other needs for the populace. This is common in Nigeria. To meet the country's food requirements and the shortfall in food production, the country relies heavily on food imports (Onime, 2019). Due to contradictions in government agricultural policies, the country, which was a food exporter in the 1960s, became a net importer of food in the 1970s. The country continues to rely on food imports to supplement its domestic food supply. The large food import costs imply that a significant percentage of the much required foreign cash meant for importing capital for development objectives was spent on food importation. As a result, the country is subject to economic shocks, which might lead to food insecurity in the long run (Abdulmalik, 2020). The COVID - 19 epidemic has exacerbated the food security situation. The pandemic has severely impacted the country's already fragile value chains, including people's ability to produce, prepare, and distribute food. Agriculture productivity and market disruptions have a severe impact on livelihoods, particularly among the most vulnerable

households (USAID, 2021).

Out of the fifteen (15) African countries now experiencing the most food insecurity, the country ranks third, with a projected 12.8 million people facing acute food shortages, trailing only the Democratic Republic of the Congo and Ethiopia (Ibirogbu, 2021). Between 2018 and 2020, 21.4 percent of Nigeria's population was hungry on average. People suffering from extreme food insecurity would go for days without eating owing to a lack of money or other resources (Sasu, 2022).

The growing population strains available resources and raises food consumption. Rising demand exacerbates inflation, worsening people's living conditions. As the population grows, so will the demand for food. An increase in demand that is not balanced by an increase in production will result in demand exceeding supply, resulting in food insecurity (Onime, 2019). The goal of this study is to explore the influence of rapid or progressive population expansion on food security in Nigeria, using agricultural output consumption/utilization as a proxy for food security.

Hypothesis:

Ho: There is no significant difference between Population growth and food security in Nigeria.

Literature review

Conceptual review

This section defines the fundamental terms of population, population growth, population growth rate, agricultural production, and food security.

A population is a collection of individuals who live in a specific place at a given moment (Mahour, 2014). It is a collection of individuals of the same species who live and interbreed in the same region. Members of a population frequently rely on the same resources, face comparable environmental restrictions, and rely on the availability of other members to survive. The population size is the number of people that live inside a given geographical area (Tarsi and Tuff, 2012). The rate at which a population grows or expands is referred to as population growth. It is a growth in the number of people in a population. In some ways, population is a source of labour that could be used to improve the country's output. On the other hand, it could be viewed as a consumer group that consumes and depletes a huge portion of the country's resources (Anulawathie and Menike, 2018). It broadly refers to all nationals who are present in, or temporarily absent from, a country, as well as aliens who are permanently settled in a country.

This indicator depicts the average number of people who live in a given location. Population growth rates are the annual changes in population caused by births, deaths, and net migration. National military forces stationed abroad; commercial seafarers at sea; diplomatic staff stationed abroad; civilian immigrants' resident in the country; displaced persons' resident in the country comprise the total population. It does, however, preclude the following: foreign armed forces stationed in the country; foreign diplomatic staff stationed in the country; and civilian immigrants visiting the country temporarily. A typical demographic tool is population forecasts. They serve as a foundation for other statistical projections, assisting governments in making decisions. This metric is calculated using the annual growth rate and thousands of people (OECD, 2022). The ratio of agricultural outputs to inputs is used to calculate agricultural productivity. It includes animal enterprise output, crop enterprise output, by-products, fodder and cultivations, and other output that covers the monetary worth of output from those agricultural activities but is not livestock or crop enterprise output. The link between agricultural outputs and agricultural inputs is used to calculate agricultural output (Mohammed, 2020). Agricultural output is the entire value of output from crop cultivation, livestock, forestry, and fishing in an economy (Njidda, 2020). Agriculture's main product categories are livestock and crops. Agricultural output consists of the following components: output sold (including trading across agricultural holdings); stock fluctuations; production for own final consumption; output produced for further processing by agricultural producers; and intra-unit consumption of livestock feed products (OECD, 2021). It is a critical component and source of food security. To examine the notion of food security, it is important to understand that the concept was first introduced at the World Food Conference in 1974, only from the standpoint of having adequate food availability on a national scale. It is now a condition in which all people have constant access to appropriate nutritional meals for a healthy and active lifestyle. This or the multidimensional character of the food security notion has four dimensions: (i) food availability, which is a function of food production; (ii) supply stability over time, which is dependent on the ability to preserve/store produced food and supplement available food through imports if necessary; (iii) access to available food, which is dependent on income levels and distribution; and (iv) food utilization, which includes procurement, ingestion, and digestion, all of which are dependent on nutritional quality, education, and hegemony (Tollens, 2000; Udemueze and Orfole, 2019).

Food insecurity is a necessary prerequisite for nutrition security, but it is not sufficient. Food insecurity is a significant predictor of nutrition insecurity as well as poor psychosocial, cognitive, and mental health outcomes

(Jones et al., 2013; Gubert et al., 2016; Ayinde et al., 2020). In addition to food security, nutrition security refers to care, health, and hygiene habits (Jones et al., 2013). Food and nutrition security includes providing energy, protein, and nutrient requirements for a healthy lifestyle. In terms of food production, food systems overlap with agricultural systems, but they also include the complex range of institutions, technology, and practices that control how food is sold, processed, transported, accessed, and eaten. Food system activities are classified into four categories: food production, food processing and packaging, food distribution and retailing, and food consumption (Capone et al., 2014). Food insecurity, on the other hand, might be defined as the absence of one or more of these components. Food insecurity is traditionally divided into two categories: chronic and transitory, with seasonal food insecurity being somewhere in the middle (FAO, 2008; Jones et al., 2013; Ayinde et al., 2020). Chronic food insecurity is a long-term or persistent situation in which people are unable to meet their minimum food requirements over an extended period of time, whereas transitory food insecurity is typically short-term or temporary and refers to brief periods of extreme scarcity of food availability and access (Afolabi et al., 2018; Ayinde et al., 2020). Food security also refers to a household's ability to obtain enough food to meet the nutritional needs of all members, whether through self-production or purchase. Food insecurity refers to a household's inability to do so. A food security line is the minimal or cut-off criterion of per capita calorie or protein consumption below which a person or household is deemed food insecure. Food security determinants are the variables that determine food security. Food insecurity is linked to hunger, malnutrition, and poverty. Hunger is a state of distress caused by a lack of food. It is food insecurity. Malnutrition is an abnormal physiological condition caused by eating the improper amount and/or types of meals; it includes both undernutrition (a lack of energy, protein, and/or micronutrients) and over nutrition (excess intake of energy or micronutrients). Micronutrient deficiency (hidden hunger) is a type of undernutrition that develops when vitamin and mineral intake or absorption is insufficient to maintain excellent health and development in children and appropriate physical and mental function in adults. Undernourishment is defined as chronic calorie deficit, with daily calorie consumption of fewer than 1,800 kilocalories, the bare minimum for most people to live a healthy, productive life (FAO, 2013). Poverty comprises several levels of deprivation related to human capabilities, such as consumption and food security, health, education, rights, voice, security, dignity, and decent work. Poverty rate is the ratio of the number of people (in a given age group) whose income falls below the poverty line divided by half the total population

median household income (OECD, 2022). Poverty line is the minimum (\$1.9 per day) or cut-off standard of food expenditure or per capita income below which an individual or household is classified as poor.

Theoretical review

The research is based on the Malthusian population theory (1798). Malthus claimed that the world's population grows faster than the world's food supply. While the population rises geometrically, manufacturing capacity only grows arithmetically. As a result, in the absence of persistent constraints on population increase, Malthus predicted that few resources would have to be divided among an increasing number of people in a short period of time. However, such checks that alleviate the pressures of population growth do exist, and Malthus distinguishes between two types: preventive checks and positive checks. The preventive measure is voluntary population growth limits (Oguntegbe et al., 2015). It will lead to famine, poverty, squalor, and diseases unless it is halted by wars, epidemics, and human vices (Abdulrahman, 2013). The hypothesis simply established a direct link between population dynamics and food resource availability. The original essay resulted from his skepticism about positivist theorists, praising man's perfectibility and welcoming breakthroughs and distribution of human knowledge as a source of welfare and freedom for future generations. Disagreeing with such viewpoints, Malthus claimed that the strain exerted by population expansion on food supply significantly hampered human development. The cornerstone of Malthus' theory is based on two fixed assumptions, namely that food and sex passion are both necessary for human survival (Oguntegbe et al., 2015). In the Western economy, Malthus' projections fell short of expectations. However, in Sub-Saharan African countries, his predictions have proven to be accurate (Ewugi, 2012). The vice predicted by Malthus' theory can be seen in the Nigerian economy. Domestic food production has continued to fall behind the population's food needs in Nigeria, resulting in enormous food importation, which is disastrous to our balance of payment (Osu, 2017).

Empirical review

Onime (2019) investigated the impact of population expansion on food security and economic growth in Nigeria. The study discovered a positive and significant association between government spending on social overheads and economic growth, but a negative relationship between food security, population, and economic growth using time series data pooled from

1981 to 2016. Population growth has been observed to impact food security and economic growth. In his paper, Population Expansion and Food Security in Nigeria, Abdulrahman (2013) concludes that population growth has a negative impact on agricultural productivity in Nigeria using a simple regression analysis technique. Osu (2017) investigated population dynamics and food security in Nigeria by categorizing the population into three age groups: 0-14 years, 15-64 years, and 65 and older. The study also divided food production into three categories: fisheries, crops, and livestock. Data on time series were collected from diverse sources and submitted to a number of econometric analyses. The empirical findings reveal that dependent populations aged 0 to 14 years and 65 and older have a detrimental and considerable impact on fisheries, livestock, and crops. This means that the country's food crisis can be explained in part by the dynamic nature of the country's population mix.

Oguntegebe et al. (2015) used secondary data on food production index and population growth rate gathered between 1980 and 2011 to analyze the influence of population expansion on food production in Nigeria. The data's time series nature was thoroughly probed utilizing unit root tests. The Engle-Granger causality test was also applied to the two variables of interest, namely the food production index and population growth rates. Two common econometric techniques were used. The model was estimated using both Ordinary Least Squares regression and the Instrumental Variable approach. The OLS empirical study demonstrates that population increase is positively connected to food production. The Instrumental Variable Approach, on the other hand, generated a more intriguing result: a rise in population growth rate greatly affects food output.

Udemezue and Oforle (2019) investigated the negative consequences of inconsistency in policy and administrative instabilities on agricultural and food security in Nigeria. An analytical approach was used to review the following issues: agricultural policy and structural reform in Nigeria, food security constraints in Nigeria, agricultural contributions to economic growth in Nigeria, Gross Domestic Product and agricultural output in Nigeria from 1970 to 2015, and agricultural policy challenges in Nigeria. They discovered that rapid population expansion was one of the biggest impediments to food security in Nigeria. In Nigeria, Owoo (2020) focused on demographic factors and food security. Owoo, (2020) demonstrated spatial patterns of food security in the country using data from three waves of the World Bank's Living Standard Measurement Survey for Nigeria. Using fixed effects regressions, she also demonstrated that larger households had poorer food security outcomes and were more likely to report being food insecure. In addition, Owoo discovered that

children from large households had worse nutritional results. Matemilola and Elegbede (2017) analyzed the challenges of food security in Nigeria, emphasizing the significance of agricultural redevelopment in reversing the food insecurity problems that befell Nigeria and the coping mechanisms. They discovered that while only a small portion of the Nigerian people benefited from the oil money, the majority of the population suffered from food insecurity since they could not afford the soaring prices of imported items.

METHODOLOGY

In order to estimate the influence of population increase on the consumption/utilization of agricultural output (proxy for food security) in Nigeria, secondary data for the period 1981 to 2019 were used. This is a span of thirty-eight (38) years. The data on agricultural output came from the Central Bank of Nigeria's (CBN) annual report and statistical bulletin, while the data on Nigeria's population came from the World Factbook of the Central Intelligence Agency (CIA). At $\alpha = 0.05$, a linear regression model was used for the study.

Food Security = F (Population growth)

$$AOP = B_0 + B_1POPt + Ut$$

where,

AOP = Agricultural Output (proxy for food security)

POPt = Population

Ut = stochastic error term.

The selection of a single independent variable, in this case population growth, is based on the assumption that all other independent variables will remain unchanged. It is possible that the population growth rate will have a positive or negative impact on the other variables, which will then have an effect on food security. For example, a rise in population may lead to an increase in food demand, food costs, farm labour, or the over-utilization of a nation's resources, all of which have the potential to negatively impact a nation's ability to ensure its food supply.

RESULTS AND DISCUSSION

Simple linear regression analysis of the effect of population growth on agricultural output in Nigeria

The OLS linear regression analysis findings are shown in (Table 1). The R squared value is 0.96, indicating that the

Table 1: Linear regression result for population and agricultural output/commodity (food security proxy) of Nigeria.

Variable	Coefficients	Standard Error	t Stat	P-value
Intercept	-9042.6	595.02	-15.197	0.0000
POPT	136.61	4.5744	29.863	0.0000
Multiple R		0.97988		
R Square		0.960165		
Adjusted R Square		0.959088		
Standard Error		1082.074		
Observations		39		

Source: Author's computation

Table 2: ANOVA.

Model	Df	SS	MS	F	Significance F
Regression	1	1.04E+09	1.04E+09	891.8231	1.69E-27
Residual	37	43322718	1170884		
Total	38	1.09E+09			

Source: Author's computation

Table 3: t-Test of difference between means of population growth and agricultural output (food security) in Nigeria.

Variable	Mean	Variance	N	DF	T - cal.	T - crit.
Population Growth	7956.731	28619590	39	38	9.14278	2.024394
Agricultural output	124.4397	1472.525	39			

Source: Author's computation

independent variable in the model explains 96% of the dependent variable AOP. R squared is 96 percent, indicating that the model is well-fitting.

At 5%, population increase (136.61) is favourable and considerable. At the 0.05 level of significance, this means that for every unit increase in population in Nigeria, consumption of agricultural output/commodity increases by 13661. Population growth, the independent variable, has a major impact on Nigerian agricultural output. In other words, as the Nigerian population grows, so does consumption, while agricultural output/commodity production decreases, resulting in a food deficit or insecurity. This is consistent with the Malthusian theory, which holds that population grows at a geometric pace while food production grows at an arithmetic rate. The conclusion also supports the findings of Oguntegbe et al. (2015), who discovered that an increase in population growth rate affects food yield significantly.

Test of Hypothesis

Test of overall significance in the regression analysis

Table 2 shows the overall significance test findings from the regression analysis. The P - value (that is, the threshold of significance $F = 1.69E - 27$ or 0.0000) is less than 0.05, implying that the regression model fits the data better than the model with no independent variables. As a

result, the model's independent variable (population growth) improves the fit. It also implies that population expansion has a considerable impact on agricultural output/commodity consumption, and thus on Nigeria's food security situation. As a result, the null hypothesis is rejected.

T-Test of difference

In Nigeria, the results of the t-test of difference between Means of Population Growth and Agricultural Output (food security) are shown (Table 3). The estimated t - ratio is 9.14278, while the table value is 2.024394. The null hypothesis is rejected in favour of the alternative hypothesis because the estimated t - ratio exceeds the critical or table value. This indicates that there is a statistical discrepancy between population growth and agricultural output. This demonstrates that Nigeria's population is more than the available agricultural output/commodity, resulting in food insecurity because the average population growth is considerably bigger than the average agricultural output.

Conclusion and Recommendations

The primary goal of this article is to investigate the relationship between Nigerian population growth and food security. In the analysis, Simple Linear Regression,

Analysis of Variance (ANOVA), and the t-Test are used. Regression with Analysis of Variance (ANOVA) results show that there is a substantial association between population growth and food security in Nigeria. It demonstrates that the country's unrestrained population growth significantly raises consumption of agricultural production (food security proxy), resulting in food decrease, which undermines national food security, lending validity to Malthusian theory. The hypothesis was tested using the t-test of difference between Means of Population Growth and Agricultural Output (food security) in Nigeria. The results revealed a statistical difference between the means of population growth and agricultural output (food security), implying that Nigeria's population is greater than the available agricultural output/commodity, resulting in food insecurity because the mean population growth is far greater than the mean agricultural output. The following recommendations were made in light of these findings:

The Government should address and check population growth through birth control, family planning education and strict legislation against polygamy and the number of immigrants from the neighbouring countries.

The government should step up agricultural financing and sustain the tempo in order to boost agricultural output and food security.

The government should ensure strict monitoring of agricultural funds for appropriate and adequate disbursement.

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Appendix: The Data for Population Growth and Agricultural Output of Nigeria.

Year	Population	Percent Change	Agricultural output (AOP)	Percentage Change
1981	70.388		2364.4	
1982	72.318	2.74%	2426	2.61
1983	74.272	2.70%	2409.1	- 0.70
1984	76.299	2.73%	2303.5	- 4.38
1985	78.435	2.80%	2731.1	18.56
1986	80.688	2.87%	2986.8	9.36
1987	83.043	2.92%	2891.7	-3.18
1988	85.488	2.94%	3174.6	9.78
1989	87.998	2.94%	3326	4.77
1990	90.557	2.91%	3464.7	4.17
1991	93.161	2.88%	3590.8	3.64
1992	95.725	2.75%	3674.8	2.34
1993	98.36	2.75%	3743.7	1.88
1994	101.068	2.75%	3839.7	2.56
1995	103.85	2.75%	3977.4	3.59
1996	106.709	2.75%	4133.6	3.93
1997	109.647	2.75%	4305.7	4.16
1998	112.665	2.75%	4475.2	3.79
1999	115.766	2.75%	4703.6	5.10
2000	118.953	2.75%	4841	2.92
2001	122.228	2.75%	5024.5	3.79
2002	125.593	2.75%	7817.1	55.58
2003	129.05	2.75%	8364.8	7.01
2004	132.602	2.75%	8888.6	6.262
2005	136.253	2.75%	9517	7.07
2006	140.004	2.75%	10222	7.41
2007	143.854	2.75%	10958	7.20
2008	147.81	2.75%	11645	6.27
2009	151.874	2.75%	12330	5.88
2010	156.051	2.75%	13049	5.83
2011	160.342	2.75%	13429	2.91
2012	164.752	2.75%	14330	6.71
2013	169.282	2.75%	14751	2.94
2014	173.938	2.75%	15380	4.26
2015	178.721	2.75%	15952	3.72
2016	183.636	2.75%	16607	4.11
2017	188.686	2.75%	17180	3.45
2018	193.875	2.75%	17544	2.12
2019	199.206	2.75%	17959	2.37

