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DEMOGRAPHIC CHANGE AND ITS IMPLICATIONS FOR ASSET PRICES AND THE MACROECONOMY

AYANO, DAVID AYANNIYI (PhD)

Phone: (+234-803-482-2401)

Mail: victoriaayano2014@gmail.com

Deputy Director, Management Consultant and Senior Research Fellow, Economic Management Department, Centre for Management Development, Management Village, Shangisha, Magodo, Lagos, Nigeria.

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ABSRACTS

This study investigates the effects of demographic changes on assets prices and macroeconomy. The study employed the use of data for financial assets: equity and treasury bill prices and demographic variables from 1988 to 2020. The study conducted Phillips-Perron for unit root test of the variables. The study performed Johansen cointegration test to determine the long run relationship among the variables. The study employed Ordinary Least Square method for estimation of the variables. The results of the findings are as follow: In model 1, there exists a negative relationship between price of equity and population percentage of age (15-64); there exists a negative and significant relationship between price of equity and population percentage of age (65 and above); there exists negative relationship between price of equity and dependency ratio; and there exists a negative and significant relationship between price of equity and gross saving rate. While in model 2, there exists a negative relationship between treasury bill rate and population percentage of age (15-64) which represents the working class of the population; there exists a positive and significant relationship between treasury bill rate and population percentage of age (65 and above); there exists negative relationship between treasury bill rate and dependency ratio; and there exists a negative relationship between treasury bill rate and gross saving rate. Based on the foregoing findings the study therefore recommends:that government needs to improve on working population conditions of service to encourage them to invest in both equity and treasury bills; that ageing population who are the risk averters should be encouraged by government through frequent issuing of treasury bills to raise funds for developmental objectives; and that government should relief the working population of their dependency burden so that it will enhance them to invest more on equity and treasury bills.

Keywords: Price per equity, Treasury bill rate, Age (0-14), Age (15-64), Age(65 and above) and Dependency ratio

1.0 INTRODUCTION

The word “demographics” comes from the Ancient Greek: “demo” meaning people and “graphics” meaning measurement. There is a strong tradition of studying demography as part of economics. Malthus’s writings on population growth are a part of many history-of-thought courses in economics. More recently, as the economy has moved from financial crisis and the Great Recession to sustainable expansion, attention has shifted from cyclical aspects of the economy to structural factors. In addition, as policy has begun to normalize, the question has been raised: What is normal? To answer such a question, we need to understand how the underlying fundamentals of the economy are evolving. A critical factor is demographics (Mester, 2018).

Demographic change can influence the underlying growth rate of the economy, structural productivity growth, living standards, savings rates, consumption, and investment; it can influence the long-run unemployment rate and equilibrium interest rate, housing market trends, and the demand for financial assets. Moreover, differences in demographic trends across countries can be expected to influence current account balances and exchange rates. So to understand the global economy, it helps to understand changing demographics and the challenges they pose for monetary and fiscal policymakers (Mester, 2018).

Demographic change is one of the most important determinants of the future economic and social landscape. Many researchers have looked into how changes in the size and the composition of an economy’s population influence macroeconomic outcomes. The channels through which demographic changes affect an economy typically include savings and investment behaviors, labor market decisions, and aggregate demand and supply responses. In the medium to long run, both changes in the labor supply and changes in productivity—either viewed as exogenous or caused by demographic changes—could significantly alter an economy’s aggregate supply and thereby economic growth, since demographic changes affect the amount and combination by which its factor inputs are utilized. In the short run, demographic transitions are likely to affect aggregate demand, since the amount of consumption and investment would depend critically on structural changes in the population’s age-earnings profiles. On the macroeconomics side, demographic issues have been most widely dealt with in the context of economic growth. In the textbook treatment of growth theories, the growth rate of population is taken as exogenous and serves as a starting point for growth in real activities (IMF, 2014).

Until the early 18th century, world population grew little because high mortality rates offset high fertility rates (Aaronson, 2015). But increased knowledge and technological

change in the form of advances in medicine, public health, and nutrition began to lower mortality rates. Fertility rates also began to decline. In the United States there were shifting preferences for smaller families because of the rising opportunity costs of having children and the higher costs of raising and educating them. The shift in population from rural to urban areas reduced the need for large families to run farms. There were changes in social norms regarding the use and availability of birth control. The baby boom in the United States after World War II, and the subsequent echo when the baby boom generation began having their own children, were exceptions to a generally downward trend in the birth rate. The U.S. fertility rate is 1.88 births per woman (United Nations 2017: 807). This is less than the United Nations' estimated 2.1 replacement rate needed to keep the population stable, and it is considerably less than the fertility rate in 1900, which was over 3 (Aaranson et al, 2014).

Older people tend to hold more assets than the young and tend to be creditors while drawing down their assets to fund their consumption during retirement. Younger people tend to be borrowers but face tighter credit constraints than the old because they hold fewer assets. As the share of the population shifts from young to old, the propagation of an interest rate change through the economy is likely to change. There will be a smaller share of young borrowers able to take advantage of a decrease in interest rates but a larger share of older people who benefit from higher asset prices; similar reasoning applies for an increase in interest rates. Demographic change may mean that wealth effects become a more important channel through which monetary policy affects the economy (Bean 2004, Imam 2013).

Reflecting projections of relatively stable fertility rates and continued aging of the population, world population growth is expected to slow. It averaged around 2 percent per year in the latter half of the 1960s and slowed to 1.2 percent per year over 2010–15 (United Nations 2017: 3). U.S. population growth, including net international migration, is expected to slow from about 0.8 percent in recent years to under 0.5 percent in 2050, with nearly two-thirds of that growth coming from net migration. A number of advanced economies are further along in this demographic transition than the United States is, and the process of population aging is accelerating worldwide (Bloom and Canning, 2004). In Japan, the population has been shrinking over the past five years, the ratio of older people to working-age people is the highest in the world, and the median age is almost 47 years old (United Nations 2017: 415).Across Europe, fertility rates have been below the replacement level for some time (United Nations 2017). In China, the growth rate of the working-age population has slowed since the late 1980s, and, partly because of its previous one child policy, China's population is also rapidly aging (United Nations 2017: 191; Peng 2011). The median age in China has increased from around 19 years in 1970 to 37 years in 2015. On the other hand,

many low- and middle-income countries are at a considerably earlier phase in the demographic transition, with young and faster-growing populations, and rising labor force participation rates. In India, the median age is around 27 years and the annualized growth rate of the population from 2010 to 2015 has been 1.2 percent (United Nations 2017: 383). The United Nations projects that, in seven years, the population of India will surpass that of China, currently the most populous country, and that India's population will continue to grow through 2050. Much of the increase in world population between now and 2050 is projected to be in Africa, where fertility rates remain high.

Although some studies have tried to explain the determination of asset prices purely in terms of age-related variables, there are others who have argued in favour of assessing the impact of demography by controlling for macroeconomic effects (Brooks, 2006; Davis and Li, 2003; Poterba, 2004). It is amply evident from the literature that macroeconomic variables interact with asset prices and, therefore, ignoring their effects may lead to biased conclusions about the impact of demographic transition on asset prices.

This study was motivated as a result of various studies from developed countries on the impacts of demographic factors on assets price while similar studies attracted low attention from developing countries. The current study therefore aimed at investigating demographic changes and its implication for asset prices and the macroeconomy in Nigeria from 1988 to 2020.

The broad objective of this study examined the effects of demographic changes on assets prices and macroeconomy. Specifically, the study:

i. examined the impact of working age population on assets prices and the macroeconomy;
ii. investigated the relationships between ageing and assets prices and the macroeconomy; and
iii. adjudged the impact of dependency ratios on asset prices and the macroeconomy.

The rest of the paper discussed the related literatures, stated the methodology, analysed and interpreted data, summarised and discussed the findings, as well as concluded and made necessary policy recommendations.

2.0 REVIEW OF RELATED LITERATURE

This chapter reviewed related theoretical and empirical literatures addressing issues on demographics dynamics and assets prices. Finally, this chapter summarized the relevant literatures under review.

Conceptual review:

Dependency ratio

The dependency ratio is an age-population ratio of those typically not in the labor force (the *dependent* part ages (0 to 14 and 65+) and those typically in the labor force (the *productive* part ages 15 to 64). It is used to measure the pressure on the productive population. Consideration of the dependency ratio is essential for governments, economists, bankers, business, industry, universities and all other major economic segments which can benefit from understanding the impacts of changes in population structure. A low dependency ratio means that there are sufficient people working who can support the dependent population. A lower ratio could allow for better pensions and better health care for citizens. A higher ratio indicates more financial stress on working people and possible political instability. While the strategies of increasing fertility and of allowing immigration especially of younger working age people have been formulas for lowering dependency ratios, future job reductions through automation may impact the effectiveness of those strategies. As the ratio increases there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. This results in direct impacts on financial expenditures on things like social security, as well as many indirect consequences. The (total) dependency ratio can be decomposed into the child dependency ratio and the aged dependency ratio.

Ageing population

The rapid aging of the population has important macroeconomic effects. The first effect is the impact on the labor market through a shrinking labor force and an increasing share of older workers in the labor force. The second is the impact on the capital market due to falling household and national savings ratios, coupled with the rising ratio of retired people to working-age people. In addition, a shrinking labor force will affect investment and thus the financing of capital. The third effect is the fiscal impact, with an increasing share of the elderly causing substantial transfers of income from the working to the retired generation through the tax and social security systems. These impacts eventually affect both investment and savings, and thus the current external account (Yashiro and Oishi, 1996).

High dependency ratios can lead to long-term economic changes within the population such as saving rates, investment rates, the housing markets, and the consumption patterns. Typically, workers will start to increase their savings as they grow closer to retirement age, but this will eventually affect their long-term interest rates due to the retirement population increasing and the fertility rates decreasing. If the demographic population continues to follow this trend, their savings will decrease while their long-term interest rates increase. Due

to the saving rates decreasing, the investment rate will prevent economic growth because there will be less funding for investment projects. There is a correlation between labor force and housing markets, so when there is a high age-dependency ratio in a country, the investments in housing markets will decrease since the labor force is decreasing due to a high dependency population (Santacreu, 2016).

Asset Price

In financial economics, asset pricing refers to a formal treatment and development of two main pricing principles together with the resultant models. There have been many models developed for different situations, but correspondingly, these stem from either general equilibrium asset pricing or rational asset pricing.

Under General equilibrium theory prices are determined through market pricing by supply and demand. Here asset prices jointly satisfy the requirement that the quantities of each asset supplied and the quantities demanded must be equal at that price - so called market clearing.

Rational pricing is the assumption in financial economics that asset prices - and hence asset pricing models - will reflect the arbitrage-free price of the asset as any deviation from this price will be "arbitraged away". This assumption is useful in pricing fixed income securities, particularly bonds, and is fundamental to the pricing of derivative instruments.

Age Structure and Dependency Burdens

According to Todaro and Smith (2011), in the less developed countries, the population is moderately young. Children under the age of 15 make up over 30 percent of the total population of less developed countries, but only 17 percent of developed nations. Indeed, at least ten less developed countries have over 44 percent of their population under the age of fifteen; by 2009, 43 percent of Ethiopia's population, 45 percent of Nigeria's population, and 38 percent of Pakistan's population was under fifteen; by both India and Mexico, 32 percent is comparable. The youth dependency ratio – the proportion of youth (under 15) to economically active adults (age 15 to 64) – is very high in countries with such an age structure. The labor force must therefore help nearly twice as many children in less developed countries as it does in the more developed countries. The workforce age group (15 to 64) is approximately 68 percent of the total population in North America. As youthful dependents, this workforce must support about 20 percent of the population. About 15 percent of the population in Europe is under the age of 15, with a comparable number over the age of 65, leaving about 69 percent in the age group of 15 to 64. Japan and at least nine European countries have a population of over 17 percent over 65 years of age. The main problems in

more developed countries are more related to their low population growth and old age dependents (over 65 years of age). In contrast, the economic labor force in sub-Saharan Africa accounts for about 54 percent of the total population (only 3 percent of the population is over 65 years of age). Generally, the faster the rate of population growth, the greater the proportion of dependent children in the overall population, and the harder it is for people who work to care for those who are not.

Saving Rate

The savings rate is a measurement of the amount of money, expressed as a percentage or ratio that a person deducts from their disposable personal income to set aside as a nest egg or for retirement. In economic terms, saving is a choice to forego some current consumption in favour of increased future consumption, so the savings rate reflects a person or group's rate of time preference. The savings rate is also related to the marginal propensity to save. (https://www.investopedia.com/terms/s/savings-rate.asp)

Theoretical review:

The Life-Cycle Hypothesis (LCH)

The life-cycle hypothesis (LCH) is an economic theory that describes the spending and saving habits of people over the course of a lifetime. The theory states that individuals seek to smooth consumption throughout their lifetime by borrowing when their income is low and saving when their income is high. The concept was developed by economists Franco Modigliani and his student Richard Brumberg in the early 1950s. It assumes that individuals plan their spending over their lifetimes, taking into account their future income. Accordingly, they take on debt when they are young, assuming future income will enable them to pay it off. They then save during middle age in order to maintain their level of consumption when they retire.

The Life-Cycle Hypothesis (LCH) makes several assumptions. For example, the theory assumes that people deplete their wealth during old age. Often, however, the wealth is passed on to children, or older people may be unwilling to spend their wealth. The theory also assumes that people plan ahead when it comes to building wealth, but many procrastinate or lack the discipline to save. Another assumption is that people earn the most when they are of working age. However, some people choose to work less when they are relatively young and to continue to work part-time when they reach retirement age. As a result, one implication is that younger people are more able to take on investment risks than older individuals, which remains a widely accepted tenet of personal finance. Other assumptions of note are that those

with high incomes are more able to save and have greater financial savvy than those on low incomes. People with low incomes may have credit card debt and less disposable income. Lastly, safety nets or means-tested benefits for the elderly may discourage people from saving as they anticipate receiving a higher social security payment when they retire.

Asset-Meltdown Hypothesis

The asset meltdown hypothesis stipulates that when a large cohort retires and seeks to sell their assets to finance their consumption in retirement, they must sell their assets to subsequent cohorts that are smaller in numbers. This postulates a direct link between demographic developments and the level of asset prices. In particular, proponents of this hypothesis argue, when baby boomers start entering retirement they will become net sellers of financial assets to finance retirement consumption. As subsequent generations are smaller in numbers, other things equal, this would put downward pressure on financial asset prices.

Capital Asset Pricing Model (CAPM)

The capital asset pricing model is an idealized portrayal of how financial markets price securities and thereby determine expected returns on capital investments. The model provides a methodology for quantifying risk and translating that risk into estimates of expected return on equity. A principal advantage of CAPM is the objective nature of the estimated costs of equity that the model can yield. CAPM cannot be used in isolation because it necessarily simplifies the world of financial markets. But financial managers can use it to supplement other techniques and their own judgment in their attempts to develop realistic and useful cost of equity calculations. Modern financial theory rests on two assumptions: (1) securities markets are very competitive and efficient (that is, relevant information about the companies is quickly and universally distributed and absorbed); (2) these markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments. The first assumption presumes a financial market populated by highly sophisticated, well-informed buyers and sellers. The second assumption describes investors who care about wealth and prefer more to less. In addition, the hypothetical investors of modern financial theory demand a premium in the form of higher expected returns for the risks they assume (Mullins, 1982).

Although these two assumptions constitute the cornerstones of modern financial theory, the formal development of CAPM involves other, more specialized limiting assumptions. These include frictionless markets without imperfections like transaction costs, taxes, and restrictions on borrowing and short selling. The model also requires limiting assumptions

concerning the statistical nature of securities returns and investors' preferences. Finally, investors are assumed to agree on the likely performance and risk of securities, based on a common time horizon.

Empirical review:

The empirical work investigating the relationship between asset prices and demographic changes has adopted a two-fold approach. The first method examines microeconomic evidence on composition of asset demand across various age classes and estimates the impact of shifting population weights on asset prices; the second assesses the influence of demographic shift on asset returns using time series models (Bosworth, Bryant, and Burtless, 2004). The approach followed by most empirical studies rests on the fundamental assumption that with changes in age, individuals' choices of portfolio vary; however, this assumption is not in accord with most models of portfolio allocation. Merton (1969) and Samuelson (1969) suggest that optimal portfolio allocation of an investor is independent of his age. Thus, this view conflicts with the more popular approach to asset prices, that is, investors gradually reduce their portfolio in risky assets as they age (Canner, Mankiw, and Weil, 1997). The relationship between population and asset prices was also demonstrated by Cohn, Wilbur, Lease, and Schlarbaum (1975) who argued that risk aversion is related to demographic variables such as age, gender, and marital status of an individual. Further, age structure is observed to play a prominent role in influencing portfolio selection behaviour of an investor (Morin and Suarez, 1983). The theoretical notion that age composition causes changes in asset prices was empirically examined by Mankiw and Weil (1989). They demonstrated that housing demand significantly increases for the age group 20–35 years and then declines for subsequent age groups. An adequate number of empirical studies provide plausible arguments that demographic structure, specifically ageing population, could have a significant negative impact on financial asset prices, supporting the claim that demographic changes influence asset Brooks, 2006; Davis and Li, 2003; Goyal, 2004; Park, 2010; Saita, Shimizu, and Watanabe (2016) investigated the relationship between ageing and asset prices. The authors use regional panel data for Japan and the USA real estate prices and estimate the effects of demographic factors, such as dependency ratio, i.e. the ratio of population aged 65+ to population aged 20-64. For Japan, as no region-by-region quality-adjusted housing price indexes covering the entire country exist, data are constructed by conducting quality adjustment using hedonic regression. Findings indicate that both in Japan and the USA, real estate prices in a region are inversely correlated with the old age dependency ratio in that region, and positively correlated with the total number of population in that region. The demographic factor had a greater impact on real estate prices in Japan than in the USA. For

Japan, it was also found that demographic impact on land prices will be -2.4 per cent per year in 2012-2040, while it was -3.7 per cent per year in 1976-2010, suggesting that aging will continue to have downward pressure on land prices over the next 30 years, although the demographic impact will be slightly smaller than it was in 1976-2010, as the old age dependency ratio will not increase as much as it did before.

Li (1996) presents an analysis of the relationship between population size and market demand in China. It is argued that a smaller elasticity of a product is related to a greater impact of the size of population on the consumption of such a product. Greater elasticity reduces the impact of population. The impact of population is also mediated by average salary and salary structure. Salary structure affects prices, and prices affect supply and demand, which affect consumption. In a market-oriented economic system, the impact of population size on market demand affects supply and demand and prices. Current market demand reflects the effect of supply and demand in previous periods. Current population size will affect future market demand through prices and supply elasticity. Population changes are slow, and consumption changes are slow. The slowness of the process of change means there is time to adjust production and distribution in order to achieve stability in market supply. Control of price increases and inflation will promote economic growth, social stability, and improvement in China's socialist market economic system. It is argued that the supply of bicycles is elastic. Despite increased investment, labor, and fixed assets, profits will not grow. However the entertainment industry, as well as education, public welfare, urban utilities, noncommercialized housing, and telephones are less elastic. A large consumer population and a smaller supply elasticity result in high costs of installation, which are made higher by the state monopoly. It is argued that in China it is necessary to regulate certain necessities with less market elasticity in order to be consistent with optimum allocation of resources.

Bloom, Cunning, and Fink (2010) find that population aging will tend to lower labor force participation and savings rates, raising concern about a slowing of economic growth, but behavioral responses (including greater female labor-force participation) and policy reforms (including an increase in the legal age of retirement) can mitigate the adverse economic consequences of an older population.

Goyal (2004) is the first one who considers stock market out-flows as a dependent variable. He finds that stock market out-flows are positively correlated with the age 65+ proportion of the population and negatively correlated with the prime working age (45-64) proportion of the population. Furthermore, population structure adds explanatory power to equity risk premium regressions. Population structure also adds explanatory power to the

investment/savings rate for the US economy. Finally, international demographic changes have some power in explaining international capital flows.

Davis (2006) conducts empirical work based on the experience of 72 countries (of which 23 are OECD countries, 36 are emerging market economies, and 13 are transition economies). Viewed in the light of the existing literature, he suggests that demographic changes have had a detectable impact on financial structure. He finds a significant positive effect of the proportion of those aged 40-64 on equities, consistent with risk aversion effects.

Park and Rhee (2007) consider the size of stock markets, which they measure as the aggregate value of listed stocks as a proportion of GDP, as the independent variable. They claim, however, that population composition variables such as the proportion of population aged 40-64 and the proportion aged 65 and over do not show a strong relationship with real stock returns. The proportion of population aged 65 and over has a negative relationship with real stock returns. The finding that the population between the age 40 and 64, who have a higher tendency to invest in stock and own greater financial wealth, does not correlate with real stock returns agrees with Poterba (2001). In one of their models in which only the population composition was considered as the explanatory variable, an increase in the proportion of elderly population (+65) considerably increases the size of stock markets.

Arnott and Chaves (2012) use dividend yields, three-month bill yields, and 10-year bond yields as control variables in their regressions. Their explanatory variables are the percentage of total population by age group and the change in these demographic shares. They estimate the joint effect of all demographic variables in the regressions through a polynomial model. One common theme emerges from all their analyses: large populations of retirees (65+) seem to erode the performance of financial markets as well as economic growth. This effect is less pronounced for bonds than equities, likely because they are sold later in retirement than stocks, based on widespread financial advice.

Favero et al. (2015) develop a simple model of the yield curve. They consider the ratio of middle-aged (40-49) to young (20-29) population in the US as the relevant demographic variable to determine the persistent component of interest rates. They also consider the performance of augmenting autoregressive models for nominal bond yields and continuously compounded annual inflation against a benchmark where the effect of demographics is forced to be nil. Their model predicts a negative correlation between their demographic variable and bond yields.

Brooks (2006) investigates the total return bond index and total return Treasury Bill index as the dependent variables. His research suggests that real bond and Treasury Bill prices are negatively and significantly related to the middle-aged cohorts (between ages 40-44 and 60-64). While, real Treasury bill prices are positively related to the age 65+ variable. These findings indicate that older investors may shift their financial asset holdings towards Treasury bills in retirement in order to reduce consumption risk.

Park (2007) shows that an increase in the population aged 65 and over increases the size of bond market. He claims that the positive correlation between the proportion of the elderly population and the size of bond market does not change if other explanatory variables are added.

3.0 METHODOLOGY

Research Design

This study employed descriptive survey search design. This study examined how an independent variable affects a dependent variable. Thus, this study used independent variables as demographic factors – age(15-64), age (65 and above), dependency ratio with economic factor such as gross saving rate as control variable and dependent variable as asset price. We therefor use financial assets which include equity price and treasury bill rate as dependent variable for each model and relate it with the demographic factors as independent variables.

Model Specification

The two models in this study were based on Life Cycle Hypothesis theory and a modification of the works of Bosworth, Bryant, and Burtless, (2004) and that of Yumi, Chihiro, Tsutomu (2016), which investigated the relationship between ageing and asset prices.

Model 1:

$$PPE = f(AGE(15-64), AGE(65+), DPR, GSR) \ldots\ldots\ldots\ldots\ldots\ldots \quad (1a)$$

$$PPE = \propto_0 + \propto_1 AGE(15-64) + \propto_2 AGE(65+) + \propto_3 DPR + \propto_4 GSR + \mu \ldots\ldots\ldots\ldots\ldots (1b)$$

Expectation Apriori: $\propto_1 > 0; \propto_2 < 0; \propto_3 < 0; \propto_4 > 0$

Null Hypothesis, H_0: $\propto_1 = \propto_2 = \propto_3 = \propto_4 = 0$

Where:

PPE = Annual Price Per Equity in Naira

AGE (15-64) = Working class population in percentage

AGE (65 and Above) = Ageing population in percentage

DPR = Dependency ratios

GSR = Gross Saving Rate

μ = Error term/Stochastic variable

Model 2:

$$TBR = f(\ AGE(15-64), AGE(65+), DPR, GSR) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2a)$$

$$TBR = \beta_0 + \beta_1 AGE(15-64) + \beta_2 AGE(65+) + \beta_3 DPR + \beta_4 GSR + \varepsilon \ldots\ldots\ldots\ldots\ldots (2b)$$

Expectation Apriori: $\beta_1 > 0; \beta_2 < 0; \beta_3 < 0; \beta_4 > 0$.

Null Hypothesis, H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

TBR indicates Treasury Bill Rates while ε is Error term/Stochastic variable

Sources of Data

The data for the study were obtained secondarily from different sources: All Age distributions and Gross Saving Rates were obtained from World Development Indicators (WDI) of Word Bank, Equity Prices were obtained from Statistical Bulletin of Central Bank of Nigeria, while Treasury Bill Rates were obtained from International Financial Statistics of International Monetary Funds.

Estimation Methods and Techniques

The results of the unit root tests for all the variables in each of the above stated models determined the estimation methods and techniques used for this study.

4.0 DATA ANALYSIS AND INTERPRETATION

The section analyzed data for this study and presented results with appropriate interpretation and discussion.

Descriptive Statistics

Table 4.1: Descriptive Statistics of the Demographic, Economics and Asset Prices

	PPE	TBR	AGE 0 14	AGE 15 64	AGE 65	DEPR	GSR
Mean	388.4649	12.71667	44.11837	53.07664	2.804998	0.884237	0.043904
Median	229.8615	14.34000	44.03521	53.22643	2.769456	0.878766	-0.066298
Maximum	1226.653	19.03000	45.20935	53.77433	2.900177	0.926759	2.786207
Minimum	0.838518	1.630000	43.48761	51.90062	2.735548	0.859624	-4.677963
Std. Dev.	391.5551	4.654650	0.464542	0.507200	0.062073	0.018176	1.256596
Skewness	0.857652	-0.707398	0.936834	-0.980113	0.385296	1.007302	-1.134309
Kurtosis	2.389955	2.442962	2.954665	2.923839	1.430087	2.968645	7.693000
Jarque-Bera	4.557332	3.178920	4.829940	5.291397	4.205354	5.581962	37.35995
Probability	0.102421	0.204036	0.089370	0.070956	0.122129	0.061361	0.000000
Sum	12819.34	419.6500	1455.906	1751.529	92.56492	29.17981	1.448840
Sum Sq. Dev.	4906091.	693.3045	6.905570	8.232045	0.123297	0.010571	50.52908
Observations	33	33	33	33	33	33	33

Source: Author's Computation from E-view 12.

The results of the descriptive statistics as shown in table 4.1 suggest that the average price per equity for the period under study (1988 – 2020) is N388.47. The maximum and minimum prices per equity are N1,226.65 and N0.84 respectively. The maximum of N1,226.65 was obtained in the year 2017 owing to the facts that Nigeria needs to break government monopoly across all infrastructure sectors, including rail transportation, power transmission, gas pipelines, oil refining, education and health, among others, and take immediate practical steps to open them up to foreign investment as part of economic policy to come out of recession experienced in 2016 . The minimum of N0.84 was obtained in the year 1989 as aftermath of the economic crisis created by adoption of structural adjustment programme in 1986 – characterized by low productivity in all sectors of the economy, acute scarcity of food and other essential commodities, an embarrassingly high level of inflation, high level of unemployment, near-total collapse of social services, including education, health care, transportation, communications, etc., and general deterioration in the standard of living of the vast majority of the people. The probability of the Jarque-Bera statistics (0.102421) suggests that the data are normally distributed.

The average treasury bill rate for the period under study was approximately 12.72. The maximum and minimum treasury bill rates are 19.03 and 1.63 respectively. The maximum 19.03 treasury bill rate was recorded in the year 2002, owing to good performance

of nearly all sectors of Nigeria economy in 2001 as well as the building and construction sector gained from activities of the federal and state governments in road and bridges construction and maintenance, rehabilitation and refurbishment of sea and airports, as capital spending of the federal and state governments increased while the minimum 1.63 treasury bill rate was observed in the year 2020 due to outbreak of Covid 19 pandemic that caused global distortion of business operations generally and Nigeria capital market operations specifically. The probability of the Jarque-Bera statistics (0.204036) suggests that the data are normally distributed.

The average percentage of the population of age (0-14) for the period under study was approximately 44.12%. The maximum and minimum percentages of the population of age (0-14) are 45.20935 % and 43.48761% respectively. The maximum 45.20935 % of age (0-14) was recorded in the year 1988, while the minimum 43.48761% of age (0-14) was observed in the year 2020 due to outbreak of Covid 19 pandemic as well as improved in maternal and child health, safe family planning and biotechnology that help in decline birth rate. The probability of the Jarque-Bera statistics (0.089370) indicates that the data are normally distributed.

The average percentage of the population of age (15-64) for the period under study was approximately 53.08%. The maximum and minimum percentages of the population of age (15-64) are 53.77433 % and 51.90062 % respectively. The maximum 45.20935 % of age (15-64) was recorded in the year 2020, while the minimum 51.90062 % of age (15-64) was observed in the year 1988 as result of increase in unemployment rate among the working class caused by aftermath of adoption of 1986 structural adjustment program (SAP) in Nigeria . The probability of the Jarque-Bera statistics (0.070956) shows that the data are normally distributed.

The average percentage of the population of age (65 and above) for the period under study was approximately 2.80%. The maximum and minimum percentages of the population of age (65 and above) are 2.900177 % and 2.735548% respectively. The maximum 2.900177 % of age (65 and above) was recorded in the year 1992, while the minimum 2.735548% of age (65 and above) was observed in the year 2015. The probability of the Jarque-Bera statistics (0.122129) indicates that the data are normally distributed.

The average dependency ratio for the period under study was approximately 0.88424 The maximum and minimum dependency ratios are 0.926759 and 0.859624 respectively. The maximum value of the dependency ratio occurred in the year 1988 while the minimum value

recorded in the year 2020. The probability of the Jarque-Bera statistics (0.061361) shows that the data are normally distributed.

The average gross saving rate for the period under study was approximately 0.043904 The maximum and minimum dependency ratios are 2.786207 and -4.677963 respectively. The maximum value of the gross saving rate occurred in the year 2010 while the minimum value recorded in the year 1999. The probability of the Jarque-Bera statistics (0.000000) shows that the data are not normally distributed.

Unit Root Test

Table 4.2: Phillips-Perron Test Statistic

Variable	Levels	1st Difference	2nd Difference	Order of Integration
PPE	-2.943466	-7.9544994***	-	I (1)
	(-3.557759)	(-3.562882)		
TBR	-2.355430	-5.317948***	-	I (1)
	(-3.557759)	(-3.562882)		
AGE (15-64)	-1.783005	-1.556528	-11.20252***	I (2)
	(-3557759)	(-3.562882)	(-3.562882)	
AGE (65and ABOVE)	-1.330750	-4.004345**	-	I (1)
	(-3.557759)	(-3.562882)		
DEPR	-1.801632	-1.574356	-11.41012***	I (2)
	(-3.557759)	(-3.562882)		
GSR	-5.094643***	-	-	I (0)
	(3.557759)			

Source: Author's Computation from E-View 12 Software (*** represents 1% probability level and ** represent 5% probability level)

From table 4.2, the unit root tests at constant and linear trend measured the stationary state of the time series data in the study. Gross saving is stationary at level, price per equity, treasury bill rates, and age 65 and above are stationary at first difference, while age (15-64), and dependency ratios are stationary at second difference.

4.3 Johansen Co-integration Test

Given the non-stationarity of some of the variables in the two models, Johansen co-integration test was carried out for variables in model 1 and 2.

Table 4.3a: Johansen Co-integration result for Variables in Model 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.629709	96.52323	88.80380	0.0124
At most 1 *	0.509391	65.72576	63.87610	0.0347
At most 2 *	0.477648	43.65040	42.91525	0.0421
At most 3	0.362710	23.51859	25.87211	0.0955
At most 4	0.265183	9.552127	12.51798	0.1490

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.629709	30.79747	38.33101	0.2821
At most 1	0.509391	22.07536	32.11832	0.4875
At most 2	0.477648	20.13181	25.82321	0.2356
At most 3	0.362710	13.96646	19.38704	0.2564
At most 4	0.265183	9.552127	12.51798	0.1490

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's Computation from E-View 12 Software

Table 4.3b: Johansen Co-integration result for Variables in Model 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.646196	91.57981	88.80380	0.0310
At most 1	0.543167	59.37039	63.87610	0.1129
At most 2	0.384066	35.08385	42.91525	0.2416
At most 3	0.332766	20.06075	25.87211	0.2229
At most 4	0.215341	7.517689	12.51798	0.2936

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.646196	32.20942	38.33101	0.2133
At most 1	0.543167	24.28654	32.11832	0.3300
At most 2	0.384066	15.02310	25.82321	0.6324
At most 3	0.332766	12.54306	19.38704	0.3663
At most 4	0.215341	7.517689	12.51798	0.2936

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's Computation from E-View 12 Software

The results of the cointegration tests are presented in Table 4a for variables in the model 1 at their various levels of stationarity. The trace and maximum eigenvalues test statistics indicate that the hypothesis of no cointegration among the variables is rejected at the 5% significance level. From the result, Trace test indicates 3 cointegrating equations at the 0.05 level. While maximum engenvalue statistics indicates no cointegrating equation. Also, the results of cointegrating tests are presented in Table 4b for variables in the model 2 at their various level of stationarity. The trace and maximum eigenvalues test statistics indicate that the hypothesis of no cointegration among the variables is rejected at the 5% significance level. From the result, there are 1cointegrating equations based on trace test and no cointegrating equations based on maximum engenvalue statistics. The existence of a stable long-run equilibrium relationship among the variables in model 1b and 2b necessitates the use of the Error Correction Mechanism (ECM) for selected model. The Error Correction Mechanism will show the speed of adjustment and the average time it will take for short-run distortions in the relationship to be corrected.

4.4 Ordinary Least Square Results

Table 4.4a: Regression Analysis of Equation 1b with Price per Equity (PPE) as Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	639706.3	655346.0	0.976135	0.3374
AGE_15_64_	-8063.425	8429.738	-0.956545	0.3470
AGE__65__	-6753.302	947.3545	-7.128591	0.0000
DEPR	-217579.9	235525.0	-0.923808	0.3635
GSR	-73.99585	32.55820	-2.272726	0.0309

R-squared	0.721651	Mean dependent var	388.4649
Adjusted R-squared	0.681887	S.D. dependent var	391.5551
S.E. of regression	220.8430	Akaike info criterion	13.77151
Sum squared resid	1365605.	Schwarz criterion	13.99825
Log likelihood	-222.2299	Hannan-Quinn criter.	13.84780
F-statistic	18.14829	Durbin-Watson stat	0.821271
Prob(F-statistic)	0.000000		

Source: Author's Computation from E-View 12 Software

Table 4.4a shows the regression analysis of the equation 1b with price per equity as dependent variable. The coefficient of determination (R-square) and adjusted R-square are 0.721651 and 0.681887 respectively. The foregoing result indicates that 72% of the

independent variables of this model explained the variations in the dependent variable. The F-statistic value is 18.14829 and significant at the probability level of 1%. – shows the best fits of the model.

The coefficient of age (15-64) is (-8063.425) and not significant. Thus the foregoing result implies that 1% increase in age (15-64) leads on average to 8063% decrease in price of equity in Nigeria within the period of study. There exists a negative relationship between price of equity and population percentage of age (15-64) which represents the working class of the population. Thus, this result indicates that working class within Nigeria economy have negative influence on the prices of equities in Nigeria capital market.

The coefficient of age (65 and above) is (-6753.302) and significant at 1% probability level. Thus the foregoing result implies that 1% increase in age (65 and above) leads on average to 6753% decrease in price of equity in Nigeria within the period of study. There exists a negative relationship between price of equity and population percentage of age (65 and above). The foregoing result shows that age (65 and above) in Nigeria have negative impacts on the prices of equities in Nigeria capital market.

The coefficient of dependency ratio is (-217579.9) and not significant. Thus the foregoing result implies that 1% increase in dependency ratio leads on average to 217580% decrease in price of equity in Nigeria within the period of study. There exists negative relationship between price of equity and dependency ratio. The foregoing result shows that dependency rates in Nigeria have negative impacts on the prices of equities in Nigeria capital market.

The coefficient of gross saving rates is (-73.99585) and significant at 5% probability level. Thus the foregoing result implies that 1% increase in gross saving rate leads on average to 74% decrease in price of equity in Nigeria within the period of study. There exists a negative relationship between price of equity and gross saving rate. This result implies that increase in gross saving rates have negative influence on the prices of equities in Nigeria capital market.

Table 4.4b: Regression Analysis of Equation 2b with Treasury Bill Rate as Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3306.522	8332.100	0.396841	0.6945
AGE_15_64_	-44.27807	107.1761	-0.413134	0.6827
AGE__65__	70.53781	12.04471	5.856331	0.0000
DEPR	-1290.963	2994.476	-0.431115	0.6697
GSR	-0.369077	0.413946	-0.891606	0.3802

R-squared	0.681603	Mean dependent var	12.71667
Adjusted R-squared	0.636118	S.D. dependent var	4.654650
S.E. of regression	2.807808	Akaike info criterion	5.041412
Sum squared resid	220.7460	Schwarz criterion	5.268156
Log likelihood	-78.18330	Hannan-Quinn criter.	5.117705
F-statistic	14.98514	Durbin-Watson stat	1.006621
Prob(F-statistic)	0.000001		

Source: Author's Computation from E-View 12 Software

Table 4.4b shows the regression analysis of the equation 2b with treasury bill rates as dependent variable. The coefficient of determination (R-square) and adjusted R-square are 0.681603 and 0.636118 respectively. The foregoing result indicates that 68% of the independent variables of this model explained the variations in the dependent variable. The value F-statistic is 14.98514 and significant at 1% probability level – indicates the best fits of the model.

The coefficient of age (15-64) is (-44.27807) and not significant. Thus the foregoing result implies that 1% increase in age (15-64) leads on average to 44% decrease in treasury bill rate in Nigeria within the period of study. There exists a negative relationship between treasury bill rate and population percentage of age (15-64) which represents the working class of the population. Thus, this result indicates that working class within Nigeria economy have negative influence on the treasury bill rate in Nigeria capital market.

The coefficient of age (65 and above) is 70.53781 and significant at 1% probability level. Thus, the foregoing result implies that 1% increase in age (65 and above) leads on average to 71% increase in treasury bill rate in Nigeria within the period of study. There exists a positive relationship between treasury bill rate and population percentage of age (65 and above). The foregoing result shows that age (65 and above) in Nigeria have positive impacts on the treasury bill rate in Nigeria capital market.

The coefficient of dependency ratio is (-1290.963) and not significant. Thus the foregoing result implies that 1% increase in dependency ratio leads on average to 1291% decrease in treasury bill rate in Nigeria within the period of study. There exists negative relationship between treasury bill rate and dependency ratio. The foregoing result shows that dependency rates in Nigeria have negative impacts on the treasury bill rate in Nigeria capital market.

The coefficient of gross saving rates is (-0.369077) and not significant. Thus, the foregoing result implies that 1% increase in gross saving rate leads on average to 0.37% decrease in treasury bill rate in Nigeria within the period of study. There exists a negative relationship between treasury bill rate and gross saving rate. This result implies that gross saving rates have negative influence on the treasury bill rate in Nigeria capital market.

4.5 Discussion of Findings

Model 1:

There exists a negative relationship between price of equity and population percentage of age (15-64). Thus, the working class of Nigeria population contributed to decline in equity price. This findings support the work of Morin and Suarez (1983), which stated that age structure is observed to play a prominent role in influencing portfolio selection behaviour of an investor.

There exists a negative and significant relationship between price of equity and population percentage of age (65 and above). The foregoing result agreed with the works of Brooks, 2006; Davis and Li, 2003; Goyal, 2004; Park, 2010; Saita, Shimizu, and Watanabe (2016) that ageing population, could have a significant negative impact on financial asset prices, supporting the claim that demographic changes influence asset prices.

There exists negative relationship between price of equity and dependency ratio. The foregoing results agreed with the work of Poterba (2001) offered evidence of a weak influence of demographic variables on the returns on bonds and equities, thus weakening the claim of a significant role of demography in asset price determination.

There exists a negative and significant relationship between price of equity and gross saving rate. This is contrary to established literature that cash accumulated can be held as currency or bank deposits, or it can be put into investments (depending on various factors, such as the expected time until retirement) such as a money market fund, or a personal individual retirement account (IRA) composed of non-aggressive mutual funds, stocks, and bonds.

Model 2:

There exists a negative relationship between treasury bill rate and population percentage of age (15-64) which represents the working class of the population. The foregoing result agreed with the work of Brook (2006) which stated that real bond and Treasury Bill prices are

negatively and significantly related to the middle-aged cohorts (between ages 40-44 and 60-64).

There exists a positive and significant relationship between treasury bill rate and population percentage of age (65 and above). The foregoing result agreed with the work of Bakshi and Chen (1994) which stated that the risk behavior of financial market participants changes with age and they become more risk averse and prefer less risky assets as they grow older. In the same vein the result agreed with the work of Park (2007) which concluded that an increase in the population aged 65 and over increases the size of bond market. Since treasury bill is risk free, then the age (65 and above) investors in Nigeria prefer to invest in it. However, the result is contrary to the work of Arnott and Chaves (2012) which stated that large populations of retirees (65+) seem to erode the performance of financial markets as well as economic growth.

There exists negative relationship between treasury bill rate and dependency ratio. The foregoing result agreed with the work of Favero et al (2015) which predicts a negative correlation between the demographic variable and bond yields.

5.0 SUMMARY OF FINDINGS, CONCLUSION AND POLICY RECOMMENDATIONS

Summary of Findings

Having collected and analysed the data for this study, the following are findings: In model 1, there exists a negative relationship between price of equity and population percentage of age (15-64); there exists a negative and significant relationship between price of equity and population percentage of age (65 and above); there exists negative relationship between price of equity and dependency ratio; and there exists a negative and significant relationship between price of equity and gross saving rate. While in model 2, there exists a negative relationship between treasury bill rate and population percentage of age (15-64) which represents the working class of the population; there exists a positive and significant relationship between treasury bill rate and population percentage of age (65 and above); there exists negative relationship between treasury bill rate and dependency ratio; and there exists a negative relationship between treasury bill rate and gross saving rate.

Conclusion

The study attempts to examine the effect of working population on assets prices and macroeconomy and there was a negative effects between population percentage of age (15-64) which is the working population and asset prices for equity and treasury bills. This shows that working population within the Nigeria economy has contributed to decrease in prices of both equity and treasury bills in capital market. It therefore implies that Nigeria economy is not healthy. Also, the study investigated the relationship between the ageing population and assets price and there was a negative and significant relationship between population percentage of age (65 and above) and equity price while treasury bill recorded positive relationship with ageing population. The ageing population therefore prefer to invest in treasury bills than equity due to less risky feature of the former. Finally, the study adjudged the impact of dependency ratio on asset prices and there was negative impact for both equity price and treasury bill price on the dependency ratio. Thus dependency burden decline prices for both equity and treasury bills.

Policy Recommendations

The following policy recommendations emanated from the findings of this study.

i. That government needs to improve on working population conditions of service to encourage them to invest in both equity and treasury bills.
ii. That ageing population who are the risk averters should be encouraged by government through frequent issuing of treasury bills to raise funds for developmental objectives.
iii. That government should relief the working population of their dependency burden so that it will enhance them to invest more on equity and treasury bills

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