International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

# Impact of Age Population Structure on Transport Infrastructure Investments

**Michael Kwabena Ofori**

School of Finance and Economics, Jiangsu University, 301 Xuefu Road, Zhenjiang, China

**Abstract:** ***Investment in transport infrastructure has been widely utilized as an instrument for inducing economic growth. Such investment usually leads to the creation of jobs and an increase in per capita income attracted by the population age structure. The transportation system plays a crucial function in linking the Ghanaian market to the world community and to trade. Moreover, as being one of the countries with a positive increase in the economy by 2030, the local economy is heavily reliant on the road network for efficient transportation of citizens, products, and services. Therefore necessary to assessthe potential impact (age structure) on transport infrastructure investment. This study used data related to age population structure from 1990-2018 obtained from the World Data Bank. The study balancedthe relation and long term of transport infrastructure investment, inflation, gross domestic product and age group 20-34, 35-59, and 60+ and also their influence on each other in Ghana For this purpose, the Autoregressive Distributive Lag method (ARDL) was used. The results of this research show that there exist significant causal effects of either single-direction or bidirectional. Starting with the single causality, transport granger causes the 20-34 and 60+, from 35-59, 60+, GDP, and inflation to the 20-34 age group and from 60+ to GDP. Bidirectional causality between GDP and transport infrastructure investment. The long-run causality demonstrated that the groups significantly caused transport. This ascribed that there exists significant causality among the transport and the respective age groups.The demographic structure could affect transport infrastructure investment through various channels. This study concluded with discussions onpolicy implications.***

**Keywords:** Transport infrastructure; Transport infrastructure investment; GDP, Inflation

## 1. Introduction

The population of every country has played a significant role in its socio-economic development since World War I. During World War I, nations involved in the conflict lost a great number of their population. The fertility rate of most European countries which include Germany, France, Italy, Belgium, and the United Kingdom dropped drastically. After some years later, the world experienced another war, known as the Second World War. The world and most countries face such problems again in the 21st Century with regards to the unprecedented growing population. Due to the reduction in fertility rate and increased longevity of humans, a lot of economically developed countries tend to get closer to an era of an aging population (Harper & Leeson, 2008). Rapid Population boom refers to a greater dependency burden which forces the young populace to work to supplement the household earnings (Boadu, 2009).

According to World Health Organization (WHO), by 2050, the world will have a massive boost in the aging population from 12% in 2015 to 22%, making it a major problem for low level and middle-level economies since will be faced with many social problems such as health insurance for the aged and also the huge chunk of the country's budget must be spent to cater for the old population (WHO, 2018). Also, there has been some light thrown on the idea that the world's population as of 1800 will increase by 10 times in 2070 (Bongaarts, 2009). In his study, he observed that there will be an estimated increase in population from and this rapid growth in the future will be located in Africa and some parts of Asia. In principle, many demographic variables influence the need for infrastructure. It covers population growth, population trends (what level of demographic transition?), urbanization, age distribution (youth and elderly share). This same population age distribution focuses on young people, working people, and older folk.It is predicted that the planet will see a doubling of the people aged 65 and over between 2010 and 2040 (Kinsella & He, 2009). The population age is predicted to grow worldwide in 2015-2080 for over 60 years (Marešová, Mohelská, & Kuča, 2014). In their research, they observed thatmost developed countries have older people as compared to younger children. It affects tremendously on many aspects of life, such as economic prosperity, safety, infrastructure, education, travel, taxes, and employment.

The shifts in the age system not only have adverse economic implications but also potential incentives. The provision of resources for health services is expected to increase the independence of a growing aging demographic, among other issues. If medical technology allows us to live longer, but with low longevity, the ability to function is will. If people age and become involved for longer, the negative consequences become minimized (Marešová et al., 2014).The population of Africa is growing very fast with an expected 50 percent growth over the next few years. There is no exception that Ghana has a greater probability of suffering from such faith even though in the past decades, the rapid demographic development of the world is alarming. From the worldly point of view, differences in age group tend to change a country's economic status due to their capabilities, social and economic needs. Ghana has undergone a huge demographic transformation as well as economic changes due to policies implemented by different changes of government. Ghana is transitioned economically from a country with lower revenues into a country with a middle revenue. Ghana has recently been one of Africa's fastest rising economies and around the globe. In the eyes of automobility and urbanization, as it continues and always growing, there is less empirical evidence that Ghana is a nation prepared to counteract the movement challenges facing both the young and old populations. Ghana's population age structure is driven by two main factors, which are mortality and fertility as stated earlier. These

factors are also common determinants of the population around the world. Many young and older people faced with movement challenges must always look out for public transport services in Ghana.

The rising population and demand for transit networks are very critical to rural and urban areas. This has put considerable pressure on the transport industry, making it almost impossible to address the wants of the increasing populace. To recognize the contraction of economic growth in a region, more attention is paid to cities. That's because the city has the highest level of development that has changed its form, especially in most emerging countries. Accra is Ghana's capital and has a growing abundance of residents and cars with insufficient transport facilities, even as it is already a global urban problem. There have been few studies conducted in the field of transportation in developing countries since it's very difficult to obtain accurate and enough date for either quantitative or qualitative research.
There is a high cost involved in the investment in road infrastructure and for that reason, most of the Europeans involved in the slave trade focused on railway transportation, whereas observed that, a railway infrastructural investment created the huge profit returns they made in the early 1900s(Abuhamoud et al., 2011).In 1898, Ghana's first railway line was established. This railway line connected trading, mainly the transportation of gold from Takoradi to Tarkwa one of the large mining sites in Ghana. However, in 1905, Ghana began the transportation of palm fruits from Accra Harbour and Dodowa to Larteh on its first-ever established road transportation. The operation of the buses then began in early 1927, which transported people, mainly from Kumasi, Obuasi, Accra, and Takoradi(Information Section, 1957). Ever since then, there has been an improvement in the bus services by policies of previous governments. This includes the Metro Mass Transit (MMT) Limited, State Transport Company (STC), and many others. In recent times, the movement of goods and services in Ghana has been solely through road transportation.

This article is split into three sections. In the first segment, we briefly analysis the history and changes of Ghana's age structure. We review the impact of age structure on the transport infrastructure on Ghana's economy, comparing data obtained from a ten-year period, which will be able to help predict some future outcomes based on our findings in the subsequent sections.The part of a reliable and affordable road system in the socio-economic growth of Ghana cannot be misjudged. Transportation forms a significant fragment of the public security net, aiding the dissemination trade and job capital prospects in the city as well as agricultural societies.

## 2. Cast Study of Ghana Population-Transport Investment

The population of Ghana, pose a very challenging problem to the development of the country and until a population control measures are put in place, the nation's effort for development will be declined. Problems and issues originating from a rapid increase in population growth and urban development abound and are massive and frightening. A country with a large young population focuses on the provision of educational infrastructure, whereas a higher working age group focuses on the provision of public infrastructure for complementary inputs for private-sector production, and on the elderly population, it focuses on the need for an elderly-friendly infrastructure. Many industrialized economies face the issue of an aging workforce. In the United Kingdom, the proportion of the population over 65 years of age will rise in the next 15 years, as well as those beyond 80 years old will treble (Christensen, Doblhammer, & Vaupel, 2009).

Urban population growth has no doubt affected transport facilities in mostly Greater Accra and Kumasi Metropolis areas. In the past few decades, there has been a huge growth in migration, contributing to a sudden rise in the amount and scale of residents in several of Ghana's towns. This has called for an intermittent re-examination of the effects of the population age structure of transportation facilities in Ghana's cities, towns, and villages. The transport industry provides as high as 95% of transport services in the country even though the sector is dominated by the informal sector whose services are not comfortable, reliable, and safe.Investment in the provision of quality roads forms a precarious part of the performance of other sectors of the economy, it is similarly significant that the country's roads continue to remain in motorable conditions, hence the need to place a high premium on-road preservation in Ghana.

Population growth has become a contagious issue that cannot be ignored. To this end, the study aimed at revealing to the people of Ghana the degree to which the population age structure affects the transport country's infrastructure. Environmental challenges such as devastating transport networks, lack of employment, financial difficulties among households, housing shortages, overcrowding, land usage, pollution, etc. have created urban issues. Going ahead plenty of effort must be put in place to manage populace enlarge in the country, in particular the most important cities to ease the strain expelled on the transportation facilities. Transportation infrastructure performs a vital function in the growth of a country's economy. When goods are produced or manufactured, they need to be transported to the consumers within the country and also around the world through the ports and airports.

The transportation of these goods can be made possible through excellent roads and adequate transport infrastructure. Bad roads will cause a delay in goods leading to the bad reputation of the country and economic losses. Nevertheless, good roads also help manufacturers obtain raw materials on time for production to be as scheduled.The results of this research will, therefore, go further to determine the economic importance for the lives of citizens in all countries and the world as a whole of transport infrastructure, and also to contribute to its economic growth. Also in this research, the results obtained will be able to help us know how to control socioeconomic and environmental problems. The relationship between transport and population will be proven vital in this research as the results obtained from data gathered showing which age group has a higher influencing factor in transportation. These findings will provide some valuable context ideas for future research into a geographical contribution to national construction.The

study's key aim is to examine the impact of age population structure on transport infrastructure, make future projections about the particular age group which has a higher tendency of creating an influence on the transport sector in some years to come, and transport policies the government can consider to make the transport sector more advanced.

## 3. Literature Review

On the educational side, the significance of attendance for pupil success is nicely hooked up as studies point out that being an extra regular at faculty is related with better grades, overall performance on standardized assessments and graduation from high school (Faria, Sorensen, Heppen, Bowdon, & Eisner, 2018). Graduating from high college, in turn, is related to increased lifetime behavioral and fitness outcomes such as lower costs of incarceration, involvement in violent crime, teen being pregnant, and substance abuse (Health, 2020). On the transportation side, existing research has recognized a lack of handy and low-priced transportation for students as a sizeable barrier to school attendance and being related with chronic absenteeism expanded instructional gaps at the college stage and that there was once a disproportionate influence on students from low-income households(Balfanz & Byrnes, 2012).As a result, it has been cautioned that the provision of free transit passes to college students would give them higher transportation picks and probably have a superb influence on a variety of academic, behavioral, and health results for college students and their households (Health, 2020).

Roback(1982),addressed the connection between transportation and population change as a well-known balancing model that shows travel costs are a key determining factor in local decisions for both enterprises and households. In order to obtain a profit maximization, a company opts for an environment in which it is feasible to reduce fuel rates and rising expenses to increase demand. Households prefer areas that deliver low land costs and conveniently access all high pay prices and town services in towns and rural natural services (Andrew M. Isserman, 2020).

The literature on transport and demographic transition directly are small, primarily in sociology (Chi, 2010). However, there is extensive work on job creation and economic growth, backed by multiple hypotheses, as well as several surveys. This research is more important for the concept of neoclassical (Solow, 1956), the theory on growth pole(Perroux, 1955),and the theory on the central place (Christaller, 1966). Three basic inputs generate outputs: labor, land, and capital, according to the theory of neoclassical growth. Road investments are kinds of state capital and they can be regarded through a production function as an input into the production process. Introduced to the highway market, this theory will forecast the rise in funding production as the sum of motorway capacity rises, resulting in population development and employment creation. The theory of growth poles utilizes the principle of proliferation and reverse impact to model the mutual spatial dependence on financial expansion and production between metropolises and rural areas. This in turn allows demographics to shift.

Transport networks and traffic control mechanisms are crucial considerations that lead to the efficiency of the transport network (Kiel, Smith, & Ubbels, 2014).Adequate funding in transport infrastructures such as avenue network, bus stops, parking lots, transport terminals, ports, and traffic lights equipment is paramount in making sure a positive transport network(Adnan et al., 2016).Baah-Boateng (2015) claims that poor road capacity is a major contributor to road inefficiencies. A shortage of road networks in the area is causing the issue of traffic congestion in Accra, Ghana.In the past decade, travel habits of today's young adults, popularly known as the millennial generation, have gained much attention. Studies based on nation-wide aggregates (Balfanz & Byrnes, 2012) and limited recent research using disaggregated data point to lower rates of drivers' licensing and car ownership among young adults compared to the previous generation.Spending a long time in academic establishments would lead to a delayed entry to the workforce, and a slower transition via existence direction (such as starting a family or having children). All these traits may, at least partly, give an explanation for their participation in economic and social things to do and associated transportation outcomes.

The core theory considers the flow of raw materials, energy, finished goods, consumers, and ideas through central locations and the suburbs as promoting road infrastructure (Chi, 2012).Many observational studies at different regional scales have generated inconsistent and conflicting results linked to demographic and monetary transition impacts of macro-roads (S. J. Goetz, Han, Findeis, & Braseir, 2010). Across agricultural regions, particularly specifically or implicitly across residential communities, the expansion of highways has secondary effects and does not have any statistically relevant effect in metropolitan areas.Rural, industrial and metropolitan regions vary in their population factors (Chi, 2010).Research on macro-road growth has been carried out in Wisconsin, with specific impacts in agricultural, suburban, and industrial areas (Chi, 2010). The extension of highways has indirect impacts on population change in rural areas, either directly or indirectly in suburban areas, and no statistically significant consequences in urban areas.A lot of literature about the impacts of airports on economic growth and development (A. Goetz & Sutton, 2004; A. R. Goetz, 1998). Airports have a significant role to play in promoting economic growth and production, as is common knowledge. The impact that airports can have on economic and employment development, comparable to highways, is direct and indirect (J. Kasarda, 2019; Kurniawan, 2017). This research line is, however, focused not only on the demographic change but on economic and labor development. Airports may often play a significant role in encouraging demographic development as population growth and growth in jobs are also quite associated. Airport activities often generate indirect work openings and include support facilities, such as airport shoppers and hotels outside the airport. Airports may also involve businesses that stand to gain from the rapid delivery of their products or easy national and international travel and may attract migrants who appreciate the convenience of long-distance travel provided by airports. Airport development can have significant impacts on urban agglomeration, business competition, and job creation; this view has been addressed

in the concept of 'aerotropolis' (J. D. Kasarda & Lindsay, 2011).

Nevertheless, this research line focuses on economic and job development rather than demographic change. Airports could also play an important role in fostering population growth, as population growth and employment growth are often highly correlated (Bougheas, Demetriades, & Mamuneas, 2001). Airports deliver longer-distance travel more easily relative to land transit, such as highways and railways. Most research has been undertaken in major towns on the effect of airports on population and economic growth and has shown that airport practices foster population and economic progress. In major cities in the United States, it was considered that an airline network to be a source of job development rather than a result of it.The per capita growth in the amount of working-age persons (15–64 years) has an accounting effect on per capita production as it translates per worker input to per capita revenue. (Kelley & Schmidt, 2005). As human resources, efficiency, labor force participation, savings, and consumption are all essentially age-specific, variations in age structure can also affect production per capita through age-specific differences in efficiency and behavior(D. E. Bloom, Canning, & Fink, 2010). The age structure of the population might influence the improvement of the industry in the economy through its association with sector-specific human resources and thereby impact the expected performance of the population(Jun & Suen, 2011).

Since the late 1990s, there has been a body of empirical literature examining the relationship between age structure and economic growth. One part of this literature includes demographic variables in the convergence growth model to determine the impact of the demographic change on economic development (D. Bloom, Canning, & Sevilla, 2002). Bloom and Williamson investigate the relation between the demographic transformation and the economic boom of East Asia between 1965 and 1990 and find that the region's dramatic demographic change – with the working-age population growing steadily faster than the population as a whole – can account for about one-third of its growth miracle.(Iqbal, Yasmin, & Yaseen, 2015).The relationship between young people and young adults has a negative impact on the overall productivity of the factor and is thus detrimental to economic growth. Despite the important position played by the age system in the process of economic development, however, several of the longitudinal research was focused solely on imbalanced growth between the dependent population and the employed population or changes in dependency (Kögel, 2005).

(Lindh & Malmberg, 1999 ) examine the effects of age structure on economic growth in the OECD during the period 1950–1990 and find a positive correlation between the initial share of the upper middle-aged group (50–64 years) and the growth rate in the subsequent time.

Using a wide panel of 87 countries,(Feyrer, 2002)observed there is also a clear and significant correlation between changes in the age structure of the workplace and increases in the efficiency of workers, with the 40–49 age group over any other age category associated with higher efficiency for workers (Gomez & Cos, 2018) employ only two demographic variables to measure demographic maturity – the ratio of the working-age to the total population and the ratio of the prime-age (35–54 years) to the working-age and demonstrating that population maturation has led to approximately half of the growth of global GDP per capita since 1960.

Population influences the ecosystem in a vast number of forms across age ranges, although some of these effects vary due to the ecological factor. The proportion of the population in the 20–34 age had a positive impact to the environment, even though the influence was not significant, whereas the proportion in the 35–64 age had a substantial negative impact when regressed; and the proportion in the 65–79 age cohort had a positive effect on residential energy usage (albeit, statistically significant only for electricity consumption) as observed by (Liddle & Lung, 2010). In their research, they observed that others travel a U-shaped cycle concerningenergy intensity: they live a relatively energy-intensive lifestyle in both early adulthoods and as they enter ''retirement-age'' or grow older than 65, but intermittingly live a relatively energy non-intensive lifestyle during ''middle-age'' or ages 35–64. Some people working with micro-level, country-specific data already have determined that environmental impact can vary across age groups; our confirmation of this variable relationship using macro-level, cross-country data provides those researchers with evidence that their findings are generalizable to other developed countries. Urbanization, again, in developed countries, measures access to a country's power grid, and thus, is significantly and positively associated with energy consumption in the residential sector. Urbanization had an insignificant impact on aggregate carbon emissions and probably an insignificant impact on carbon emissions from transport. In developed countries, urbanization is not an accurate proxy for the spatial density of living.

The distance between major airports is unimportant for economic growth in rural places (Andrew M Isserman, Feser, & Warren, 2009). Few studies have compared the effect of airports on population and economic development between metropolitan and non-metropolitan areas. Airport impacts on population and economic growth that differ across metropolitan and non-metropolitan areas, even as road impacts vary across rural, suburban, and industrial areas. Migrants in agricultural, industrial, and metropolitan regions may perceive convenient access to airports differently; those going to urban areas are likely to appreciate public services more (Fallah, Partridge, & Olfert, 2018) but those that migrate to rural areas are likely to have more natural facilities. An airport could be seen as a growth pole in the region it serves. Airport development or extension will shift the composition of the social structure and alter the demographic through rural, industrial, and metropolitan regions (Henderson & Abraham, 2017).

### 3.1 Empirical Literature

The study of (Berg, Deichmann, Liu, & Selod, 2015) evaluated the effect of transport policies on development and sustainability in the sense of developing countries. The study examined the existing state of economic literature, in

particular those linked to the problems of endogeneity in empirical studies. Similar policy issues for transport strategies in developed countries have been addressed. The macro size, transportation, and infrastructure can have revolutionary influences as long as there is an encouraging climate to grow the industrial market and trade. The study concluded that linking unemployed people to work will have a small influence without preparation to reduce the loss of skills.

The research motive of (Weisbrod & Reno, 2019) examined the economic impact of public transport investment.Their research concentrated specifically on one dimension of how public transit spending impacts the economy in terms of jobs, salaries, and business profits. It primarily addressed the question of how key aspects of the financial sector are affected by decisions that have been made on public transport investment.

The availability of transport infrastructure is essential for an efficient transport network, but it is equally critical how such services are used efficiently and effectively for the best possible gain. They continue to argue that traffic management and regulation ensures the effective usage of transport infrastructure. Traffic management is therefore as essential as transport infrastructure. For example, malfunctioning traffic lights in the city cause traffic congestion and lead to delays in travel(Anin, Annan, & Alexander, 2018).

The public transport system is a key factor ensuring an efficient transport system, especially in urban areas. They claim that the public transport network (also known as mass transit) provides one of the best solutions to minimize traffic congestion and improve energy efficiency due to its high passenger occupancy rate and fuel savings potential.A quantitative study of the economic effects of public transport, prepared by the Cambridge Systematics and Urban Growth Research Group, was used by the American Public Transport Association (Weisbrod & Reno, 2019). Their main results have been grouped into three categories: the effect of investing money on public transport, which generates immediate employment and profits through funding for engineering, building, and public transit operations; the long-term effects of public transport expenditure, which allows for a variety of economic performance and growth impacts as a consequence of a change in time traveled.

Key findings were categorized into three categories: the effect of spending money on public transportation, which creates immediate jobs and income by supporting manufacturing, construction, and public transportation operation activities; long-term implications of public transport investment, which allows a range of economic efficiency and productivity impacts to be produced as a result of an increase in travel times, costs and connection factors; and research on understanding and government analysis of the economic impacts of mass transit investment.The research indicates that expenditure on public transport will have a beneficial impact on the economy and therefore represents a significant public policy issue. Nevertheless, the economic effects should not be offset by the importance of the overall social gains associated with an investment in public transport. Care should also be taken to consider the short-term effects of public transit expenditure as well as the long-term benefits of continuous investment in travel times, prices, and economic growth.

The effect of transportation networks on the travel of the older individual in the ages of the New Zealand community (Frith, Mara, & Langford, 2012) has been recorded. The analysis showed that the shift in population age structure must be taken into consideration for any forecasts to be considered for the growth of our transport network. This also noted that the planned improvements to the network flow would differ considerably in each country, which would entail potential national policies. If these forms of transportation are to be used ideally to a private vehicle, the connection between the public and special transport and the older individual must be rendered more convenient. Residents will be allowed to consider their mobility requirements when choosing accommodation, with community planners needing to take into consideration usability to public transit systems and non-motorized types.
(Pablo-Martí & Sánchez, 2017)research how the design of the network impacts town or city geography and also the decision-making process required to determine which connections should first be strengthened. Their study began by establishing that the Delaunay networks provide a productive baseline for the design of the network and, at the very same time, for the implementation of a computational model. Successive developments lead to clustered designs in geographies where cities are more or less homogeneously distributed, whereas radial designs occur where there is a core-peripheral distribution of nodes. The analysis also found that the optimization of Delaunay networks outperforms the optimization of complete networks at a lower cost by allowing it easier to increase the right collection of connections. In conclusion, conclusions relevant to policy-making have been applied to the design of transport networks and point out how the study can be useful in identifying mechanisms relevant to the historical development of a region (Marsden & Stead, 2018).

### 3.2 Factors that influence the development of the transport system

The growth and development of transportation provide a tool that contributes to agricultural development, military, education, health, or any other social community. The present-day transport network has evolved out of the previous framework due to trails performed to improve the dirt roads, linked to improved farm roads, and then into the present day paved highways and heavy motor traffic. Several considerations may be correlated with the construction of a transport network. The actual transport structure of a nation or area cannot be defined by a single element alone.Interrelated factors' operations are critical to the extension of the transport network as seen in the figure below. Five special forces that affect the growth and evolution of transport networks and how reforms are taking place in a book called Transport Geography(White & Senior, 1983). These factors include the historical, technological, physical, economic, and political/ social.

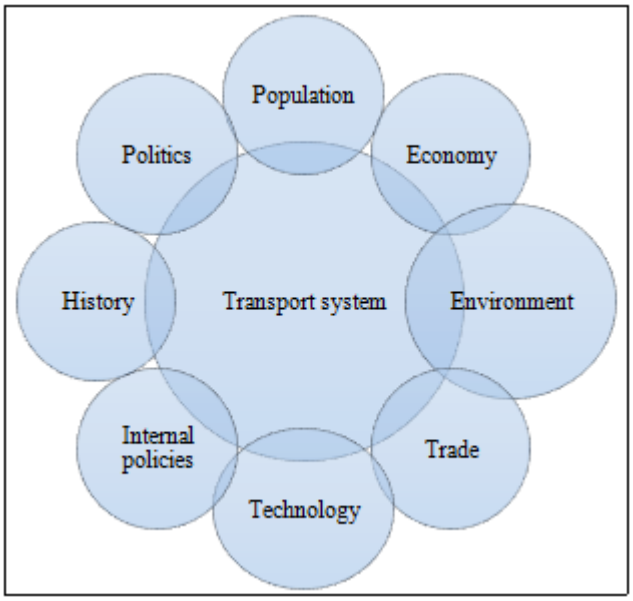


**Figure 1:** Factors that influence the growth and development of the transport system

The above-mentioned variables impact transport in various forms, influence each other, and impact transport networks explicitly or indirectly. Transport networks themselves, along with the physical environment in which they are situated, do affect all these various fields of human life. Each element can function in a positive, negative, or neutral manner; it may influence transport on a range of scales, from local to global.

### 3.3 Hypothesis

***$H_1$*:** 20-34 age(young/youth) group hasa significant relationship with transport infrastructure investment.
***$H_2$*:** 35-59 age (working) group hasa significant relationship with transport infrastructure investment.
***$H_3$*:** 60+ age(aged/retired) group has a significant relationship with transport infrastructure investment.

Population influences the ecosystem in a vast number of forms across age ranges, although each of these effects vary due to the ecological factor measured. Throughout the 20-34 age group, the ratio of citizens has almost seemed to have a beneficial bearing on environmental consequences, although this effect is not always important, but in all empirical statistical analyses, the proportion of people in the 35-64 demographic has a major, adverse effect group has had a favorable impact (albeit, statistically important only for electricity use) on residential energy use, as noted by (Liddle & Lung, 2010). In their investigation, they find that people are in the context of a U-lifecycle concerning (certain kinds of) energy intensity: both in early adulthood they lead a fairly energy-intensive lifestyle, reaching the 'retirement age' or older than 65, but intermediately during "middle-age," or ages 35-64 live a comparatively energy-sparing lifestyle.

Many individuals experimenting with state-specific nano-level data have also established that even the impacts will differ through the age demographic; our validation of this factor interaction with nation-specific meta-level data indicates that their statistical results are commonly applied to many developing nations. Albeit, urbanization tests exposure to a nation's infrastructure in developing nations, thereby allowing an important and beneficial addition to household energy use. The urbanization does not affect net carbon pollution and potentially no influence on rail carbon dioxide emissions.The spatial existence intensity in developed nations cannot be calculated by urbanization.

## 4. Methodology

The study was conducted on Ghana's demographic population and transport services data obtained from World Bank Data. The study utilized quantitative techniques like factor analysis, regression analysis, and descriptive techniques. Eviews11 was used to analyze data gathered from World Bank Indicators and was processed into factor analysis and regression analysis.This study targeted the entire age structure of Ghana's population from 1990 to 2018.Regarding the age structure 20-34 (youth/young population), 35-59 (working group), 60+ years (aged/retired).This study adopted a content analysis approach. Content analysis was chosen for this research because it was commonly utilized in empiric and accounting studies, especially in corporate disclosure studies (Beretta & Bozzolan, 2004; Elzahar & Hussainey, 2012).

### 4.1 Model Specification

We use this data from 1990 to 2018 of Ghana. We found them in World Data Bank. One vector autoregressive (VAR) model which possesses k as an exogenous variable and p as time`s inhibition for each variable, in shape matrix is shown as following:

$$\boldsymbol{Y_t} = \boldsymbol{A_t Y_{t-1}} + \boldsymbol{A_2 Y_{t-2}} + \cdots + \boldsymbol{A_p Y_{t-p}} + \boldsymbol{U_t} \approx \mathrm{IN}(0, \sum)$$

In this relation, $\boldsymbol{Y_t}$and its lags, k × 1 vectors are related to model variables. $\boldsymbol{A_t}$, I = 1, 2,.., p are model's coefficient for k × k matrix. And$\boldsymbol{U_t}$ , k × 1 vector is related to terms of the model's error. Now for linking short term behavior of $\boldsymbol{Y_t}$to long term balance values, we can bring above relation as vector model as following:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\beta_t} \Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\beta_2} \Delta \boldsymbol{Y_{t-2}} + \cdots + \boldsymbol{\beta_{p-1}} \Delta \boldsymbol{Y_{t-p-1}} + \Pi \boldsymbol{Y_{t-p}} + \boldsymbol{U_t}$$

Where:

$$\boldsymbol{B_i} = -\left(\boldsymbol{I} - \boldsymbol{A_1} - \boldsymbol{A_2} - \cdots - \boldsymbol{A_p}\right) \boldsymbol{i} = 1,2, \ldots, p-1$$
$$\Pi = -\left(\boldsymbol{I} - \boldsymbol{A_1} - \boldsymbol{A_2} - \cdots - \boldsymbol{A_p}\right)$$

Matrix Π contains information on long term balance variables. We follow the method of Johansen in deciding long-term relationships (Hendry & Doornik, 2001; Patterson, 2000), ensure that the problem raised with this approach is thoroughly handled. The first move is to approximate the VAR at rates with a correct lag structure. The next stage includes the calculation of a cointegrating level, i.e. the number of long-term balance interactions or vector cointegration tests between the possible factors.Finally, cointegration vectors are defined to enable a fair analysis of the findings.

### 4.2 Correlation Matrix

**Table 3.1:** Correlation matrix

| | Transport | 20-34 (youth) | 35-59 (working group) | 60+ (aged) | GDP (control) | Inflation (control) |
|---|---|---|---|---|---|---|
| Transport | 1 | | | | | |
| 20-34 (youth) | -0.403 | 1 | | | | |
| 35-59 (working group) | -0.879 | 0.0233 | 1 | | | |
| 60+ (aged) | -0.922 | 0.8734 | 0.1097 | 1 | | |
| GDP (control) | -0.3626 | -0.1853 | -0.7837 | -0.4786 | 1 | |
| Inflation (control) | 0.3293 | 0.0223 | 0.0607 | 0.0233 | 0.87 | 1 |

Table 3.1 contains the correlation matrix regarding transport, the age groups, and the control variables. Both negative and positive correlations and of variegated strengths are evident. It's mainly a positive relationship except for all the groups to GDP and transport, GDP to transport where it is positive.In this line, the highest mean (and median) values are by GDP followed by transport, and lastly is by the age group 60+ having the smallest. Transport has a consequentially larger standard deviation after GDP while the least is by the group 20-34. Concerning skewness, they are positively skewed except for the transport, and the young and working-age group. Further, they are normally kurtotic as with normality, all except the 60+ group and inflation are abnormally distributed. Based on these insights, further analysis done therefore begins with the investigation of their descriptive statistics to identify their physical characteristics held in Table 3.2

### 4.3Descriptive Statistics

In this line, the highest mean (and median) values are by GDP followed by transport, and lastly is by the age group 60+ having the smallest. Transport has a consequentially larger standard. Deviation after GDP while the least is by the group 20-34. Concerning skewness, they are positively skewed except for the transport, and the young and working-age group. Further, they are normally kurtotic as with normality, all except the 60+ group and inflation are abnormally distributed.

**Table 3.2:** Descriptive statistics

| | Transport | _20_34 | _35_59 | _60+_ | GDP | INFLATION |
|---|---|---|---|---|---|---|
| Mean | 68.241 | 16.289 | 8.687 | 6.321 | 3349.747 | 19.703 |
| Median | 66.000 | 16.330 | 8.742 | 6.290 | 2993.282 | 15.490 |
| Maximum | 103.000 | 16.477 | 9.888 | 7.010 | 5191.894 | 59.462 |
| Minimum | 27.000 | 15.980 | 7.412 | 6.050 | 2343.043 | 7.126 |
| Std. Dev. | 21.575 | 0.152 | 0.767 | 0.217 | 920.066 | 11.993 |
| Skewness | -0.034 | -0.332 | -0.103 | 1.411 | 0.702 | 1.724 |
| Kurtosis | 2.411 | 1.717 | 1.788 | 5.335 | 2.009 | 5.802 |
| Jarque-Bera | 0.425 | 2.522 | 1.825 | 16.21** | 3.565 | 23.85*** |

This next exercise, therefore, involved testing for the occurrence of a unit root in the variables and hence, ensuring that the variables are stationary to avoid spurious regression and appropriately method choice. The author, therefore, executed this using the Augmented Dickey-Fuller (ADF) and the Philips and Perron (PP) respectively. These results are displayed in the next table.

### 4.4Unit Root Test

**Table 3.3:** Unit root test

| | Level | | 1st difference | |
|---|---|---|---|---|
| | ADF | PP | ADF | PP |
| Transport | -8.808 | -0.738 | -5.754*** | -5.754** |
| 20-34 | -2.714* | -2.132 | -3.155** | -2.455 |
| 35-59 | -2.342 | -2.342 | -3.365** | -3.428** |
| 60up | 1.927 | 1.760 | -3.737** | -0.449 |
| Inflation | -3.017 | -2.968** | -3.921** | -- |
| GDP | 0.997 | 1.092 | -3.263** | -0.456** |

Notes: The ***, **, and * are the 1, 5, and 10% significance. The optimal lag chosen is based on AIC

Thus, regarding the Table 5.3, which tested unit root, the results of testing at both levels, and the first difference are displayed. The first column regards when the test is done at level, and the second one at first difference. From this, most of the statistics accepted the null hypothesis of unit root presence when the test is done at level except for the age group 20-34 at ADF and inflation at PP. However, after the first difference, the series are stationary except for the group 20-34 at PP and implying that, the variables that variables may be stationary at level or first difference. The econometric implication is that the variables are mixture stationary and meaning that there is a need for an appropriate choice of the modeling technique. In this regard, and not forgetting the fact that there are many underlying dynamics in the transport sector of Ghana, the typically dynamic autoregressive distributive lag (ARDL) was used. The method chosen was because it best captures the dynamics in the temporal transports system via integrating the short run into the co-integrating component, and synchronously estimates per the long-run coefficient while maintaining the strength of the estimates. Another befitting advantage is that the techniques best suit mixture stationary data conditionally without I (2) stationarity besides suiting small sample properties as may be exhibited by the variables. These results were estimated and presented from the next table that, however, started from the analysis of the bound test important I identifying whether the variables are co-integrating in the long run.

### 4.5 Bound Test

**Table 3.4:** Bound test

| | | | Critical bounds | |
|---|---|---|---|---|
| | | Significance | I(0) | I(1) |
| F-statistic | 5.663** | 1% | 3.410 | 4.680 |
| t-statistic | -6.73*** | 1% | -3.430 | -4.79 |
| Note: *** and ** is the rejection of the null hypothesis at 1and 5%. The null hypothesis is that there is no long-run cointegrating relationship. | | | | |

Hence, concerning Table 5.4, presented are the results of the bound testing to identify their long-run cointegrating of the transport system and various age groups. The statistics which majorly rejects the null hypothesis indicates that the variables engender long-run cointegrating connection and therefore, the subtleties in the transport sector of Ghana concerning transport efficiency should be postulating long-run relationship. In this regard, the author exploited how the effects and the dynamics exist in the long run using the said ARDL. These results were presented in the next table.

### 4.6Auto-regression Distribution Lag (ARDL)

Therefore, the outcome of the ARDL model is implied to recognize the impact of the age groups on the transport system. The outcomes of the short and long run are displayed in the upper and lower portion of the table, respectively. First and foremost, confirmation of the presence of the long-run cointegrating information which implied to the rejection of the null hypothesis suggests that there existsa long-run relationship between the age groups and the transport system, and this coincides with those of the previous investigation.

**Table 3.5:** ARDL Impact results

| D.V(lnTransport) | Coefficient | t-statistic |
|---|---|---|
| ***Short-run coefficients*** | | |
| C | -8.626*** | -8.624(0.000) |
| △ln(20-34) | 0.145 | 0.163(0.873) |
| Δln(20-34)(-1) | -2.129 | -1.75(0.110) |
| Δln(20-34) (-2) | 2.825*** | 3.617(0.004) |
| **Δln(35-59)** | **4.526*** ** | **1.837 (0.096)** |
| Δln(GDP) | 3.673** | 3.245 (0.008) |
| Δln(GDP)(-1) | 2.284** | 2.263 (0.0447) |
| Δln(inflation) | 0.019 | 0.447(0.664) |
| Δln(inflation)(-1) | 0.202*** | 4.073(0.002) |
| Δln(inflation)(-2) | 0.137** | 3.071 (0.018) |
| ECT(-1) | -1.394*** | -8.224(0.000) |
| ***Long run coefficients*** | | |
| ln(20-34) | 1.075*** | 2379 (0.021) |
| ln(35-59) | -0.636*** | -2.379(0.038) |
| ln(60+) | -1.102*** | -5.759 (0.000) |
| ln(GDP) | 0.729 | 1.013(0.334) |
| ln(Inflation) | -0.147 | -1.175(0.266) |
| ***Diagnostics tests*** | | |
| Serial correlation | 2479 (0.145) | |
| Normality | 0.176 (0.915) | |
| ARCH | 1.171 (0.290) | |
| RESET | 0.069 (0.945) | |
| Note: ***, ** and * are the 1, 5 and 10% significance level. The statistic in parenthesis are the respective p-values and the coefficients. The selected model was based on BIC. The joint probability is P(F-statistic (10.126) = 0.000, $R^2$ =0.870. | | |

From the analysis, if it initiates with the short-run estimates, we read significant findings. The all the age groups and the control variables have significant coefficients to the transport systems. However, the short-run effects of the 60+ age group are missing as the effects of the group 20-29 being inertia and lagging to affect much longer. Specifically, the twice lagged group 20-34 coefficient is positive together with the group 35-59 and implying that the rate of use of the transport system s high with the young and the working population for the short period. With the controls, both inflation and GDP positively controls the intensity or way of utility of the transport system. This may be implied via the way GDP and inflation effects increases or enhances allotment of the resources for the improvement of the transport sector.

Regarding the long-run estimates, significant causal effects are also eminent. Both groups have palatable long-run effects on the transport system. The group 20-24 has increasing effects on the transport sector unlike with the group 35-59 and 60+ giving an implication that the young have an increased utility of the transport sector unlike for the working-age and the aged. However, the controls seem to not impact the long-term development of the transport sector.A comparison of the short and long-run findings seems to greatly paint an imperfectly similar picture. This means that short-term implications are often associated with long-term outcomes. However, since they are the long term impacts of the population structure causing important changes in the transport system, then, the youth are the most users of the transport system while the utility is least for the working population and the aged.

These results are supported by the significant test diagnostics statistics. That is, the statistics which indicate that the models residual are serially uncorrelated, normally distributed and without any conditional volatility supports to a correctly specified model. Also, the statistically insignificant RESET statistic at any rule of thumb implies the same.However, the developmental changes may not sufficiently be traced solely by the effects of the social system only as there may be other impetus of the relationship. This implies that the underlying relationship may be inappropriately captured by a single model of analysis. This called for the imploration of the granger causality to identify the robustness of the effect that, there is an increasing (decreasing) effects of the age group 20-34 (35-59 and 60+). The results of Granger causality are thus held in Table 3.6

### 4.7 Granger Causality

From the table below, we read significant causal effects and of either single-direction or bidirectional. Starting with the single causality, transport granger causes the 20-34 and 60+, from 35-59, 60+, GDP, and inflation to the 20-34 age group and from 60+ to GDP. With bidirectional causality, it's between GDP and transport. The long-run causality demonstrated that the groups significantly caused transport and these effects are reversal with these techniques that the transport is causing the groups and this is ascribing that there exists significant causality among the transport and the groups.

**Table 3.6:** Granger Causality Findings

| | Transport | 20-34 (youth) | 35-59 (working group) | 60+ (aged) | GDP | Inflation |
|---|---|---|---|---|---|---|
| Transport | -- | 6.391*** | 0.286 | 2.822* | *2.799** | 2.469* |
| 20-34 (youth) | 2.349 | -- | 1.035 | 2.237 | 0.400 | 0.038 |
| 35-59 (working group) | 2.176 | 7.039*** | -- | 1.614 | 1.787 | 2.144 |
| 60+ (aged) | 0.320 | 5.268* | 0.678 | -- | 5.163** | 0.896 |
| GDP | *2.585** | 8.094*** | 0.287 | 11.95 | -- | 0.329 |
| Inflation | 0.431 | 5.928*** | 0.054 | 0.747 | 0.202 | -- |

## 5. Conclusion and Implications

Population distribution can impact expenditure in transport infrastructure via numerous mediums. Nonetheless, no research explores a wide variety of networks that can influence population dynamics intransport infrastructure investment. We introduce a new approach in this study to explore analytical relations between certain population framework and transport infrastructure investment.

This research has scrutinized the transportation hitchestackled by the age structure of the country, exploring the issues surrounding young (dependent age range), working-age group, and older age group (retired), usage, and successful ride of public transport. Even though currently constituted, researchers argue that perhaps the wants of the wider population, as well as the poorly healthy, low-income, and remote areas individuals, are not addressed by mass transit.

The government has seen significant improvements in transport services. There are three main prospects for change in this research: challenges created by technological changes, prospects for improved collective decision-making, and challenges for volunteering.

### 5.1Recommendation

Improving infrastructure should conform to the World Health Organization checklist. In order to ensure that each age group is taken into account and integrated into plans, it is also important to consider all age groups in the planning process. Age is a better transport demand determinant, no doubt. It is imperative to continue monitoring the trend of difference in the age structure from time to time in other to ensure provision of appropriate transport system for the country. The government will, most notably, have an aging transport network as this leads to the economic development of the nation as well as to the increase of its people's standard of living.

The availability or consumption of transportation would be influenced by expenditure, price, or legislation. Various policy choices, usually with complex implications, are open. Various policy choices, usually with complex implications, are open. Rising energy resources, while logical, are ineffective in the case of the United States to tackle congestion and air emissions (Duranton & Turner, 2011). Display that increased road construction in the United States raises traffic by increasing secondary road travel, by promoting industrial freight and by recruiting new users. Along the same line, (Anas & Timilsina, 2009)predict that even though modern road-building might decrease current cars' pollution by rising traffic rates, the total emissions will be boosted by drawing more vehicles.

## 6. References

[1] Abouie-Mehrizi, M., Atashi, S. M., & Elahi, M. (2018). The effect of variables population growth, urbanization, and economic growth on CO2 Emissions in Iran. *African Journal of Business Management, 6*(28), 8414-8419.

[2] Abuhamoud, M. A. A., Rahnat, R. A. O. K., & Ismail, A. (2011). Transportation and its Concerns in Africa. *Medwell Journal*, 51-63.

[3] Adler, N. E., & Newman, K. (2002). Socioeconomic disparities in health: pathways and policies. *Health Affairs, 21*(2), 60-76.

[4] Adnan, M., Pereira, F. C., Azevedo, C. M. L., Basak, K., Lovric, M., Raveau, S., . . . Ben-Akiva, M. (2016). *Simmobility: A multi-scale integrated agent-based simulation platform.* Paper presented at the 95th Annual Meeting of the Transportation Research Board Forthcoming in Transportation Research Record.

[5] Aloba (Producer). (2018, 1 21). Effect of population growth on transportation facilities in Warri metropolis. *Research Clue*. Retrieved from https://nairaproject.com/projects/3611.html

[6] Anas, A., & Timilsina, G. (2009). Impacts of policy instruments to reduce congestion and emissions from urban transportation *Research Working Papers* (Vol. 1, pp. 1-30).

[7] Anin, E., Annan, J., & Alexander, O. (2018). Assessing the causes of urban transportation challenges in the Kumasi Metropolis of Ghana. *American Based Research Journal, 2*(6), 1-12.

[8] Ary, D., Jacobs, L., Razavieh, A., & Sorensen, C. (2002). Introduction to research in education 6 the ed. *Belmont, CA: Wadsworth*.

[9] Baah-Boateng, W. (2015). Unemployment in Ghana: A Cross-Sectional Analysis from Demand and Supply Perspectives. *African Journal of Economic and Management Studies (AJEMS), 6*.

[10] Balaker, T., & Kim, C. J. (2020). Do economists reach a conclusion on rail transit? *Econ Journal Watch, 3*(3), 551.

[11] Balfanz, R., & Byrnes, V. (2012). The Importance of Being There: A Report on Absenteeism in the Nation's Public Schools. *Johns Hopkins University School of 4 Education, Everyone Graduates Center, Get Schooled.*, 1-46.

[12] Balmer, M., Axhausen, K. W., & Nagel, K. (2006). Agent-based demand-modeling framework for large-scale microsimulations. *TRANSPORTATION RESEARCH RECORD, 1985*(1), 125-134.

[13] Bauer, P. T. (1983). The population explosion: Myths and realities. *Africa Insight, 13*(3), 172-182.
[14] Baum-Snow, N. (2005). The Effects of Changes in the Transportation Infrastructure on Suburbanization: Evidence from the Construction of the Interstate Highway System: Manuscript.
[15] Baum-Snow, N. (2007). Did highways cause suburbanization? *The quarterly journal of economics, 122*(2), 775-805.
[16] Beretta, S., & Bozzolan, S. (2004). A framework for the analysis of firm risk communication. *The International Journal of Accounting, 39*(3), 265-288.
[17] Berg, C. N., Deichmann, U., Liu, Y., & Selod, H. (2015). Transport Policies and Development. *World Bank Policy Research Paper*.
[18] Berger, J. (2018). *Ways of seeing*: Penguin UK.
[19] Besagni, G., & Borgarello, M. (2020). A bottom-up study on the relationships between transportation expenditures and socio-demographic variables: Evidences from the Italian case study. *Travel Behaviour and Society*, 151-161.
[20] Bilsborrow, R. E. (2017). Migration, population change, and the rural environment. *Environmental change and security project Report, 8*(1), 69-84.
[21] Blanche, M. T., Durrheim, K., & Painter, D. (2006). Research in practice: Applied methods for the social sciences. Cape Town: South Africa: University of Cape Town Press.
[22] Bloom, D., Canning, D., & Sevilla, J. (2002). Technological Diffusion, Conditional Convergence, and Economic Growth.
[23] Bloom, D. E., Canning, D., & Fink, G. (2010). Implications of population aging for economic growth. *Oxford review of economic policy, 26*(4), 583-612.
[24] Blumberg, B., & Cooper, D. (2005). R. and Schindler, P., S. *Business research methods*.
[25] Boadu, E. A. (2009). Rapid Population Growth and Development in Ghana *Population and Development*.
[26] Boarnet, M., Chalermpong, S., & Geho, E. (2018). Specification Issues in Models of Population and Employment Growth. *Papers in Regional Science, 84*, 21-46. DOI: 10.1111/j.1435-5957.2005.00002.x
[27] Bocarejo S, J. P., & Oviedo H, D. R. (2019). Transport accessibility and social inequities: a tool for identification of mobility needs and evaluation of transport investments. *Journal of Transport Geography, 24*, 142-154.
[28] Bongaarts, J. (2009). Human population growth and the demographic transition. *Philosophical transactions of the Royal Society of London*, 364.
[29] Bougheas, S., Demetriades, P., & Mamuneas, T. (2001). Infrastructure, Specialization, And Economic Growth. *Canadian Journal of Economics/Revue Canadienne d`Economique, 33*. DOI: 10.1111/0008-4085.00026
[30] Brown, L. R. (1974). *In the human interest*.
[31] Brueckner, J. (2019). Airline Traffic and Urban Economic Development. *Urban Studies, 40*, 1455-1469. DOI: 10.1080/0042098032000094388
[32] Buhaug, H., & Urdal, H. (2020). An urbanization bomb? Population growth and social disorder in cities. *Global environmental change, 23*(1), 1-10.
[33] Button, K. (2010). *Transport economics*: Edward Elgar Publishing.
[34] Cervero, R. (2019). Road Expansion, Urban Growth, and Induced Travel: A Path Analysis. *Journal of the American Planning Association, 69*, 145-163. DOI: 10.1080/01944360308976303
[35] Chenoweth, J., & Feitelson, E. (2018). Neo-Malthusians and Cornucopians put to the test: Global 2000 and The Resourceful Earth revisited. *Futures, 37*(1), 51-72.
[36] Chi, G. (2010). The impacts of highway expansion on population change: an integrated spatial approach. *Rural Sociology, 75(1)*, 58-89.
[37] Chi, G. (2012). The Impacts of Transport Accessibility on Population Change across Rural, Suburban, and Urban Areas: A Case Study of Wisconsin at Subcounty Levels. *urban studies, 49*. DOI: 10.1177/0042098011431284
[38] Chillies. (2010). Arrive Alive. Retrieved 12 December, 2019, from http://www.arrivealive.co.za/pages.aspx?i=2857
[39] Chopra, S., & Meindl, P. (2017). SC Management: Strategy, Planning, and Operation: Pearson Prentice-Hall, Upper Saddle River, NJ.
[40] Christaller, W. (1966). Central Place Theory. *Wiley Online Library*.
[41] Christensen, K., Doblhammer, G., & Vaupel, J. W. (2009). Aging populations: the challenges ahead. *Lancet*, 1196-1208.
[42] Ciari, F., Balmer, M., & Axhausen, K. W. (2008). A new mode choice model for a multi-agent transport simulation. *Arbeitsberichte Verkehrs-und Raumplanung, 529*.
[43] Cobb-Clark, D., & Stillman, S. (2009). The Retirement Expectations of Middle-aged Australians. *The Economic Record, 85*, 146-163. DOI: 10.1111/j.1475-4932.2009.00543.x
[44] Comtois, C., & Slack, B. (2019). *The geography of transport systems*: Routledge.
[45] Connelly, M. J. (2019). *Fatal misconception: the struggle to control world population*: Harvard University Press.
[46] Correia, G. (2019). *Carpooling and carpool clubs: Clarifying concepts and assessing value enhancement possibilities*: Ph.D. in Transportation, Department of Civil Engineering, Instituto Superior ….
[47] Council, B. o. P. R. (2010). Study of the Relationship Between an Aging Population and the Transport System in the Bay of Plenty Region. *Transportation Publication*.
[48] Creswell, J. W. (2009). Mapping the field of mixed methods research: Sage Publications Sage CA: Los Angeles, CA.
[49] Cullinan, D., & Laugesen, S. (2010). 2010 Bus Satisfaction survey. *Key Research Ltd*.
[50] Curtis, C., & Scheurer, J. (2020). Planning for sustainable accessibility: Developing tools to aid discussion and decision-making. *Progress in Planning, 74*(2), 53-106.
[51] Dalenberg, D. R., & Partidge, M. (2019). Public infrastructure and wages: public capital's role as a productive input and household amenity. *Land Economics*, 268–284.

[52] Davey, J., & Nimmo, K. (2003). Older People and Transport in NZ. *New Zealand Institute for Research on Ageing*.
[53] Debbage, K. G., & Delk, D. (2018). The geography of air passenger volume and local employment patterns by US metropolitan core area: 1973–1996. *Journal of Air Transport Management*, *7*(3), 159-167. DOI: https://doi.org/10.1016/S0969-6997(00)00045-4
[54] Dunn, P. M. (1998). Thomas Malthus (1766–1834): population growth and birth control. *Archives of Disease in Childhood - Fetal and Neonatal Edition*, *78*(1), F76-F77. DOI: 10.1136/fn.78.1.F76
[55] Duranton, G., & Turner, M. A. (2011). The fundamental law of road congestion: Evidence from US cities. *American Economic Review*, *101*(6), 2616-2652.
[56] Eberts, R. (2020). Public infrastructure and regional economic development. *Economic Review*, 15–27.
[57] Economics, T. (2020). Ghana GDP. Retrieved April, 2020, from www.tradingeconomics.com
[58] Eddington, R. (2006). *The Eddington Transport Study. Main Report: Transport's Role in Sustaining the UK's Productivity and Competitiveness*.
[59] Egharevba, M., Iruonagbe, T., Azuh, D. E., Chiazor, A., & Suleiman, B. (2016). Poverty, inequality, and human development in Nigeria: Appraising the non-attainment of the MDGs. *IFE PsychologIA: An International Journal*, *24*(2), 26-46.
[60] Elzahar, H., & Hussainey, K. (2012). Determinants of narrative risk disclosures in UK interim reports. *The Journal of Risk Finance*.
[61] Erath, A., Fourie, P. J., van Eggermond, M. A., Ordonez Medina, S. A., Chakirov, A., & Axhausen, K. W. (2012). Large-scale agent-based transport demand model for Singapore. *Arbeitsberichte Verkehrs-und Raumplanung*, *790*.
[62] Evans, L. (2001). Age and Fatality from Similar Severity Impacts. *Journal of Traffic Medicine*, 29(21).
[63] Fallah, B., Partridge, M., & Olfert, M. (2018). Urban sprawl and productivity: Evidence from US metropolitan areas. *Papers in Regional Science*, *90*, 451-472. DOI: 10.1111/j.1435-5957.2010.00330.x
[64] Faria, A.-M., Sorensen, N., Heppen, J., Bowdon, J., & Eisner, R. (2018). Getting Students on Track for Graduation: Impact of the Early Warning Intervention and Monitoring System After One Year *American Institutes for Research*.
[65] Fawcett, P. (2000). *Managing passenger logistics: the comprehensive guide to people and transport*: Kogan Page Publishers.
[66] Ferguson, E. (2016). Demographics of Carpooling. *TRANSPORTATION RESEARCH RECORD*, 142-150.
[67] Feyrer, J. (2002). Demographics and Productivity. *Review of Economics and Statistics*, *89*. DOI: 10.2139/ssrn.325365
[68] Frith, W., Mara, M. K., & Langford, J. (2012). *Demand for transport services: impact on networks of older persons' travel as the population of New Zealand ages*.
[69] Gammeltoft, P., Barnard, H., & Madhok, A. (2019). Emerging multinationals, emerging theory: Macro- and micro-level perspectives.
[70] Gärling, T., Eek, D., Loukopoulos, P., Fujii, S., Johansson-Stenman, O., Kitamura, R., . . . Vilhelmson, B. (2017). A conceptual analysis of the impact of travel demand management on private car use. *Transport policy*, *9*(1), 59-70.
[71] Gensch, D. H. (2018). A Practical Segmentation Strategy To Increase Ride Sharing. *Transportation Research Procedia, ISA No. 3*, 331-337.
[72] Gerschenkron, A. (1962). Economic backwardness in historical perspective: a book of essays: Belknap Press of Harvard University Press Cambridge, MA.
[73] Geurs, K., & van Wee, B. (2017). Accessibility: perspectives, measures, and applications. *The Transport System and Transport Policy*, 207-226.
[74] Goetz, A., & Sutton, C. (2004). The Geography of Deregulation in the U.S. Airline Industry. *Annals of the Association of American Geographers*, *87*, 238-263. DOI: 10.1111/0004-5608.872052
[75] Goetz, A. R. (1998). Air Passenger Transportation and Growth in the U.S. Urban System, 1950–1987. *Growth and Change*, *23*(2), 217-238. DOI: 10.1111/j.1468-2257.1992.tb00580.x
[76] Goetz, S. J., Han, Y., Findeis, J., & Braseir, K. J. (2010). U.S. Commuting Networks and Economic Growth: Measurement and Implications for Spatial Policy. *Growth and Change*, *41*(2), 276-302. DOI: 10.1111/j.1468-2257.2010.00527.x
[77] Gomez, R., & Cos, P. (2018). The importance of being mature: The effect of demographic maturation on global per capita GDP. *Journal of Population Economics*, *21*, 589-608. DOI: 10.1007/s00148-006-0107-6
[78] Green, M. (2019). The Impact of Airport Development on Economic Development. *Urban Economics Literature Survey*.
[79] Gutiérrez, J., Condeço-Melhorado, A., & Martín, J. C. (2020). Using accessibility indicators and GIS to assess spatial spillovers of transport infrastructure investment. *Journal of Transport Geography*, *18*(1), 141-152.
[80] Hair, J. F., Money, A. H., Samouel, P., & Page, M. (2007). Research methods for business. *Education+ Training*.
[81] Harper, S., & Leeson, G. (2008). Introducing the journal of population aging. *Journal of Population Ageing*, *1*(1), 1-5.
[82] Harriet, T., Poku, K., & Emmanuel, A. K. (2020). An assessment of traffic congestion and its effect on productivity in urban Ghana. *International Journal of Business and Social Science*, *4*(3).
[83] Health, L. A. C. D. o. P. (2020). The Potential Costs and Benefits of Providing Free Public Transportation Passes to Students in Los Angeles County: Full Report, 2013. from www.publichealth.lacounty.gov/plan/docs/HIA/12.16.2013Report.pdf.
[84] Henderson, J., & Abraham, B. (2017). Can Rural America Support a Knowledge Economy? *Economic Review*, *89*, 71-96.
[85] Hendrixson, A. (2014). Beyond bonus or bomb: upholding the sexual and reproductive health of young people. *Reproductive health matters*, *22*(43), 125-134.

[86] Hendry, D. F., & Doornik, J. A. (2001). *PcGive 10: Empirical econometric modeling using PcGive 10*: Timberlake Consultants.
[87] Hodgson, D., & Watkins, S. (1998). From Mercantilists to Neo-Malthusianism: International Population Movement and the Transformation of Population Ideology in Kenya.
[88] Horni, A., Nagel, K., & Axhausen, K. W. (2016). *The multi-agent transport simulation MATSim*: Ubiquity Press London:.
[89] Information Section, G. O. (1957). *Ghana Today: Volumes 1-2*.
[90] Iqbal, K., Yasmin, N., & Yaseen, M. R. ( 2015). Impact of Demographic Transition on Economic Growth of Pakistan. *Journal of Finance and Economics., 3*.
[91] Isserman, A. M. (2020). The competitive advantages of rural America in the next century. *International Regional Science Review*, 35–58.
[92] Isserman, A. M., Feser, E., & Warren, D. E. (2009). Why some rural places prosper and others do not. *International Regional Science Review, 32*(3), 300-342.
[93] Jayne, T. S., Chamberlin, J., & Headey, D. D. (2017). Land pressures, the evolution of farming systems, and development strategies in Africa: A synthesis. *Food policy, 48*, 1-17.
[94] Jedwab, R., & Moradi, A. (2011). Transportation Infrastructure and Development in Ghana. *Paris School of Economics*.
[95] Jiwattanakulpaisarn, P., Noland, R. B., Graham, D. J., & Polak, J. W. (2019). HIGHWAY INFRASTRUCTURE INVESTMENT AND COUNTY EMPLOYMENT GROWTH: A DYNAMIC PANEL REGRESSION ANALYSIS*. *Journal of Regional Science, 49*(2), 263-286. DOI: 10.1111/j.1467-9787.2008.00579.x
[96] Johnson, S. (2013). *The politics of population: Cairo 1994*: Routledge.
[97] Johnston, B. F., & Mellor, J. W. (2017). The role of agriculture in economic development. *The American Economic Review, 51*(4), 566-593.
[98] Jun, H., & Suen, W. (2011). The age structure of the workforce in growing and declining industries: Evidence from Hong Kong. *Journal of Population Economics, 24*, 167-189. DOI: 10.1007/s00148-009-0291-2
[99] Kasarda, J. (2019). Logistics Is about Competitiveness and More. *Logistics, 1*, 1. doi: 10.3390/logistics1010001
[100] Kasarda, J. D., & Lindsay, G. (2011). *Aerotropolis: The Way We'll Live Next*. New York: Farrar, Straus, and Giroux.
[101] Kelley, A. C., & Schmidt, R. M. (2005). Evolution of Recent Economic-Demographic Modeling: A Synthesis. *Journal of Population Economics, 18*(2), 275-300.
[102] Kiel, J., Smith, R., & Ubbels, B. (2014). The impact of transport investments on competitiveness. *Transportation Research Procedia, 1*(1), 77-88.
[103] Klein, N. J., & Smart, M. J. (2020). Millennials and car ownership: Less money, fewer cars. *EconPapers, 53*(C), 20-29.
[104] Kobina, J., & Richardson. (2007). Ghana Urban Transport Project. Retrieved 10, 2019
[105] Kögel, T. (2005). Youth dependency and total factor productivity. *Journal of Development Economics, 76*(1), 147-173. DOI: https://doi.org/10.1016/j.jdeveco.2003.11.003
[106] Kothari, C. R. (2004). *Research methodology: Methods and techniques*: New Age International.
[107] Krippendorff, K. (2004). Content analysis: An introduction to its methodology Thousand Oaks. *Calif.: Sage*.
[108] Krizek, K. J., Handy, S. L., & Forsyth, A. (2019). Explaining changes in walking and bicycling behavior: challenges for transportation research. *Environment and Planning B: Planning and Design, 36*(4), 725-740.
[109] Kurniawan, J. (2017). Perwujudan/Implementasi Konsep Interaksi Aerotropolis Berbasis Tata Ruang di Indonesia. *WARTA ARDHIA, 42*, 195. DOI: 10.25104/wa.v42i4.249.195-202
[110] Labor, D. o. (2008). Workforce 2020 Forces for Change in the Future Labor Market of New Zealand.
[111] Lambert, D., Grant, D., Stock, J., & Ellram, L. (2006). Fundamentals of Logistics Management, European Edition. *Maidenhead, Berkshire: McGraw-Hill*.
[112] Lang, W., Jedermann, R., Mrugala, D., Jabbari, A., Krieg-Brückner, B., & Schill, K. (2010). The "intelligent container"—a cognitive sensor network for transport management. *IEEE Sensors Journal, 11*(3), 688-698.
[113] Lewis, D. (2008). *America's Traffic Congestion Problem: Toward a Framework for Nationwide Reform*: Brookings Institution.
[114] Liddle, B., & Lung, S. (2010). Age-structure, urbanization, and climate change in developed countries: revisiting STIRPAT for disaggregated population and consumption-related environmental impacts. *Popul Environ, 31*, 317-343.
[115] Lindh, T., & Malmberg, B. (1999 ). Age Structure Effects and Growth in the OECD, 1950-1990. *Journal of Population Economics, 12*(3).
[116] Linsley, P. M., & Shrives, P. J. (2006). Risk reporting: A study of risk disclosures in the annual reports of UK companies. *The British Accounting Review, 38*(4), 387-404.
[117] Litman, T. (2018). Land use impact on transport. *Victoria Transport Policy Institute*.
[118] Marešová, P., Mohelská, H., & Kuča, K. (2014). Economics Aspects of Ageing Population. *ScienceDirect*, 534 – 538.
[119] Marsden, G., & Stead, D. (2018). Policy transfer and learning in the field of transport: A review of concepts and evidence. *Transport policy, 18*(3), 492-500.
[120] Mason, A. (2020). *Demographic transition and demographic dividends in developed and developing countries.* Paper presented at the United Nations expert group meeting on social and economic implications of changing population age structures.
[121] Mbara, T. C. (2002). Transport: How have African cities managed the sector? What are the possible

options?*Urban & City Management Course for Africa. Kampala*.
[122] McCartney, K., & Burchinal, M. R. (2006). Best practices in quantitative methods for developmentalists. *Monographs of the Society for Research in Child Development, 71*(3), i-145.
[123] McNicoll, G. (2018). Consequences of rapid population growth: An overview and assessment. *Population and Development Review*, 177-240.
[124] Meister, K., Balmer, M., Ciari, F., Horni, A., Rieser, M., Waraich, R. A., & Axhausen, K. W. (2010). *Large-scale agent-based travel demand optimization applied to Switzerland, including mode choice.* Paper presented at the 12th World Conference on Transportation Research, Lisbon.
[125] Melia, S., Chatterjee, K., & Stokes, G. (2018). Is the urbanization of young adults reducing their driving? *Transportation Research Part A: Policy and Practice, 118*, 444-456.
[126] Midgley, J. (1999). Growth, redistribution, and welfare: Toward social investment. *Social Service Review, 73*(1), 3-21.
[127] Muñuzuri, J., Larrañeta, J., Onieva, L., & Cortés, P. (2005). Solutions applicable by local administrations for urban logistics improvement. *Cities, 22*(1), 15-28.
[128] Naim, M. M., Potter, A. T., Mason, R. J., & Bateman, N. (2006). The role of transport flexibility in logistics provision. *The International journal of logistics management*.
[129] Nations, U. (2019). World Population Prospect (2019 Revision). Retrieved January 25th, 2020, 2020, from https://population.un.org/wpp/
[130] Nortey, E. (2019). *National Analytical Report: 2010 Population and Housing Census*.
[131] O'fallon, C., & Sullivan, C. (2009). Trends in older people's travel patterns. *N.T. Agency*.
[132] OECD. (2020). Infrastructure investment (indicator). Retrieved May 02, 2020, from https://data.oecd.org/transport/infrastructure-investment.htm
[133] Oosterhaven, J., & Elhorst, J. P. (2003). Indirect economic benefits of transport infrastructure investments. *Across the Border: Building on a Quarter Century of Transport Research in the Benelux, Antwerp: De Boeck*.
[134] Oosterhaven, J., & Knaap, T. (2018). Spatial economic impacts of transport infrastructure investments. *Transport projects, programs, and policies: Evaluation needs and capabilities*, 87-105.
[135] Pablo-Martí, F., & Sánchez, A. (2017). Improving transportation networks: Effects of population structure and decision making policies. *Scientific reports, 7*(1), 4498.
[136] Panayotou, T. (2000). Population and environment. *CID Working Paper Series*.
[137] Partridge, M. D., Rickman, D. S., Ali, K., & Olfert, M. R. (2018). Lost in space: population dynamics in the American hinterlands and small cities. *Journal of Economic Geography*, 727–757.
[138] Patterson, K. D. (2000). *An introduction to applied econometrics: a time series approach*: Macmillan.
[139] Patton, M. Q. (1990). *Qualitative evaluation and research methods*: SAGE Publications, inc.
[140] Pendyala, R. M., Bhat, C. R., Goulias, K. G., Paleti, R., Konduri, K., Sidharthan, R., & Christian, K. P. (2012). SimAGENT Population Synthesis. *Synthesis*.
[141] Perroux, F. (1955). The role of the concept of growth poles for regional development. *Science Research An Academic Publisher*.
[142] Pyramid, P. (2020). Population Pyramids of the World from 1950 to 2100. 2020, from https://www.populationpyramid.net/ghana/2020/
[143] Rahman, M. M., D'Este, G., & Bunker, J. M. (2018). *Problems and prospects of non-motorized public transport integration in developing cities.* Paper presented at the Proceedings of the 30th Conference of the Australian Institutes of Transport Research.
[144] Rainford, N. Z. S., & Wight, C. (2018). Owner-Manager Perspectives on Environmental Management in Micro and Small Tourism Enterprises in the Bay of Plenty, New Zealand *Tourism Enterprises and Sustainable Development* (pp. 179-197): Routledge.
[145] Rasker, R., Gude, P. H., Gude, J. A., & Noort, J. v. d. (2018). The Economic Importance of Air Travel In High-Amenity Rural Areas *Journal of Rural Studies*.
[146] Rasouli, S., & Timmermans, H. (2014). Activity-based models of travel demand: promises, progress, and prospects. *International Journal of Urban Sciences, 18*(1), 31-60.
[147] Ravallion, M. (2011). A comparative perspective on poverty reduction in Brazil, China, and India. *The World Bank Research Observer, 26*(1), 71-104.
[148] Riet, V. d., & Egeter. (1998). Transport supply and demand.
[149] Ritchie, H., & Roser, M. (2020). Age Structure. *Our World in Data*.
[150] Roback, J. (1982). Wages, rents, and the quality of life. *Journal of Political Economy*, 90.
[151] Sanchez-Robles, B. (1998). Infrastructure investment and growth: Some empirical evidence. *Contemporary economic policy, 16*(1), 98-108.
[152] Santacreu, A. M. (2016). Long-Run Economic Effects of Changes in the Age Dependency Ratio. *Economic Synopses*(No. 17).
[153] Saunders, M. L., & Lewis, P. (2009). P. &Thornhill, a.(2009). *Research methods for business students, 4*.
[154] Service, G. S. (2013). Population Age Structure Potentials.
[155] Simon, J. L. (2019). *The economics of population growth*: Princeton university press.
[156] Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 65–94.
[157] Stuckler, D. (2008). Population causes and consequences of leading chronic diseases: a comparative analysis of prevailing explanations. *Milbank Q, 86*(2), 273-326. DOI: 10.1111/j.1468-0009.2008.00522.x
[158] Teal, R. (2019). Carpooling: Who, How, and Why. *Transportation Research Procedia, Vol 21*.
[159] Tseng, Y.-y., Yue, W. L., & Taylor, M. A. (2005). *The role of transportation in the logistics chain*.
[160] Vandenbulcke, G., Steenberghen, T., & Thomas, I. (2019). Mapping accessibility in Belgium: a tool for land-use and transport planning? *Journal of Transport Geography, 17*(1), 39-53.

[161] Voss, P. R., & Chi, G. (2006). Highways and Population Change*. *Rural Sociology, 71*, 33-58. DOI: 10.1526/003601106777789837
[162] Weisbrod, G., & Reno, A. (2019). *Economic impact of public transportation investment*: Citeseer.
[163] Weisbrod, G., Vary, D., & Treyz, G. (2019). Measuring economic costs of urban traffic congestion to business. *TRANSPORTATION RESEARCH RECORD, 1839*(1), 98-106.
[164] White, H. P., & Senior, M. L. (1983). *Transport geography*: Addison-Wesley Longman Ltd.
[165] WHO. (2004). World Development Report.
[166] WHO. (2007). Global age-friendly cities: a guide. 2007.
[167] WHO (Producer). (2018, February 5). www.who.int/news-room. Retrieved from http://www.who.int/news-room/fact-sheets/detail/ageing-and-health
[168] Winters, M., Brauer, M., Setton, E. M., & Teschke, K. (2020). Built environment influences on healthy transportation choices: bicycling versus driving. *Journal of urban health, 87*(6), 969-993.
[169] Zhang, H., Zhang, H., & Zhang, J. (2015). Demographic age structure and economic development: Evidence from Chinese provinces. *Journal of Comparative Economics, 43*(1), 170-185. DOI: https://doi.org/10.1016/j.jce.2014.07.002
[170] Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2018). Logistics flexibility and its impact on customer satisfaction. *The International journal of logistics management*.