# Differences in the Relationship between Economic Growth and Population Change in Developing and Developed Countries

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**Abstract.** The world's countless economies are constantly undergoing various changes. This study analyses the role played by population in different levels of economic development, namely developed countries and developing countries, on a national level. The main text is based on theories such as Malthusianism and Boserup theory, combined with case studies of two types of countries represented by Pakistan and Japan, to analyse the relationship between population and economy. In developing countries, the relationship between population changes and economic development is negatively correlated; while in developed countries, the relationship is positively correlated. The next step is to delve into the reasons behind the results obtained from in-depth analysis and explore why there are differences between developed countries and developing countries. Some of the reasons include the baby boom, industrial structure, health care and education. The interplay between these factors and populations has led to economic differences between developed and developing countries.

## 1 Introduction

### 1.1 Research background

Right now, there are 195 countries on this planet, home to nearly 8.2 billion people. In order to better understand and study social development, scholars at different levels in different fields will inevitably divide and compare these billions of unique individuals from different dimensions. This paper is no exception. As a research paper with human beings as the main body, under the premise that everyone has a nationality, all countries are divided into two categories according to a specific standard, that is, developing countries and developed countries. Importantly, this paper not only analyzes population, but also integrates another globally significant area of focus – economic growth. Both of these aspects are close to people's real life to a large extent. It is worth mentioning that this paper will make the comparison between developing countries and developed countries, which can be analyzed from a more detailed starting point, so as to make the theoretical content more concrete and persuasive.

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### 1.2 Research purposes and research questions

The primary purpose of this paper is to deeply analyze the interrelationship between population change and economic growth, and to explore the differences of this exercise among countries at different levels of development. After dividing countries into developing countries and developed countries according to the degree of development, the analysis of these two types of countries is carried out respectively. In the analysis of population in different paragraphs, the change and rate of population in each country is the focus of this paper. The paper capitalizes on the combination of quantitative and qualitative analysis, integrates historical research and the latest data, and uses charts and text explanations to visually demonstrate the relationship between population change and economic growth. The relationship between population and economy, from the root point of view, is the relationship between population and resources. In addition to the analysis of academic theories, this paper chooses two classic cases of developing countries and developed countries respectively. The content analyzes the demographic trend, industrial structure and economic development of the two countries, and uses examples to verify the correctness of the theory and the applicability of the Malthus model and Boserup model mentioned above in different societies. These two models show the relationship between population and resources. Although they have the same variables, the quantity of population and the quantity of resources, they hold very different attitudes, as can be seen from the results in the form of images. From the collision of the two scholars' views, it is obvious that the differences in social patterns does exist. This study will consider the unique traditions and development strategies of different regions, as well as the impact of changing times on population and economic relations, in order to fully understand the dynamics of population and economic growth in different social contexts. Therefore, the analysis of other factors that can affect economic growth and the interaction between these factors and population change will also be included in this paper, such as education level, medical conditions and legal environment.

Labor resources refer to individuals who, by virtue of their abilities and expertise, can engage in activities of social utility. Furthermore, the greater the level of abilities, skills, education, and qualifications, the greater the potential of their bearer and the higher the quality of the goods and services they produce. In this context, one can observe the highly qualified workforce in Europe, which constitutes a marked contrast in GDP volume with developing nations such as Argentina and Brazil. Additionally, the quantity of individuals participating in labor activities undoubtedly exerts a significant influence. The organic composition of capital is also contingent upon the size of the workforce within an enterprise, that is, an increase in the proportion of variable capital. A case in point is China, where the amount of labor resources serves as a principal component of the industrial sector.

## 2 How the correlation between economic development and population change differs in developing and developed countries

Before incorporating demographic factors into analysis, it is crucial to understand the concepts of developing countries and developed countries, there is a need for an accurate understanding of the concepts of developing and developed countries.

Standard criteria for evaluating a country’s level of development include both economic and noneconomic factors. The economic factors usually considered are income per capita or per capita gross domestic product, the level of industrialization and the amount of technological infrastructure. Noneconomic factors, often quantified by human development index (HDI). Through the analysis from multi-dimensions, the fact that developing countries

lag behind developed countries in several ways supports the differentiation between developing countries and developed countries.

For instance, according to the latest World Bank regulations, high-income countries are defined as those with a GNI per capita of more than $14005. This standard not only includes the United States, Japan, Saudi Arabia, Singapore, the United Kingdom, Germany and other countries. The World Bank's definition of high-income countries is constantly adjusted. This adjustment reflects changes in global economic conditions and the World Bank's reassessment of the country's level of economic development.

## 2.1 The correlation between economic development and population changes in developing countries

### *2.1.1 Demographic transition model (DTM)*

In early modern times, most countries were considered developing countries, as the allocation of resources and development of technology were deficient. As the human society developed the way of living had change dramatically. The demographic data also experienced changes in stages. The Demographic Transition Model (DTM) divides population development into five stages: High stationary, Early expanding, Late expanding, Low stationary, Declining. Each stage has its corresponding characteristics of population change. These characteristics are defined and distinguished by birth rates, death rates, and natural growth rates.

**Table 1.** Demographic transition model [1]

| Stage | 1. High Stationary | 2. Early Expanding | 3. Late Expanding | 4. Low stationary | 5. Declining |
|---|---|---|---|---|---|
| Examples | A few remote groups | Egypt, Kenya, India | Brazil | USA, Japan, France, UK | Germany |
| Birth rate | High | High | Falling | Low | Very low |
| Death rate | High | Falls rapidly | Falls more slowly | Low | Low |
| Natural increase | Stable or slow increase | Very rapid increase | Increase slows down | Stable or slow increase | Slow decrease |

As shown in Table 1, The second stage and the third stage include almost all typical developing countries. Hence, the characteristics of demographic changes in developing countries are usually high or falling birth rate and death rate falling at different rates. The total population is in a state of gradual increase.

### *2.1.2 Malthusian growth model and relationship between population growth and economic well-being*

In the late twentieth century, most countries were in a similar situation. At that moment, a remarkable theory was born. Thomas Malthus (1992) proposed one of the earliest theories which shows the negative relationship between population growth and well-being before most scholars. The principle of this theory is also expressed in the form of a graph, the Malthusian Growth Model.

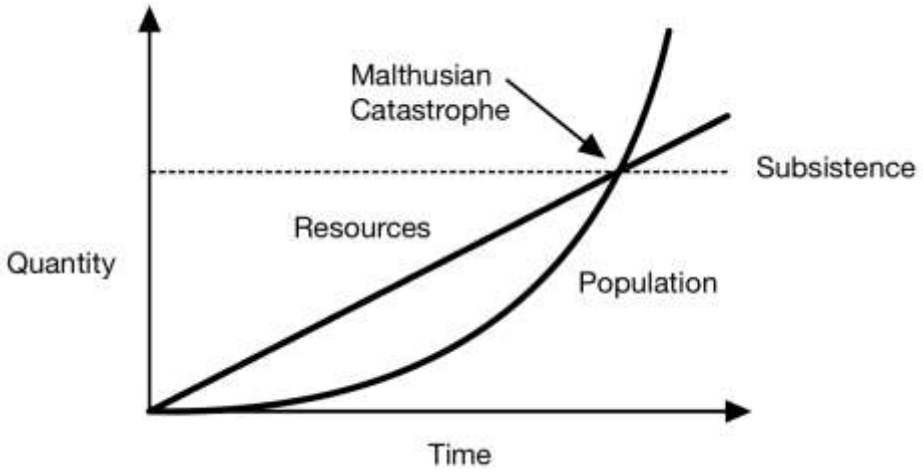


**Fig. 1.** Malthusian Growth Model [2]

Fig.1 displays two lines: a straight-line representing resource and a curved line representing population. The pessimistic nature of this theory is that population increases at different rates than resources. While population is thought to be growing exponentially, resources grow at a linear rate. Within a certain time, the quantity of resources can support the current quantity of population. However, when the time goes by, there will be a fundamental change in the circumstance. At the intersection of resources and population, the surplus in resources gradually turn into mere subsistence. Subsequently, the Malthusian Catastrophe [2]. Under this circumstance, the power of population is indefinitely greater than the power in the earth to provide subsistence for man [3]. Another concept of Malthusian theory is that when the technology is assumed limited, the population will shrink in all sorts of inevitable ways. Possible tragedies include famine, plague, and war. After all, since the premise of this theory can be largely applied to developing countries that are often unable to improve the efficiency of resource allocation through revolutionary technological breakthroughs, the results of this theoretical analysis are persuasive. In other words, from the economic perspective, average incomes will always be driven down by population growth to a level that is just adequate for the population's subsistence [4,5].

## 2.2 The correlation between economic growth and demographic change in developed countries

### *2.2.1 Three sector model*

Normally, the three-sector model in economics is used as the foundation of the analysis of different industries. The three sectors are primary, secondary, and tertiary sectors, responsible for the acquisition of raw materials, manufacturing, and services respectively. From the macroscopic angle, a country's economic system can be derived from this. To a large extent, the relationship between economic growth and population change can be explained from the three-sector model.

Therefore, in developed countries, the specific relationship between economic growth and demographic change can be modified. While the Malthusian theory is suitable for developing countries with limited technological advances assuming diminishing supply of labor from marginal products, its applicability would be weaker in comparison to developed economies with changed proportions of basic industry types.

According to 2019 data, in developing countries, the service sector generates 55% of GDP and 45% of employment. At the same time, the service sector in developed countries create 75% of the two quantities, which is dominant [6].

Europe, with its generally high level of development, witnessed a significant rise in the prominence of service sector. In fact, the manufacturing sector has increasingly outsourced numerous activities to intermediate producer services. This trend is largely attributed to their proximity and the escalating returns to scale experienced by services, leading to reduced marginal costs [7].

#### *2.2.2 Boserup population theory*

In contrary to Malthusian theory, another economist, Ester Boserup, puts forward a theory that combines real social developments. Unlike Malthusian pessimism, Boserup's vision assumes that society will not collapse.

The traditional hypothesis – Malthusian theory -- posits that demographic growth within primitive societies occurs reactively, in alignment with the inherent capacity of the natural setting and the prevailing food production techniques. However, this perspective neglects the fact that population dynamics are also subject to--and concurrently impact--factors such as health, infrastructure, conflict, governance, and ecological conditions. By examining a multitude of historical instances involving the transition between various subsistence strategies, which are prevalent across societies at disparate levels of advancement, Boserup posed that an initial transition to a subsistence method with an increased carrying capacity is typically met with a decline in output per unit of labor; hence, population expansion seems to be a catalyst for the adoption of innovative, and ultimately more efficient, technologies. Malthusian Catastrophe will never happen, as innovations will inevitably occur at critical points to prevent populations from exceeding the capacity of resources [8].

### 2.3 Case analysis

#### *2.3.1 Pakistan – a typical example of developing countries*

Among 195 countries in the world today, 152 of them are classified as developing countries with a current population of around 6.87 billion. This quantity occupies a considerable proportion of the world's population, at 85.53 percent. It includes all countries in Africa, almost all countries Asia, and a whole of Central and South America. Although these countries are similar in terms of level of development, they have different development strategies under different political systems and industrial structures。

Pakistan is a classic developing country with a large population base. It is in South Asia and has a population of 240.5 million. Until 2023, the births per 1000 population is still high at 27 and the deaths per 1000 population has dropped to 7. The rate of natural increase remained at 2% that year. Currently, its GNI per person in PPP – a figure indicating the local economic well-being -- is 6350. The Human Development Index is at a low level of 0.540.

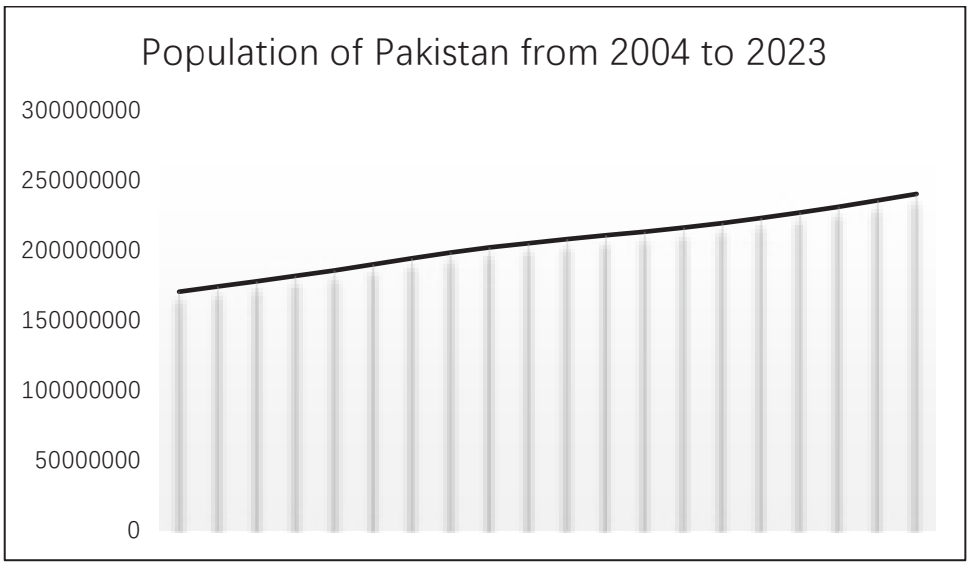


**Fig. 2.** Population of Pakistan from 2004 to 2023 [9]

Earlier in the late 20th century, Pakistan is one of the developing countries which was confronted with the problem of uncontrollable rapid population growth. Fig. 2 shows the population change of Pakistan from 2004 to 2023. Its circumstance is the same as countries in stage 2 of DTM. There is a continuous increase in population because of sustained high fertility (total fertility rate of 3.4 in 2023) and declining death rate due to the advancement in health care and technology.

Pakistan is an agricultural country, which indicates the significance of agriculture in its economy. However, due to the limitation of irrigation technology on which the arable land and almost all crops rely, rapidly growing population levies a great pressure on the availability of agricultural resources, including arable land, forests, and water resources. It's expected that, with the stagnant agricultural condition, Pakistan will potentially face a scarcity of arable land, as shown in Fig. 3. which displays the arable land. Subsequently, the supply of food for the large population will be in an unprecedented shortage. Other social-economic problems like poverty and income inequality are the direct or indirect results of the malignant demographic change [10]. For instance, the distribution of income has deteriorated during the period from 1988 to 2005. National inequality estimates, as indicated by the Gini coefficient, reveal an approximate 17 percent increase or a 6-percentage point rise from 0.35 in 1987-88 to 0.41 in 2004-05. The Gini coefficient for urban regions has witnessed an escalation from 0.20 to 0.43, whereas for rural regions, it has ascended from 0.30 to 0.35 over the said duration. Politically, the distribution of the increasing supply of labor force posed another serious question to the government. They were not successfully arranged into productive activities. This also shows that the country has not succeeded in reaping the demographic dividend [11]. More specifically from an economic point of view, the reduction of arable land per person in Pakistan can also represents the degradation of people's economic well-being.

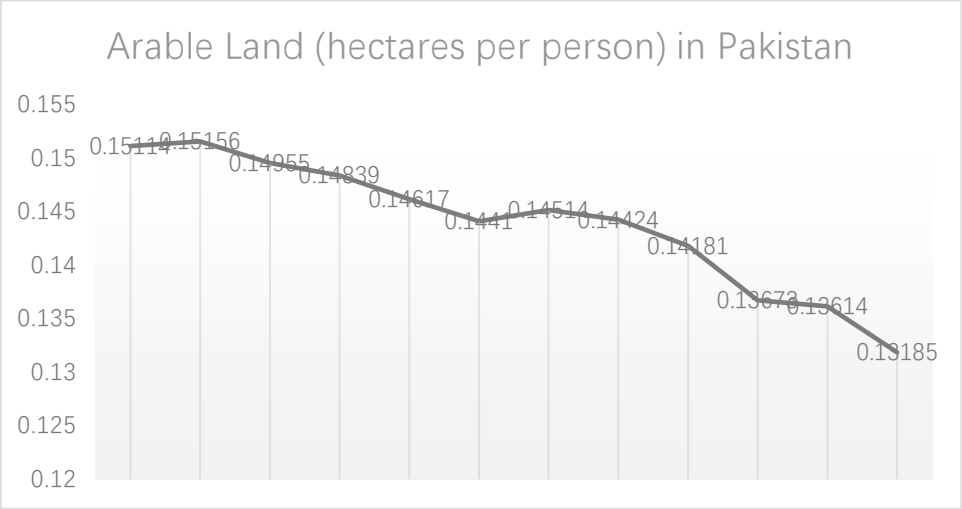


**Fig. 3.** Arable Land (hectares per person) in Pakistan from 2010 to 2021 [12]

Overall, Pakistan's circumstance demonstrated the frustrating outcome of population growth. The negative correlation between the population changes and economic growth is further illustrated.

### *2.3.2 Japan – a typical example of developed countries*

Japan ranks number 12 in the list of countries by population. It is an island country located in East Asia. As one of the earliest Asian countries to enter the ranks of developed countries, it has a relatively high representativeness.

First, the analysis starts with the underlying economic and demographic data. Unlike Pakistan, which has a GNI per capita of $6350, Japan has a GNI per capita of $48470 that is several times higher. This figure alone does not tell the story of Japan's economic trend. The reality is that Japan's finances are getting worse.

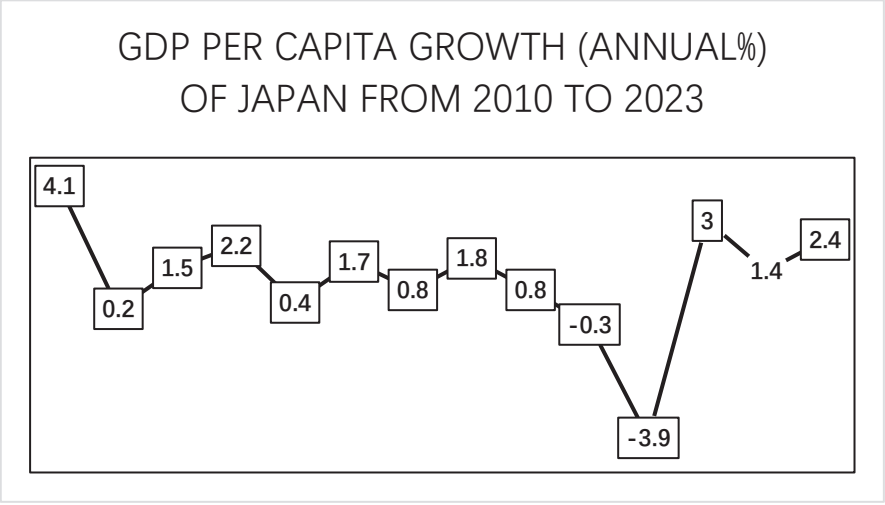


**Fig. 4.** GDP per capita growth (annual%)-Japan [13]

Fig. 4. shows the rate of change in Japan's per capita GDP over the last 14 years. Despite some fluctuations, the overall trend is downward, with a decrease of 41.46% in 2023 compared to the 2014 value.

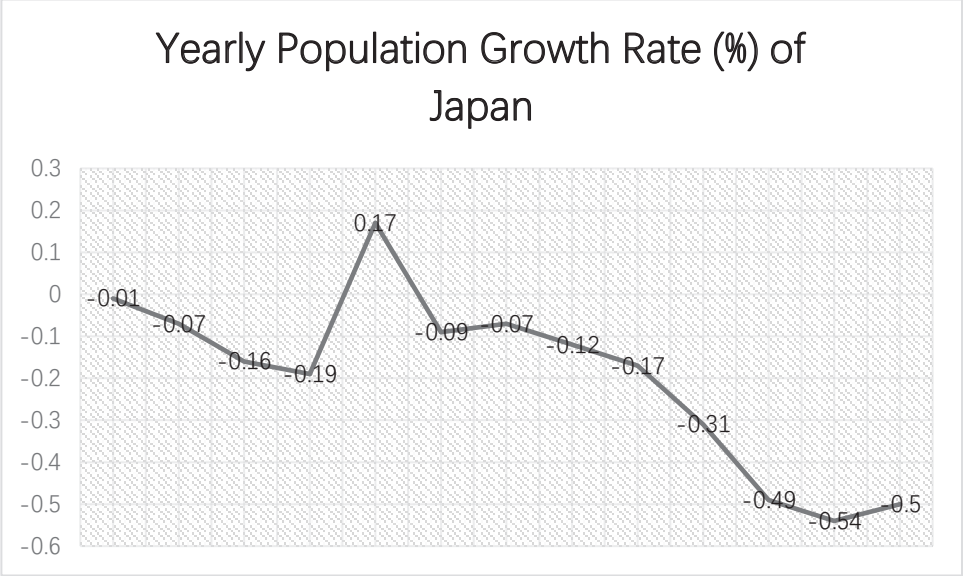


**Fig. 5.** Yearly Population Growth Rate (%) of Japan from 2010 to 2023 [14]

Like the graph of GDP per capita, the curve in Fig. 5., which shows the rate of population change in Japan over the same period, also shows a downward trend. The similarity of the trend of change in the two sets of data for Japan, in other words, is fully consistent with the positive correlation between population change and economic development in developed countries.

Specifically, Japan tops the world with a life expectancy of nearly 84 years. With a low birth rate, high life expectancy means that the proportion of the elderly population is gradually rising. This demographic shift is largely negative. If Japan fails to innovate, productivity will decline as the average age of the population increases. At the same time, the rising dependency on the elderly puts more pressure on a shrinking economically active population, hitting Japan's economy harder and harder [15]. These are the main reasons why Japan's economic growth has slowed as the population decline has accelerated. To sum up, the current situation of other developed countries is also like that of Japan, although the actual situation will be different, indicating this case's high reference value.

## 3 Reasons behind differences in the relationship between economic growth and demographic change in developing and developed countries

### 3.1 Reasons for the correlation between economic growth and population change in developing countries

To begin with, the developing countries usually has relatively higher birth rate. From the most direct point of view, the most basic medical measures may be lacking or even absent. As noted by Syse, A., Dommermuth, L., & Hart, R. K., their findings indicated a negative correlation between long-term health benefit uptake and fertility, while a positive correlation

was observed between the use of sickness absence and fertility. Poor health conditions might increase people's demand towards and change their preferences on having more children. In one detail, people with suboptimal health may be unable to afford costs of raising a child with care, including money and time. Instead of spending money on the academic and career development of one child, having more children as a basic labor force to support the future self seems to be a more reasonable and popular choice [16]. Table 2 displays the population data of Middle Africa, an area with countries that are all developing countries. The births per 1000 population ranges from 28 to 44 – a very high value range. About the natural increase rate (only accounting for birth and death rates in a specific population), while a majority of developed countries' figures are close to 0% or even negative, such as the United States of America's 0.1% and Germany's -0.4%, the average rate of natural increase in Middle Africa is 3%.

**Table 2.** Population data sheet of Middle Africa [17]

| | Population (millions) mid-2023 | Births per 1000 population | Deaths per 1000 population | Rate of Natural Increase (%) | GNI per Capita, PPP |
|---|---|---|---|---|---|
| Africa | 1453 | 32 | 8 | 2.4 | 5645 |
| Sub-Saharan Africa | 1197 | 34 | 9 | 2.6 | 4292 |
| Middle Africa | 202 | 40 | 9 | 3.0 | 3001 |
| Angola | 36.7 | 38 | 8 | 3.0 | 6450 |
| Cameroon | 28.1 | 35 | 9 | 2.6 | 4350 |
| Central African Republic | 6.2 | 44 | 20 | 2.3 | 1020 |
| Chad | 18.3 | 43 | 12 | 3.1 | 1640 |
| Congo | 66.1 | 30 | 7 | 2.3 | 3520 |
| Congo, Dem. Rep. | 102.3 | 42 | 9 | 3.2 | 1280 |
| Equatoria Guinea | 1.7 | 30 | 9 | 2.1 | 12850 |
| Gabon | 2.4 | 30 | 7 | 2.3 | 14880 |
| São Tomé and Príncipe | 0.2 | 28 | 6 | 2.2 | 4770 |

One economic reason why the correlation between economic growth and population changes in developing countries is negative matches with one reason of their high fertility. In developing countries, about 50 per cent of workers are employed in the agriculture sector. In contrast, in developed countries agriculture employs just over 4 per cent of workers. In technologically underdeveloped countries, agriculture is a human-centred work When

agricultural employment becomes saturated, like the situation in Pakistan, increasing population will only increase the exploitation and competition for fixed resources. Until finally, when the limited resources have played the maximum value under the current level of science and technology, human resources will gradually depreciate. The economic well-being of people will be driven down.

From a social perspective, the scarcity of educational resources caused by overpopulation is also an important factor to explain the inverse correlation between population change and economic development. Globally, deficient educational levels are a contributing factor to the persistent poverty experienced by millions. An estimated 400 million adolescents aged 12 to 17 in developing nations are denied access to secondary education. Extensive scholarly research indicates that this demographic will exhibit diminished economic productivity, compromised health outcomes, and elevated fertility rates in comparison to their more educated counterparts. This leads to a vicious circle: from high population growth to low education and economic growth, to high birth rate, back to high population growth.

### 3.2 Reasons for the correlation between economic growth and population change in developed countries

Developed countries tend to have a lower fertility rate due to several reasons. According to their industrialized nature, the economic well-being has been improved by advanced technology ad better allocation of resources. People no longer need to do hard and tiring low-level jobs that require human labor. From the reality perspective, mortality rates decline because of better medical resources and healthcare services. In the mind of contemporary adults in developed countries, newborn would only levy a heavy burden on them as children can cost large amount of money. Bringing them up require infinite expenditure on housing, education, and other fundamental spendings. From a woman's viewpoint, in the era when women have more rights, they have the opportunities to receive higher levels of education for longer periods of time. There are also more career-minded and ambitious women who value the workplace over family [18].

One expression of the economic well-being previously discussed is the Gross National Income (GNI) or Gross Domestic Product (GDP) per capita. In other words, it measures the productivity. For a labor, productivity can simply mean real output per hour of work or real output per unit of all inputs [19]. Since 2000, productivity in the developed countries has shown an irreversible decline.

One specific reason for it is the baby boom. From the mid to late 1940s to the late 1960s or early 1970s, developed countries faced the baby boom, a long-overdue demographic resurgence. The root cause of this baby bust is the World War II. When people's lives become stable, indicators of fertility are rising at an unusual rate: the marriage rates accelerated; total fertility rate raised, and the number of newborn increased. Until 2000, the time when baby boomers retire and exit the labor force, workers were working fewer hours, which, combined with lower unit output, has led to an overall decline in economic conditions, a slower GDP growth. Other bad thing that happened at that time, when the birth rate had declined, were the stagnation in educational attainment, inequality, and government debt. Even though it was the highlight of technological innovations, the positive impact would be offset by this demographic change. If this situation cannot be changed in a short time, the United States, a typical developed country, would experience an extremely low average annual per capita GDP growth over the period of 2015 to 2040. These facts all prove a point: declining natural increase rate leads to the deceleration of economic growth. There's a positive correlation between population change and economic development [20].

Through analyzing from the opposite side, in a developed country with constantly decreasing proportion of agriculture industry, population raises productivity in the urban

sector when natural resources are no longer the sole source of human survival. Higher population density means shorter distances between people, and the cost of coordinating experts goes down. The process of labor division will also be smoother. In developed countries, it's logic to state that population increase would boost the economic growth. In a model of urban productivity, within which the agglomeration effect of density is augmented by the human capital stock of a metropolitan area. By leveraging novel data concerning output per worker across U.S. metropolitan areas, complemented by a density metric that acknowledges the spatial dispersal of the populace, a doubling of density precipitates a productivity enhancement of approximately 2 to 4 percent, which aligns with theoretical frameworks of learning and knowledge spillovers within urban environments. These trends are most conspicuous within industries where the exchange of information and the sharing of concepts are pivotal components of the manufacturing process [21].

# 4 Conclusion

## 4.1 Research conclusion

In this paper, the relationship between population changes and economic development is deeply analyzed and discussed. Through data analysis, theoretical studies and case studies, clear differences are observed between developed countries and developing countries in the relationship between population and economy.

In developing countries, the content is based on Malthusian population theory and discusses its applicability in developing countries. In developing countries with relatively backward scientific and technological level, Malthusian population theory is largely in line with reality. That is, the high rate of population growth has a negative impact on the economy and resources. As a typical developing country, Pakistan has a characteristic industrial structure, a high proportion of agriculture. While the population continues to rise, the area of arable land per capita shows an obvious downward trend. This is consistent with previous assumptions and further demonstrates the inverse correlation between economic development and population change in developing countries.

Industrial structure is further discussed before analyzing developed countries. According to the three-sector model, the different levels of development of a country, especially in the economy, can be reflected in the proportion of different industries. In developed countries with a higher share of services, Boserup's optimistic theory is more in line with reality. Population growth will not worsen the relationship between people and resources but will promote the development of science and technology and increase the capacity of resources. In this part, Japan, a country that entered the ranks of developed countries earlier, is used as a case study. Specific data used include population growth rate, GDP growth rate and GDP per capita growth rate. A series of objective analysis further demonstrate the positive correlation between population change and economic development.

The analysis of the principles behind these relationships begins with the reasons for the demographic characteristics of both types of countries. The high fertility rates characteristic of developing countries is effectively reflected in the example of Middle Africa. The main and direct reason is the backward medical level, which affects people's preference for having children. This paper presents two reasons for explaining the relationship between population change and economic development in developing countries. The first is still the excessive proportion of agriculture and the continuous exploitation of resources, resulting in an over-saturated population unable to obtain higher economic conditions. The second is the lack of universal education due to overpopulation, which limits the ability to innovate at the earliest stages of life and prevents economic development.

Oppositely, developed countries are featured with low fertility. The reasons include an industrial structure with low labor requirements, high-quality and adequate medical resources, high parenting costs, and higher female status. The explanation of the positive correlation between population changes and economic development is from two directions: the baby boom that affected much of the rich world reduced both the natural increase rate and the rate of economic growth after a few years; Increased population density in metropolitan areas in developed countries will enhance productivity.

### 4.2 Research limitations and future directions

The discussion of demographic factors in this article mainly focuses on the change of population base. The characteristics of the population involved in the change, such as age and gender, are not explored in greater detail. Demographic analysis is missing from country case studies. Another point is that this series of analyses is based only on current economic and demographic conditions and cannot be applied to other times.

In the future, relevant research can make the demographic analysis more thorough and combine with other social factors not included in this paper, such as religion and local customs. Economic development can be analyzed from more dimensions, including urbanization and welfare policies.

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