SOCIO-ECONOMIC CONSEQUENCES OF POPULATION CHANGE: A COMPARATIVE ANALYSIS OF PAKISTAN AND JAPAN

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Abstract

This paper analyzes and compares socio-economic consequences of demographic change in Pakistan and Japan. Using data from 1950-2050, our comparison shows that speed of demographic transition is much faster in Japan while Pakistan is experiencing a much favorable age structure and other demographic ratios, which provide a window of demographic dividend in future. Moreover, Shapley's GDP breakdown approach is used to help us understand how marginal changes in labor productivity, effective employment and age structure are transformed into per capita GDP growth for both the countries. Our results show that despite larger increase in population, all three factors, i.e. labor productivity, effective employment and age structure have contributed positively towards per capita GDP growth in Pakistan. While in the case of Japan, a decline in the share of working age population (WAP) has contributed negatively towards per capita GDP growth, which is compensated by a remarkable growth in labor productivity.

Key words: *demographic change, growth decomposition, effective employment*

1. INTRODUCTION

Over the past two decades, the process of ageing has got the attention of many researchers and policy makers. According to the United Nations' report on World Population Ageing, the process of ageing is largely irreversible and young population of the past in many countries may not occur again. Report further states the socio-economic consequences of population ageing in following words: "Population ageing is profound, having major consequences and implications for all facets of human life. In the economic area, population ageing will have an impact on economic growth, savings, investment and consumption, labor markets, pensions, taxation and intergenerational transfers. In the social sphere, population ageing affects health and health care, family composition and living arrangements, housing and migration" (United Nations, 2002). However, the process of ageing and demographic change is not same in all the countries. Many developing countries like Pakistan are still not at their advance stage of demographic transition. With the median age of just 22 years, Pakistan is experiencing a sharp decline in dependency ratios and increasing share of working age population (WAP). While Japan being on its last stage of demographic transition and with the median age of 45 years, is facing the problem of ageing population and a declining labor force. This demographic divide presents different challenges and opportunities for countries depending upon their stage of demographic transitions. The aim of this paper is to analyze and compare the process of demographic change in Japan and Pakistan which can help us to understand the policy Pakistan needs to adopt to avoid ageing future by learning from the experience of Japan.

The study also aims to investigate how marginal changes in labor productivity, rate of effective employment, and two distinct age structures are transformed into per capita GDP growth of both the countries. Specifically, the objectives of this paper are as follows:

- To measure and compare the speed at which demographic transition is taking place in Pakistan and Japan, and how it will affect their respective ageing index, potential support ratio (PSR), and the share of WAP.
- Analyze the impact of changing age structures, employment ratios, and output per worker on per capita economic growth of both the countries.

2. LITERATURE REVIEW

Recently, a lot of research has been done on the economic implications of population ageing. In Japan, for example, Braun et al. (2009) analyzed the impact of ageing on saving rates and found a negative relationship during 1990s. Faruqee and Muhleisen (2003) also showed that annual GDP growth rate in Japan will decline by 0.5 percent over the next half century due to population ageing. Similarly, Bloom et, al. (2010) also concluded that population ageing will tend to decrease labor supply and saving rates that will slow down the economic growth in future.

The composition of public expenditures also changes with the process of ageing and they are more inclined toward social security and provision of pension etc. For instance, Turner et al. (1998) found that providing pension to increasing ageing population will exert a huge pressure on the financial system of Japan, which may lead to further deterioration of financial balance up to 10 percent of national income by the mid of 21st century. Similarly, a decrease in the share of WAP leads to a decrease in tax revenue that further imbalances the public finance in OECD economies (Gonzalezand and Niepelt, 2012). On same grounds, Faruqee and Muhleisen (2003) found that adverse population dynamics in Japan are making public debt unsustainable, so the government has to put cuts on its expenditures. An and Jeon (2006) also concluded that if the share of older population exceeds more than 7%, then it will start to depress economic growth rate in future.

Contrary to ageing, the impact of growing WAP on economic growth has also been analyzed by many demographers. Prskawetz et al. (2007) found a positive effect of growth rate of WAP on labor productivity in India. Studies by Azomahou and Mishra (2008) and Crenshaw et al. (1997) also found a positive relationship between economic growth and rising share of WAP in different countries.

In Pakistan, Ahmad and Azeem (2010) analyzed the labor market of youth population and concluded that having young population presents a huge opportunity and challenge as lack of opportunities for youth may divert their attentions towards violence and non-productive activities.

The role of demographic change in the prediction of future economic growth has also been analyzed by many researchers. Bloom et al. (2007) found that the inclusion of age structure improves the prediction power of the model for the period of 2000-2020. Choudhry and Elhorst (2010) also estimated the expected contribution of demographic variables in the future economic growth of China, India, and Pakistan for the period of 2005-2050. They found that the total contribution of demographic factors will be -0.79%, 1.49%, and 1.97% in China, India and Pakistan respectively. Bloom and Finlay (2009) found that a decline in the share of WAP in East Asian nations (China, Japan, South Korea, and Singapore) will lead to a decline in economic growth in future. They projected that the South Asian countries will experience a positive economic growth due to growth in WAP for the period of 2005-2050.

Lack of young labor force may also affect countries' future economic performance in many ways. Auer and Fortuny (2000) in their study of ageing of the labor force in OECD countries suggested that due to lack of young labor force, elderly people have to stay in labor force for a longer period of time, for this, countries have to re-design their retirement and training polices to accommodate older work force. In Japan, a study by Katsumata (2001) showed that Japanese due to concern of shrinking work force are using labor saving technologies in the process of production.

3. A COMPARISON OF DEMOGRAPHIC CHANGE BETWEEN JAPAN AND PAKISTAN

In the following section, we measure the speed and magnitude of demographic transitions between Pakistan and Japan along with their impact on respective ageing index and potential support ratio for the period of hundred years (1950-2050). The data used in this section is taken from World Population Prospect: The 2015 Revision (United Nation, 2015).

3.1 Speed and Magnitude of the Demographic Change

Table 1 presents the speed of demographic change in Pakistan and Japan for the period of hundred years (1950-2050). It clearly shows that the process of losing the share of younger population, which provides a base of future labor force started much earlier in Japan at a very high rate as compared to Pakistan.

The most remarkable is the speed at which the share of old age people is increasing in Japan, from 1950 to 2050, the share of elderly people will increase from 4.9 percent to 36.5 percent, which shows a 645 percentage point increase over the period of hundred years. This also shows the improvement in average life of Japanese people, which is almost 84 years and one of the highest in the world (WHO, 2015).

Table 1. Speed of Demographic Change in Pakistan and Japan

Country/Period	**Percentage of Population (below 15)**						**Percentage Change (1950-2050)**
	1950	**1970**	**1990**	**2010**	**2030**	**2050**	
Pakistan	40.3	42.4	43.0	36.2	30.7	25.0	
Percentage change		**5.2**	**1.4**	**-15.8**	**-15.2**	**-18.6**	**-38.0**
Japan	35.4	24.1	18.4	13.3	12.2	12.4	
Percentage change*		**-31.9**	**-23.7**	**-27.7**	**-8.3**	**1.6**	**-65.0**
	Percentage of Population (15 to 65 years)						
Pakistan	54.1	53.8	53.1	59.4	63.8	66.1	
Percentage change		**-0.6**	**-1.3**	**11.9**	**7.4**	**3.6**	**22.2**
Japan	59.6	68.9	69.6	64.0	57.8	51.4	
Percentage change		**15.6**	**1.0**	**-8.0**	**-9.7**	**-11.1**	**-13.8**
	Percentage of Population (above 65)						
Pakistan	5.6	3.8	3.9	4.4	5.5	8.4	
Percentage change		**-32.1**	**2.6**	**12.8**	**25.0**	**52.7**	**50.0**
Japan	4.9	7.1	12	22.9	30.4	36.5	
Percentage change		**44.9**	**69.0**	**90.8**	**32.8**	**20.1**	**644.9**

Source: Based on data from United Nation, 2015 and authors' own calculations.

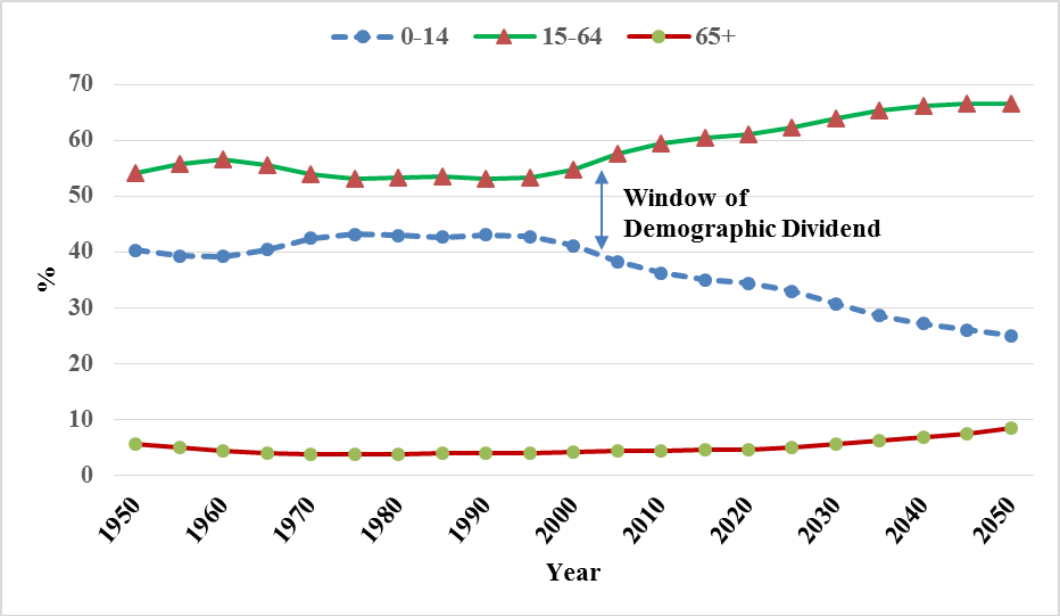
* shows the percentage change over 20 years period

Figures 1 and 2 also depict how changing share of age structures gives rise to a window of demographic dividend for Pakistan and a concern of ageing population for Japan.

3.2 Index of Ageing

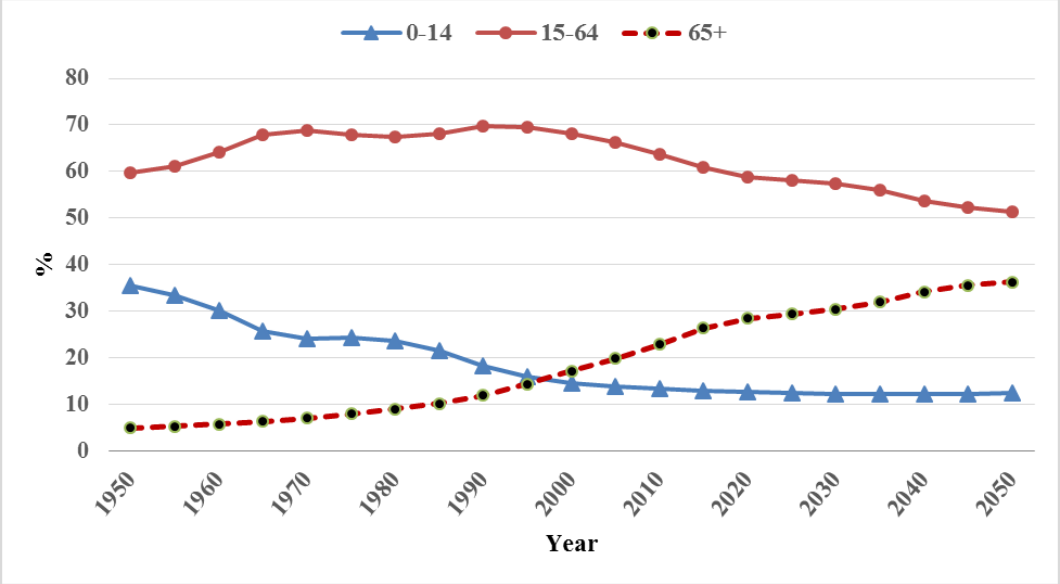
Index of Aging is a measure which shows whether a population is getting older or younger. It shows the number of older people (65 or over) for every hundred children in a society. Figure 3 shows that Japan experienced a huge increase of around 13.5 times in its ageing index from 14 older people (aged over 65 years) per hundred children (less than15) in 1950 to 204 per hundred children in 2015.

Figure 1. Percentage share of different age groups, Pakistan



Source: Author's own presentation based on data from United Nation, 2015.

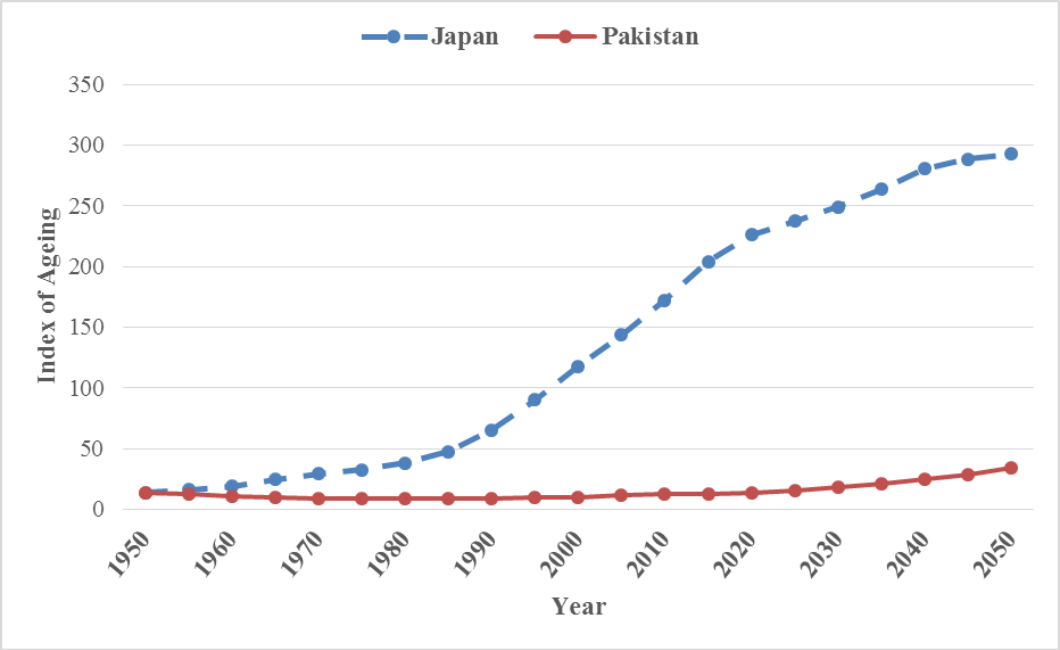
Figure 2. Percentage share of different age groups, Japan



Source: Source: Author's own presentation based on data from United Nation, 2015.

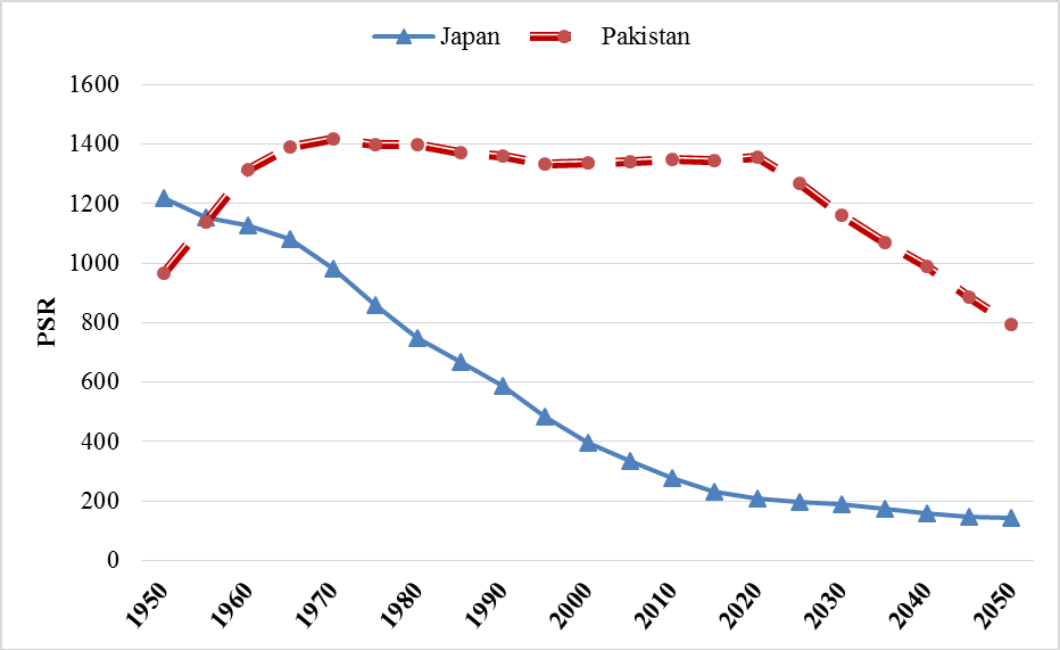
In the case of Pakistan, ageing index declines slightly from 14 older people per 100 children in 1950 to 13 older people per 100 children in 2015. However, the speed of ageing in future will be much faster in Japan and by the end of year 2050, there will be 293 aged people for every 100 children as compare to just 34 aged people for every 100 children in Pakistan. It also shows the potential change in allocation of resources in future for both the countries. Pakistan being a youthful country would have to divert its resources towards education and employment generation, while Japan being an ageing society would need to have focus on more healthcare and old age institutions.

Figure 3. Index of Ageing



Source: Source: Author's own presentation based on data from United Nation, 2015.

Figure 4. Potential Support Ratio, PSR



Source: Source: Author's own presentation based on data from United Nation, 2015.

3.3 Potential Support Ratio, PSR

Potential support ratio - as the name suggests - shows the percentage of population who are more likely to be productive relative to the people who are more likely to be dependent. The reverse of it is known as Parent Support Ratio, which measures the support that is demanded by older members of a family in order to spend the last period of their lives. In other words, it is a rough indicator that highlights the

changes in the family support system required for elder members in a society (United Nations, 2002). The Figure 4 clearly shows that in 1950, Japan was in better position than Pakistan in terms of number of people in prime working age per 100 older people of age 65 or above. However, Pakistan experienced a gradual increase in the potential support ratio, while Japan experienced a sharp decrease in that ratio and by the year 2050, there will be just 1.4 people in primary working age to support every older person in Japan compared to almost 8 persons in Pakistan.

4. RELATIONSHIP BETWEEN DEMOGRAPHIC CHANGE AND PER CAPITA INCOME GROWTH: SHAPLEY'S DECOMPOSITION APPROACH

To analyze how different demographic factors such as share of working age in total population and economic factors such as labor productivity and employment rate have affected the GDP per capita in Pakistan and Japan we used Shapley's Approach of Decomposition of GDP. This approach is outlined in Reference Manual of JoGGs Decomposition Tool developed by World Bank (World Bank, 2010). According to Shapley's approach, GDP per capita of a country can be decomposed into the following factors:

$$\frac{GDP}{Total\ Population} = \frac{GDP}{Employed} \times \frac{Employed}{\text{WAP}} \times \frac{\text{WAP}}{Total\ Population}$$

Above equation can be written in following functional form

$$\boldsymbol{Y = \alpha^* \beta^* \gamma^*} \qquad \textbf{(1)}$$

Where

$\boldsymbol{Y}$ **= GDP Per Capita**

$\boldsymbol{\alpha^*}$ **= Output per worker/ Labor Productivity**

$\boldsymbol{\beta^*}$ **= Employment Rate**

$\boldsymbol{\gamma^*}$ **= Share of WAP/Age Structure**

Above decomposition of GDP has the property of being additive. Thus, we can say that the total change in GDP per capita ($\boldsymbol{Y}$) is the sum of growth of output per worker ($\boldsymbol{\alpha^*}$), employment rate ($\boldsymbol{\beta^*}$), and age structure of population ($\boldsymbol{\gamma^*}$). Taking $\bar{\alpha}, \bar{\beta}, \text{ and } \bar{\gamma}$ as the share of growth contributed by each component, the above equation can be written as

$$\bar{Y} = \bar{\propto} + \bar{\beta} + \bar{\gamma} \qquad \textbf{(2)}$$

Where$\bar{Y}$ = Growth rate of GDP per capita, $\bar{\alpha}$ = Change in output per worker or growth in labor productivity, $\bar{\beta}$= change in employment rate, and $\bar{\gamma}$ = change in share of WAP to total population.

4.1 Data Sources

Data for WAP and employed population is only available from the year 1976, so we take that year as a reference or base year in order to compare the growth rates in different variables from 1976 to 2015. Data of total population and WAP is taken from World Population Prospects: The 2015 Revision. Data for total number of employed is taken from ILO statistical database (ILOSTAT), while data of GDP is taken from The World Development Indicators, 2016.

4.2 Results and Interpretations

Table 2 & 3 present data of basic variables used in our analysis for Pakistan and Japan respectively. A comparison of demographic variables shows a much larger increase in total population, WAP, and employed population for Pakistan as compared to Japan, which suffers a decline in the share of WAP from 1976 to 2015 by 6.68 percentage points. The distinct feature in these two tables is the remarkable increase in output per worker or labor productivity in Japan, which confirms the result of earlier study of Katsumata (2001). Japan, despite of unfavorable demographic structure, has been able to increase its

per capita GDP by 112 percent during the reference period. This may be due to the advance use of technology and very high employment rate.

Table 2. Employment, Output, Productivity and Population. Pakistan 1976-2015

	1976	**2015**	**% change**
GDP in Constant US$ (2010)	33,813,533,506	215,894,314,582	538.5
Total population	68,818,471	188,924,874	174.5
Total WAP (working age population)	36,521,963	114,299,549	213.0
Total number of employed	20,549,195	95,841,589	366.4
GDP per capita	491	1,143	132.58
Output per worker	1,645	2,253	36.90
Employment rate	56.27	83.85	49.03
Share of WAP	53.07	60.50	7.43

Source: Generated from JoGGs Decomposition Tool, World Bank (2010)

Table 3. Employment, Output, Productivity and Population. Japan 1976-2015

	1976	**2015**	**% change**
GDP in Constant US$ (2010)	2.5E+12	5.99E+12	139.69
Total population	1.13E+08	1.27E+08	12.58
Total WAP (working age population)	76097871	77190751	1.44
Total number of employed	69793972	72696421	4.16
GDP per capita	22146.59	47150.37	112.90
Output per worker	35783.79	82344.33	130.12
Employment rate	91.71606	94.17763	2.68
Share of WAP	67.48	60.8	-6.68

Source: Generated from JoGGs Decomposition Tool, World Bank (2010)

Results of Decomposition of GDP into its components as explained in equation 2 are presented both in absolute and percentage terms through Table 4 and Table 5 for Pakistan and Japan respectively.

Results show that in Japan, growth in output per worker is the main contributor of per capita income growth, while a decline in the share of WAP has contributed negatively. In the case of Pakistan, all three factors i.e. growth in output per worker, employment rate, and increase in the share of WAP has contributed positively in per capita income growth with their respective shares of 37%, 47%, and 15.7%.

Table 4. Decomposition of Growth in per capita GDP, Pakistan 1976-2015

	US$ Constant, 2010	**Respective Share in Per Capita Growth**
Total Growth in GDP per capita	651.41	100 %
Growth due to Labor Productivity (output per worker)	242.57	37.24 %
Growth due to change in employment rate	306.35	47.03 %
Growth due to changes in the share of WAP	102.49	15.73 %

Source: Generated from JoGGs Decomposition Tool, World Bank (2010)

Table 5. Decomposition of Growth in per capita GDP, Japan 1976-2015

	US$ Constant, 2010	**Respective Share in Per Capita Growth**
Total Growth in GDP per capita	25003.8	100.0 %
Growth due to Labor Productivity (output per worker)	27751.2	111.0 %
Growth due to change in employment rate	926.2	3.7 %
Growth due to changes in the share of WAP	-3673.6	-14.7 %

Source: Generated from JoGGs Decomposition Tool, World Bank (2010)

5. LESSONS AND POLICY RECOMMENDATIONS

The experience of Japan as one of the ageing societies presents great lessons for the countries like Pakistan. Pakistan has already passed its baby boom period and now experiencing low dependency ratios and higher rate of WAP. Population projections show that by the mid of the 21stcentury, Pakistan will face the problem of ageing population. In this situation, perusing the active population control policy may accelerate the pace of demographic transition and ageing future. The experience of Japan also teaches a lesson that once the ageing process starts getting momentum, it becomes very difficult to slow it down. Moreover, to reap the benefits of favorable demographic variables, Pakistan needs to improve the quality of labor force by providing critical skills and education to enhance their productivity. Japan, despite all unfavorable demographic factors, is able to sustain a steady growth due to its human capital and continuous improvement in technology and productivity.

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