A Note on Demographic Dividend and Bonus

Yoshiaki HISAMATSU*

Abstract

This short note examines literature on “Demographic Dividend (Bonus or Gift)” in the framework of the impact of demographic forces on economic growth. Recently, a number of economists have tried to shed new lights on the impact of demographic factors on economic growth and called the positive impact “Demographic Dividend (Bonus or Gift).” The analysis shows that there are certain fruitful research areas.

1. Introduction

Our research addresses the following set of tasks. First, we evaluate recent macroeconomic studies on the demographic transition, in terms of conceptualization, analytics and empirics. Second, we examine micro reasoning behind the macro formulations. Third, we conclude by proposing a development economics-based approach.

2. Recent macroeconomic studies on the demographic transition (DT)

2-1. Conceptualization

The recent emphasis on the age composition of population and its change over the DT cycle has shed new light on the impacts of demographic factors on macroeconomic growth. The central concept is the “Demographic Dividend (Bonus or Gift)” (DD), or the potential for growth offered by a higher level of the ratio of working age population to total population (WA Ratio). The reverse side of this conception is that of “Demographic Burden” (DB) caused by a lower level of the WA Ratio.

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2-2. Analytics

Formalization and theorization of the DD (and DB) thesis incorporates and combines the growth convergence theory and the demographic accounting; the latter offers an expression for the impact of a change in the WA Ratio on growth rate.

The demographic account part is explained by demographic transition from one situation where both high death rate and high birth rate coexist to the other situation where both low death rate and low birth rate coexist. It is commonly

![Chart 1](image)

*Figure 1. Demographic Transition and Population Growth*

*Chart 1*

Source: Bloom and Williamson (1998)
understood that in history during the transition death rate declines first and that
birth rate decline follows with certain time lag (Chart 1).

The full impact of the changes in death and birth rates on age composition are
not fully captured by mere population growth rate. The different timing of the two
rates mentioned above produces temporary population spur and a populational
bulge. This age group is larger in population than both preceding age group and
following age group.

This age group affects economy in various ways. First, when they are children,
they create more demand childcare–related services simply because the size of this
age group is larger. This effect is called “Demographic Burden (DB)” Second,
when this age group reaches working age and participates labor force, the economy
has more labor force relative to total population than before. This effect could be
called “Demographic Opportunity.” When this opportunity is seized and realized
productively, the economy enjoys “Demographic Dividend (Bonus or Gift).”
Third, this age group gets old and retires, the demand of social security could be
sizable. So, there is another possibility of “Demographic Burden.” From eco-
nomic point of view, the first and the third phases of the total process create the
demands for broadly–defined social services (childcare–related services in the first
and social security for the elderly in the third phase). The second phase, in
contrast, could have positive impact on labor supply.

There is a long and significant amount of research between population and
economic performance, which dates back to Malthus (1766–1834). Recently, three
Harvard economists have focused on the effect of age composition to economic
growth in a framework of conditional convergence of economic growth.

2–3. Empirics

The growth regression formula is employed and expanded to include the WA
Ratio as explanatory variable in conditional growth convergence model (Barro and
Xala–I–Martin, 1995). In a simple model, the two parts of the equation are
postulated to be separable.

Growth convergence in demographic dividend literature is framed in Solow
–Swan Model. The main idea of conditional convergence is that an economy
grows faster the further it is from its own steady–state value. Among the various
formulations of technological progress, only labor–augmenting technological
change (Harrod neutral) is consistent with the existence of a steady state. A log
-linear approximation of the dynamic equation in the neighborhood of the steady rate would derive transitional growth rate:

\[ g_\gamma = \alpha \ln \left( \frac{y^*}{y(T_1)} \right) \]  

(1)

as written in Broom and Williamson (1998), where \( y^* \) is income per worker in the steady rate and \( y(T_1) \) is income per worker at time \( T_1 \). A standard Solow–Swan growth model with Cobb–Douglas technology says:

\[ \alpha = (1 - \theta)(x + n + \delta) \]  

(2)

where \( \theta \) is capital–share parameter, \( x \) is growth rate of technological progress, \( n \) is population growth rate, and \( \delta \) is capital depreciation ratio. This equation implies that given \( \theta, n, \) and \( \delta \), the estimated \( \alpha \) gives \( x \), which is the growth rate of income per capita. The equation (1) can be used to calculate the half–life of convergence which is the time that it takes for half the initial gap to be eliminated\(^1\). The half life is

\[ \log(2)/\alpha = 0.69/\alpha. \]  

(3)

Bloom and Williamson (1998) introduce a modification which changes the model from output per worker \( y \) to output per capita \( \hat{y} \).

\[ \hat{y} = Y/N = (Y/L)(L/N) = y(L/N) \]  

(4)

where \( N \) is the total population, \( L \) is the number of workers, and \( \hat{y} \) is output per capita. In growth terms,

\[ g_\gamma = g_\gamma + g_{\text{workers}} - g_{\text{population}} \]  

(5)

This expression says that changes in population and age structure have a purely transitional effect on economic growth.

Bloom and Williamson (1998) assume that \( y^* \) is formed that

\[ y^* = X\beta \]  

(6)

where \( X \) is a matrix with \( k \) determinants of the steady state.

The equations (1), (5), (6) and a stochastic term would create the equation (7):

\(^1\) Barro and Sala–i–Martin (1995: 37)
\[ g_5 = X_1 \Pi_1 + y(T_1) \Pi_2 + g_{\text{workers}} \Pi_3 - g_{\text{population}} \Pi_4 + \varepsilon \quad (7) \]

With the regression result based on (7), Bloom and Williamson (1998) defends Chart 2 (their Figure 6). They claim that, if the East Asian miracle is defined as a share of per capita GDP growth between 1960 and 2010 (6.1%), then the demographic transition (1.9%) accounts for about one-third of the miracle. If it is defined as the surplus over the sustainable rate (2%), then the transition accounts for almost half.

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>1a</th>
<th>1b</th>
<th>2a</th>
<th>2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate of economically active population, 1965–90</td>
<td>1.95</td>
<td>1.46</td>
<td>(0.38)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Population growth rate, 1965–90</td>
<td>1.87</td>
<td>1.03</td>
<td>(0.43)</td>
<td>(0.40)</td>
</tr>
<tr>
<td>Difference in growth rates*</td>
<td>1.97</td>
<td>1.68</td>
<td>(0.38)</td>
<td>(0.35)</td>
</tr>
<tr>
<td>GDP per capita as a ratio of U.S.</td>
<td>1.36</td>
<td>2.00</td>
<td>1.39</td>
<td>1.97</td>
</tr>
<tr>
<td>GDP per capita, 1965 (logged)</td>
<td>(0.21)</td>
<td>(0.21)</td>
<td>(0.21)</td>
<td>(0.22)</td>
</tr>
<tr>
<td>Log life expectancy, 1960</td>
<td>3.96</td>
<td>2.94</td>
<td>(0.97)</td>
<td>(0.97)</td>
</tr>
<tr>
<td>Log years of secondary schooling, 1965</td>
<td>0.50</td>
<td>0.28</td>
<td>0.50</td>
<td>0.28</td>
</tr>
<tr>
<td>Natural resource abundance</td>
<td>4.86</td>
<td>2.35</td>
<td>4.86</td>
<td>2.57</td>
</tr>
<tr>
<td>Openness</td>
<td>2.06</td>
<td>1.92</td>
<td>2.00</td>
<td>1.72</td>
</tr>
<tr>
<td>Quality of institutions</td>
<td>0.23</td>
<td>0.20</td>
<td>0.22</td>
<td>0.15</td>
</tr>
<tr>
<td>Access to ports dummy</td>
<td>-0.35</td>
<td>-0.64</td>
<td>-0.31</td>
<td>-0.40</td>
</tr>
<tr>
<td>Average government savings rate, 1970–90</td>
<td>0.14</td>
<td>0.14</td>
<td>(0.03)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Tropics dummy</td>
<td>-1.31</td>
<td>-1.20</td>
<td>(0.30)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>Ratio of coastline to land area</td>
<td>0.24</td>
<td>0.23</td>
<td>(0.11)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.46</td>
<td>-19.5</td>
<td>-2.28</td>
<td>-14.3</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.76</td>
<td>0.86</td>
<td>0.78</td>
<td>0.85</td>
</tr>
<tr>
<td>( F(1, 68) ) &amp; 0.22; Prob &gt; F = 0.64 &amp; 9.03; Prob &gt; F = 0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The dependent variable is the growth rate of real GDP per capita in 1965–90 in purchasing power parity terms. Estimates are from ordinary least squares. The sample size is 78 economies (see the appendix). Standard errors are reported in parentheses.

a. Growth rate of the economically active population minus growth rate of the total population, 1965–90.
b. Test of the null hypothesis that the population growth rate equals the negative of the growth rate of the economically active population between 1965 and 1990.

Source: Authors’ calculations.

One result of Bloom and Williamson (1998) is Table 1 (their Table 3). They note that this “table confirms that the growth of the working-age population has a
powerful, positive impact on growth of GDP per capita, while growth of the total population has a powerful negative impact after controlling for other expected influences.” They use this result to account for demographic impact of East Asia’s high economic growth between 1965 and 1990. Table 2 (their Table 7) shows the estimated contribution which is created by multiplying the coefficients on the growth rate of economically active population and the population growth rate by the regional averages and adding the two for each of the reported specifications. They argue that population dynamics can explain between 1.37 and 1.87 percentage points of growth of GDP per capita in East Asia or as much as one-third of the miracle \((1.9/6.11=0.31)\).

<table>
<thead>
<tr>
<th>Region</th>
<th>Average growth rate of real GDP per capita</th>
<th>Average growth rate of population</th>
<th>Average growth rate of economically active population</th>
<th>Average growth rate of dependent population</th>
<th>Estimated contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>3.33</td>
<td>2.32</td>
<td>2.76</td>
<td>1.56</td>
<td>1.04 1.04 0.86 0.73</td>
</tr>
<tr>
<td>East Asia</td>
<td>6.11</td>
<td>1.58</td>
<td>2.39</td>
<td>0.25</td>
<td>1.71 1.87 1.60 1.37</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>3.80</td>
<td>2.36</td>
<td>2.90</td>
<td>1.66</td>
<td>1.25 1.81 1.07 0.31</td>
</tr>
<tr>
<td>South Asia</td>
<td>1.71</td>
<td>2.27</td>
<td>2.51</td>
<td>1.95</td>
<td>0.66 1.34 0.48 0.41</td>
</tr>
<tr>
<td>Africa</td>
<td>0.97</td>
<td>2.64</td>
<td>2.62</td>
<td>2.92</td>
<td>0.14 1.10 0.07 0.06</td>
</tr>
<tr>
<td>Europe</td>
<td>2.83</td>
<td>0.53</td>
<td>0.73</td>
<td>0.15</td>
<td>0.43 0.52 0.39 0.33</td>
</tr>
<tr>
<td>South America</td>
<td>0.85</td>
<td>2.06</td>
<td>2.50</td>
<td>1.71</td>
<td>1.03 1.54 0.87 0.74</td>
</tr>
<tr>
<td>North America</td>
<td>1.61</td>
<td>1.72</td>
<td>2.13</td>
<td>1.11</td>
<td>0.94 1.34 0.81 0.69</td>
</tr>
<tr>
<td>Oceania</td>
<td>1.97</td>
<td>1.57</td>
<td>1.89</td>
<td>1.00</td>
<td>0.74 1.14 0.62 0.53</td>
</tr>
</tbody>
</table>

*Note:* The averages in the first four columns are unweighted country averages. The estimated contribution is created by multiplying the coefficients on the growth rate of economically active population and the population growth rate (table 5) by the regional averages and adding the two for each of the reported specifications. Source: Authors’ calculations.

Source: Bloom and Williamson (1998)

Then, to summarize their argument, they draw Chart 2 (their Figure 6) to make their case. They note that the chart “offers a stylized version of the economic hypothesis in which the sustainable growth rate is taken to be about 2 percent a year.” They claim that the 2 percent is the estimated steady state growth rate where population is also in steady state and has no impact.

Although their chart is quite illustrative of their message, it raises a number of questions. First, they are not explicit about the calculation of the steady growth rate. But, as we pointed out before, the equation (2) could be used to calculate the steady state growth rate \(x\).

Second, they simply assume that around 2010 all the transitional forces including demographic impact will end. Certainly, as one of their chart shows, the ratio of working-age population relative to nonworking-age population is forecasted to
peak out around 2020. Thus, positive demographic impact would end at the moment. But, there is no reason why other transitional forces will end at the same time, too. In addition, there is no reason why other forces started around 1960, too.

Third, in spite that they were quite explicit about the fact that there was demographic burden period before 1960s, they just don’t presume that there will be another after demographic gift phase. It is quite puzzling to see economic growth returning to its sustainable rate without demographic burden period after.

Instead of the equation (4), Bloom and Canning (2004) use an accounting identity that links income per capita \( Y/N \) to income per member of the working age population \( Y/WA \):

\[
Y/N = (Y/L) (L/WA) (WA/N)
\]  

(4)

Assuming \( L/WA \) is constant, this implies in growth rate terms:

\[
g_{Y/N} = g_{Y/L} + g_{WA/N}
\]

(4)"
The equation (1) could be written with initial point as 0:

$$g_{Y/L} = \alpha (\ln Y/L - \ln Y_0/L_0)$$

(1')

Inserting (1)' into (4)' ,

$$g_{Y/N} = \alpha (\ln Y/L - \ln Y_0/L_0) + g_{WA/N}$$

(8)

Assuming $\ln Y/L = X\beta$ and an accounting identity that $\ln Y_0/L_0 = \ln Y_0/N_0 - \ln L_0/WA_0 - \ln WA_0/N_0$,

$$g_{Y/N} = \alpha (X\beta + \ln L_0/WA_0 + \ln WA_0/N_0 - \ln Y_0/N_0) + g_{WA/N}$$

(9)

The ratio of workers to total population appears both as a level term and as a growth term. Due to the identity used to derive this regression, the coefficients on these terms are fixed (equal to $\lambda$, or minus the coefficient on initial income per capita for the level term, and equal to one for the growth term).

The estimation result is Table 3 (their Table 1). Bloom and Canning (2004) note that in column 2, Log initial working age over total population has a positive and significant coefficient. In terms of growth rate of working age over total population, the estimated coefficient is closed to one. They claim that the effect of increases in the working-age population on labor supply is to give a supply-side boost to potential output. In addition, they try to estimate an interaction effect between the ratio of working-age to total population and the degree of openness of the economy, to test whether the effect of increasing the working-age ratio depends on the flexibility of the economy as measured by its openness. They find a large positive coefficient on this interaction term in column 3. They argue that the impact of demographic change may be to increase labor supply, but how well this extra supply of workers is put to productive employment depends on the economic system and policies being used.

The interpretation of the interaction term is intriguing in the sense that given a low working age over total population ratio, the impact of flexibility of the economy is small. In other words, with high dependent population ratio, the closed economy is less harming to economic performance.
Table 3

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.607***</td>
<td>0.650***</td>
<td>0.531***</td>
</tr>
<tr>
<td></td>
<td>(3.58)</td>
<td>(3.73)</td>
<td>(2.84)</td>
</tr>
<tr>
<td>Openness</td>
<td>0.070***</td>
<td>0.067***</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>(3.96)</td>
<td>(3.86)</td>
<td>(1.19)</td>
</tr>
<tr>
<td>Institutional Quality</td>
<td>0.008*</td>
<td>0.008*</td>
<td>0.009*</td>
</tr>
<tr>
<td></td>
<td>(1.73)</td>
<td>(1.69)</td>
<td>(1.90)</td>
</tr>
<tr>
<td>Ethno-linguistic</td>
<td>-0.049**</td>
<td>-0.048*</td>
<td>-0.046</td>
</tr>
<tr>
<td>Fractionalization</td>
<td>(1.71)</td>
<td>(1.73)</td>
<td>(1.60)</td>
</tr>
<tr>
<td>Landlocked</td>
<td>-0.013</td>
<td>-0.011</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(0.72)</td>
<td>(0.58)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Tropical Area</td>
<td>-0.032</td>
<td>-0.035*</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>(1.57)</td>
<td>(1.71)</td>
<td>(1.44)</td>
</tr>
<tr>
<td>Initial average years of schooling</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.48)</td>
<td>(0.45)</td>
<td>(0.37)</td>
</tr>
<tr>
<td>Initial life expectancy</td>
<td>0.003***</td>
<td>0.005***</td>
<td>0.007***</td>
</tr>
<tr>
<td></td>
<td>(3.41)</td>
<td>(2.93)</td>
<td>(3.33)</td>
</tr>
<tr>
<td>Log initial income per capita</td>
<td>-0.096***</td>
<td>-0.095***</td>
<td>-0.101***</td>
</tr>
<tr>
<td></td>
<td>(5.48)</td>
<td>(5.50)</td>
<td>(5.58)</td>
</tr>
<tr>
<td>Log initial working age over total pop</td>
<td>0.205*</td>
<td>0.241*</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td>(1.71)</td>
<td>(1.89)</td>
<td>(1.17)</td>
</tr>
<tr>
<td>Growth of working age over total pop</td>
<td>0.006***</td>
<td>1.394**</td>
<td>-0.310</td>
</tr>
<tr>
<td></td>
<td>(3.06)</td>
<td>(2.49)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Growth of working age times openness</td>
<td>2.524**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.08)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.321</td>
<td>0.318</td>
<td>0.313</td>
</tr>
</tbody>
</table>

Based on 507 observations, from 5 year panel of countries, over the period 1965-1995. Time dummies included but not reported. Heteroskedasticity-consistent standard errors are reported in parentheses below the coefficient estimates.


In sum, the messages from the macroeconomic studies on DT are clear and may be summarized as follows:

1. DD contributes to a higher rate of economic growth.
2. DB depresses the rate of economic growth
3. DD is an opportunity to be captured. It takes right policies and institutions to make best of it.

2-4. Evaluation

In this paper, we focus on how to convert “Demographic Opportunity” into “Demographic Dividend (Bonus or Gift).” Our attention into the first demo-
graphic burden phase is limited in the sense that we focus on the issues where its implication of the “Demographic Opportunity” phase is relevant. We also focus on labor issues only, though Bloom and his company also talks about savings. Four points could be highlighted.

First, the impacts of changes in the WA Ratio on macroeconomic performance represent a meaningful and fruitful focus of research. After all, demographic transition gives economy a big push in working age population. The literature led by Bloom and his company highlighted this simple, straightforward and important fact.

Second, however, labor market considerations are almost exclusively in terms of quantity of labor supply. Three additional questions related to that factor seem to merit more explicit and systematic investigation, i.e., (i) quality of labor (health and functional status, and knowledge and skill status); (ii) labor–market adjustment (real wage, informal institutions, and public policies and institutions); (iii) investment demand with (i) and (ii) above included as determinants. It should be noted that skilled and unskilled labor markets should be separately indicated.

Third, there may be meaningful areas of research on the labor mobility into and out of the DD phase. There may be certain conditions that will help enhance economic potentials during the subsequent phases in the DT cycle. For example, health might cause demographic transition anyway. Education could cause the transition, too. Healthy and educated/skilled labor force is necessary.

Fourth, the question of “capturing or missing DD” might better be formulated differently, i.e., in more traditional growth/development approaches with demographic factors tacked on rather than within the demography-centric formulation. The next section summarizes and discusses country experiences documented in a few “demographic dividend hypothesis” papers.

3. Examination of country experiences

3-1. Ireland

Bloom and Canning (2003, 2004) examine Ireland’s high growth experience, arguing that this is one of country experiences which have taken advantage of demographic dividend. They documented that the legalization of contraception in 1980 resulted in a sharp decline in fertility and a sizeable increase in the relative share of the working-age population. They convincingly argue that the resulting
demographic shift, operating in conjunction with a favorable policy environment, can explain in large measure the birth of the Celtic Tiger.

Bloom and Canning consider it as important that Ireland, like the “miracle” economies in East Asia, had in place economic and social policies that favored its taking advantage of the demographic shift it experienced. In the case of Ireland, they highlight two policies. The first one is the policy change in the mid–1960s from closed economy model to new policies with an emphasis on encouraging direct foreign investment and promoting exports. The second one is the introduction of free secondary education adopted in mid–1960s. It is interesting to note that the both changes took place in mid–1960s. It should be kept in mind that the “Celtic Tiger” was named in 1990s when Ireland’s economic growth rate jumped to around 6% from 3.5% between mid–1960s and 1980s. Thus, the time lag from important policy changes and the high growth was about 25 years, a fairly long period.

3-2. Latin America and East Asia Comparison

Bloom and Canning (2004) noted that the potential of this “demographic dividend” is not always realized. According to them, without appropriate policies the extra labor supply can result in unemployment or underemployment, with political instability, elevated rates of crime, and the deterioration of social capital a possible further consequence.

They single out economy–wide flexibility and its ability to absorb labor force in determining whether a country will capitalize on its demographic opportunity. They use Latin America and East Asia comparison to illustrate their point. Even though both Latin America and East Asia have similar demographic histories, demographic opportunity alone has been insufficient for Latin America. Bloom and Canning (2004) put forward three hypotheses to explain the difference. First, they highlight the difference in engaging in international trade. East Asia, taking advantage of international trade, could find a way to absorb rapidly increasing labor force. In contrast, Latin America, with inconsistent economic policies, could not find a way to provide employment to the working-age population. Second, they highlight labor laws, which they claim is more flexible in East Asia than in Latin America. This contributes to labor absorption. Third, the difference in financial market may matter in transferring resource in the economy.

Therefore, in summary, Bloom and Canning (2004) say that well–chosen and effectively implemented policies in these areas — engagement with global economy,
labor practices, and capital market (and education) — are all potential complements to the demographic dividend.

3-3. Discussion

In explaining the country difference, or sorting out winners against losers, “Demographic Dividend” literature boils down to a following criteria: whether a country could be sufficiently flexible enough to absorb a rapidly increasing labor force. We believe that direct focus on country’s ability in labor force absorption is indispensable. This applies both to empirical framework and to theoretical framework. The empirical attempt should have multi-sector labor market since it would generally involve agricultural, industrial and service sectors. It is worth mentioning that Bloom and Freeman (1986, 1988) are the pioneers of this exercise, directly examining labor market performance. Unfortunately, their data coverage ends in 1979, which did not include “tiger” performances in both East Asia and Ireland. Likewise, the appropriate theoretical framework should also be equipped with multi-sector treatment (e.g., Matsuyama 1992), against one sector model which is exemplified by typical economic growth model.

4. The Result of Literature Survey

We believe that the key messages of the macroeconomic DT studies, i.e. the DD and DB propositions and the view of DD as an opportunity open to all countries, spelled out in 1-4 above, are better addressed in a development economics–based approach. The proposed approach will be based on the traditional two-sector modeling of economic development a la Fei and Ranis (1964) and Kelley, Williamson, and Cheetham (1972). This approach provides a useful template to incorporate agenda for further investigation mentioned in the section 2.

On empirical side, a fruitful approach would be an update of Bloom and Freeman (1986,1988). They provide us with comparable empirics. Thus, in the future, we will intend to follow up

Reference:


