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Age and Education Effects in the First Demographic Dividend of Bangladesh: A Decomposition Analysis

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The paper attempts to examine the economic effect of changing age structure in Bangladesh in the demographic dividend while being cautious of aggregation bias. One of the major contributions of this paper to the estimation of the demographic dividend literature is its use of a disaggregated dataset to produce a representative estimation of demographic dividend and compare among different education groups. The findings of the paper shed light on the debate on the sources of the first demographic dividend—whether this dividend comes from a pure age structure factor or represents an education dividend. When the economic profiles are disaggregated by levels of education, the Economic Support Ratio (ESR) decreases compared to the estimates when it only classified by ages. After estimating the first demographic dividend, the paper disaggregates the dividend into education effect and age effect using the Das Gupta decomposition technique. Results show that the size of the dividend is driven largely by age effects, while the education effect has been negative in Bangladesh for the past decades. The negative education effect indicates the aggregation bias in the estimates of support ratio if data is not disaggregated at that level.

Keywords: First Demographic Dividend; Economic Support Ratio; Das Gupta Decomposition; Aggregation Bias; National Transfer Accounts; Education Effect; Age Effect.

JEL Classification: C14, C18, J11

I. INTRODUCTION

The demographic dividend, which is viewed as a window-for-boost in economic growth offered by the changes in the age structure of a population, results from the increasing shares of the working-age population. This youth bulge driven demographic, as well as economic, phenomenon is referred to as the "First Demographic Dividend." More sinpecifically, the first demographic dividend is the phenomenon of total output growth led by the positive changes in labour force participation rates, and unemployment rates due to an increased working-age population, given that output per capita is fixed (Mason 2005). The

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same window of opportunity is assumed to be closed after a few decades, with the introduction of a "second" dividend. The second demographic dividend is the increase in consumption of the retired population as a result of savings accumulated during their working-age (Mason and Lee 2006). The idea behind relating economic prosperity, measured by the growth of per capita real output, with the changes in age structure is due to the opportunities offered by the fall of the dependency ratio. If the ratio of the population of the ages below 15 and above 64 years is comparatively lower than that of the economically and potentially active population of the ages 15-64 years in a country, the country will prosper more. As the country has a fewer dependent population to feed than the number of wage earners, it yields a nationwide surplus.

At the beginning of "the baby boom," some of the productive resources, both at household and national levels, are reallocated and invested to children as the share of the dependent group increases. However, once a larger portion of this baby boom generation mature to their twenties, some of the resources are reallocated and invested in productive activities as the share of the working-age population rises (Bloom and Canning 2011). Thus, an increase in the proportion of the youth bulge can be beneficial to an economy in several considerations. Firstly, if there is an increase in the labour force participation rate in the labour market with desired flexibilities, the size of the employed population will increase. This change speeds up an economy on the route to economic growth. Secondly, it is possible that the number of dependent members within households will fall and the households will have, on average, the opportunity to reallocate their assets. Household savings can be increased substantially in this way. Thirdly, the country that experiences this "demographic gift" will have the opportunity to reallocate its resources as the budgetary allocation for economically dependent citizens is changed. Hence, it can reduce the budget deficit and/or reallocate these released resources towards some productive activities. Lastly, the right investment in human capital can increase the factor productivity of the country with an implication for economic growth. As Bloom and Canning (2011) described, working age is the prime time for savings, and accumulation of physical and human capital. At the same time, FDD is driven by lower fertility rates among women as a process to reduce the dependent age population. The same low fertility changes age structure after few decades when the ageing population holds a larger share in the population. However, this aged and retired population accumulated so many savings throughout their working life that can change the base of physical capital. This effect of ageing is theoretically known as the second demographic dividend. So, the first and second demographic dividends are opposite sides of the same coin (Mason and Lee 2006). The only distinguishing aspect is that the first demographic dividend leads to the second demographic dividend.

Bangladesh has experienced a dramatic success in its population control policy. The fertility rate has fallen from 6.9 in 1972 to 2.1 in 2016. Despite this immense success in population control, the country has demonstrated a fragile capacity to manage its human resources. The age structure has implied importance on the growth of an economy through the skills and productivity embodied in the labour force. The country is experiencing an increase in its labour supply. The question that arises next is about the capability of accommodating this labour supply into its labour market. Khondker and Rahman (2018) projected that the first demographic dividend will cease within the period 2030-2040: the timeline depends on different assumptions on fertility growth. However, our paper uses age and education-wise disaggregated (i.e., cross-classified) data and shows how this additional level of disaggregation (by level of education) removes bias in estimation compared to only age-wise classified data.

This paper estimates the extent of first demographic dividend with the cross-classified disaggregated data, as mentioned above, and discusses the differences with Khondker and Rahman (2018) estimates. We also show the sources of aggregation bias with implications from the Das Gupta decomposition.

II. NEW DIMENSION OF POPULATION DEBATE

The concept of the demographic dividend has introduced a new dimension in the existing debate of the effects of population on economic growth. There are many tenets about the effects of population or fertility growth on economic growth when country-specific heterogeneities are considered. However, we can divide them into three groups based on the findings from empirical literature (Headey and Hodge 2009). One group of empirical development economists claims that population growth has a positive economic growth effect, while another tenet is opposite to this claim. The population neutralist group takes a middle of the road position, claiming that the population growth has no deterministic effect on the per capita output growth (Headey and Hodge 2009).

As a variant of the old debate, Bloom and Freeman (1986) investigated the effects of changes in fertility rates and mortality rates on labour supply and employment. Similar to the idea of cross-country convergence of per capita income, convergence can also happen to the population growth rate. Coale and Hoover (1958) studied the history of growth and the story of convergence in relation to fertility and mortality rates. They found that the population growth rate, in general, has a negative effect on economic growth. Countries with higher population growth rates are trapped in a low-income equilibrium, while the fertility decline drives a country to higher economic growth. Later, Bloom and Williamson (1998) found a strong and significant effect of the demographic transition on the

growth of per capita output and also on growth-stimulating indicators like savings and investment. The estimated effect of population growth on per capita output was 0.4 percentage point contribution in Asia and 0.6 percentage point in East Asia.

The investigation into this concept took a new direction. Becker and Lewis (1973), counting the benefit of low fertility and using a microeconomic household utility framework, showed a trade-off between the quantity and the quality of children reared by parents. He also argued that there is a trade-off between the cost of having an additional child and the income of the mother. Lee and Mason (2010) showed that low fertility leads to the boost in the investment of human capital and hence to human capital accumulation, which has a positive effect on growth. Cuaresma *et al.* (2014) investigated whether the demographic dividend is an "Education Dividend." To show this, they disentangled the productivity effect (i.e., the effect of education) and the translation effect (i.e., demographic effect) from the income growth.

As time passes, the future of the first demographic dividend in Bangladesh lies in education since the age effect slows down and eventually becomes negative. However, this paper shows negative education effects and a positive age effect during the observed phase of the demographic dividend in Bangladesh. Decomposition methodology is discussed in section IV, and decomposition results and estimates of first demographic dividend are presented in section V.

III. THE BANGLADESH CONTEXT

The employed population in Bangladesh is mostly low educated and low skilled. For example, 58 per cent of the employed population either ended their schooling before completing the primary level or passed primary education (i.e., class 5) according to the Quarterly Labour Force Survey (BBS 2018). The skill composition of selected sector employees is featured in the BIDS skill gap study (2017) where it finds the skill composition of current employment in those sectors. While the RMG industry employs approximately 8.4 per cent of the total labour force, it has half of the workforce who are either unskilled or semi-skilled. In addition to that, the skill gap is second highest in the RMG (BIDS 2017) industry and the highest in the agro-food production industry. The employment to population ratio was stagnant at 60 per cent over the period 2009-2016 and was lower compared to earlier periods. According to a Bangladesh Labour Force Survey (2013), the unemployment rate among the labourers with post-secondary education was 11.2 per cent (this rate is even higher in the LFS 2010), whereas it was approximately 1.5 per cent among the labourers with no formal education.

McCartney (2017), given the recent pattern of production relations, discussed about the possibility to get stuck in a low-wage, low productivity trap. The report additionally claims that although the country has thrived in providing greater coverage for formal education to its population, the level of learning is low and unequal. Within this demographic and the labour market situation, it could be an optimistic but tenuous assumption that the country will achieve the full benefits of the demographic dividend. We are unsure about the types of demographic-compositional effects in the country. Thus, this paper aims to manipulate the education and age compositions of the working-age population to find the directions and factors of first demographic dividend.

Two papers are dedicated to the demographic dividend in Bangladesh: Chaudhury (2014) and Khondker and Rahman (2018). Chaudhury (2014) analysed the age structure of the population of Bangladesh and showed that the working-age population is sharply rising. He prescribed some policies to grasp the economic benefit of this demographic change. Another paper, by Khondker and Rahman (2018), extensively investigated the possible deadline of the first demographic dividend and the possible policies for obtaining benefits from this demographic dividend. In explaining the demographic dividend, the previous works did not include education as an endogenous factor and hence could not measure the effects of education on the demographic dividend. The existing literature is also unable to present evidence-based conclusions on whether Bangladesh's demographic dividend is dominated by an age component. The contribution of this paper will be the decomposition of the effects of education and age on the demographic dividend, treating education as an endogenous factor and, more specifically, evaluating the contribution of the education sector in capturing this dividend's economic benefits.

IV. METHODOLOGY

Use of NTA Methodology for Defining ESR

National Transfer Accounts (NTA) attempted to measure the trend of the demographic dividend, using the support ratio (UN 2013). This paper uses the Economic Support Ratio (ESR) to measure and analyse the demographic dividend. To elucidate the meaning of ESR, NTA starts with a macroeconomic identity from which it derives an expression for ESR. This section portrays the construction of ESR and discusses how it can be decomposed into education effect and age effect.

NTA follow Mason (2005) as a foundation for its definition of ESR. Following Mason (2005), a country's income per capita can be written as:

$$\frac{Y(t)}{N(t)} = \frac{W(t)}{N(t)} * \frac{Y(t)}{W(t)} \quad (1)$$

$$y(t) = w(t) * \hat{y}(t) \quad (2)$$

where Y is the total income, N is the total population size and W is the size of the working population. $w(t)$ is the share of the working-age population in the total population. When there is less friction in the labour market, $w(t)$ approaches to unity and it is also defined as the support ratio. $\hat{y}$ can be defined as the output per labourer if the labour force participation rate is close to 1 (similar to the case when $w(t)$ approaches 1). Using first order differential calculus, equation 2 can be transformed into growth form as following:

$$g(y) = \mathrm{g(SR)} + \mathrm{g}(\hat{y}) \quad (3)$$

Therefore, per capita income growth is equal to the sum of two growths—the growth in the support ratio and the growth in output per labourer. The growth of the support ratio has been termed the "translation effect," and the growth in the income of labourers is due to the "productivity effect." However, a modified version of the support ratio, the ESR, is used in this paper. The ESR embodies both the per capita age profile of income and consumption, and instead of using the number of total labours and population data, it uses the effective number of labours and the effective number of consumers to calculate the ratio. This replacement of labours and population data by the effective number of labours and the effective number of consumers helps incorporate relevant economic profiles into the analysis of a purely demographic context.

A series of effective labourers and effective producers or consumers are defined in the National Transfer Accounts (NTA) as

$$\hat{L}(t) = \sum_i N_i(t) * l_i \quad (4)$$

$$\hat{C}(t) = \sum_i N_i(t) * c_i \quad (5)$$

The summation is over different age groups. l_i and c_i are ratios of the per capita age profiles of the labour income and consumption to the per capita age profiles of the labour income and consumption of the population between 30 and 49 years of age, respectively, measured at a fixed year.

Modifications with Cross-classified Data

Following Renteria *et al.* (2016), this paper modifies equations (4) and (5) with the information on the levels of education. That is, we further disaggregate them by the level of education and define it as equations with cross-classified data.

$$\hat{L}(t) = \sum_j \widehat{L_j}(t) = \sum_i \sum_j N_{ij}\,(t) * l_{ij} \quad (6)$$

$$\hat{C}(t) = \sum_j \widehat{C_j}(t) = \sum_i \sum_j N_{ij}\,(t) * c_{ij} \quad (7)$$

The paper argues that the number of effective labour resulting from a cross-classified labour income profile differs from the labour income profile only classified by age groups. Age and education-level specific population size and the per capita labour income are both considered a weight to each other. If it is found that the per capita labour income of an education group is low while the population size of the group is high, the group will yield a lower number of effective producers/labourers. On the other hand, if a single profile for all five education groups is used to estimate the number of effective labourers, the difference between these two methods might be high. Technically, the same argument holds for the number of effective consumers. This paper argues that cross-classified and representative data can estimate economic support ratios more accurately than less disaggregated datasets can. Since labour income within an age group can be different between two education groups, a single profile for all education groups can lead to an unjustified smoothing of the economic profiles, yielding a biased result. To make them concise, the estimates of equation (4) and equation (6) should differ from each other since average labour between 30 and 34 years of age differs from a labour of the same age group, but that has a post-secondary education qualification.

The ESR can be defined as the ratio of effective labours to effective consumers.

$$ESR(t) = \frac{\hat{L}(t)}{\hat{C}(t)} \quad (8)$$

The second summation over index j is the summation over levels of education. We will use the ratio of equation (6) and (7) as the ESR that contains the information on the education level of the population.

Decomposition of ESR

Considering the work of Das Gupta (1993), Renteríaet. *al.* (2016) used a non-parametric approach and further modified an ESR series with education data incorporating the income and consumption profiles over different age groups and levels of education. They decomposed the ESR into two effects (i.e., the education effect and the age effect) to show how much of the demographic dividend is achieved through educational attainment, for two economies—Spain, a developed economy, and Mexico, a developing economy. Our study followed a similar methodology used by Renteria *et al.* (2016), for a Bangladesh case.

After estimating the ESR (with projections), the paper will proceed to decompose the changes in the ESR between two consecutive periods, following Gupta's (1993) method. Gupta's method, which is a refined version of Kitagawa (1995), is widely used in demography to find the effects of contributing factors on a rate: each factor's effect is estimated while keeping other factors constant. This paper uses his method for decomposing the ESR for cross-classified data. The decomposition estimates the effect of age and education separately for each period. The population composition captures the main parts of the effects.

$$\frac{N_{ij}(t)}{N(t)} = \underbrace{\left(\frac{N_{ij}(t)}{N_j(t)} * \frac{N_i(t)}{N(t)}\right)^{0.5}}_{= a_{ij}(t)} \underbrace{\left(\frac{N_{ij}(t)}{N_i(t)} * \frac{N_j(t)}{N(t)}\right)^{0.5}}_{= e_{ij}(t)} \tag{9}$$

a_{ij} and e_{ij} capture the variation in the composition of population due to age structure and years of education, respectively, over time.

$$\mathrm{A(t)} = \sum_i \sum_j \frac{esr_{ij}(t)+esr_{ij}(t-1)}{2} . \frac{e_{ij}(t)+e_{ij}(t-1)}{2} . a_{ij}(t) \tag{10}$$

$$\mathrm{E(t)} = \sum_i \sum_j \frac{esr_{ij}(t)+esr_{ij}(t-1)}{2} . \frac{a_{ij}(t)+a_{ij}(t-1)}{2} . e_{ij}(t) \tag{11}$$

A (t) corresponds to the rate and age standardization of the age effect at time t, $E(t)$ corresponds to rate and education standardization of the education effect, and $esr(t)$ stands for the growth in the ESR at period *t*.

Now, the effects are defined as follows:

$$Age\ effect = A(t) - \mathrm{A(t\text{-}1)} \tag{12}$$

$$Education\ effect = E(t) - E(\mathrm{t\text{-}1}) \tag{13}$$

As a change in the ESR between two consecutive periods, t and (t+1), is seen as the first demographic dividend at the $(t+1)^{th}$ period, equations 12 and 13 measure the contribution of age characteristics and education characteristics to the change. Hence, the two equations provide us with the age effect and the education effect. We find two statistical tools to implement the decomposition method mentioned: one is a Stata program (Li 2017), and the other is a computer program developed only for the purpose of the Das Gupta and Kitagawa decomposition methods for cross-classified data (Wang *et. al.* 2000).

V. DATA

Two types of data are required for estimating the ESR—population data and data on economic profiles. The population data is collected from the Wittgenstein

Centre for Demography and Human Capital (WICD). This paper developed age profiles of the per capita labour income and per capita consumption, taking the NTA dataset developed by the NTA country team. The NTA profiles provided a series of per capita consumption and per capita labour income disaggregated by age groups. However, this study disaggregates the age profiles further by five levels of education and excludes the population below ages 15 since the WICD population data does not assign a level of education to this population age group. Thus, this study includes 14 age groups of five years of age intervals and five education categories, resulting in 70 observations for each of the profiles. Alternatively, each of the education groups has 14 observations, under an economic profile. This study suggests that along with the age level, education is a major component in determining the income and consumption profiles. Thus, we find the first demographic dividend of Bangladesh, using the age and education profiles of per capita labour income and per capita consumption, thereby improving the existing literature.

We use HIES 2010 for consumption profiles and LFS 2010 for income profiles. The major motivation of using 2010 round HIES and LFS is to find the aggregation bias in the estimates of FDD. This has been done considering Khondker and Rahman (2018) as the benchmark. Khondker and Rahman (2018) also use the same round of LFS and HIES as we do in this paper. Secondly, since both the age profiles of income and consumption are normalized by the respective profiles of 30-49 years old population, the choice of survey round will not create differences in the estimates. Thirdly, time-invariant age profiles is used for estimating past ESRs and future ESRs as in NTA, and. Thus, using a different round of dataset is weekly justified to produce significant changes. Moreover, we prefer to be stick to Khondker and Rahman (2018) data and methods to show the disaggregation bias, if any, in the FDD of Bangladesh and compare the NTA data disaggregation technique to ours.

For population data, we used WICD data that is primarily collected from the United Nations Population Division. WICD makes various projections using data from the Shared Socioeconomic Pathways (SSPs). The SSPs include sex-specific life tables, age-specific fertility rates, age-sex specific immigration and emigration rates, and an education profile of a country. This study uses three, out of five, SSPs and two variants of the most likely pathway (SSP2-medium). The WICD projections have been done following a standard meticulous method (Samir and Lutz 2014). However, the projection includes educational data as a major factor for projection, and argues that this helps develop a better projection. Consistent with the study's requirement, the population data are cross-classified by age groups, on five years intervals, and by levels of education. The WICD classifies

the dataset in terms of six educational categories—No Education, Incomplete Primary, Primary, Lower Secondary, Upper Secondary, and Post-secondary. However, it offers an option to have four categories, omitting the "Incomplete Primary" category and merging the two secondary education types into a single category. This study includes five categories, keeping each one of the six categories and merging the two secondary education categories. We briefly discuss the SSPs below.

TABLE I
ASSUMPTIONS FOR SHARED SOCIO-ECONOMIC PATHWAYS (SSPS) FOR POPULATION PROJECTION

Characteristics	SSP1 (Rapid Development	SSP2 (Medium)	SSP2-CER (Constant Enrolment Rates)	SSP2-FT (Fast Track Education)	SSP5 (Conventional Development)
Education	High	Global Education Trend	Adjusted Constant Enrolment Rates	Set to the level of frontrunners in East and South East Asia	High
Fertility	Low	Medium	Medium	Medium	Low
Mortality	Low	Medium	Medium	Medium	Low
Health Investment	High	-	-	-	-
Migration	-	Medium	Medium	Medium	-

Source: Lutz and Belanger (2017).

SSP2 (Medium) setting combines for all countries medium fertility with medium mortality, medium migration, and the global education trend (GET) scenario. In short, this is the middle of the road scenario which can be seen as the most likely or average path for every country. For the SSP2-CER projection scenario, the attainment shares at age 30-34 of future cohorts are chosen to be fixed at the levels observed in the base year. But the projections were adjusted for the necessary cases if younger age groups in the base year already exhibit higher than predicted attainment. This setup will work for any country in current but usual enrolment situations. For the SSP2-FT scenario, the most rapid country-specific expansion parameters are applied to all countries, including Bangladesh. In other terms, all countries follow the educational development paths taken in the past by the frontrunners in East and South East Asia.

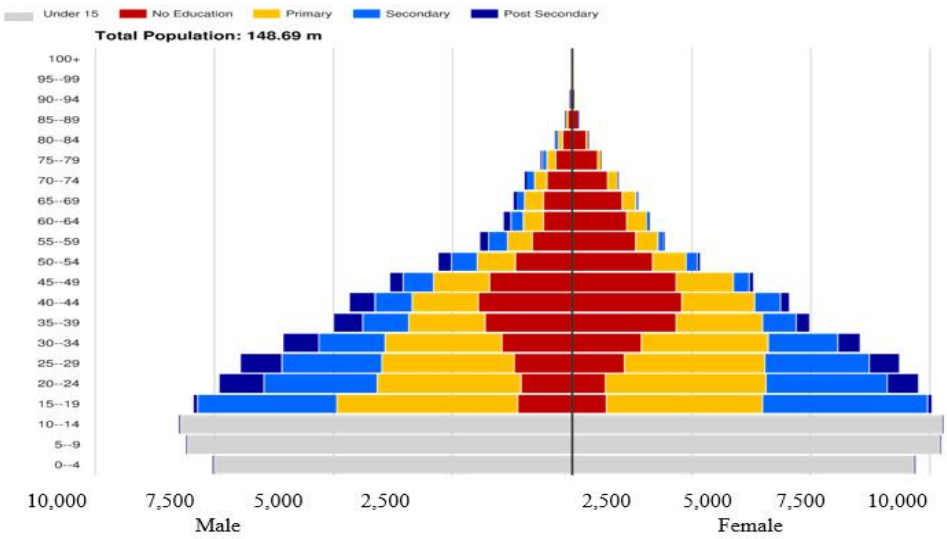
Assumptions for SSP1 (rapid but sustainable development) and SSP5 projection scenario include high education and low mortality across all countries. In the case of fertility, low fertility assumed for all other countries except the OECD and rich countries. Hence, low fertility has been chosen for the projections of Bangladesh. The difference in SSP1 with SSP5, and other SSPs as well, is that SSP5 does not assume anything about health investment (Lutz and Belanger 2017).

VI. RESULTS

Bangladesh was an ideal representation of the population pyramid hypothesis of the 2000s (not shown in the figue). Bangladesh's birth control policies, which decreased the size of the population under age 15, changed the bottom bars of the pyramid: this change is more visible for the population below 10 years of age. Figure 1 represents this population control phenomenon in which the bottom two bars shrank substantially in 2010.

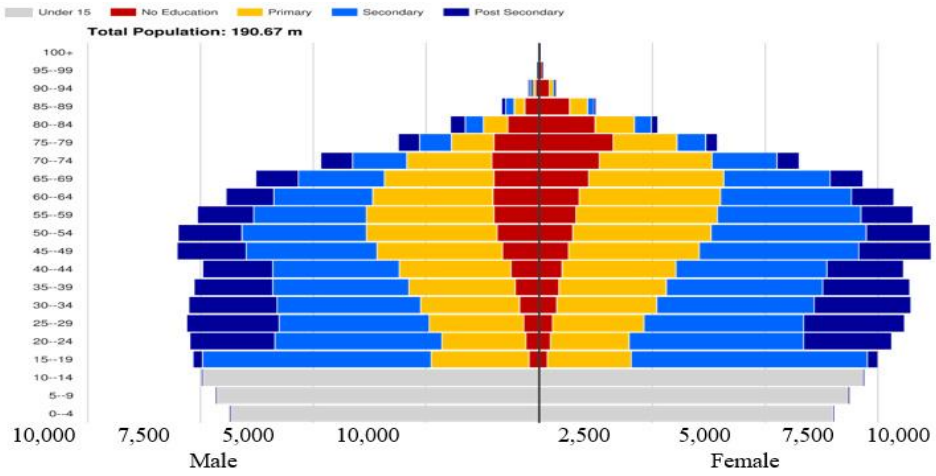
Although the birth rates fell, the upper bars were unaffected. Thus, the representation still resembles a pyramid if the population group aged 10 years and below is ignored. However, in 2050, the projected distribution of the population will not resemble a pyramid. In 2050, the bars in the ages 15-44 population group are quite similar in length to those in 2010, and the age groups between 5-9 and 10-14 years of age in 2010 will be the age groups between 45-49 and 50-54 years of age. In 2050, the latter two groups will be larger compared to all other five years of age interval groups. Figure 1 shows that although the age 40 and above population with no education exhibits a pyramid shape, the population below age 40 does not. This indicates that the education exhibits a pyramid shape, the population below age 40 does not. This indicates that the distribution of the illiterate population started changing decades ago. However, the population with other types of education resembles a pyramid shape across the whole distribution.

Figure 1: **Bangladesh Population in 2010**



Source: Wittgenstein Centre for Demography and Human Capital (WICD).

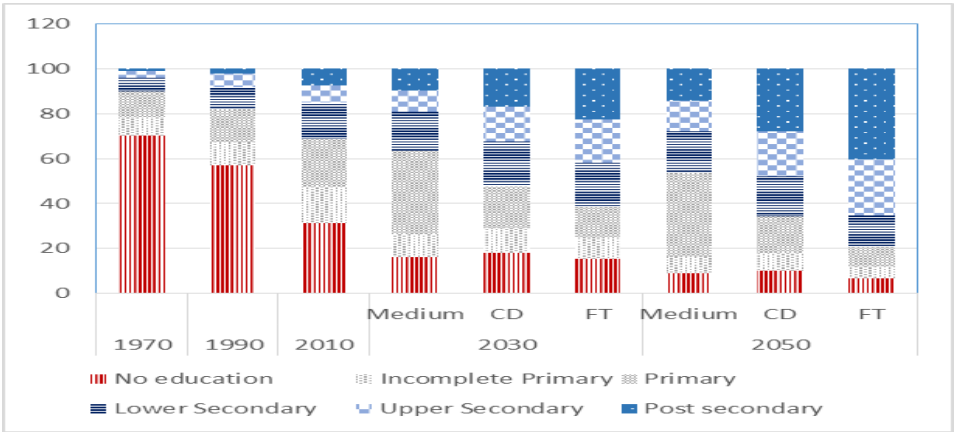
Figure 2: **Bangladesh Population in 2050 (projected)**



Source: Wittgenstein Centre for Demography and Human Capital (WICD).

In recent decades, the country has achieved gender parity in terms of educational attainment, across all categories. It is projected that, in 2050, the population with a primary or no education will squeeze in number, for all the groups aged below 50, as the educational characteristics of the working-age population will be changed, and gender parity will be achieved largely. It is projected that the age 65+ population will be increased with a little reduction in the population below 15 years of age, indicating that there will not be an overwhelming change in the share of the dependent population.

Figure 3: **Distribution of Population**



Sources: Author's calculation from WICD data.

In terms of educational attainment, Bangladesh has made considerable progress. Starting from one-third of the population with no institutional education in the early 1980s, it has achieved an educational attainment level in 2010, in which one-third of the population has a post-primary education. On the other hand, the size of the no-education group decreased by 30 percentage points. Since a (varying) portion of the previous cohorts with a nearly unchanged educational status remains in each period, the distribution of the population in terms of education is affected. So, the past education composition within the contemporary population contributes to the current educational composition. Figure 3 shows that the country progressed significantly in educational achievement in the 2000s and that the progress continued onward. If the current trends continue, Bangladesh will have 20 per cent and 30 per cent of the population with secondary and post-secondary certificates/degrees in 2030 and 2050, respectively (see the bars over SSP2-medium). The population with less than a primary education will fall to 30 per cent and 15 per cent in 2030 and 2050, respectively. However, two other optimistic projections forecast that more than 50 per cent of the population will have above a lower secondary education, keeping the population with a primary or less than primary education at less than 50 per cent in both 2030 and 2050. However, this type of achievement in education is too divergent from the SSP2-medium scenario projection and is not consistent with the storyline of Bangladesh.

Labour Income and Consumption Profiles

Labourer income is an important variable in defining ESR. If labourer income, disaggregated by age groups, has a favourable profile, ceteris paribus, the employed population from the pool of the working age population will be able to support more. Thus, the number of effective labourers increases if the labourer income series moves up. On the other hand, the consumption profile for adults does not vary much in the presence of consumption smoothing.

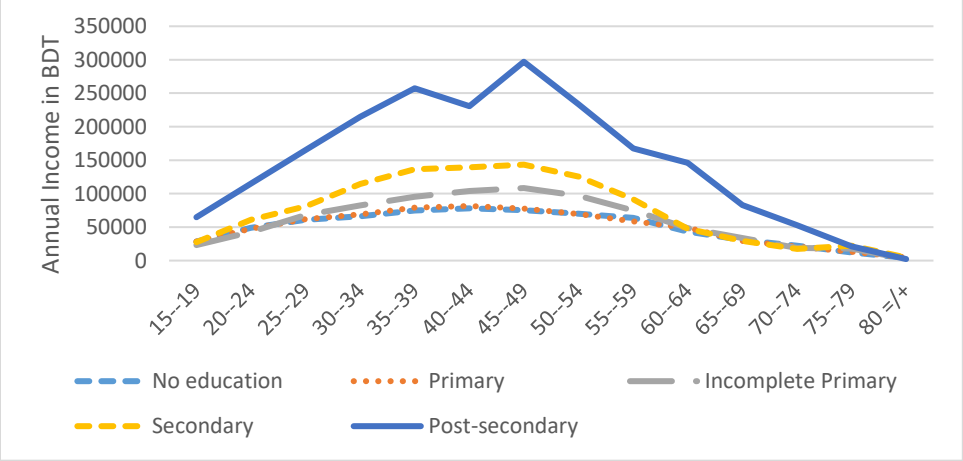
Figure 4 shows that the highest level of per capita annual income across different age groups is observed for the post-secondary level educated population, as expected. The population with no education has the lowest profile of per capita income across age groups. It can be deducted from the figure that the per capita labourer incomes across age groups are positively associated with educational qualification. However, the variation in annual income rises as the level of education increases. These findings indicate that the expected level of annual income earned by a group with higher educational status will be lower than the level depicted by the simple average figures in the graph. Alternatively, the groups with lower education can expect a labourer income close to the average income.

This phenomenon has a broader impact on labour market competition and outcome and will be investigated later in this study. Another important but normal feature is revealed in the figures that show incomes at the retirement ages falling for all education groups, and that, except for the post-secondary education group, this does not vary largely across education groups.

Figure 5 describes the per capita annual consumption across age groups for different education groups. Similar to the income series (see Figure 4 and Figure 5), consumption follows the assumption of the life-cycle hypothesis. There is little variation in the consumption series across the education levels, and consumption is not linearly related to income. We find evidence of, non-linear, consumption smoothing over the life cycle. We can infer from the life-cycle hypothesis of consumption that the reason for this slight variation is that consumption is financed by wealth accumulation over life. The Life Cycle Deficit (LCD) is defined as the difference between income and consumption and can also be analogized with savings.

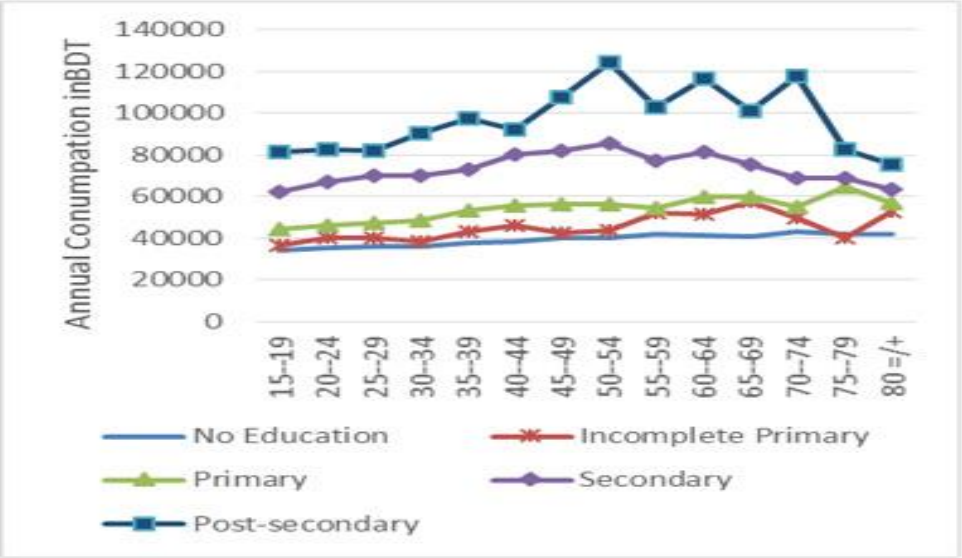
Figure 6 illustrates the LCD for the education groups: the groups with post-secondary education reach their peak in terms of life-cycle surplus (savings) at the ages 45-49; the group with incomplete primary education reaches it at the ages 35-39, and the other three groups reach their LCD peak at the ages 40-44. The series of LCD reflects the shapes observed in the income series since there is little variation in the consumption series. None of the age profiles of income and consumption is smoothed and there are rise and fall across the age groups. Consumption profiles have more visible zigzag patterns. This paper finds it difficult to explain and leaves it as a limitation.

FIGURE 4: **Income Profile**



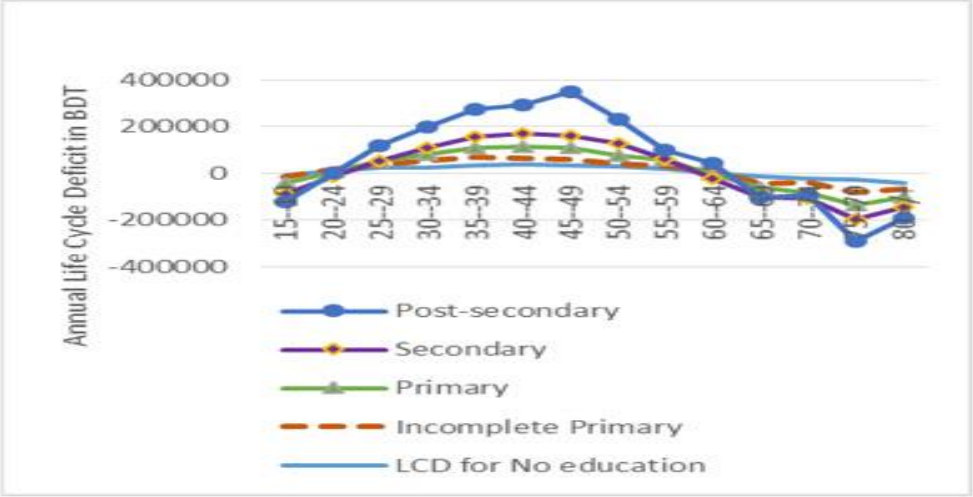
Source: Author's calculation.

FIGURE 5: **Consumption Profile**



Source: Author's calculation.

FIGURE 6: **Life Cycle Deficits**



Source: Author's calculation.

When Does the First Demographic Dividend End in Bangladesh?

This question concerns a projection. We are using four relevant projections for Bangladesh to answer this question. Figure 7 illustrates the timeline when the dividend is projected to reach its peak point. For both assumptions of conventional development and rapid development, the dividend will reach its maximum around the year 2035. The fast-track enrolment rate under the assumption of the medium scenario could extend this period by five years, while the medium (SSP2) scenario and the constant enrolment rate CER (SSP2) scenario will expedite the timeline by five and ten years, respectively. These findings hint that the fast-track enrolment rate can boost the support ratio and extend the rising part of the ESR curve for another decade. However, we cannot expect an extended period of demographic dividend, as we are only a decade away from the peak of the ratio, and an overhauling change is unexpected to happen.

The best-fit assumption for each country in the database is the medium (SSP2) scenario where fertility, mortality, migration, and enrolment all are set at a country-level medium—not having a too optimistic or too pessimistic view. It is assumed in the SSP2 medium scenario that the current trend will prevail for the next one or two decades. Under the SSP2 (medium) projection, the dividend will reach its maximum value in 2030. However, support ratios vary across the projections.

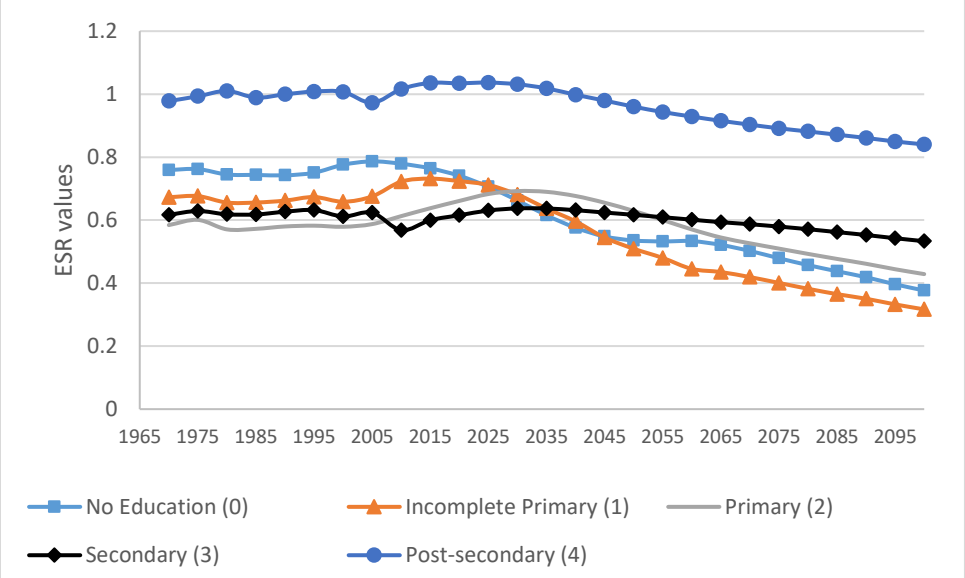
Two important pieces of information can be derived from the time-series graph of educational status-wise ESRs. First, the within-group capacities to support its members and the comparisons of ESRs across the education groups can be derived. It is evident from the graph that the curves of support ratios are placed in a way that does not exhibit a positive role of education. Until 2010, the group with the highest observed ESRs was the group with post-secondary education. The ordering of the position of the curves for ESRs across other levels of education is inverse to the order of educational attainment: no education, incomplete primary, secondary and primary education groups take position in a consecutive order. This does not provide any positive evidence in favour of the effect of education on support ratios.

Education can support the members within the group at the second highest ratio for the same period. However, the group with secondary education can support the members within its group at a lower rate than that of the incomplete primary education group.

Second, the projection on when the groups will reach the peaks of their respective support ratios can be derived from the time-series graph of educational status-wise ESRs. From the observed data, we cannot differentiate the contribution of education in terms of support ratios since the behaviour of education-related ESRs is erratic. However, for the future horizon, education will play an important role in the demographic dividend. The peaks of group-wise support ratios are positively associated with the levels of education, in the desired order. Two groups

of the population at the lower end of the educational attainment spectrum have already crossed the apex point in the series of support ratios—the group with no education reached it in 2005 and the group with an incomplete primary education reached it in 2015. The primary education group is projected to reach its maximum in 2015, while the primary, secondary and post-secondary educational groups will reach it in 2025, 2030 and 2035, respectively. It is clear that the intra-group support ratios meet the peak of the first demographic dividend in an order that is positively related to educational attainment if the case of the post-secondary group is put aside. The groups at the lower end of the educational spectrum have already reached their optimum support point, and the other three groups exhibit a still-burgeoning support series projection.

FIGURE 7: **Educational Status-wise ESR: Medium (SSP2)**



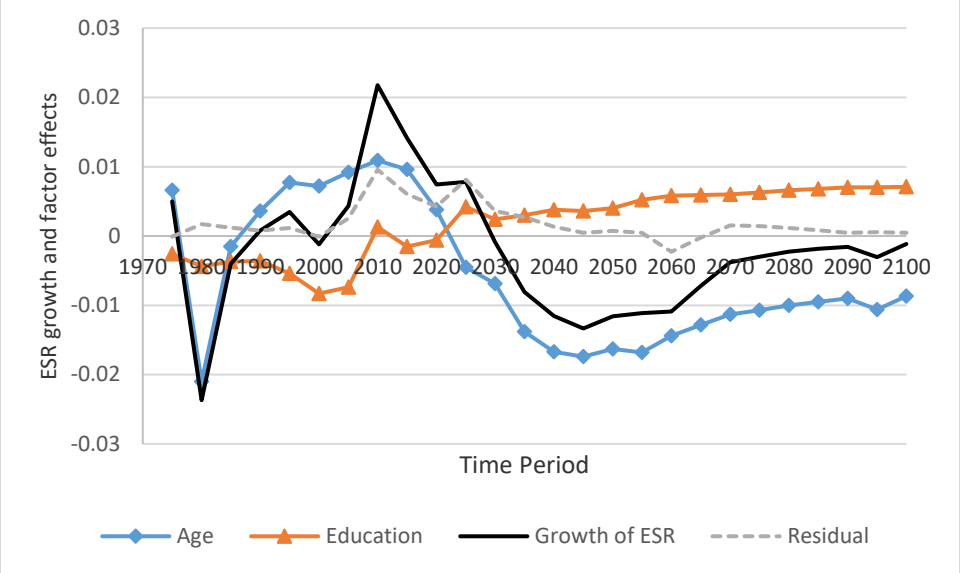
Source: Author's calculation.

Though the first type of information invalidates the role of education in the support ratio because of the erratic pattern across education groups, the second type of information shows that educational attainment plays a positive role in the support ratio. In a changing scenario over the future horizon, the population with a higher level of education will be able to provide support for a longer period and vice versa. The question remains why the past experience did not provide evidence of the positive role of education.

Decomposition of the Demographic Dividend: Age Effect and Education Effect

Finding source(s) of the demographic dividend in terms of policy suggestions is important. There is a debate where one group claims that the demographic divi dend is purely an age effect. To address the debate, the study decomposes the ESR into two major components: age and education, and a residual component.

FIGURE 8: **Decomposition of Demographic Dividend: Medium (SSP2)**



Source: Author's calculation.

Figure 8 graphs three curves—the grey curve shows the change in ESR or the demographic dividend, the blue curve is the curve showing the education effect, and the red curve shows the age effect. Age effects and education effects are found by decomposing the demographic dividend or by the change in the ESR. The sum of the latter two curves will be close to the first curve since there is a residual curve. The demographic dividend before 1990 was negative, except for the period 1970. In 1971, a historical event, a war, which affected the working age population, occurred. The series probably contains the aftermath of this event until 1990, but this is not conclusive. The support ratio remained stagnant until 2005 and started growing after 2005. Based on the assumption of conventional development, it will grow until 2040 and reach its apex, at which time the growth in the ESR will be zero. It is projected that 2040 will be followed by a longer period of negative ESR growth. The negative education effect shows the importance of disaggregating the

dataset by educational level. If we would not disaggregate it accordingly, our estimates would have upward bias and this bias is necessarily the aggregation bias.

For the period 1990-2015, the positive growth in the ESR is associated with a positive age effect and a negative education effect if we skip the period 2010. Therefore, we can argue using this evidence that Bangladesh did not experience a positive effect from education on its demographic dividend and that the dividend was dominated by the pure age component. However, the post-2020 ESR growth (i.e., dividend) will be accompanied by the two effects in reverse directions—a positive education effect and a negative age effect.

Estimation of Support Ratio: Comparison with NTA Estimates

We argue that the ESR estimates while the disaggregation is only by ages are not as robust as the case when it is further disaggregated by education. The reason is that the distribution of per capita income varies by the education level of the population. Since the level of education is an important indicator in measurjng the labour market return (labour income), it is necessary to disaggregate the income data by the level of education. Mathematical intuition behind disaggregation of data by level of education is as follows:

$$\frac{\partial(l_{ij}N_{ij})}{\partial N_{ij}} = l_{ij} \quad (1)$$

$$\sum_j \frac{\partial(l_{ij}N_{ij})}{\partial N_{ij}} = l_i \quad (2)$$

So, $\sum_j \sum_i l_{ij}N_{ij} \neq \sum_i l_i N_i$ and $\sum_j \sum_i c_{ij}N_{ij} \neq \sum_i c_i N_i$.

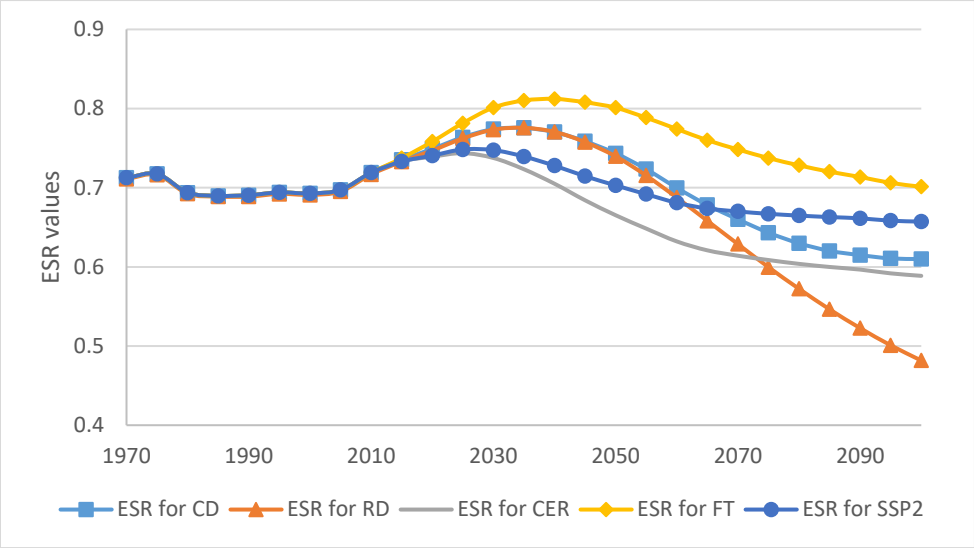
Since l_{ij} varies over education group, N_{ij} is weighted with varying weight. If l_{ij}=l_i for all j, our result would be the same as NTA estimates. However, both labour income and consumption vary over age (i.e., ***i***) and level of education (i.e., ***j***). This makes our result different from Khondker and Rahman (2018).

The estimation of the number of effective labour uses the ratio of labour income (concerning labour income of the 30-49 age group) and population data. Therefore, the variation in the effective labour definition comes from these two variables. Note that the population data is also required to be disaggregated by the levels of education since the ratio of labour income is treated as a weight to estimate the number of effective labour. If the population data is not disaggregated by levels of education, it is likely that the uneducated group, which is large in Bangladesh, would have an unjustifiably larger weight. The level of education is an important determinant of labour income, as Bangladesh still has a large share of the uneducated population. This requires both population data and economic profiles to be disaggregated by education.

The theories of consumption smoothing assert that people smooth their consumption over their life cycle. This theory indicates that consumption smoothing leads to little variation in consumption data. Since the ratio of per capita consumption (expressed in terms of the per capita consumption of the 30-49 age group) is used as a weight for the population, to measure the number of effective consumers, the consumption data can be disaggregated by age groups and levels of education. However, the expectation is that there will be less variation in consumption due to changes in age groups and more variations due to changes in educational levels; this variation mostly comes through the channel of income. The overall variation in consumption should be lower than the variation in labourer income as we do not expect that there is any type of smoothing in labourer income. These hypotheses indicate that the demographic dividend is primarily driven to a larger extent by the labourer's income profile than by the consumption profile.

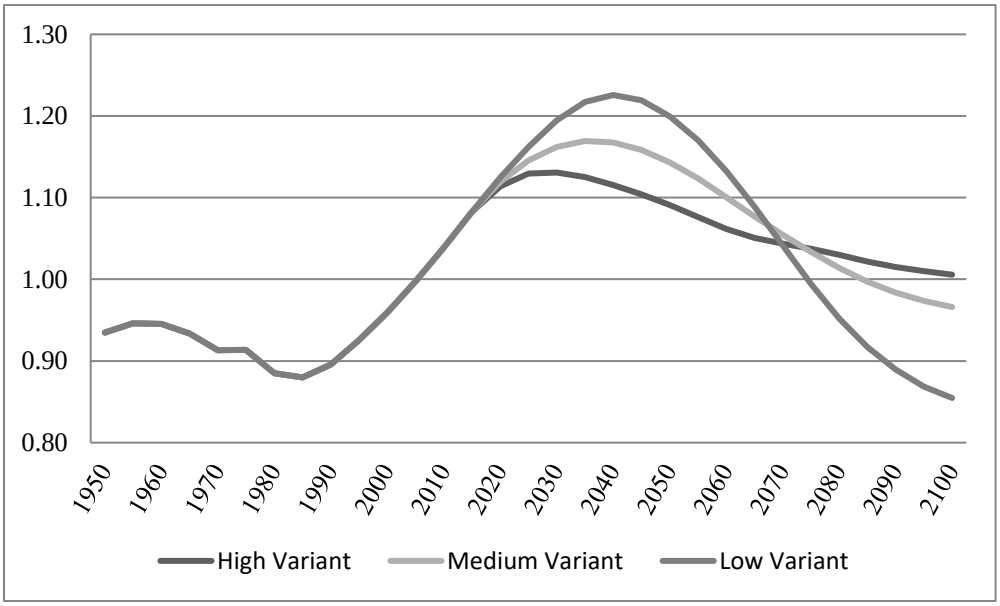
Figures 3, 4, and 5 show how population data, per capita labour income and consumption vary across education classifications. While half of the population has below primary education, they have annual per capita income lower than other education groups. The same statement holds for per capita consumption as well. As a result, our estimates of ESR (Figure 9) are lower than that of Khondker and Rahman (2018), for all three variants. For example, Khondker and Rahman (2018), presented in Figure 10, finds ESR larger than 1 in 2010 while we find the value somewhere between 0.70 and 0.75. If we limit our attention to our SSP2 (medium) estimates and medium variant estimates of Khondker and Rahman (2018), the differences in the estimates become obvious. While our ESR estimates range between 0.689 (in 1985) and 0.75 (in 2025), all of ESR estimates of Khondker and Rahman (2018) exceed 0.80 (Figure 9 and Figure 10). This difference is due to the difference in disaggregation levels between these two papers. An ESR estimate closes to 0.90 in the 1970s and 1980s seems very high compared to other developing countries. For example, Lee and Mason (2011) show some ESR estimates of some African, Asian, Latin American, and European countries. India, Indonesia, Taiwan, and Thailand have ESRs in the 1970s and 1980s below 0.80. By definition, the ESR of unity means 100 per cent consumption of an economy that can be supported by labour income. When ESR exceeds 1, either role of income from assets becomes very negligible or net international lending of a country is equivalent to the amount of national income that exceeds total consumption. Since Bangladesh's balance of payment (Bangladesh Bank 2020) does not support such a proposition, high values of ESR should be considered with caution.

FIGURE 9: **ESR Profiles with Cross-classified Data**



Source: Author's calculation.

FIGURE 10: **ESR Profiles only Disaggregated by Ages**



Source: Khondker and Rahman (2018).

Returns to education vary across the countries. For example, returns to investment in education is 5.7 pe cent in MENA region and this goes up double in Latin America. More importantly, the relationship between mean years of schooling and returns to education is negative (Psacharopoulos and Patrinos 2018). This type of argument is applicable for other countries as well. The countries having labour market characteristics and educational composition of its population similar to those of Bangladesh should disaggregate the population and economic profiles both by age groups and by the levels of education. Since the numbers of effective labourers and consumers are weighted by these profiles, this type of disaggregation can provide more representative estimates of the ESR for the countries around the world.

VII. DISCUSSION

This paper finds different sets of support ratios, compared to those in Khondker and Rahman (2018). One of the findings is that the support ratio from an aggregate measure can vary if the dataset is further cross-classified. Our data is cross-classified by ages and levels of education that differ from many cutting-edge studies on the demographic dividend. There are two reasons for differences in the estimates of the ESR. First, Samir and Lutz (2014) argue that education is an important factor in population projection. Thus, this leads to differences in projected values and brings changes in the support ratio in the future horizon. Second and most importantly, for the aggregate population, the per capita age profiles of the labourers' income and consumption vary from the per capita age profiles estimated from the different population group disaggregated by levels of education. This aspect diminished the values of the ESR for Bangladesh because the population series of Bangladesh is largely dominated by the group with no education or little education. Since the population with lower education achieves low levels of income, the number of effective labourers within those groups decreases. On the other hand, the number of effective consumers does not decrease considerably, considering public consumption. The second reason explains why the working age population in Bangladesh can support a smaller number of population members. This study argues that these findings regarding comparative studies may prevail for other countries having a similar population composition, based on the relationship between education and labour market outcomes. Under the SSP2-medium scenario, at the peak point of the ESR curve, the working age population in Bangladesh can support 75 per cent of its population, and the range of the ESR lies in the interval 66-75 per cent: the current rate is approximately 73 per cent. Who supports the rest of the consumers or the dependent population? An easy answer to this question is that this support comes from non-labour income.

Asset income, income from asset liquidations or sales and government's revenue collection are the major sources of non-labour income. Consequently, the government has an important role in mitigating the support deficit.

Similar microeconomic implications apply to the household as the macroeconomics features. From HIES 2010 (2005), it is observed that about 26 (28) per cent of household income comes from assets. The changes in income between the two surveys indicate that share of labour income increased during this period for almost every decile (Figure A4). This envisages that the number of effective labours per household relative to consumers per household increases, on average, as the country approaches the pick of the demographic dividend. When we divide the dataset by household income deciles, it is observed that higher income groups have a higher proportion of income that comes from non-labour sources. However, the proportion of household income from non-labour components is not less than 18 per cent for any income deciles, indicating the importance of asset income.

Per capita monthly consumption expenditure is approximately 15,420 BDT (MoF 2017) and the per capita social safety net support is 212 BDT. The ratio of the social safety net support to the consumption expenditure is minimal. The revenue collection is approximately 11 per cent of the GDP (BER 2017), and this rate is the lowest in South Asia. These statistics indicate that Bangladesh has the potential to increase this rate to a regional average, which can further increase the ratio of the social safety net to consumption. This finding implicates that a larger part of the support, approximately 20 per cent, neither comes from the labourers' income nor the social safety net programmes of the GoB. The volatility in asset prices and in the asset market can be hazardous for consumers since a larger part of consumption comes from this market.

We can also comment on the sources of consumption expenditures of the Bangladeshi population. The answer remains dependent on the features of the wage distribution. This study discusses labourers' income, which, necessarily, comes from the labourer's activities. The support ratio could be increased through wages if the labourer income gap between the active age population, that is, ages between 30 and 49 years, and the other age groups could be diminished so that the wage ratio would be unity or greater than unity for more age groups. Per capita relative consumption, which includes both public and private consumption, is higher than per capita relative income for nearly every age group, irrespective of education level. This aspect brings forth the issue of productivity and human capital across ages. Though NTA methodology assumes that the population aged between 30 and 49 years have a higher per capita ratio of income relative to consumption, it does not state how much heterogeneity would be accepted within

this 30-49 aged population. It is expected that job market experiences would add value to labour income. Two channels are important to have a favourable alternative labour income profile. First, a country should have a higher proportion of the population in high-income groups. Second, it is important to pull up the income of groups with a higher within-group proportion of the population, as we see from the evidence that higher income groups have higher per capita income but a smaller within-group population. This evidence suggests that both the channels to improve the labour income profile are not a good fit for the Bangladesh case. The challenge for Bangladesh is to develop a population composition with a high proportion of higher-earning groups.

To understand the labour income profile, a closer investigation of the labour market is required. According to a BBS Labour Force Survey (2015-2016), the rate of unemployment is the highest among the group with tertiary education. This might be a result of producing a larger than an optimum number of university graduates. If a group of a population has a higher percentage of the unemployed population, the support ratio for the group scales down, reflecting the fact that the group has a higher number of economically dependent population members. The data on income reflects more than 50 per cent of the employed population with zero income. These "labourers with zero wage" come from the unpaid family worker or self-employed groups in the population. The self-employed population add values to a country's economic production and receives sales revenue or profit in return, but not in the form of wages. However, unpaid family workers might be unemployed because of having no better option available and, possibly, they are employed as surplus labour. The second group dampens the labour income profiles and lowers the support ratio.

How smoothly Bangladesh is facing these challenges is a subject of investigation. LFS 2009-2010 shows that 20 per cent of the ages (15-30) population reports themselves as students. It is expected that the remaining 80 per cent should be merged with the labour force. Another alarming statistics is that approximately 30 per cent of the ages 25–30 population is not either in education or the labour force. However, about half of the ages (15-30) population is out of the labour force. Another labour force survey conducted five years later shows that more than one-third of the population who were in the age interval 15-30 in 2009-2010 is still out of the labour force (Tables A1 and A2). If we take a closer look at the young cohort aged between 25 and 30, in the 2009-2010 period, students only represented 4 per cent of this group, but 36 per cent of the members of this age group were out of the labour force. In the 2015-2016 period survey, 33 per cent of these youths were still not in the labour force. The improvement during this 5 to 6-year period is not significant. It is visible from the findings that there might have

some barriers to entry into the labour force. Traditionally, the female population constitutes most of this "not in the labour force" population. This phenomenon raises the issue of the dependent population within the group of working age population that creates an additional difficulty for the support ratio. The lower female labour force participation rate is a big concern, but it is unlikely that the situation will be improved in the near future. The percentage of the population working in formal sectors is another factor in a lower support ratio. The population working in informal sectors does not have the advantages of pension or provident funds. The concern remains how this group will be supported after their retirement. Traditionally, grown-up children take the responsibility of supporting their parents in their old age. Support for the senior citizens from GoB is limited and insufficient. Thus, the effect of the informal-sector-centric labour market on the support ratio is negative.

Since the first demographic dividend ends by 2025-2035, it will be too optimistic to assume to overcome all these barriers within this short length of time. However, there is still hope and possibilities to make the best out of it.

VIII. CONCLUSION

The paper attempts to decompose and examine the first demographic dividend in Bangladesh. Since the outcomes through education result from the investment in the educational sector, the educational investment should be revisited based on the diagnostic check obtained from the study. The findings from the study are not very optimistic for Bangladesh, while the study maintains the current trends in educational investments. The major findings are summarised as follows:

1. The demographic dividend in Bangladesh ends by the period 2030. This timeline could be extended by five to ten years if the population distribution results in a higher share of educational attainment. This does mean that if the population with lower education could be diminished and the population with a higher level of education could be increased, the support ratio will increase and thus the peak of the support ratio would be attained a few years later. Though this is statistically possible, it will be a difficult job to accomplish within a decade.
2. The education effect on the demographic dividend has been negative throughout the last four decades in Bangladesh.
3. It is projected that the economic support ratio in the future will be accompanied by a negative age effect and that this negative effect will be mitigated by a positive education effect to some extent.

4. Though labour income profile is considered a major factor in achieving favourable progress in the support ratio, it could not stimulate the demographic dividend.

The focus of the study was limited to the first demographic dividend of the country. The study finds the presence of a moderate support ratio, which further indicates the importance of the government having a mediating role in the goods market, especially in the education and health sectors. Since the country has been primarily escalated to the category of a lower middle-income country (LMIC) and is expected to have the status finally within the next few years, financial assistance and grants from international communities will fall. The country must finance the support schemes on an alternative self-dependent module. This has an implication for its internal revenue collection and foreign direct investment. Though the timeline found in the study has implications for the country, we cannot categorically state that all opportunities will be gone by that time.

Major contribution of the large youth base could stimulate the per capita income. While the share of youth working age population increased over the last two decades, the labour force participation rate of educated youth was not shiny. The high rate of unemployment and underemployment among the youth population (especially among educated youths) is an indicator of missing this dividend opportunity. Tables A1 and A2 show the pattern of the integration of the youth population in the labour force between LFS 2010 and 2015/16 rounds. A large proportion of (25-29 years old) youth is found out of the labour force in the LFS 2015/16.

The study recognises that a general equilibrium analysis would find better recommendations for the labour market. New studies can be undertaken using a general equilibrium technique to analyse the possibility of capitalising on the demographic dividend. The second demographic dividend or the role of future savings was not the concern of this study. This paper is focused on the first demographic dividend and comes with a conclusion that the size of the dividend is not large after removing the aggregation bias.

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Appendix

Table A1: **Labour Force Characteristics of 15-30 Years Aged Population**

LFS 2010 (age 15 to 30)				LFS 2015 - 16 (age 21 to 36)	
Status	Per cent	Educational Status	Per cent	Status	Per cent
Included in labour force	50.63			Included in labour force	63.18
Not in labour force	49.37	Student	20.37	Not in labour force	36.82
		Not Student	79.63		
Total	100				100

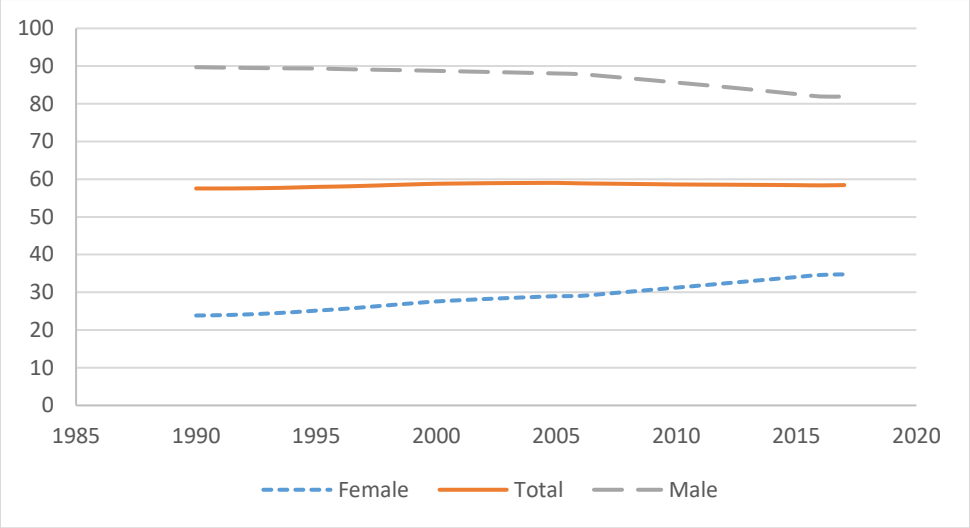
Source: Author's calculation from BBS Labour Force Surveys.

Table A2: **Labour Force Characteristics of 25-30 Years Aged Population**

LFS 2010 (age 25 to 30)				LFS 2015/16 (age 31 to 35)	
Status	Per cent	Educational Status	Per cent	Status	Per cent
Included in labour force	64.2382			Included in labour force	67.25
Not in labour force	35.7618	Student	3.78	Not in labour force	32.75
		Not Student	96.22		
Total	100				100

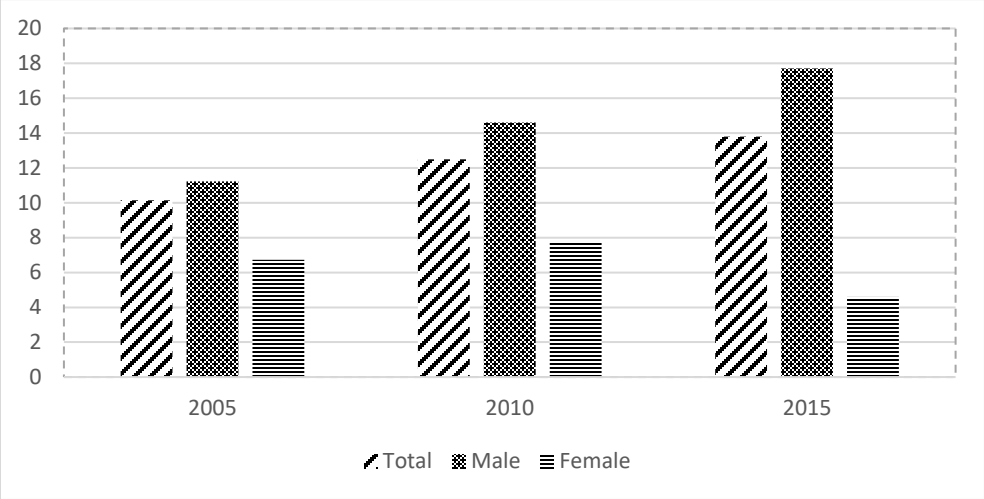
Source: BBS Labour Force Surveys.

Figure A1: **Labour Force Participation Rates**



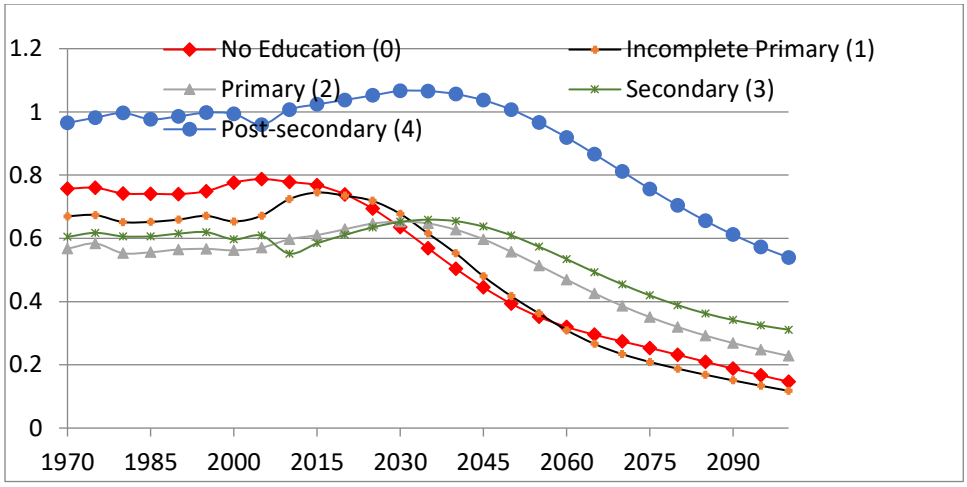
Source: *World Development Indicators*.

Figure A2: **Formal Employment by Gender**



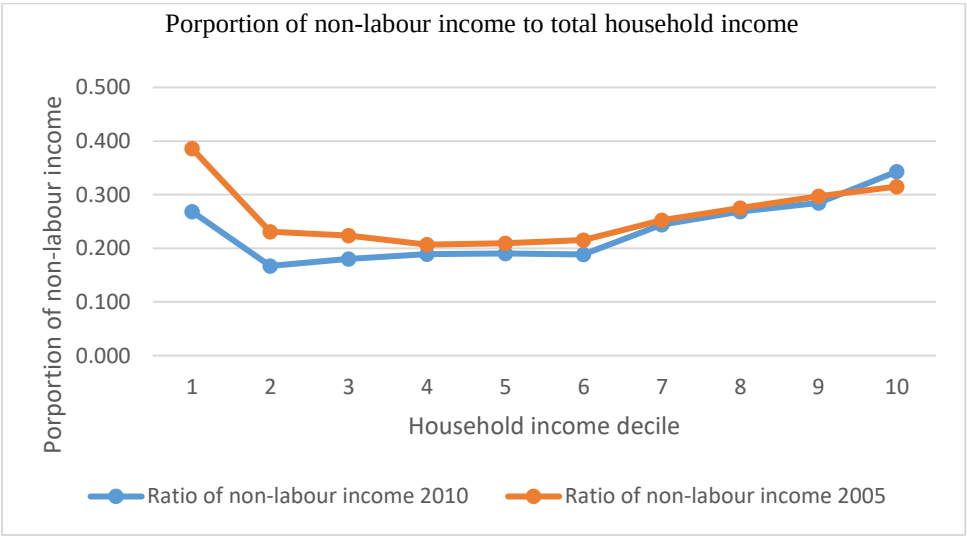
Source: BBS Labour Force Surveys.

Figure A3: **Educational status wise ESR (Conventional Development)**



Source: Author's calculation.

Figure A4: **Proportion of Non-labour Income toTtotal Household Income**



Source: Author's calculation from LFS 2005 and 2010 rounds.