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Abstract

This study examines whether Bhutan's rural economic growth was pro-poor from 2007-2017 by using expenditure data from the Bhutan Living Standard Surveys. It also conducts an IV probit analysis to explore the determinants of poverty. Even in rural areas, growth is necessary for the reduction of poverty. Besides relying on trickle-down effects from hydropower projects and tourism, promotion of agriculture-based small scale industries is essential for the acceleration of rural economic growth, where further development of basic industrial infrastructure and socioeconomic facilities is imperative. The country also needs to further promote and strengthen basic education in rural areas since education is found to have played an important role in reducing poverty. Many rural households are vulnerable to poverty. To prevent vulnerable households from falling into poverty, more effective social safety net programs may be necessary based on regional differences in factors affecting living conditions.

Keywords: pro-poor growth, rural economic growth, poverty incidence. expenditure inequality, education, Bhutan

JEL code: I32, O15, O18

Running head: Pro-poorness of Rural Economic Growth in Bhutan

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1. Introduction

Bhutan has been very successful in reducing poverty over the last decade. During the period from 2007-2012, the country grew rapidly at an annual average rate of 6.9% (World Bank, 2020); this reduced poverty incidence prominently from 23.2% to 12.0% (NSB, 2017b).¹ The growth was decelerated to 5.3% from 2012-2017 (World Bank, 2020) and the speed of poverty reduction was slowed down. Nevertheless, the poverty incidence further declined to 8.2% in 2017 (NSB, 2017b). Among south Asian countries, it is the second lowest next to Sri Lanka (World Bank, 2020).² However, there is a large difference in poverty incidence between urban and rural areas in Bhutan. While urban areas registered a very small poverty incidence at less than 1%, 11.9% of rural population was still below the national poverty line in 2017 (NSB, 2017b). Poverty is by and large a rural phenomenon in Bhutan. This appears to have facilitated internal migration from rural to urban areas (Gosai and Sulewski, 2014). Reducing rural poverty is thus one of the most important policy issues in Bhutan.

This study focusses on rural Bhutan and analyzes whether its economic growth was pro-poor during the period from 2007-2017 using expenditure data from the 2007, 2012 and 2017 rounds of the Bhutan Living Standard Survey (BLSS) (NSB, 2007, 2012, 2017a). The analyses are conducted by using the pro-poor growth indices and methods. By dividing the study period into two subperiods, 2007-2012 and 2012-2017, it tries to examine the change in the pro-poorness of the rural economic growth. It also conducts an instrumental variable probit analysis to explore the determinants of poverty using the same surveys. Here, a particular attention is paid to the roles of education in reducing poverty because 90% of the poor have not completed any formal education.

Bhutan is a mountainous small landlocked country with an area of 38 thousand square km, which is bordered by China to the north and India to the south (see Figure 1 for the map of Bhutan) (NSB, 2019). It is a member of the South Asian Association for Regional Cooperation (SAARC), which includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. With the population of 763 thousand in 2019,

¹ Poverty incidence or poverty headcount ratio is defined as the proportion of people below the poverty line. In this paper, poverty incidence and poverty headcount ratio are used interchangeably.

² Using the national poverty line, the incidence of poverty is 33.7% in Afghanistan (2016), 24.3% in Bangladesh (2016), 21.9% in India (2011), 4.1% in Sri Lanka (2016), 25.2% in Nepal (2010) and 24.3% in Pakistan (2015) (World Bank, 2020).

Bhutan is the second least populous country next to Maldives in SAARC (World Bank, 2020). While the economy is one of the world's smallest, it has grown very rapidly over the last two decades. Its GDP per capita in 2018 was 3,128 at constant 2010 US dollars, which was the third largest in SAARC next to Maldives and Sri Lanka (World Bank, 2020). According to the United Nations, Bhutan is classified as a least developed country, but expects to graduate from this status by 2023 (United Nations, 2018; GNHC, 2019).

Figure 1

Bhutan's economy depends highly on agriculture, hydroelectric power generation and tourism. While more than 70% of total land area is covered by forests and agricultural land constitutes 14% of total land area (World Bank, 2020), the agricultural sector accounts for 17% of total GDP and 54% of total employment in 2018 (Asian Development Bank, 2020). However, Bhutan's agriculture is labor intensive and consists mainly of subsistence farming and animal husbandry (NSB, 2019). Thus, its labor productivity is very low. On the other hand, the manufacturing sector is underdeveloped as it accounts for only 7% of total GDP, which is the third lowest in SAARC next to Maldives and Nepal in 2018 (World Bank, 2020). In terms of value added, it is dominated by a small number of major enterprises, which are resource-based (e.g., cement, carbide, ferro alloy, chemical products and wood products) (NSB, 2019). Besides these enterprises, there are a large number of cottage and small manufacturing firms, which are concentrated in food processing activities (NSB, 2019).

Hydroelectric power generation has served as a main engine of economic growth since the construction of the first major hydropower plant in Chukha district in the 1980s (NSB, 2019). In 2007, the country grew at 18.4% at constant 2000 prices, up from 7.0% in 2006 (see Figure 2) (Asian Development Bank, 2020). But, this is due mainly to the full operation of the mega Tala hydropower plant with the installed capacity of 1,030 MW in Chukha district (NSB, 2019). The Tala plant was fully financed by India and most of the electricity generated has been exported to India. Currently, there are six large-scale hydropower plants and the revenues earned from the export of electricity is a significant contributor to the economy. Tourism has also played an important role in Bhutan's economy since the 1980s due to the pristine state of the country's cultural and natural heritage (NSB, 2019). The revenue from international tourism constitutes 21% of total exports in 2017 (World Bank, 2020).

Figure 2

Administratively, Bhutan consists of twenty districts (*Dzongkhag*) (see Figure 1). To examine regional differences in the pro-poorness of rural economic growth, this study classifies these districts into three regions: Western, Central and Eastern Regions. Western Region is most developed with an urbanization ratio of 47% in 2017 (NSB, 2017a). The region includes the capital district of Thimphu, the only international airport in Paro district and the Tala hydropower plant in Chukha district, while the second largest national park, Jigme Dorji National Park, has been developed in its northern part (NSB, 2019; GNHC, 2019). Central Region is least developed where 81% of the population live in rural areas in 2017 (NSB, 2017a). While the region includes the poorest and second poorest districts (Figure 3) (NSB, 2017b), the largest national park, Wangchuck Centennial Park, has been developed in its northern part (NSB, 2019; GNHC, 2019). It also includes the Jigme Singye Wangchuck National Park in Trongsa district (NSB, 2019; GNHC, 2019). Finally, having the fifth largest city in Samdrup Jongkhar district, Eastern Region has an urbanization ratio of 25% in 2017, but includes the third poorest district (Figure 3) (NSB, 2017b). Meanwhile, three of four wildlife sanctuaries are located in the region (NSB, 2019; GNHC, 2019).

Figure 3

2. Literature Review

If the distribution of income remains constant, economic growth should reduce poverty. However, it is usually accompanied by changes in the distribution of income. If economic growth is accompanied by the changes against the poor, the poverty-reducing effects of economic growth is lowered by the changes. If, on the other hand, economic growth benefits the poor disproportionately more than the rich, then the growth will bring about a substantial reduction of poverty. Such a growth is considered pro-poor.

Since the 1990s, numerous studies have been conducted to examine the nexus between economic growth, income redistribution and poverty reduction.³ They include Datt and Ravallion (1992), Kakwani (1993, 1997), Ravallion (1997), Kakwani and Pernia (2000), Balisacan, Pernia and Asra (2003), Ravallion and Chen (2003), Son (2003, 2004), Essama-Nssah (2005), Kakwani and Son (2008), Nissanov and Silber (2009), Deutsch and Silber (2011), Kang and Imai (2012), Zaman, et.al. (2012), De Silva and Sumarto

³ In this paper, income redistribution is referred to as the change in income distribution.

(2014), Gimenez, Jolliffe and Sharif (2014), Fuwa, Balisacan and Bresciani (2015), Tebaldi and Kim (2015), De Silva (2016), Ali, et. al. (2017), and Fambon (2017).

Kakwani (1997) proposed a poverty decomposition method that can analyze the extent to which economic growth and income redistribution contribute to the reduction of poverty. The method decomposes changes in poverty measures into the growth and income redistribution components.⁴ By using the four rounds of the Household Expenditure Survey from 1988 to 1994 in Thailand, Kakwani (1997) observed that when poverty is measured by the headcount ratio and the poverty gap index, the poverty-reducing growth effect has dominated over the poverty-increasing redistribution effect, resulting in a substantial reduction in poverty over the study period. Our study employs this decomposition method to analyze the determinants of poverty changes in rural areas (see Section 3.2 for the method).

Kakwani and Pernia (2000) introduced an index called the pro-poor growth index (PPGI) to examine the pro-poorness of economic growth in Lao PDR, Thailand and Korea. They observed that while economic growth in Korea has been highly pro-poor, economic growth in Lao PDR and Thailand has not been strictly pro-poor though it has resulted in the considerable reduction of poverty. On the other hand, by using the poverty equivalent growth rate (PEGR), Kakwani and Son (2008) examined the pro-poorness of the economic growth of Brazil for the period from 1995-2005 and found that except for the 1995-96 period, the growth has been mostly pro-poor as PEGR has been greater than the actual growth rate. Ravallion and Chen (2003) introduced the growth incidence curve (GIC) to analyze the distribution of income growth across quantiles in the initial distribution of per capita incomes. By estimating GIC for China over the period from 1990-99, they found that GIC is upward sloping over all quantiles, but in spite of rising inequality, poverty has declined no matter where the poverty line was drawn. Our study employs PPGI, PEGR and GIC to investigate the pro-poorness of rural economic growth (see Section 3.2 for PPGI, PEGR and GIC).⁵

In Bhutan, most previous studies on living standards have focused on poverty. They include Santos (2013), Tenzin, Otsuka and Natsuda (2015) and Nidup, Feeny and Silva

⁴ Kakwani (1997) rectified the poverty decomposition method advanced by Datt and Ravallion (1992), which includes the residual term in addition to the growth and income redistribution components. Datt and Ravallion (1992) used their method to examine the contributions of economic growth and income redistribution to the change in poverty in India and Brazil.

⁵ Deutsch and Silber (2011) summarized the various alternative approaches that have appeared in the literature on pro-poor growth.

(2018). Santos (2013) estimated multidimensional poverty in Bhutan by using the Alkire and Foster method with data from the 2003 and 2007 rounds of BLSS and found that there was an unambiguous reduction in multidimensional poverty over the period from 2003-2007.

Tenzin, Otsuka and Natsuda (2015) analyzed the effect of social capital on the poverty of rural households in eastern Bhutan using the two-stage probit least squares simultaneous equation model with data from the 2012 round of BLSS. They found that social capital contributed positively to the reduction of poverty and non-farm income was important in reducing poverty in rural areas. With data from the 2012 round of BLSS, Nidup, Feeeny and Silva (2018) examined, using probit and ordered probit models, whether there are common correlates of the following four measures of human well-being: income poverty, multidimensional poverty, perceived poverty and happiness. They found that different measures of human well-being had different correlates and argued that policy formulation aimed at maximizing human well-being must be multifaceted and there is no “one size fits all” policy option.

To the best of our knowledge, no previous studies on poverty have investigated the pro-poorness of rural economic growth in Bhutan using the 2007, 2012 and 2017 rounds of BLSS.

3. The Data and Methods

3.1. The Data

The National Statistics Bureau (NSB) has been conducting the Bhutan Living Standard Survey (BLSS) based on the methodology of World Bank’s Living Standard Measurement Study (LSMS). The BLSS is a nation-wide sample survey, collecting information on education, health, employment, housing condition, asset, income, and consumption expenditure of households to analyze the standard of living for the twenty districts (*dzongkhag*) of Bhutan (see Figure 1). This study uses the 2007, 2012 and 2017 rounds of the BLSS to examine the pro-poorness of rural economic growth over the period from 2007-2017 (NSB, 2007, 2012 and 2017a). Table A1 in the appendix presents the sample sizes of the BLSSs for urban and rural areas by region.

This study uses household consumption expenditures to estimate poverty

incidence.⁶ In the BLSS, monthly household consumption expenditures are collected for both food and non-food items. Since the prices of these items differ across regions and across urban and rural areas, the NSB employs a Paasche index as a regional deflator to convert nominal expenditures to real expenditures to adjust for price differences across regions and across urban and rural areas (NSB, 2017b).

To identify the poor, per capita expenditure for a household, which is obtained by dividing household consumption expenditure by the number of household members, is compared with the national poverty line.⁷ The poverty line is the sum of the food and non-food poverty lines. The food poverty line is based on the estimated cost of a single reference food bundle providing a subsistence diet of 2,124 Kcal per day (NSB, 2017b). The poverty line is then constructed by adding non-food allowance to the food poverty line, where the non-food allowance was estimated as per capita monthly nonfood consumption of households in the reference population whose food spending was near the food poverty line (NSB, 2017b).

People below the poverty line are considered poor; thus, the incidence of poverty (or head count ratio) is obtained by dividing the number of people below the poverty line by the total number of people. We should note that to calculate real growth of mean per capita expenditure, expenditures in 2012 and 2017 are converted to expenditures at constant 2007 prices using the current price poverty lines in 2007, 2012, and 2017, which are deemed price indices for the poor segment of the economy (NSB, 2017).⁸

3.2. Methods

3.2.1. Decomposition of the Change in Poverty Incidence into Growth and Redistribution Components

To examine how economic growth and income redistribution have affected the

⁶ The amount of poverty is often measured by the following Foster-Greer-Thorbecke (FGT) poverty index (Foster, Greer and Thorbecke, 1984): $P_\alpha(z) = \frac{1}{n} \sum_{i=1}^q \left(\frac{z-y_i}{z} \right)^\alpha$, where n , q and y_i are, respectively, the total number of people, the number of poor people, and per capita expenditure of i th person. When $\alpha = 0$, 1 and 2, the index is, respectively, the head count ratio, the poverty gap index and the poverty severity index. In this study, we focus on the poverty headcount ratio (or the incidence of poverty), though it cannot account for the depth and severity of poverty.

⁷ Some studies use consumption expenditure per adult equivalence scale to account for differences in needs among household members, where children are given much smaller weights than adult household members. According to Haughton and Khandker (2009), however, adult equivalence scales are controversial and may not be estimated satisfactorily; thus, this study uses consumption expenditure per capita as a measure of welfare. It should be noted that the NSB estimates poverty incidence using per capita expenditures.

⁸ Using the current price poverty lines, Miranti (2010) converted current price expenditures to constant price expenditures in Indonesia.

reduction of poverty incidence, we use the decomposition method proposed by Kakwani (1997).⁹ We first let z , μ and L denote, respectively, the poverty line, the mean per capita expenditure, and the Lorenz curve of the distribution of per capita expenditures. Then, poverty incidence can be defined by a function of z , μ and L as follows

$$P = P(z, \mu, L) \quad (1)$$

Using equation (1), changes in poverty incidence between years 1 and 2 can be decomposed into the growth and redistribution effects (GE and RE , respectively) as follows.

$$\Delta P = P(z, \mu_2, L_2) - P(z, \mu_1, L_1) = GE + RE, \quad (2)$$

where

$$GE = \frac{1}{2} [(P(z, \mu_2, L_1) - P(z, \mu_1, L_1)) + (P(z, \mu_2, L_2) - P(z, \mu_1, L_2))]]$$

$$RE = \frac{1}{2} [(P(z, \mu_1, L_2) - P(z, \mu_1, L_1)) + (P(z, \mu_2, L_2) - P(z, \mu_2, L_1))]]$$

GE presents the change in poverty incidence due to the change in mean per capita expenditure provided that the Lorenz curve remains constant, while RE presents the change in poverty incidence due to the change in Lorenz curve provided that mean per capita expenditure remains constant.

3.2.2. Pro-poor Growth Indices and Growth Incidence Curve

To measure the pro-pooriness of economic growth, we employ the pro-poor growth index (PPGI) and the poverty equivalent growth rate (PEGR) proposed, respectively, by Kakwani and Pernia (2000) and Kakwani and Son (2008). We also use the growth incidence curve (GIC) developed by Ravallion and Chen (2003) to visualize the distribution of economic growth across quantiles in the initial distribution of per capita expenditures.

Pro-poor Growth Index (PPGI)

To obtain the pro-poor growth index (PPGI) for the period between years 1 and 2, we let P_{12} , GE_{12} , RE_{12} and G_{12} denote, respectively, proportional change in poverty incidence, proportional change in poverty incidence due to the change in mean per capita expenditure provided that Lorenz curve remains constant, proportional change in poverty incidence due to the change in Lorenz curve provided that mean per capita expenditure remains constant, and proportional change in mean per capita expenditure where

⁹ For the definition of income redistribution, please see footnote 3.

$$\begin{aligned}
P_{12} &= \ln \left(\frac{P(z, \mu_2, L_2)}{P(z, \mu_1, L_1)} \right), \\
GE_{12} &= \frac{1}{2} \left[\ln \left(\frac{P(z, \mu_2, L_1)}{P(z, \mu_1, L_1)} \right) + \ln \left(\frac{P(z, \mu_2, L_2)}{P(z, \mu_1, L_2)} \right) \right], \\
RE_{12} &= \frac{1}{2} \left[\ln \left(\frac{P(z, \mu_1, L_2)}{P(z, \mu_1, L_1)} \right) + \ln \left(\frac{P(z, \mu_2, L_2)}{P(z, \mu_2, L_1)} \right) \right], \text{ and} \\
G_{12} &= \ln \left(\frac{\mu_2}{\mu_1} \right)
\end{aligned}$$

Then, PPGI is defined by

$$PPGI = \frac{\varepsilon}{\varepsilon_G} \quad (3)$$

where $\varepsilon = \frac{P_{12}}{G_{12}}$ and $\varepsilon_G = \frac{GE_{12}}{G_{12}}$ are, respectively, the growth elasticity of poverty incidence and the growth elasticity of poverty incidence provided that Lorenz curve remains constant. We now assume that $G_{12} > 0$. Then G_{12} can be referred to as the growth of mean per capita expenditure. Then, we have $\varepsilon_G < 0$ since GE_{12} is always negative under the condition that the Lorenz curve remains constant.

There are three cases with respect to PPGI: $PPGI > 1$, $0 < PPGI \leq 1$, and $PPGI \leq 0$. $PPGI > 1$ indicates that the growth of mean per capita expenditure is associated with changes in the distribution of per capita expenditures in favor of the poor, resulting in a substantial reduction of poverty incidence. $0 < PPGI \leq 1$ indicates that the growth brings about the reduction of poverty incidence even though the associated changes in the distribution of per capita expenditures are not necessarily in favor of the poor. $PPGI \leq 0$ shows that the growth leads to an increase in poverty incidence since the associated changes in the distribution of per capita expenditures badly hurt the poor.

Poverty Equivalent Growth Rate (PEGR)

It has been argued that PPGI fails to take into account the magnitude of observed growth. To rectify the problem, Kakwani and Son (2008) proposed another pro-poor growth index, called the poverty equivalent growth rate (PEGR). PEGR encompasses both the magnitude of observed growth and the degree to which the poor benefited from the growth. It is defined by the multiplication of PPGI and the growth of mean per capita expenditure as follows.

$$PEGR = G_{12} PPGI \quad (4)$$

Depending on the value of PPGI, there are three cases: $PEGR > G_{12}$, $0 < PEGR \leq G_{12}$, and $PEGR \leq 0$, which correspond, respectively, to $PPGI > 1$, $0 < PPGI \leq 1$, and $PPGI \leq 0$.

Growth Incidence Curve (GIC)

To obtain the growth incidence curve (GIC), we let $p = F_t(y)$ be the cumulative distribution function of per capita expenditure y , which presents the proportion of the population with per capita expenditure smaller than y at time t , where $0 \leq p \leq 1$. Then, the frequency density function at time t is given by $f_t(y) = F_t'(y)$. Using this frequency density function, the Lorenz curve can be defined by $L_t(p) = \frac{1}{\mu_t} \int_0^{y_t(p)} x f_t(x) dx$ where $y_t(p) = F_t^{-1}(p)$. With some derivations, we can obtain $y_t(p) = \mu_t L_t'(p)$. The growth rate of per capita expenditure at the p th quantile between years 1 and 2 is thus given by

$$g_{12}(p) = \frac{y_2(p)}{y_1(p)} - 1 = \frac{L_2'(p)}{L_1'(p)} (G_{12} + 1) - 1 \quad (5)$$

where $G_{12} = \frac{\mu_2}{\mu_1} - 1$ is the growth rate of mean per capita expenditure. Letting p vary from 0 to 1, equation (5) presents GIC. If the Lorenz curve remains constant, then $g_{12}(p) = G_{12}$ for all p , where $0 \leq p \leq 1$. Also, we have $g_{12}(p) > (<) G_{12}$ if and only if $\frac{L_2'(p)}{L_1'(p)} = \frac{y_2(p)/\mu_2}{y_1(p)/\mu_1} > (<) 1$ at the p th quantile.

3.2.3. Probit Analysis for the Determinants of Poverty

To explore the determinants of poverty, we conduct a probit analysis and estimate the following *probit* model using the maximum likelihood estimator.

$$P(\text{poor} = 1 | \mathbf{x}) = F(\beta_0 + \beta_1 \text{edyear} + \beta_2 \text{hsize} + \beta_3 \text{age} + \beta_4 \text{age}^2 + \beta_5 \text{gender} + \beta_6 \text{urban} + \beta_7 \text{edyear} * \text{urban} + \sum_i \gamma_i (\text{regional dummies})_i) \quad (6)$$

where \mathbf{x} is a vector of independent variables and F is the standard normal cumulative distribution function. In equation (6), *poor* is the binary dependent variable (*poor* = 1 when per capita expenditure is below the poverty line). We consider the following independent variables: *edyear*, *hsize*, *age*, *age*², *gender* and *urban*, where *edyear* is years of education of household head, *hsize* is household size, *age* is age of household head, *gender* is a binary variable designating gender of household head (*gender* = 1 for female-headed households), and *urban* is a binary variable showing whether a household lives in urban or rural areas (*urban* = 1 if a household lives in urban areas).¹⁰ In addition to these independent variables, regional dummy variables are included in the model to account for

¹⁰ We determined years of education based on the levels of education used in the Bhutan Living Standard Survey (see Table A2 in the appendix).

regional differences in poverty.

We expect that (1) $\beta_1 < 0$ since the more educated the head of household is, the richer the household tends to be, (2) $\beta_2 > 0$ since the larger the size of household is, the poorer the household tends to be, (3) $\beta_3 < 0$ and $\beta_4 > 0$ since the younger or the older the head of household is, the poorer the household tends to be, (4) β_5 is unknown, (5) $\beta_6 < 0$ since urban households tend to be richer.

Since the number of years of education (*edyear*) is likely to be endogenous, we conduct an instrumental variable (IV) probit analysis, where we use district-specific urban and rural mean years of education (*m_edyear*) as an instrumental variable, since *m_edyear* is correlated with *edyear* but does not directly account for individual poverty.¹¹

4. Empirical Results

4.1. Growth of Mean per capita Expenditure and Change in Expenditure Inequality

This subsection presents the two main determinants of the change in poverty incidence: growth of mean per capita expenditure and change in expenditure inequality. Table 1 shows the annual average growth rate of mean per capita expenditure at constant 2007 prices in urban and rural areas by region. Bhutan grew at 5.1% for the period from 2007-2012. But, the growth was decelerated to 2.7% for the 2012-2017 period. Between 2007 and 2012, rural areas grew more rapidly than urban areas (6.1% against 2.1%), and this is observed in all regions. For the 2012-2017 period, the growth rate decreased substantially to 2.2% in rural areas. But, there are large differences in the growth rate between three regions. While Western Region grew very rapidly in rural areas at 6.1%, Central and Eastern Regions grew, respectively, at -1.5% and 0.1%.

Table 1

Growth is usually accompanied by the change in expenditure inequality. By the Gini coefficient, Table 2 presents the changes in expenditure inequality in urban and rural areas by region.¹² In the country as a whole, expenditure inequality rose from 0.395 in 2007 to 0.411 in 2012. But, it decreased to 0.388 in 2017. Rural sector exhibits the same pattern;

¹¹ The correlation coefficient between *edyear* and *m_edyear* is around 0.5, while the correlation coefficient between the dependent variable and *m_edyear* is around -0.2.

¹² The Gini coefficient can be obtained by the following formula: $G = \frac{2}{n\mu} \text{cov}(i, y_i)$, where n is total number of households, μ is mean per capita expenditure, and y_i is per capita expenditure of household i . The Gini coefficient satisfies several desirable properties as a measure of inequality such as anonymity principle, income homogeneity, population homogeneity and Pigou-Dalton transfer principle (Anand, 1983). It ranges between 0 (perfect equality) and 1 (perfect inequality).

after increasing to 0.377 in 2012 from 0.344 in 2007, rural inequality decreased to 0.369 in 2017. It should be noted that unlike many other Asian countries, rural inequality was larger than urban inequality in 2017 in all regions. This shows the uniqueness of Bhutan's rural economic development over the last several years. In rural areas, Western Region had the highest inequality in 2007 at 0.345, and this was followed by Central Region (0.342) and Eastern Region (0.328). But, Central Region raised its inequality prominently to 0.404 in 2012, and in 2017, it had the highest inequality at 0.381.

Table 2

4.2. Change in Poverty Incidence

Table 3 shows the changes in poverty incidence in urban and rural areas by region. In the country as a whole, poverty incidence declined from 23.2% in 2007 to 12.0% in 2012 and to 8.2% in 2017. Western and Eastern Regions had the same level of poverty incidence in 2007 at 22.9%. But, while Western Region reduced its poverty incidence prominently to 3.7% in 2017, Eastern Region lowered its incidence to about half of the 2007 level. Central Region had the highest poverty incidence in 2007 at 24.3%. It reduced its poverty incidence to 12.8% in 2012 and became the second poorest region next to Eastern Region. But, in 2017, it raised its incidence slightly to 13.2%. This was the highest among the three regions in 2017.

Table 3

In all three regions, rural areas had a much larger poverty incidence than urban areas. In rural areas, Western Region had the highest poverty incidence in 2007 at 33.4%. But, it lowered its incidence substantially to 6.6% in 2017. Central and Eastern Regions also reduced their poverty incidence in rural areas; but the reduction speed was much smaller than in Western Region. In 2017, Central Region had the highest poverty incidence in rural areas at 16.2%, which was followed by Eastern and Western Regions. We should note that Central Region had a relatively high poverty incidence in urban areas, but it was only 2.3% in 2017. In all three regions, poverty is a rural phenomenon.

4.3. Growth, Redistribution and Poverty Reduction in Rural Areas: Pro-poorness of Rural Economic Growth

This subsection examines the extent to which economic growth is conducive to the reduction of poverty incidence in rural areas using the poverty decomposition method, the pro-poor growth index (PPGI), the poverty equivalent growth rate (PEGR) and the growth incidence curve (GIC).

To analyze the pro-poorness of rural economic growth, we first decompose the change in poverty incidence into the growth and redistribution components using equation 2, whose result is presented in Table 4. We then estimate PPGI and PEGR using equations 3 and 4, whose results are presented in Table 5. According to Kakwani and Pernia (2000), imposing a PPGI value of greater than one is too stringent for the growth to be pro-poor because poverty incidence could decline even if the economic growth is accompanied by the change in the distribution of expenditure against the poor.¹³ They thus introduced the following classification in terms of the value of PPGI: (1) if $PPGI < 0$, growth is antipoor; (2) if $0 < PPGI \leq 0.33$, growth is weakly pro-poor; (3) if $0.33 < PPGI \leq 0.66$, growth is moderately pro-poor; (4) if $0.66 < PPGI \leq 1$, growth is pro-poor; and (5) if $1 < PPGI$, growth is highly pro-poor.

Tables 4 and 5

We should note that expenditure inequality provides a summary measure of the distribution of per capita expenditures and the change in expenditure inequality does not show which parts of the expenditure distribution are benefitted more or less by the economic growth. The growth incidence curve (GIC) rectifies this problem by exhibiting the whole distribution of economic growth. We thus estimate GIC for each region using equation 5.

For the period from 2007-2012, Bhutan's rural sector grew at 6.1% in terms of mean per capita expenditure. According to the GIC in Figure 4, the growth was accompanied by the change in the distribution of expenditure in favor of the rich. Expenditure inequality increased prominently from 0.344 to 0.377 by the Gini coefficient (see Table 2). The decomposition result shows, however, that the change in poverty incidence due to redistribution was not large at 2.8% (see Table 4). This is indicated by a very flat GIC in the poorer half of the expenditure distribution. Expenditure inequality for the poorer half rose only slightly from 0.189 to 0.196. Thus, Bhutan's rural sector reduced its poverty incidence substantially from 31.0% to 16.7%. As shown in Table 5, PPGI was 1.0, indicating that the growth was pro-poor in the 2007-2012 period.

Figure 4

There are some regional differences in the pro-poorness of rural economic growth for the 2007-2012 period. Western Region grew less rapidly than the other two regions in

¹³ Hereafter, we use 'the distribution of expenditure' or 'the expenditure distribution' to refer to 'the distribution of per capita expenditures'.

rural areas, but the change in poverty incidence due to redistribution was very small at 0.9% (see Table 4). According to Table 2, its rural expenditure inequality rose from 0.344 to 0.362. But, the GIC in the poorer half of the expenditure distribution is slightly downward sloping (see Figure 4). Thus, the region reduced its poverty incidence substantially from 33.4% to 17.3%. Since its PPGI was 1.1, its rural economic growth was highly pro-poor according to the Kakwani and Pernia criterion.

Central Region grew more rapidly than the other two regions in rural areas at 6.6%, but the change in poverty incidence due to redistribution was positive at 4.6% (see Table 4). The region had an upward sloping GIC in the poorer half of the expenditure distribution, indicating that expenditure inequality among the poor increased (see Figure 4). It reduced its poverty incidence from 26.6% to 14.7%. In 2012, Central Region had the smallest poverty incidence in rural areas. But, it could have reduced its incidence by 16.6 percentage points to 10.0% if the expenditure distribution remained constant. Since its PPGI was 0.9, its rural economic growth was pro-poor according to the Kakwani and Pernia criterion. We should note that the region raised its rural inequality notably from 0.342 to 0.404 by the Gini coefficient (see Table 2). But, this is due mainly to a very rapid growth among the richest 15% (see Figure 4).

Eastern Region grew at 6.2% in rural areas, but the change in poverty incidence due to redistribution was positive at 6.7% (see Table 4). The region had an upward sloping GIC in the poorer half of the expenditure distribution, indicating that expenditure inequality among the poor increased (see Figure 4). It lowered its poverty incidence from 26.1% to 18.6%. But, it could have reduced its incidence by 14.2 percentage points to 11.9% if the expenditure distribution was kept constant. In 2012, Eastern Region had the highest poverty incidence in rural areas. Since its PPGI was 0.6, its rural economic growth was moderately pro-poor according to the Kakwani and Pernia criterion.

For the period from 2012-2017, Bhutan's rural sector grew at 2.2%. According to Table 2, its expenditure inequality declined slightly from 0.377 to 0.369. But, this is due to a much slower growth rate registered by the richest 5% (see Figure 5). The expenditure share of the richest 5% declined from 19.7% to 17.9%, while the shares of all other groups increased. According to the decomposition result, the change in poverty incidence due to redistribution was very small at 0.4%. Bhutan's rural sector lowered its poverty incidence from 16.7% to 12.0%. Since its PPGI was 0.8, it achieved a moderately pro-poor growth (see Table 5).

Figure 5

As discussed in the previous subsection, there are large differences in the growth rate between three regions in rural areas. Western Region's rural sector grew very rapidly at 6.1% and its expenditure inequality declined slightly from 0.362 to 0.356. According to the GIC in Figure 5, the poorest 5% grew relatively rapidly. The change in poverty incidence due to redistribution was 0.9%; thus, the region reduced its poverty incidence substantially from 17.3% to 6.6% in rural areas (see Table 4). Since the PPGI was 2.1, its rural economic growth was highly pro-poor according to the Kakawani and Pernian criterion. The PEGR at 12.5% was twice as much as the rural economic growth.

Central Region's rural sector experienced a negative growth at -1.5%, while it reduced its expenditure inequality from 0.404 to 0.381. According to Figure 5, it had a downward sloping GIC in the poorer half of the expenditure distribution; thus, the change in poverty incidence due to redistribution was negative at -2.0% (see Table 4). Unlike the other two regions, Central Region raised its poverty incidence from 14.7% to 16.2% in rural areas. But, this is due wholly to its poor growth performance. If the region achieved a positive growth in rural areas, it could have reduced its poverty incidence. Since its PPGI was -0.2, the growth was antipoor.

Eastern Region's rural sector grew very slowly at 0.1%, while it lowered its expenditure inequality from 0.368 to 0.354. Figure 5 shows that it had a downward sloping GIC in the poorer half of the expenditure distribution; thus, the change in poverty incidence due to redistribution was negative at -4.2%. According to the Kakwani and Pernia criterion, Eastern Region achieved a moderately pro-poor growth in rural areas with its PPGI being 0.6. It reduced its poverty incidence from 18.6% to 14.3%.

4.4. Determinants of Poverty: An Instrumental Variable (IV) Probit Analysis

Table 6 presents the descriptive statistics of the dependent and independent variables used in the IV probit analysis, while Table 7 presents the results of the maximum likelihood estimation. According to the Wald test of exogeneity, we can reject the null hypothesis that *edyear* is exogenous for the 2007 and 2012 samples. This means that *edyear* is endogenous in 2007 and 2012. On the other hand, we cannot reject the null hypothesis for the 2017 sample.

Tables 6 and 7

All the coefficients are significant at the 1% significant level and have expected

signs for the 2007 and 2012 samples. For the 2017 sample, all the coefficients except the interaction term (*edyear*urban*) are significant either at the 1, 5 or 10% level and have expected signs. Since the coefficient of *hsize* is positive, the larger the size of household is, the higher the likelihood that the household is poor. Since the coefficients of *age* and *age*² are, respectively, negative and positive, the younger or older the head of household is, the higher the likelihood that the household is poor. Since the coefficient of *gender* is negative, female headed households are less likely to be poor.

The number of years of education (*edyear*) is significantly negatively associated with the likelihood of being poor after controlling for the other independent variables. This means that the higher the level of education the head of household has attained, the lower the likelihood that the household is poor. Education appears to have played an important role in reducing poverty, particularly in rural areas.

We now examine poverty incidence by educational group in rural areas using the 2017 round of BLSS, where households are classified into the following groups in accordance with the highest level of education the household head has attained: (1) no education; (2) primary education; (3) secondary education; and (4) tertiary education. No education group includes households whose heads have never received formal education.¹⁴ Primary and secondary education groups include households whose heads have ever attended primary and secondary schools, respectively, as their highest education. For details, please see Table A2 in the appendix.

Table 8 presents poverty incidence by educational group in rural areas in 2017. It also shows the distribution of households across educational groups. Under the guidelines of the five year plans, basic education has expanded rapidly over the last two decades. The net enrollment ratios in primary and secondary education are now 88% and 70%, respectively (Figure 6) (World Bank, 2020). However, until the 1960s, education had been provided by monasteries; thus, three-quarters of rural household heads have never received formal education, while 13% of rural household heads have ever attended primary schools as their highest education.¹⁵ There are some variations across regions; in Eastern Region, no education group accounts for 83%, while in Western Region it accounts for 68%. In Eastern Region, only 17% of rural household heads have attended

¹⁴ No education group includes those who have attended monastic schools as their highest education.

¹⁵ Though not shown in Table 8, 33% and 16% of urban households were in the no education and primary education groups in 2017, respectively.

primary schools or higher.

Table 8 and Figure 6

Poverty incidence decreases with the level of education in all three regions. For the whole country, poverty incidence for the no education group was 14.3% in 2017; but it fell notably to 6.5% for the primary education group and 3.2% for the secondary education group. Central Region had the highest poverty incidence for the no education group at 19.5%, followed by Eastern Region at 16.0% and Western Region at 8.2%. Central Region also had the highest poverty incidence for the primary group at 8.1%, followed by Eastern Region at 7.6% and Western Region at 4.6%.

Poverty incidence depends on the national poverty line determined by the NSB. In 2017, the national poverty line of Nu.2,195.95 was obtained by adding estimated food and non-food requirements, respectively, of Nu.1,473.45 and Nu.722.50 per person per month (NSB, 2017b). People below this national poverty line is considered poor. In rural areas, however, a large number of people are clustered around the national poverty line; thus, a small increase in the poverty line would raise the poverty incidence substantially.

To see how sensitive the incidence of poverty is to the change in the poverty line, we perform a simulation analysis using the rural sample of the 2017 BLSS. Figure 7 presents the result, where we estimated poverty incidence when the poverty line is increased by 10, 20, 30, 40 and 50%. For those households whose heads have never received any formal education, Central and Eastern Regions have a similar pattern of increase in poverty incidence. If the poverty line is raised by 50%, both regions will increase their poverty incidence to 46%, respectively from 19.5% and 16.0%. On the other hand, Western Region will increase its poverty incidence to 29% from 8.2%.

Figure 7

For those households whose heads have attended primary schools as their highest education, Central Region's poverty incidence is slightly more sensitive to the increase in the poverty line than Eastern Region's. If the poverty line is raised by 50%, Central Region will raise its poverty incidence from 8.1% to 40%, while Eastern Region from 7.6% to 36%. Western Region will also increase its poverty incidence, but the increase is much smaller (from 4.6% to 17%). For those households whose heads have attended secondary schools as their highest education, Eastern Region has a unique pattern of increase in poverty incidence. But, if the poverty line is raised by 50%, then Central and Eastern Regions will have the same level of poverty incidence at around 20%.

5. Conclusions

This study focused on the rural sector and examined whether its economic growth was pro-poor for the period from 2007-2017 by using expenditure data from the Bhutan Living Standard Surveys. It also conducted an instrumental variable probit analysis to explore the determinants of poverty where a particular attention was paid to the roles of education in reducing poverty. The following provides a summary of the major findings.

First, for the period from 2007-2012, all three regions (Western, Central and Eastern Regions) grew rapidly in rural areas. Though the growth was smaller than the other two regions, Western Region's rural sector achieved a highly pro-poor growth since the redistribution effect was very small. It lowered its poverty incidence substantially. Central Region's rural sector achieved a pro-poor growth due to its high growth and its poverty incidence became the smallest in 2012. Eastern Region's rural sector had a large positive redistribution effect, which was not favorable to the poor. Though the growth was high, its economic growth was moderately pro-poor.

Second, for the period from 2012-2017, Western Region's rural sector grew rapidly. Like in the 2007-2012 period, it achieved a highly pro-poor growth. It lowered the poverty incidence prominently to 6.6%, the lowest in 2017. On the other hand, Central Region's rural sector experienced a negative growth. Though the redistribution effect was in favor of the poor, the growth was antipoor and the poverty incidence increased to 16.2%, the highest in 2017. Eastern Region's rural sector grew very slowly. But, it achieved a moderately pro-poor growth, since the redistribution effect was in favor of the poor. It lowered the poverty incidence to 14.3%.

Third, according to an instrumental variable (IV) probit analysis, the number of years of education is significantly negatively associated with the likelihood of being poor, meaning that the higher the level of education the head of household has attained, the lower the likelihood that the household is poor. Education appears to have played an important role in reducing poverty. Fourth, poverty incidence decreases with the level of education in rural areas in all three regions. For the whole country, poverty incidence was 14.3% for those households whose heads have no formal education in 2017; but, for those households whose heads have attended primary schools as their highest education it delined to 6.5%.

Fifth, a simulation analysis shows that a small rise in the poverty line would raise rural sector's poverty incidence substantially since many people are clustered around the national poverty line. If the poverty line is increased by 50%, the poverty incidence would increase by 21, 26 and 29 percentage points for those households whose heads have no formal education, respectively, in Western, Central and Eastern Regions. On the other hand, for those households whose heads have attended primary schools, the poverty incidence would increase by 12, 32 and 28 percentage points, respectively, in Western, Central and Eastern Regions.

We can draw some policy implications from these findings. The rural sector had a much larger poverty incidence than the urban sector. In Bhutan, poverty is a rural phenomenon. Since about one-third of households are living in rural areas, the rural sector accounted for 97% of total poverty incidence in 2017. Thus, the reduction of rural poverty is imperative to alleviate total poverty.

According to the pro-poor growth analysis, for the period from 2007-2012, economic growth was the main driver of the reduction of rural poverty in all regions. For the period from 2012-2017, Central Region's rural sector raised its poverty incidence, but this is solely because it experienced a negative growth. Even in rural areas, growth is necessary for the reduction of poverty. It is however a hard task to accelerate rural economic growth since Bhutan's agriculture is labor intensive and consists mainly of subsistence farming and animal husbandry. Besides relying on trickle-down effects from hydropower projects and tourism, promotion of agriculture-based small scale industries is essential to the acceleration of rural economic growth, where further development of basic industrial infrastructure and socioeconomic facilities is imperative. We should note in this connection that the manufacturing sector constitutes only 7% of total GDP, which is the third lowest among the SAARC countries (World Bank, 2020).

Basic education has expanded rapidly over the last two decades. However, three-quarters of rural household heads had no formal education in 2017 because education had been provided by monasteries until the 1960s. The country needs to further promote and strengthen basic education in rural areas since basic education is essential to the increase in labor productivity. According to the IV probit analysis, education is found to have played an important role in reducing poverty. In rural areas, poverty incidence decreases prominently with the level of education. However, rural areas lack employment opportunities and higher education facilities; thus, young rural households who have

attended primary or secondary schools would give up their rural life and migrate to urban areas (Gosai and Sulewski, 2014). On the other hand, in urban areas, employment opportunities are limited since industrial activities are resource oriented; they may not be able to meet the skills and knowledge of young rural migrants. To accommodate those who have acquired basic education, promotion of agriculture-based small scale industries is essential in rural areas. At the same time, the country needs to enhance agricultural labor productivity.

In rural areas, many households are clustered around the poverty line, and a small increase in the poverty line would increase poverty incidence significantly. Many rural households are vulnerable to falling into poverty whether they have acquired basic education or not. There are also some regional differences; rural households in Central and Eastern Regions seem to be more vulnerable to unexpected shocks, such as bad harvest, illness, and natural and man-made disaster. The government has implemented poverty-alleviation policies and programs in line with the general guidelines of the five year plans, such as capacity development and broad-based social sector programs (GNHC, 2019). To prevent vulnerable households from falling into poverty, more effective social safety net programs may need to be introduced in accordance with regional differences in factors affecting living conditions.

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Figure 1. Map of Bhutan

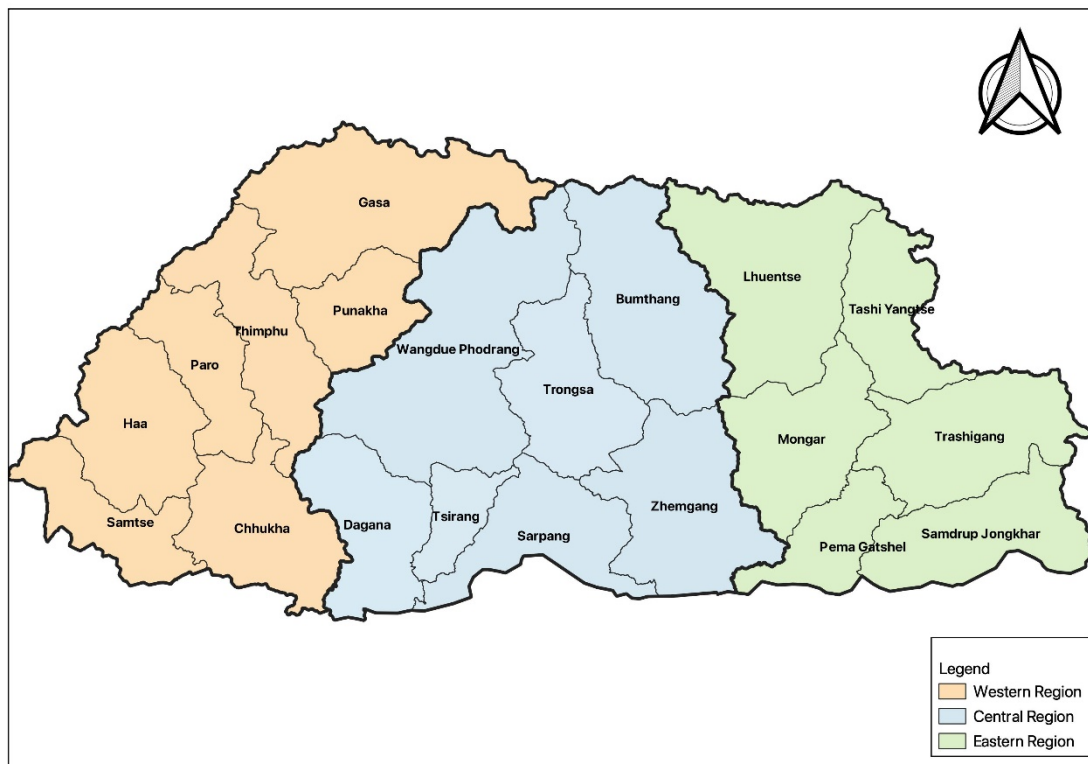
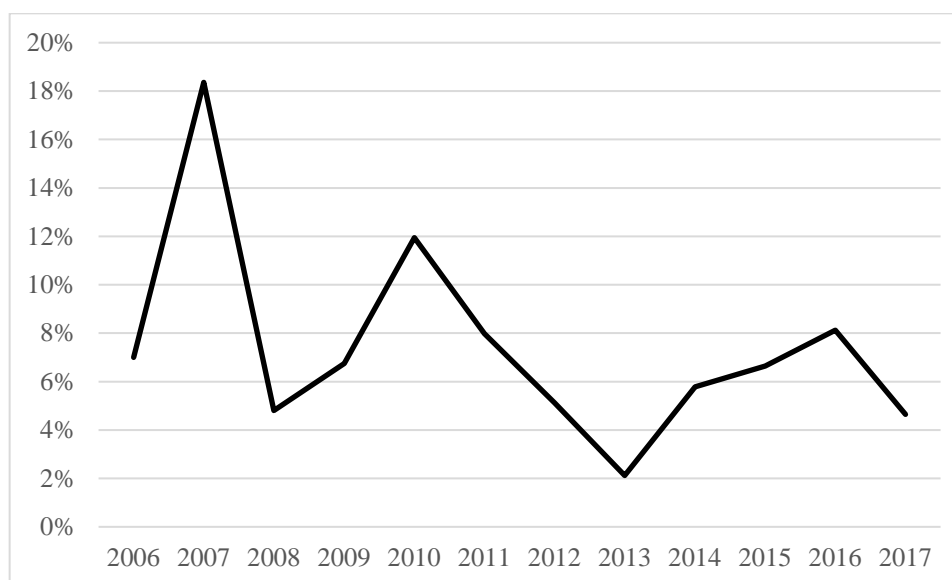
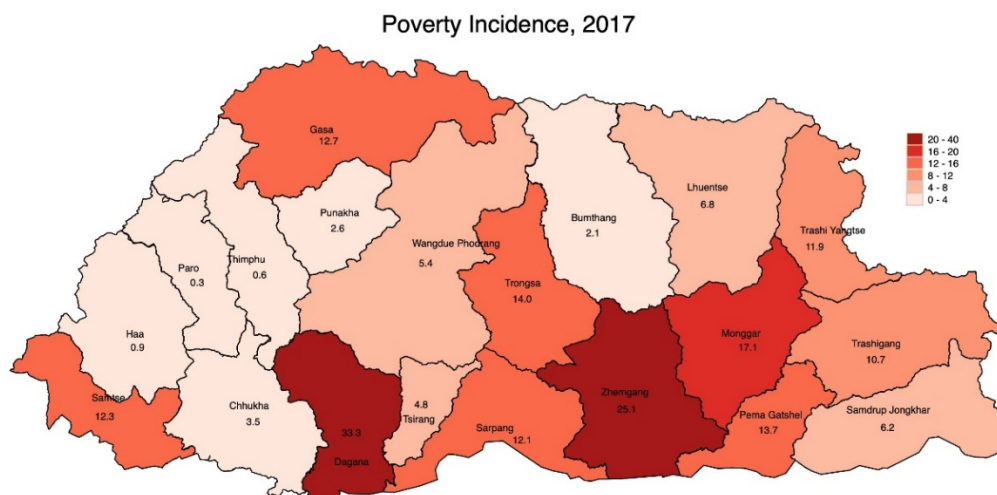


Figure 2. GDP Growth Rate at Constant Prices, 2006-2017



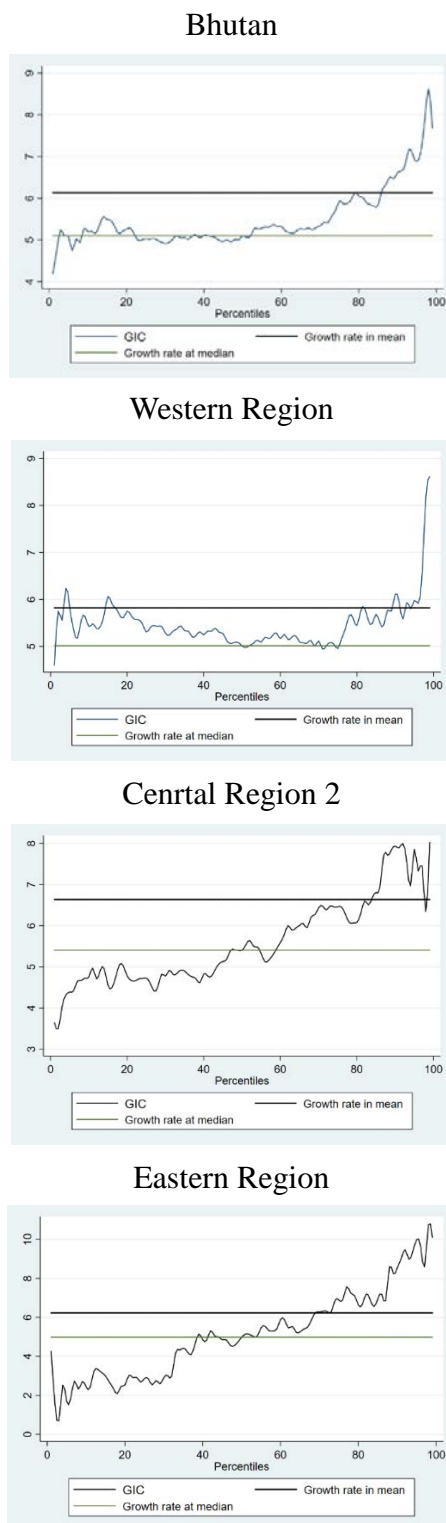
(Source) World Bank (2020).

Figure 3. Poverty Incidence in 2017 (in %)



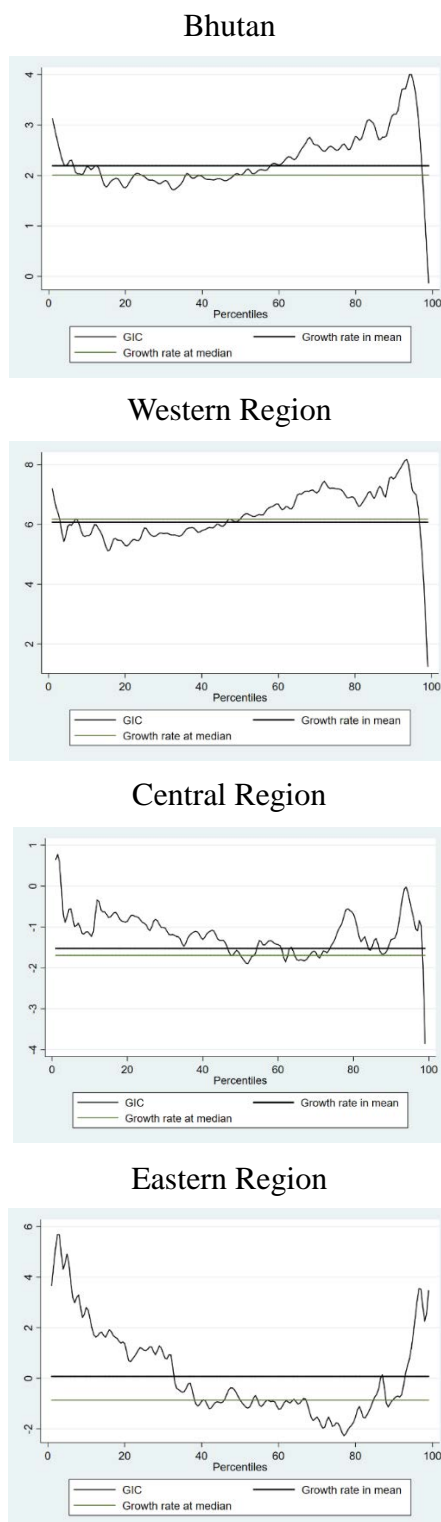
(Source) Constructed from the 2017 Bhutan Living Standard Survey.

Figure 4. Growth Incidence Curve in Rural Areas, 2007-2012



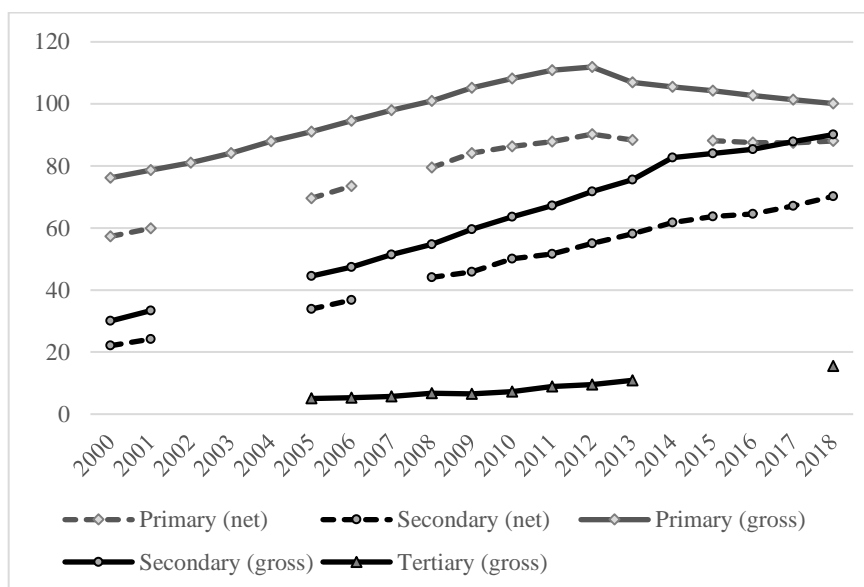
(Source) Constructed from the 2007 and 2012 Bhutan Living Standard Surveys.

Figure 5. Growth Incidence Curve in Rural Areas, 2012-2017

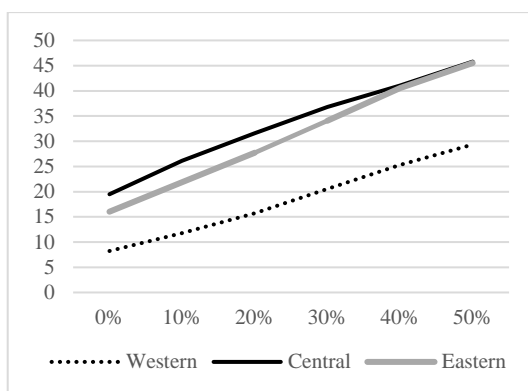
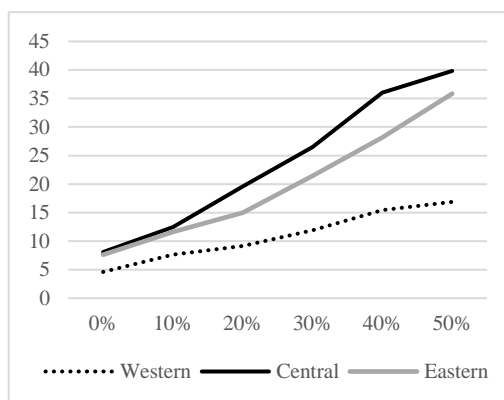
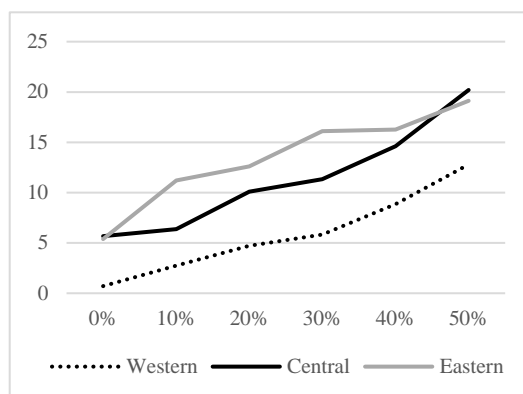


(Source) Constructed from the 2012 and 2017 Bhutan Living Standard Surveys.

Figure 6. School Enrollment Ratio, 2000 – 2018



(Source) World Bank, 2020

Figure 7. Simulation Analysis**No Education****Primary Education****Secondary Education**

(Note) Horizontal axis presents the change in the poverty line, while vertical axis presents the poverty incidence.

(Source) Constructed from the 2017 Bhutan Living Standard Survey.

Table 1. Annual Average Growth Rate of Mean Per Capita Expenditure (at constant 2007 prices)

	Mean per capita expenditure (Ngultrum)			Growth rate		Ratio to Bhutan's mean per capita expenditure		
	2007	2012	2017	07-12	12-17	2007	2012	2017
Bhutan	2,314	2,962	3,376	5.1	2.7	1.0	1.0	1.0
Urban	3,858	4,282	4,839	2.1	2.5	1.7	1.4	1.4
Rural	1,759	2,369	2,640	6.1	2.2	0.8	0.8	0.8
Western region	2,430	3,027	4,016	4.5	5.8	1.1	1.0	1.2
Urban	3,932	4,330	5,153	1.9	3.5	1.7	1.5	1.5
Rural	1,690	2,243	3,012	5.8	6.1	0.7	0.8	0.9
Central region	2,068	2,853	2,806	6.7	-0.3	0.9	1.0	0.8
Urban	3,424	4,060	4,261	3.5	1.0	1.5	1.4	1.3
Rural	1,925	2,654	2,460	6.6	-1.5	0.8	0.9	0.7
Eastern region	1,937	2,620	2,784	6.2	1.2	0.8	0.9	0.8
Urban	3,077	3,778	4,168	4.2	2.0	1.3	1.3	1.2
Rural	1,743	2,356	2,364	6.2	0.1	0.8	0.8	0.7

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 2. Changes in Expenditure Inequality by the Gini Coefficient

	2007	2012	2017
Bhutan	0.395	0.411	0.388
Urban	0.335	0.391	0.337
Rural	0.344	0.377	0.369
Western region	0.404	0.413	0.368
Urban	0.333	0.393	0.331
Rural	0.345	0.362	0.356
Central region	0.355	0.410	0.397
Urban	0.320	0.387	0.361
Rural	0.342	0.404	0.381
Eastern region	0.359	0.376	0.374
Urban	0.369	0.352	0.318
Rural	0.328	0.368	0.354

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 3. Changes in Poverty Incidence (in %)

	Poverty incidence			Absolute change		Proportional change	
	2007	2012	2017	07-12	12-17	07-12	12-17
Bhutan	23.2	12.0	8.2	-11.2	-3.8	-48.1	-31.8
Urban	1.7	1.8	0.8	0.1	-1.0	5.7	-55.9
Rural	31.0	16.7	12.0	-14.3	-4.7	-46.1	-28.3
Western region	22.9	11.5	3.7	-11.4	-7.8	-49.8	-68.2
Urban	1.5	1.8	0.4	0.3	-1.4	19.3	-79.1
Rural	33.4	17.3	6.6	-16.1	-10.7	-48.2	-62.2
Central region	24.3	12.8	13.2	-11.5	0.4	-47.3	2.8
Urban	2.0	1.3	0.6	-0.8	-0.7	-38.0	-53.0
Rural	26.6	14.7	16.2	-11.9	1.5	-44.8	9.8
Eastern region	22.9	15.5	11.5	-7.4	-4.0	-32.3	-25.8
Urban	4.4	2.1	2.3	-2.3	0.2	-51.6	9.8
Rural	26.1	18.6	14.3	-7.5	-4.3	-28.8	-23.0

(Source) Calculated from the 2007, 2012 and 2017 Bhn Living Standard Surveys.

Table 4. Decomposition of Change in Poverty Incidence into Growth and Redistribution Components in Rural Areas, 2007-2012 and 2012-2017 (in %)

	Poverty in 2007 (1)	Poverty in 2012 (2)	Change in poverty (2) – (1) = (GE) + (RE)	Change in poverty due to growth (GE)	Change in poverty due to redistribution (RE)
2007 - 2012					
Bhutan	31.0	16.7	-14.3	-17.1	2.8
Western Region	33.4	17.3	-16.1	-17.0	0.9
Central Region	26.6	14.7	-11.9	-16.6	4.6
Eastern Region	26.1	18.6	-7.5	-14.2	6.7
2012 - 2017					
Bhutan	16.7	12.0	-4.7	-5.1	0.4
Western Region	17.3	6.6	-10.7	-11.6	0.9
Central Region	14.7	16.2	1.5	3.5	-2.0
Eastern Region	18.6	14.3	-4.3	-0.1	-4.2

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 5. Pro-poor Growth Indices in Rural Areas, 2007-2012 and 2012-2017

	Change in mean per capita expenditure (G ₁₂)	Growth elasticity of total poverty (ε)	Growth elasticity of poverty without redistribution (ε _G)	Pro-poor growth index (PPGI)	Poverty equivalent growth rate (PEGR)
2007-2012					
Bhutan	6.1%	-2.02	-1.99	1.02	6.2%
Western Region	5.8%	-2.26	-2.07	1.09	6.4%
Central Region	6.6%	-1.79	-1.93	0.93	6.1%
Eastern Region	6.2%	-1.09	-1.86	0.59	3.7%
2012-2017					
Bhutan	2.2%	-3.03	-3.89	0.78	1.7%
Western Region	6.1%	-3.20	-1.55	2.06	12.5%
Central Region	-1.5%	-1.24	5.44	-0.23	0.3%
Eastern Region	0.1%	-77.13	-121.93	0.63	0.0%

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 6. Descriptive Statistics

Variable	No. of observations	Mean	Standard deviation	Min	Max
2007					
poor	9,798	0.1662	0.3722	0	1
edyear	9,798	2.5411	4.4587	0	20
hsize	9,798	5.0179	2.3145	1	19
age	9,798	45.2638	14.6157	14	102
gender	9,798	0.3102	0.4626	0	1
urban	9,798	0.3003	0.4584	0	1
2012					
poor	8,968	0.0677	0.2512	0	1
edyear	8,968	4.3958	5.4875	0	20
hsize	8,968	4.4408	1.9942	1	17
age	8,968	43.6921	14.7491	15	103
gender	8,968	0.2685	0.4432	0	1
urban	8,968	0.5151	0.4998	0	1
2017					
poor	11,659	0.0491	0.2160	0	1
edyear	11,659	4.1324	5.4480	0	20
hsize	11,659	4.1715	1.9129	1	17
age	11,659	45.2538	14.4104	15	98
gender	11,659	0.3552	0.4786	0	1
urban	11,659	0.4242	0.4942	0	1

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 7. Instrumental Variable (IV) Probit Analysis

	2007		2012		2017	
	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error
edyear	-0.4363***	0.0180	-0.3093***	0.0264	-0.2327*	0.1431
hsize	0.1001***	0.0149	0.1056***	0.0177	0.1469***	0.0565
age	-0.0622***	0.0067	-0.0454***	0.0115	-0.0582*	0.0299
age ²	0.0005***	0.0001	0.0003***	0.0001	0.0005**	0.0002
gender	-0.4763***	0.0321	-0.3606***	0.0524	-0.3234***	0.1055
edyear*urban	0.3593***	0.0269	0.2437***	0.0305	0.1335	0.1574
urban	-1.3955***	0.0776	-1.1462***	0.0626	-1.1243***	0.2359
Central region	-0.1069***	0.0388	-0.0347	0.0550	0.4451***	0.1685
Eastern region	-0.0796	0.0566	0.1350	0.0863	0.3572	0.2431
Constant	1.9138***	0.2157	0.9196*	0.4986	0.1917	2.0054
Number of observations	9,798		8,968		11,659	
Wald chi-squared	2,861***		1,121***		531***	
Log pseudolikelihood	-1,626,401		-1,571,160		-1,840,834	
Wald test of exogeneity: chi-squared	79.2500***		28.3700***		0.6400	

(Note) *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table 8. Poverty Incidence by Educational Group in Rural Areas in 2017 (in %)

	Distribution of households	Poverty incidence
Bhutan		
No education	74	14.3
Primary	13	6.5
Secondary	10	3.2
Tertiary	3	0.0
Total	100	11.9
Western region		
No education	68	8.2
Primary	15	4.6
Secondary	12	0.7
Tertiary	5	0.0
Total	100	6.6
Central region		
No education	72	19.5
Primary	16	8.1
Secondary	9	5.7
Tertiary	3	0.0
Total	100	16.2
Eastern region		
No education	83	16.0
Primary	8	7.6
Secondary	7	5.4
Tertiary	2	0.0
Total	100	14.3

(Source) Calculated from the 2017 Bhutan Living Standard Survey.

Appendix

Table A1. Sample Sizes of 2007, 2012 and 2017 Bhutan Living Standard Surveys and the Distribution of Households

Region	2007			2012			2017		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Western	2,603	4,359	6,962	4,005	2,763	6,768	3,462	2,373	5,835
Central	229	1,893	2,122	436	1,245	1,681	844	2,224	3,068
Eastern	110	604	714	178	341	519	640	2,116	2,756
Total	2,942	6,856	9,798	4,619	4,349	8,968	4,946	6,713	11,659

Region	2007			2012			2017		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Western	88	64	70	86	64	71	67	38	48
Central	8	28	22	11	29	23	15	31	26
Eastern	4	8	7	4	7	6	19	31	27
Total	100	100	100	100	100	100	100	100	100

Region	2007			2012			2017		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Western	33	67	100	37	63	100	47	53	100
Central	10	90	100	14	86	100	19	81	100
Eastern	15	85	100	18	82	100	23	77	100
Total	26	74	100	31	69	100	33	67	100

(Note) The distribution of households is estimated using household weights in the Bhutan Living Standard Survey.

(Source) Calculated from the 2007, 2012 and 2017 Bhutan Living Standard Surveys.

Table A2. Educational Categories and Years of Education

Educational categories	Levels of education	Years of education	No. of sampled rural households
No education	No education	0	4,893
Primary education	Grade 1	1	90
	Grade 2	2	165
	Grade 3	3	150
	Grade 4	4	154
	Grade 5	5	161
	Grade 6	6	181
Secondary education	Grade 7	7	92
	Grade 8	8	148
	Grade 9	9	40
	Grade 10	10	213
	Grade 11	11	6
	Grade 12	12	161
Tertiary education	Vocational education	14	16
	Diploma	14.5	53
	Bachelor's degree	15	157
	Master's degree	17	30
	Above Masters	20	3

(Source) Constructed from the 2017 Bhutan Living Standard Survey (BLSS).