

Least Developed, Most Uneven: Inequality and Sustainable Development in the LDCs

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Abstract

Inequality is often discussed in the context of developed economies, whereas poverty is seen as a greater concern in poorer countries. However, inequality has always played a critical role in the Least Developed Countries (LDCs) and will affect their future sustainable development paths. LDCs as a group lose the most development gains from inequality (as measured by the Inequality-adjusted Human Development Index - IHDI). The paper analyzes in depth the levels and trends of inequality in LDCs - not just in the distribution of income but also in health and education, using the distributions underlying each component of the IHDI. It also applies regression analysis to examine the linkages in LDCs between inequality and progress on the SDG index, both overall and for specific goals. We find that health inequalities, in particular, are detrimental to LDCs' SDG progress. Finally, we utilize the findings to project the prospects of LDCs - individually and collectively - to achieve the SDGs by 2030. These projections show that LDCs can gain more progress towards the SDGs by reducing inequalities by 20% even at current economic growth rates, than they could if inequalities levels remained the same as in the past decade, but economic growth met the 7% per year target stipulated in the SDGs. The analysis in the paper thus provides policy-relevant and actionable insights for LDCs, highlighting where inequality hurts their sustainable development prospects the most and where the greatest gains can be made from enhancing equitable and inclusive development.

Keywords: least developed countries; inequality; sustainable development; human development

1. Introduction

Since its establishment in 1971, the Least Developed Countries (LDC) category has been the only official country grouping by the United Nations. Based on low per capita income and structural impediments to development, this category has allowed special focus on the LDC group in both monitoring and special measures such as trade preferences, aid and concessional financing.

In the 40 years since then, only six countries have fully graduated from the LDC list, and four more are scheduled to graduate by 2024. At the time of writing, there are 46 LDCs remaining. Many are struggling to maintain their progress towards the sustainable development goals (SDGs), especially in the midst of a global pandemic which has shut down large sectors of the world economy. Both reduced demand from other countries as well as decline in tourism, remittances and foreign direct investment (FDI) have contributed to make LDCs' situation worse than it already was before COVID-19. The pandemic has also exacerbated inequalities, adversely affecting those already relatively worse off at the onset of the crisis. Addressing inequalities in the recovery efforts will be key to set the world on track to reach the SDGs.

This paper looks at the role multidimensional inequalities play in hampering LDCs' progress towards meeting the SDGs. As UNDP's Inequality-adjusted Human Development Index shows, LDCs lose the most progress from their inequalities in income, health and education, even though they need such progress the most. Inequalities in health, measured by disparities in life-expectancy at birth, are especially harmful to LDCs.

The rest of the paper is organized as follows. Section 2 surveys the role of inequalities in general and in LDCs in particular beyond income and beyond averages. It uses the IHDI and its components to analyze the various inequalities affecting LDCs, and some of the linkages between these inequalities are broader areas of development. Section 3 analyzes the effect these inequalities have on progress towards the SDGs, by using a regression of the SDG index (developed by the Sustainable Development Solutions Network) on average inequalities in health, education and income, as well as several control variables. This is done first for all countries and then specifically for LDCs. Four additional regressions for specific SDGs are presented, all confirming the negative effects of inequalities, especially in health.

These regressions of the latest SDG index score on inequality variables are then followed by projections, estimating the impact of inequality on SDG progress beyond today. Three scenarios are projected for the remaining years before 2030. Scenario 1 examines business as usual, assuming LDC economies grow at the same rate as they have between 2010-2019, and keeping the same average levels of inequalities. Scenario 2 assumes the SDG goal of 7% growth per annum, but also maintains previous inequality levels. Scenario 3 applies previous growth rates

(2010-2019) but reduces all inequalities by 20%. Scenario 4 combines 7% growth rates and reduced inequalities.

While scenario 4 is the ideal, it is not very realistic given previous growth rates as well as the impacts of the pandemic. Scenario 3 shows dramatically how LDCs can maximize progress towards the SDGs without changing the average growth rate of the previous decade, by applying inequality-reducing policies. On average, LDCs can improve their 2020 SDG score by 24% by 2030 using the same growth rates but lower inequalities, compared to only 20% using 7% economic growth and constant inequalities. Section 4 concludes and discusses some policy implications.

2. Inequality and Sustainable Development in the Least Developed Countries

- Recent increase in interest in inequality (academic and popular literature) - Piketty, SDG 10
- Most studies focus on income or wealth - Sen (1980) inequality of what
- UNDP focuses on multidimensional inequality - standard of living, health and education (HDR 2019)

Eight countries have graduated or are set to graduate from the LDC category. Whilst they have very different annual GDP-growth rates during their “graduation”-period, all countries except Sao Tome and Principe say reduced inequality before graduation. Sao Tome and Principe decreased its GINI coefficient from 32.1 in 2000 to 30.8, but then saw it almost double to 56.3 in 2017. However, the country’s Inequality in Human Development-index (IHDI) shows a decreasing trend in income inequality over the same period: the IHDI component of inequality in income actually fell from 44.2 in 2011 to 14.9 in 2018, corresponding to a 66% drop.

Country	Change in GINI coefficient	Average GDP growth rate per annum	Period	Graduation (or expected*)
Cabo Verde	-10%	7,42%	2001-2007	2007
Maldives	-7%	6,25%	2002-2009	2011
Samoa	-5%	1,86%	2002-2013	2014
Angola	-1%	5,78%	2000-2018	2021*
Bhutan	-9%	7,36%	2003-2017	2023*
Sao Tome and Principe	75%	4,67%	2010-2017	2024
Solomon Islands	-20%	5,14%	2005-2013	2024

* Scheduled for graduation. Data for Vanuatu’s GINI coefficient are only available for one year.

And whilst most economists agree that growth is key for poverty reduction, economic growth alone does not translate into reduced poverty when the distribution of income and assets is highly unequal and increasing (Deininger & Squire, 1998; Bourguignon, 2004). The relationship between inequality and economic development has gained traction as global inequality in income and wealth and in human development is on the rise (Alvaredo et al, 2018; Piketty 2014, UNDP, 2019). Estimates show that within-country income and wealth inequality are now at the highest levels since the nineteenth century (Piketty, 2014), and almost all countries across the world have seen stark increases in income inequality over the last decade, driven largely by inequalities in wealth or capital ownership (Alvaredo et al, 2018). Data from the World Inequality Report show that since 1980 the top 1% richest individuals in the world have captured as much of global economic growth as the bottom half of the world's population (Alvaredo et al, 2018).

Furthermore, rising income inequality is accompanied by increased and persistent horizontal inequalities in a number of dimensions important to human development (UNDP, 2019). Whilst the world has seen great progress in expanding access to basic education and health care, gaps are opening up between those at basic education and health-levels and those with access to higher levels of education and quality health care services (ibid.) These gaps compound and are reproduced over generations, creating systemic difficulties for both individuals and countries to break inequality traps and trigger sustainable and inclusive development. This is particularly concerning for the Least Developed Countries (LDC). LDCs have the lowest levels of socioeconomic development in the world, with severe and widespread poverty, high levels of economic and environmental vulnerability, and low human capital levels. These countries are also on the low end of human development, as measured by the Human Development Index (HDI).

2.1 *Beyond Income*

Inequality and human capital

The LDCs have made progress in expanding education to all, having more than doubled gross primary education enrollment rates since 1970 (UNESCO, 2020). However, in a knowledge-intensive economy characterized by global competition and rapid technological change, investing in the basics may be essential but not enough to keep up with the 'moving targets' of the 21st century (UNDP, 2019). The 2019 Human Development Report shows that the share of people with tertiary education is growing at a significantly higher rate in high human development countries than in low human development countries and LDCs (ibid), and in 2019, the mean expected years of schooling in the LDCs was 9.9 years, to be contrasted with the world average of 12,7 years and the OECD average of 16,3 years.

Raising overall education levels is key for LDCs to graduate, as is reducing education inequality. Figure 1 shows high and persistent inequalities in education for LDCs 2010 - 2018, with the latest inequality in education estimates almost twice as large as the world average. The gaps are

higher and increasing at higher levels of education. The top educated quintile in low human development countries, including the LDCs, have seen approximately an 8 percent change in post-secondary education attendance over the last ten years whereas the bottom two quintiles experienced almost no change in post-secondary education during the same period (UNDP, 2019).

Gaps in education reduce social and economic mobility across generations (UNDP, 2019), and are associated with lower equality of opportunity, as well as inequality in other dimensions such as health and income. At country level, these gaps imply losing out on human capital formation, human potential for innovation and economic development. They may imply fewer qualified professionals (ibid.) and reduced possibilities for transforming to a knowledge-intensive economy, further exacerbating the country’s relative disadvantage at a global scale.

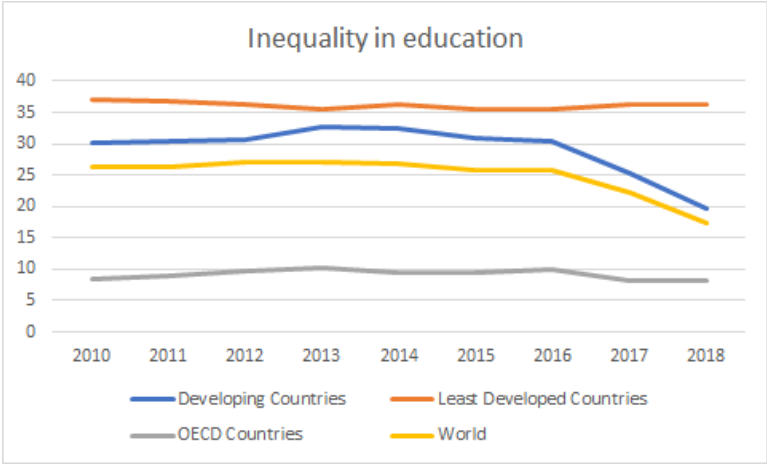


Figure 1: Inequality in Education as per the IHDI (UNDP)

Health is another key determinant of human capital (Oster et al, 2013), and health outcomes are an integral part of the LDC-criteria. The Human Assets Index (HAI) is part of the LDC-criteria and includes three health indicators: under-five mortality rates, prevalence of stunting, and maternal mortality ratio. A lower HAI represents lower human capital development and structural barriers to sustainable development (UN DESA). Disadvantages in health are persistent and both influence, and are influenced by, other socioeconomic outcomes. Children with poor health are more likely to miss school, adversely affecting their learning and human capital formation which may lead to lower productivity and persistent poverty (HDRO, 2019). Poor health will also negatively impact an individual's opportunity to participate in the labour market and benefit from economic growth (OECD, 2019), illustrating the importance of a more granular analysis of the inequality-growth-poverty reduction nexus.

Whilst inequality in health, as measured by life-expectancy, have decreased in the LDCs over the last decade, levels are still the highest in the world.

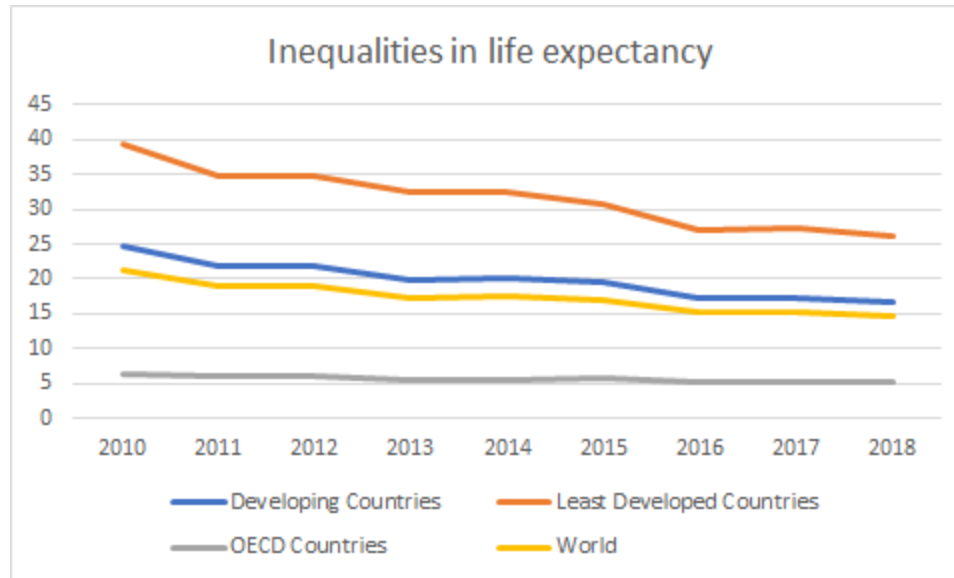


Figure 2: Inequality in Health as per the IHDI (UNDP)

Inequality and vulnerability

Sustaining long-term growth is of particular importance to the LDCs as it is key to achieve significant and sustainable poverty reduction (Berg and Ostry, 2011). The duration of growth as well as the medium-term growth rates tend to be shorter when income inequality is high (Berg and Ostry, 2011, Stiglitz, 2016). As previously discussed, income inequality affects, and is affected by, human capital development which may in turn adversely impact the possibilities for sustainable growth (ibid.), but there are other channels through which inequality affects long-term economic development trajectories worth noting. High inequality is associated with low levels of social trust and weak institutions (Wilkinson and Pickett, 2016) which may increase economic volatility and uncertainties, and decrease productive private and public investment (Stiglitz, 2016), slowing down the rate of structural transformation (Baymul and Sen, 2020). Structural transformation is needed for the LDCs to mitigate economic vulnerability, increase resilience, and spur long-term economic development.

Wilkinson and Pickett (2010) argue that high inequality erodes trust and social cohesion, which makes it harder for communities to cooperate and generates economic inefficiencies through increased transaction costs (also see Putnam, 2000). The polarization of society that comes with inequality may also lead to political and social unrest as the perceptions of injustice and politicization of grievances mobilize groups to take collective, and sometimes violent, action (Schoch and Ferreira, 2020, United Nations and World Bank, 2018), increasing economic uncertainty, discouraging investments and negatively affecting growth (Stiglitz, 2016).

Social cohesion is also a key determinant for the strength and quality of formal institutions (Easterly et al, 2006), and a vast strand of literature stress the importance of institutions for

economic development outcomes (North, 1990; Rodrik, 2000; Rodrik, 2007; Acemoglu and Robinson, 2008). Whilst high levels of inequality may lead to calls for increased redistribution (Ostry et al, 2014), Stiglitz (2016) argue that highly unequal societies are less inclined to increase public spending and invest in productivity-enhancing in public goods (such as education or technology). With weak institutions and high inequality, rent-seeking becomes a prominent feature of the economy (Stiglitz, 2016) further enhancing economic instability and reducing the potential for growth-induced poverty reduction. This is mirrored empirically in the World Inequality Report (2018) which shows a global increase in wealth inequality coupled with a global decrease in public net wealth since the 1980s, further reducing public institutions' capacity to provide high quality government services and public goods.

Thus, inequality, polarization, political volatility, and poor institutions are barriers to economic resilience and adaptability, and reduces countries' effectiveness in responding to exogenous shocks (Rodrik, 1999; Ancarbi et al 2005, as cited in Stiglitz 2016). Again, this is of particular importance to LDCs. The LDCs face structural barriers to sustainable development due to their high levels of vulnerability to economic and environmental shocks. Guillaumont (2011) argues that exogenous shocks have "detrimental effects" on economic growth and poverty reduction in developing countries, and that high levels of vulnerability is a major concern when income and human capital levels also are low (as with the LDCs).

Whilst structural vulnerability is derived from external factors such as exposure to environmental and trade-related shocks (Guillaumont, 2010), a country's ability to deal with these shocks is endogenous and closely linked to institutional quality and its levels of social cohesion and equality. In fact, Easterly et al (2006) found that the quality of institutions (proxied with rule of law) had a positive impact on growth rates in LDCs, and Hashim et al (2011) find that institutional quality (as measured by government stability, corruption, ethnic tensions, and socioeconomic conditions) explain growth performance in 27 Sub-Saharan countries during 1984-2003, many of which are also LDCs.

Structural transformation of the economy is dependent on both institutions and human resources (UN Habitat, 2016). Transformation implies the reallocation of economic activity across sectors thus diversifying the economy and increasing adaptability and resilience to shocks. A country's development trajectory is closely linked to the structural transformation of its economy (Kuznets, 1996), and is associated with higher levels of innovation, productivity and long-term sustainable economic growth (Herrendorf et al, 2013). Traditional economic growth theory hypothesizes that inequality will increase as a country undergoes structural transformation, and decrease when a certain level of economic development (GDP-level) is reached (Kuznets, 1996). The inverted U-shaped relationship between inequality and economic development is derived from changes in the return to labor and a general shift from agriculture to industry and from rural to urban jobs. As a country undergoes industrialization, workers move from subsistence farming to better

paying jobs in urban industries, creating an initial increase in inequality, but as the process continues human capital becomes increasingly important for GDP growth and high levels of inequality would then slow down growth. However, research by *inter alia* Piketty (2014) has shed doubt on the relationship, showing that inequality has risen in developing countries since the 1960s, in spite of the relative importance of human capital and industrial jobs in these countries.

High initial levels of inequality may itself be a barrier to structural transformation if, as noted above, it increases economic volatility and discourages productivity-enhancing investments in infrastructure, technology and education (Stiglitz, 2016). Structural transformation is dependent on these investments, as on the institutions and human resources available (UN Habitat, 2016). And the economic development–increasing inequality-relationship is not a law of nature. Baymul and Sen (2020) argues that the relationship will depend on the typology of structural transformation that a country follows. They find that manufacturing-driven structural development, that is a shift from agricultural to manufacturing-intensive work, will *unambiguously* decrease inequality *at all stages* of economic development, whereas a service-driven structural transformation, a movement of workers from agriculture to service-jobs, will increase inequality in developing countries.

Inequality and human development

A related, but slightly different approach comes from the capabilities-literature. Rather than looking at human capital, vulnerability and institutions in relation to economic growth and poverty reduction, the approach focuses on what people can do and become as a result of their social context, individual endowments, opportunities and choices available to them, that is as a result of their capabilities (Sen,1999, Robeyns, 2005). Human development is the process of enlarging peoples’ freedoms to live the life they have reason to value (UNDP). Inequalities in income, health, and education creates barriers for those at the bottom of the distribution to achieve basic capabilities, which translates into a structural disadvantage throughout the life-cycle that may be transmitted to the next generation (UNDP, 2019).

The 2019 Human Development Report (HDR) shows an overall global convergence in basic capabilities, but a divergence in enhanced capabilities. Basic capabilities can be understood as the “initial steppingstones” (UNDP, 2019) of development, and they create the foundation for developing further capabilities in life. Examples cited include early childhood survival and primary education, which are the foundations for achieving enhanced capabilities such as a long and healthy life and higher education. All LDCs fall in the low human development-category. As shown in figures 3-4 below, low human development countries have seen an increase in both life-expectancy at birth and primary education over the last decade but almost no change in life expectancy at age 70 and tertiary education reflecting the global convergence and divergence patterns.

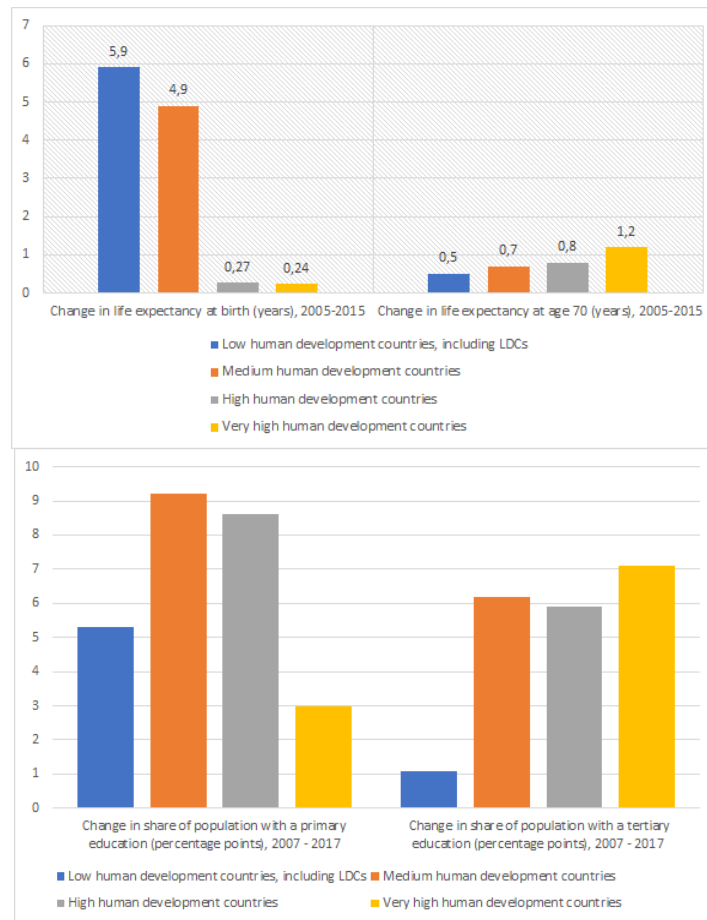


Figure 3 & 4: Changes in life expectancy at birth and at age 70 for the years 2005 - 2015, and changes in the share of population with primary and tertiary education for the years 2007-2017, per human development country category, based on UNDP, 2019, Human Development Report 2019, p. 8

In addition to global inequality-patterns, within-country inequality in human development is high in LDCs reflecting how an individual’s socio-economic position impacts their capabilities. For example, the 2019 HDR shows a 9-year gap in median years of education between women at the top and at the bottom of the income distribution in Angola, whereas the country’s gender gap in mean years of schooling show that men outweigh women with 2.4 more years of schooling. As discussed below, increases in women’s education have shown positive effects beyond the individual (World Bank, 2018).

The Inequality-adjusted Human Development Index (IHDI) shows a country’s loss in human development when inequality is accounted for, that is when the distribution of education, health and income across the population is considered. LDCs show the largest overall loss in human development because of inequality, but there is a great deal of variation in inequality-induced human development loss between the countries.

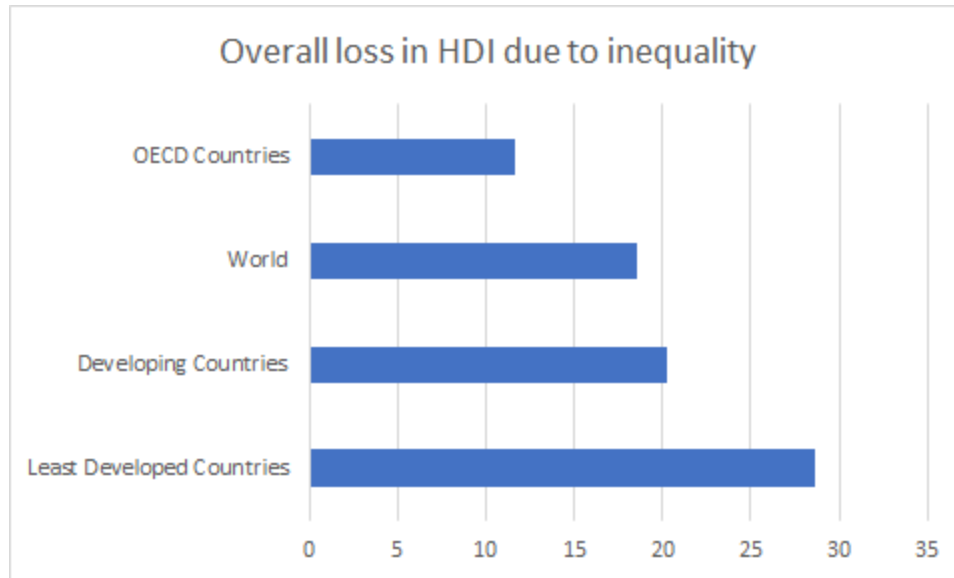


Figure 5: Overall loss in human development due to inequality (UNDP 2020)

Conversely, whilst graduated and graduating LDCs saw income inequality reduced as measured by the Gini-coefficient, they display somewhat contradictory trends when expanding the analysis beyond income. Both Bhutan and the Maldives saw stark increases in education inequality, offsetting the progress in equality in human development stemming from decreased income- and health inequality. Given the importance of education for human capital development, technological change and sustained growth in a knowledge-intensive economy (Fuente and Ciccone, 2002), reviewing inequality trends beyond income is of importance for LDCs aiming for long-term sustainable economic development.

Beyond the normative importance of capabilities for human well-being, agency, and empowerment, reduced capabilities imply that an individual is not able to fully participate in the economy and in society, hampering development outcomes at a macro level. Inequalities in human development have also been associated with low social cohesion and reduced generalized trust (UNDP, 2019) which is detrimental to economic development. Furthermore, the global progress in enhancing basic capabilities, as measured by the Human Development Index (HDI), 1990 – 2020 has been paralleled by global increases in income and wealth inequality (UNDP, 2019, Piketty, 2014), suggesting that expanding primary education and basic healthcare might not be enough to shift power-balances and unlock inclusive development.

This average, however, masks a great deal of variation among LDCs. The chart below shows the LDCs losing the most and the least human development due to inequality.

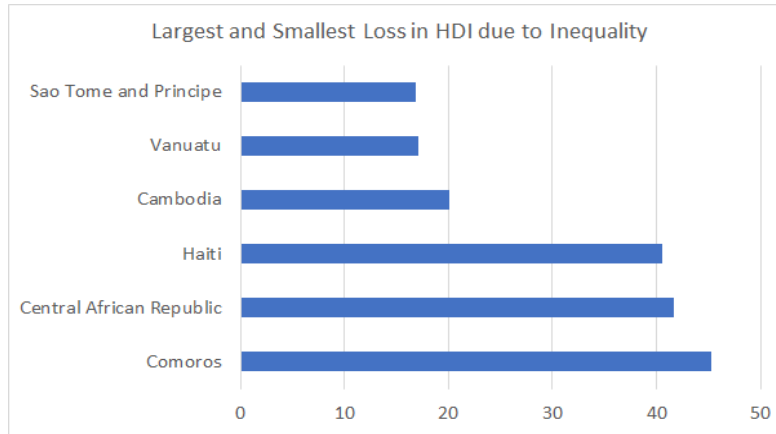


Figure 6: Top and Bottom Countries in HD Loss due to Inequality (UNDP)

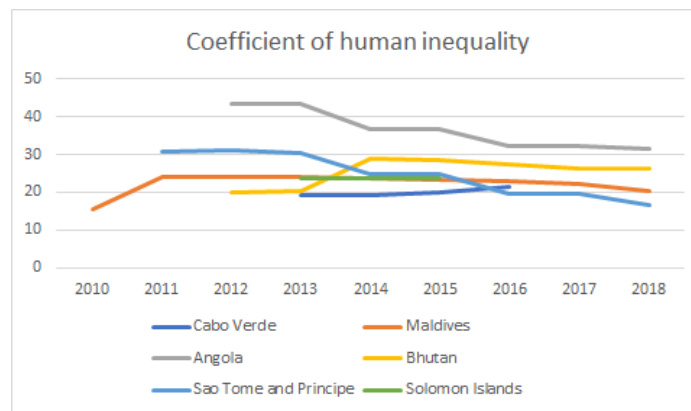


Figure 7: Coefficient of human inequality, selected LDCs (UNDP)

2.2 Beyond Averages

Decomposition of loss due to inequality by three dimensions

While Solomon Islands' CHI remained mostly the same over 2010-2018, Angola and Sao Tome saw reductions in human inequality during this period. However, CHI increased by 32% in both the Maldives and Bhutan. The IHDI allows us to decompose this change by its three dimensions:

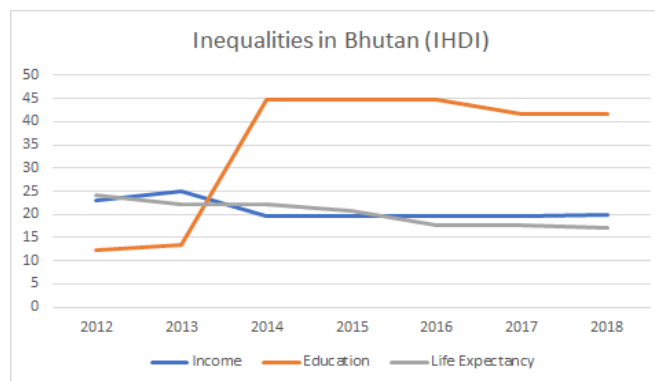


Figure 8: Inequalities in income, education and health in Bhutan (UNDP)

Bhutan has seen some decline in inequalities in both income and life expectancy, but its education inequality has more than doubled since 2012. As the CHI is an unweighted average of the three inequalities, the sharp rise in education inequality has outweighed the small reduction in income and life expectancy inequalities.

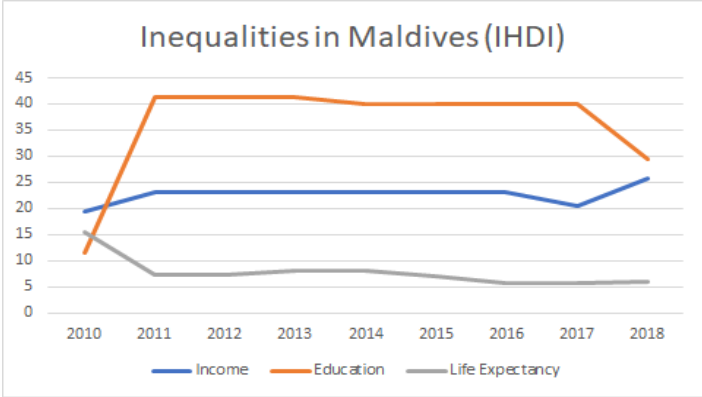


Figure 9: Inequalities in income, education and health in Maldives (UNDP)

Maldives likewise had contradictory trends. The inequality of life expectancy has fallen by 61% between 2010 and 2018, but income inequality has risen by 32% and inequality in education has more than doubled (an 154.8% increase), causing the overall CHI to increase.

Other LDCs which saw an increase in their CHI between 2010 and 2018 are Benin (8%), Comoros (3%), Kiribati (4%), Myanmar (23%) and Zambia (6%).

Gender disparities in education are persistent in LDCs, although women seem to be catching up. The expected years of schooling for women in LDCs more than doubled since 1990, whereas expected years of schooling for men increased with 82 percent over the same period. Looking at school enrollment rates, gross primary school enrollment rates are converging for boys and girls in LDCs, whereas secondary and tertiary school enrollment rates show increases for both sexes but persistent differences between sexes. Closing the gender gap in education will improve LDC’s human capital levels and positively affect growth rates, and educating women has benefits beyond economic growth. Increases in women’s education is associated with better health outcomes for all household members, including better nutrition for children, and increases in children’s education (World Bank, 2018).

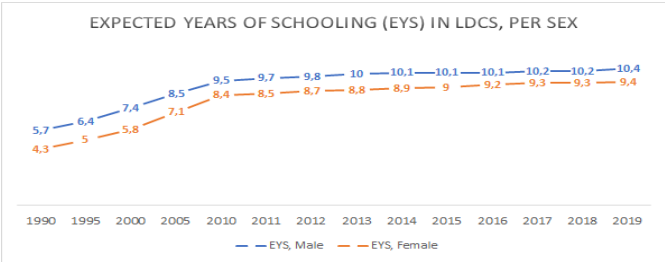


Figure 10: Based on data from the Human Development Report Office, “Expected Years of Schooling, Female, Male, (Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child’s life), Human Development Data Center, UNDP 2020, <http://hdr.undp.org/en/indicators/123306>)

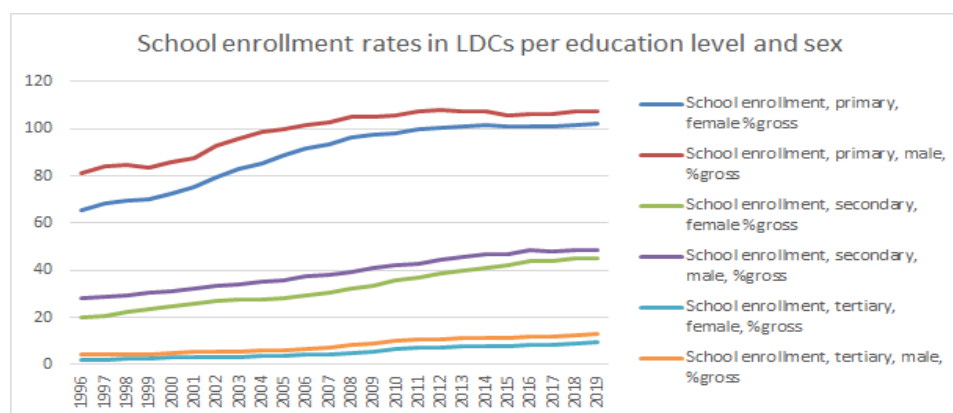


Figure 11: Data from the World Bank, “Gross enrollment ratio, primary, secondary and tertiary education, Female, Male” (Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown, here by sex and by level of education), World Development Indicators, The World Bank Group, 2020, <https://databank.worldbank.org/source/world-development-indicators>)

The Covid-19 pandemic forced lockdowns and school closures across the world, pushing more children than ever before out of school. Data from UNESCO (2021) find that in 36 LDCs schools were closed for an average of 79 full days during the first year of the pandemic (see Appendix), affecting almost 160 million primary and secondary school-aged children. Some countries experienced more than 150 days of closure (Bangladesh and Ethiopia). For many of these children, online remote learning might not be an option. In 2019, only 7 percent of households in LDCs had access to computers and 16.9 percent of households had access to the internet (ICT indicators database, 2020). They risk falling behind in their education and many may not return to school at all (UNESCO, 2020), severely damaging LDCs’ long-term human capital development. However, the averages mask inequalities in ICT-access as almost half of urban LDC households whereas only 26.6 percent of rural households have access to the Internet.

Table 1: Digital Access in LDCs (2019)

	Total	Urban	Rural
Percentage of households with access to computers, by urban/rural area, 2019	7,2	16,5	3,0
Percentage of households with access to the Internet, by urban/rural area, 2019*	26,6	48,7	16,3

3. Multidimensional Inequality as an Obstacle for LDCs to Meet the SDGs

Since 2016, the Sustainable Development Solutions Network has published an annual report including a Sustainable Development Goal index (SDGi). This index averages 85 global indicators - some official and others not - for all 17 goals. Of the 166 countries for which the index has been calculated in 2020, 40 LDCs were included given available data. Of these, 33 LDCs are at the bottom 50 ranks of the index. The other seven fare only a little better:

Table 2: SDG Index 2020 scores and ranks, selected SDGs

Country	SDG Index Score	SDG Index Rank
Bhutan	69.27	80
Nepal	65.93	96
Myanmar	64.58	104
Cambodia	64.39	106
Bangladesh	63.51	109
Sao Tome and Principe	62.57	115
Lao PDR	62.06	116

Of these, Bhutan and Sao Tome are already scheduled to graduate.

In order to empirically test what role multidimensional inequalities play in explaining LDCs' poor performance towards the SDGs, we performed several regressions of the SDGi score on both the three dimensions of the IHDI as well as control variables. However, sustainable development and inequality can affect each other as described above. To avoid a problem of endogeneity, we regress the latest data point of SDGi (2020) on the *change* in the control and inequality variables over time. For sensitivity analysis purposes, we use both the change in the last 5 years and the change in the last 10 years.

3.1 Inequality and Overall SDG Progress

The following model is then used in the initial OLS regression:

$$SDGi = \alpha + \beta * Xi + \gamma Ii + \delta LDCi + \varepsilon$$

where SDGi is the overall SDG Index score in 2020 for country i, X is a matrix of control variables (log of income per capita in 2020, economic growth rate between 2010-2019) and I is a matrix of inequality variables (averaged IHDI sub-indices for health, education, income and

gender inequality over the most recent 5 or 10 years). LDC is a dummy variable which equals 1 for LDCs and 0 for non-LDCs

As expected, income per capita in the latest year and economic growth between 2010 and 2019 explains over three-quarters of the performance on the SDG index (model 1). Being an LDC also predicts a score nearly five times worse, a fact which confirms the severe structural challenges faced by these countries as recognized by the LDC criteria.

Models 2-4 show the effects of higher inequality in each of the three dimensions of the IHDI separately. Income inequality (in the last 5 but not 10 years) has a negative and statistically significant effect on SDG progress, even after controlling for income, economic growth and LDC status. Inequality of life-expectancy (averaged in the last 5 but not 10 years) has an even larger negative effect on SDG progress. Inequality of education is significant in the last 10 rather than 5 years, but has a similar negative effect on a country's SDG index score.

When all averages of inequality are combined in model (5), life-expectancy inequality still has the largest negative effect, followed by income and education inequalities. Overall, the model explains nearly 90% of all variation among countries' SDG performance.

Table 3: Regressions results. Dependent variable is SDG index 2020

	(1)		(2)		(3)		(4)		(5)	
constant	10.977 (4.890)	**	16.576 (4.964)	***	59.728 (6.554)	***	27.568 (5.671)	***	58.619 (6.410)	***
Per capita income (log PPPs)	6.010 (0.492)	** *	5.962 (0.465)	***	1.716 (0.607)	***	4.678 (0.535)	***	2.135 (0.590)	***
Growth 2010-2019	0.702 (0.208)	** *	0.331 (0.189)	*	0.534 (0.166)	***	0.553 (0.192)	***	0.287 (0.154)	*
LDC (1 or 0)	-4.826 (1.356)	** *	-4.730 (1.191)	***	-2.172 (1.111)	**	-2.835 (1.291)	**	-1.828 (1.040)	*
Income inequality			-0.175 (0.038)	***					-0.107 (0.033)	***
Life-expectancy inequality					-0.593 (0.064)	***			-0.433 (0.058)	***
Education inequality							-0.210 (0.041)	***	-0.064 (0.035)	*
N	145		140		145		144		140	
Adjusted R2	0.768		0.833		0.855		0.808		0.889	

Standard errors are shown in parentheses. Statistical significance is noted with asterisks: *** for 1%, ** for 5%, * for 10%.

When we restrict the sample to only the 40 LDCs for which there is data for all variables, the following model results:

$$\text{SDGi} = 45.8 + 3.56 \text{ income p.c.} - 0.44 \text{ life-expectancy inequality} - 0.17 \text{ income inequality}$$

Economic growth as well as changes in education inequality were not statistically significant for the LDC regression. Education inequality may be already captured by income inequality, as the former - coupled with poorer health and - lowers a country’s human capital levels (Ostry et al, 2014). Inequality in health and education may also create structural barriers to economic development and poverty reduction. The traditional human capital theory developed by Becker (1962) models how productivity is dependent on an individual's knowledge, skills, abilities, and competencies, with more productive individuals earning higher wages. On an aggregate level, human capital development leads to improved firm productivity as workers become better at performing their tasks, and in the endogenous growth-models increased marginal product of labour translates into increased economic growth. Large disparities in access to education would thus adversely affect the income distribution in a country, as well as overall growth rates. Likewise, Lee and Lee (2018) analyze educational expansion in more than 60 countries between 1980 and 2015, showing that a more equal distribution of education significantly reduces income inequality.

These results imply that, on average, while income does improve an LDCs progress on the SDG index, health and income inequality reduce these gains. The loss from health inequality is especially large, as each 10% increase in inequality of life-expectancy lowers an LDCs overall SDG score by 4.4 points (this is similar to the average effect on all countries in the sample).

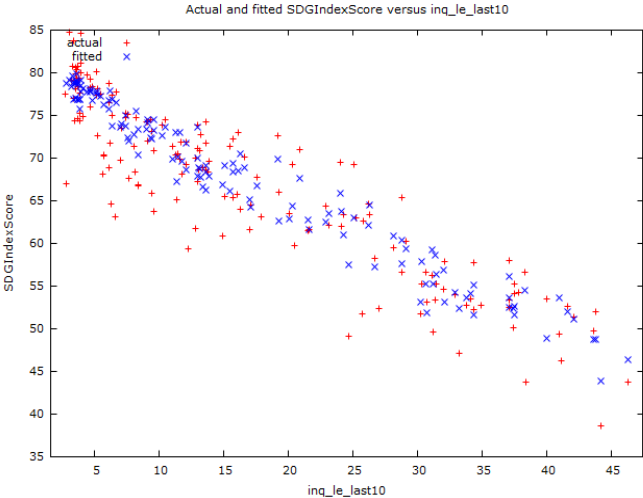


Figure 12: Observed and fitted values of SDG index based on regression inequality in health (10 year average)

3.2 Inequality and Progress towards Specific SDGs

The analysis above demonstrated the importance of reducing inequalities, especially in health, to countries' overall progress towards achieving the SDGs. The SDG index, however, covers 17 goals and is made up of dozens of indicators. Thus the effect of inequalities on each SDG is not discernible from the above regression.

We next regressed each average SDG score on the same variables. SDGs 14 and 15 had insufficient data coverage for regression analysis, and SDG 17 was omitted as it represents means of implementation for the other 16 SDGs. Of the remaining 14 SDGs, all had one or more significant impacts of changes in inequalities on progress towards the goal. However, in many cases the explanatory power of the model dropped significantly. Therefore, in the following table we present only the four models where adjusted R2 was 0.8 or greater.

Table 4: Regressions results. Dependent variables are selected SDG index goal scores

	SDG 1		SDG 3		SDG 7		SDG 9	
constant	6.758 (24.345)		71.217 (10.511)	** *	35.479 (19.049)	*	-164.602 (13.313)	***
Per capita income (log PPPs)	6.567 (2.245)	** *	10424 (0.970)	** *	5.878 (1.765)	***	22.996 (1.249)	***
Growth 2010-2019	2.295 (0.604)	** *	-0.175 (0.254)		0.691 (0.4825)		-1.436 (0.503)	***
LDC (1 or 0)	-16.422 (3.973)	** *	-0.124 (1.690)		-23.981 (3.230)	***	8.962 (3.202)	***
Income inequality (5 year average)	-0.327 (0.123)	** *						
Income inequality (10 year average)			-0.112 (0.052)	**			-0.238 (0.101)	**
Life-expectancy inequality (5 year average)					-0.980 (0.190)	***		
Life-expectancy inequality (10 year average)	-1.267 (0.221)	** *	-1.310 (0.094)	** *				
Education inequality (5 year average)								
Education inequality (10 year average)	0.409 (0.1336)	** *						
N	138		140		145		140	

Adjusted R2	0.838	0.923	0.847	0.835
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These models suggest several key findings:

- Economic growth is only significant for SDGs 1 (poverty reduction) and 9 (innovation, industry and infrastructure). For SDG 3 (good health) and 7 (affordable and clean energy) there is no statistically significant relationship between progress on the goal and economic growth.
- LDC status (as measured by the dummy variable) is a serious impediment to progress on three of these SDGs. The exception - SDG 3 - is especially interesting. The small negative coefficient is also not statistically significant, suggesting LDCs can make progress towards healthier lives as much as other countries. Given the interlinkages between health and other SDGs, this is definitely good news.
- Income inequality has a negative and statistically significant coefficient for all four SDGs, but it is not large. The effect of a 10% increase in income inequality ranges between 1.1 and 3.2 points reduction in the SDG index
- By contrast, inequality in health (life-expectancy) is strongly negative for SDGs 1, 3 and 7. Each 10% increase in health inequality reduces a country’s SDG index by between 9.8 and 13 score points.

3.3 Beyond Today: Projections for LDCs’ SDG Index Progress

Having estimated the impact of multidimensional inequalities on LDCs’ progress towards the SDG thus far, we are now in a position to project this impact forward. We do so in four different scenarios (Table X). Each scenario takes as parameters a growth rate and level of (health and income) inequalities, and projects the resulting effect on the 2030 SDG index.

Table 5: Projections with different growth and inequality scenarios

		Economic Growth Rate	
		Trend (2010-2019)	7% per year
Inequalities	Same as 2010-2019	Scenario 1	Scenario 2
	20% lower	Scenario 3	Scenario 4

The results of the projections are shown in Table Y in the annex.. Several key insights can be gleaned from these results:

Scenario 1: business as usual

This base scenario simply extrapolates LDCs' current growth rates and inequality levels. These countries that did well between 2010-2019 do even better in the next 9 years to 2030. Lao PDR, for example, grew by an average of 7.5% in the past decade, so assuming similar growth, its income per capita grows from \$6,875 today to \$13,198 in 2030. Combining this with its relatively low levels of health and income inequality in the past decade (23.2 and 19.0 respectively), Lao's SDG index increases from 62.1 in 2020 to 82.8 in 2030. This is not only a 33% improvement, but also puts it at a level of SDG achievement comparable to France or Finland in 2020.

By contrast, a country that did poorly in the preceding decade would do worse in the next. The Central African Republic had an economy contracting by 2.2% a year between 2010-2019, and high levels of inequalities (44.3 for health, 40.8 for income). Scenario 1's extrapolation puts its 2030 income at \$787 (compared to \$959 today), and assuming the same levels of inequality, its SDG score in 2030 is still very low, 38.95.

Scenario 2: 7% growth per year but holding inequalities constant

This scenario is a bit more interesting. A growth rate of 7% per year is very ambitious, but it is the SDG aspiration for LDCs, so it is included here as the best an LDC could do without reducing its inequalities. In this scenario, Madagascar gains the most, increasing its SDG score from 49.1 in 2020 to 68.20 in 2030, a 39% improvement. This puts it at the level of Brunei Darussalam today. Several LDCs still reach an SDG score of over 80 - Bhutan, Lao PDR, Bangladesh, Cambodia, Nepal and Myanmar.

Even LDCs with very high health inequalities - Chad, Central African Republic, Sierra Leone, Congo, Dem. Rep., Mali, Angola, Burundi and Afghanistan - increase their SDG score due to the high economic growth rate - by between 8 and 19%.

Scenario 3: trend growth but lower inequalities

This scenario combines the trend growth rate of the economy (2010-2019) with lower inequality (20% below previous levels) in health and income. The assumption underlying this scenario is that a 7% growth rate for LDCs, while desirable, may not be possible for all LDCs. First, economic growth rates depend on a host of external factors - demand for a country's exports, its exchange rate, etc. Second, even if such a growth rate is achievable, it often comes at a high

environmental cost (HDR 2020). Thus scenario 3 examines what would happen if LDCs’ growth rates continued in the next 9 years to 2030 as they had been in 2010-2019, but with inequalities in health and education 20% lower. Inequalities are often (but not always, HDR 2019) subject to more direct policy control than economic growth rates.

The most striking feature of this scenario is that all 37 LDCs which have data are projected to increase their SDG score by 2030. Burundi was growing at -1.1% on average during 2010-2019, and in scenario 1 its SDG score falls by -4.3% from 2020 to 2030. In scenario 2 its SDG score increased only by 0.4%, to 53.7. But in scenario 3 it increases the score by 3.4%. Furthermore, *all* LDCs show a higher increase in SDG scores under scenario 3 than scenario 2. This is a critical finding - *even countries not growing quickly can improve their SDG progress if the gains from growth are distributed more equally*, especially in improving health equities. The biggest SDG gains have been registered by some of the poorest and most unequal LDCs:

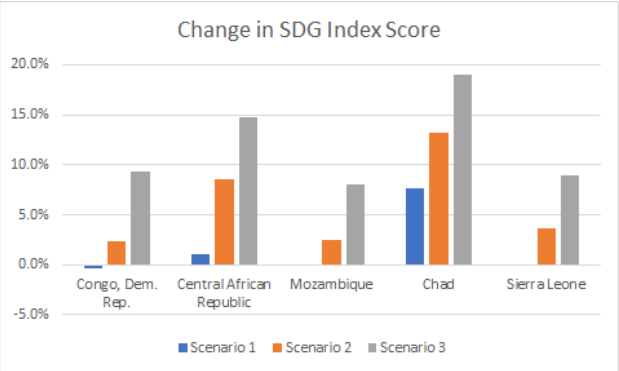


Figure 3: Changes in SDG score by scenario in poorest and most unequal LDCs

Scenario 4: 7% growth AND lower inequalities

This is the most ambitious scenario, assuming both high economic growth and lower health and income inequalities. Intuitively, most LDCs show more SDG progress under scenario 4 than under 3. Exceptionally, Lao PDR performs slightly better under S3 than S4, reaching 85.5 compared to 85.3 (since it averaged 7.5% growth in reality rather than the projected 7%).

However, the average LDC grew at only 1.9% during 2010-2019. Therefore, assuming a 7% growth rate is quite a stretch, especially in a world still reeling from COVID-19. External shocks, even beyond pandemics, can constrain LDCs’ economic growth - weak demand from middle-income and OECD countries, stagnant tourism and remittances, lower FDI etc.

In this sense, Scenario 3 presents the best realistic option for LDCs, where even low-growth countries can benefit from reduced inequalities. The finding is also encouraging considering that only seven LDCs are currently achieving the growth rates set out in the SDGs.

Furthermore, reducing inequalities can itself help spur higher economic growth. Whilst the traditional growth economics-literature hypothesized that income inequality may have a positive effect on economic development at low income levels, with the inequality-income per capita-relation following an inverted U-curve (Kuznets curve), more recent research on global income inequality have found little support for this theory, and show overall negative effects of inequality on growth (Ostry et al, 2014; Assa, 2012; Palma, 2011; Deininger & Squire, 1998). High inequality may have negative effects on economic growth as poverty and exclusion reduces a country's overall human capital level (Ostry et al, 2014); it can create political and social unrest (Ferreira and Schoch, 2020) discouraging investment; it may incentivize rent-seeking and corruption thus diverting investment away from productive sectors (Gupta et al, 1998, Jong-sung, Y., & Khagram, S. 2005, Stiglitz, 2016); and it erodes trust and social cohesion (Wilkinson and Pickett, 2010) which reduces the resilience and adaptability of the economy to external shocks making it harder to sustain growth in the long term (Ostry et al 2014).

4. Conclusions and Further Research

The current COVID-19 pandemic is a reminder of both how fragile development progress is, and how critical good health is for achieving many of the SDGs. Good health has intrinsic value as it is an essential part of human welfare but is also a driver of economic growth and poverty reduction. Improved health means increases in human capital which raises productivity and boosts incomes (Weil, 2014). Health can impact economic growth via the education channel: healthier children and youths have lower levels of absenteeism and perform better in school (ibid, Miguel and Kremer, 2004), and higher levels of education implies increases in productivity and income. And improved health can be crucial for social mobility, when parents are healthy, they can be more likely to earn an income allowing them to invest in children's health and education, and improving children's health and education make them better prepared to make use of job market opportunities and move up the social ladder (UNDP, 2019).

And finally, for governments, a healthier population implies less need for expensive ill health-treatments, freeing up fiscal resources to invest in other areas of sustainable development (WHO, 2001). Conversely, health inequalities lead to compounding disadvantages in education, income (and in health) over the lifecycle and may reproduce over generations (UNDP, 2019).

This paper has examined several inequalities in human development in LDCs and their impact on their SDG progress. While income per capita is the biggest predictor of performance on the SDG index, the second biggest is LDC status, highlighting these countries' deep structural vulnerabilities. And while economic growth has a small positive effect on countries' SDG progress, inequalities – in income and especially in health - make things worse for LDCs, who lose the most because of them.

So what are some policy options to decrease health inequalities? Studies suggest that addressing social determinants of health is as, or even more, important as improving health care services (Smith et al, 2015, Saunders et al, 2017). Because income is a main determinant of health status, Smith et al (2015) argue that a more progressive distribution of income and wealth is needed to reduce health inequalities, alongside greater investments in disadvantaged communities.

A finding which is echoed in the 2019 Human Development Report, which suggests that, due to the interlinkages between different types of inequalities, countries need a set of pre-, in-, and post-market policies to reduce inequalities. This implies improving access to public service such as education and generalized health care so that people enter the labor market better equipped to make use of opportunities, reviewing regulations to boost labor market opportunities, wages and labor force participation rates, and re-distribution of income and wealth via taxes on market incomes to fund public services. (UNDP, 2019, p.42).

For low-income countries, the challenge is to improve quality of health services, expanding access to said services to reach the poorest households (Leon and Walt, 2001), whilst simultaneously addressing social causes of health inequalities.

Further research is needed, building on the work in this paper. One avenue of analysis could investigate the relationships between multidimensional inequalities and each SDG, something briefly touched on above. Another is gender inequality and other horizontal inequalities, which are also significant obstacles to sustainable human development.

Overall, however, it is clear that reducing inequalities in their various dimensions is key for all countries, and especially LDCs, to accelerate their progress towards the SDGs and truly leave no one behind.

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Annex I: SDG Progress under Four Scenarios

	<u>2020 SDG Index</u>		<u>Scenario 1</u>		<u>Scenario 2</u>		<u>Scenario 3</u>		<u>Scenario 4</u>	
Country	Observed	Fitted	2030 SDG score	Score change	2030 SDG score	Score change	2030 SDG score	Score change	2030 SDG score	Score change
Afghanistan	54.2	55.7	64.4	18.8%	66.6	22.8%	68.1	25.6%	70.3	26.2%
Angola	52.6	55.2	61.6	17.2%	64.1	21.9%	66.5	26.5%	69.0	25.0%
Bangladesh	63.5	63.4	82.8	30.3%	83.4	31.4%	85.2	34.2%	85.9	35.5%
Benin	53.3	51.8	60.3	13.1%	61.8	16.0%	64.5	20.9%	66.0	27.4%
Bhutan	69.3	66.2	87.9	26.8%	89.0	28.4%	90.4	30.4%	91.5	38.1%
Burkina Faso	55.2	52.7	59.9	8.4%	61.4	11.2%	63.9	15.8%	65.5	24.4%
Burundi	53.5	48.6	51.1	-4.3%	53.7	0.4%	55.3	3.4%	57.8	19.0%
Cambodia	64.4	64.2	82.2	27.6%	82.8	28.7%	84.8	31.7%	85.5	33.1%
Central African Republic	38.5	41.6	39.0	1.1%	41.8	8.5%	44.2	14.8%	47.1	13.2%
Chad	43.8	46.0	47.1	7.7%	49.5	13.2%	52.1	19.0%	54.5	18.5%
Comoros	53.1	50.2	56.1	5.7%	58.0	9.3%	60.7	14.3%	62.6	24.7%
Congo, Dem. Rep.	49.7	48.1	49.5	-0.4%	50.9	2.4%	54.4	9.4%	55.7	15.8%
Djibouti	54.6	57.8	71.7	31.4%	72.4	32.8%	75.3	38.0%	76.1	31.6%
Ethiopia	55.2	57.7	71.1	28.8%	71.6	29.6%	74.3	34.5%	74.7	29.4%
Gambia, The	57.9	53.3	61.6	6.4%	63.9	10.5%	65.4	13.0%	67.7	27.0%
Guinea	52.5	54.2	63.0	20.1%	64.2	22.3%	67.1	27.8%	68.2	25.8%
Haiti	51.7	51.0	58.0	12.2%	60.0	16.0%	62.3	20.6%	64.3	26.0%
Lao PDR	62.1	62.4	82.8	33.4%	82.6	33.1%	85.5	37.7%	85.3	36.7%
Lesotho	54.0	53.3	60.5	12.0%	62.4	15.6%	64.8	20.1%	66.8	25.3%

Liberia	47.1	52.1	59.2	25.6%	61.4	30.4%	62.8	33.4%	65.1	25.0%
Madagascar	49.1	57.1	68.2	38.8%	70.3	42.9%	71.2	45.0%	73.3	28.4%
Malawi	52.2	50.9	56.0	7.3%	58.0	11.0%	60.0	14.9%	61.9	21.7%
Mali	51.4	51.8	58.2	13.3%	60.0	16.7%	62.5	21.6%	64.3	24.1%
Mauritania	57.7	56.5	68.2	18.2%	70.1	21.4%	72.0	24.7%	73.9	30.8%
Mozambique	54.1	49.8	54.1	-0.1%	55.5	2.5%	58.5	8.0%	59.9	20.1%
Myanmar	64.6	62.5	80.5	24.6%	81.1	25.6%	83.2	28.9%	83.8	34.3%
Nepal	65.9	62.7	80.8	22.6%	81.8	24.1%	83.3	26.3%	84.2	34.3%
Niger	50.1	52.0	58.8	17.2%	60.4	20.5%	62.6	24.9%	64.3	23.6%
Rwanda	56.6	55.6	64.6	14.2%	65.6	16.0%	68.5	21.1%	69.5	25.0%
Sao Tome and Principe	62.6	61.9	75.4	20.5%	77.6	24.0%	78.6	25.7%	80.8	30.4%
Senegal	58.3	58.5	72.0	23.5%	73.5	26.1%	75.2	29.0%	76.7	31.1%
Sierra Leone	51.9	48.5	51.9	0.0%	53.8	3.6%	56.5	8.9%	58.4	20.4%
Sudan	49.6	55.2	65.8	32.7%	67.2	35.5%	69.7	40.6%	71.1	28.8%
Tanzania	56.6	57.6	70.0	23.5%	71.3	25.8%	73.2	29.3%	74.5	29.3%
Togo	52.7	52.3	60.6	15.1%	61.9	17.5%	64.4	22.2%	65.7	25.6%
Uganda	53.5	53.7	61.9	15.8%	63.6	18.9%	65.8	23.1%	67.5	25.6%
Zambia	52.7	53.4	60.0	13.8%	62.1	17.9%	64.4	22.3%	66.6	24.7%

Annex II: School closings during the Covid-19 pandemic and ICT access in LDCs

Data on school closings from UNICEF School Closures Database and data on ICT access from the ITU World Telecommunication/ICT Indicators Database

Country	School closings during the Covid-19 pandemic, year 2020 # Fully closed days	Proportion of households with access to a computer (latest year available)	Proportion of households with Internet access at home (latest year available)
Afghanistan	115	NA	NA
Angola	139	32.2 (2018)	6.7 (2018)
Bangladesh	198	5.5 (2019)	37.6 (2019)
Benin	21	4.7 (2017)	4.6 (2017)
Bhutan	99	23.6 (2017)	44.3(2017)
Burkina Faso	48	5.1 (2017)	NA
Burundi	0	1.0 (2017)	0.3(2017)
Cambodia	77	13.3 (2019)	41.0(2019)
Central African Republic	67	NA	NA
Chad	119	NA	NA
Comoros	128	NA	NA
Democratic Republic of the Congo	107	5.3 (2017)	1.3 (2017)
Djibouti	34	36.6 (2017)	57.7 (2017)
Eritrea	68	NA	NA
Ethiopia	151	5.0 (2016)	15.4 (2016)
Gambia	101	18.9 (2018)	63.3 (2018)
Guinea	109	7.0 (2019)	13.0 (2019)
Guinea-Bissau	89	NA	NA
Haiti	NA	11.0 (2018)	7.0 (2018)
Kiribati	15	31.4 (2018)	47.2 (2018)
Lao, People's Democratic Republic	42	13.5 (2017)	1.7 (2017)

Lesotho	42	13.4 (2018)	36.9 (2018)
Liberia	75	6.2 (2016)	NA
Madagascar	12	5.2 (2018)	13.3 (2018)
Malawi	69	4.2 (2018)	10.5 (2018)
Mali	62	4.6 (2019)	22.2 (2019)
Mauritania	92	NA	NA
Mozambique	126	6.7 (2018)	2.2 (2017)
Myanmar	177	3.4 (2017)	NA
Nepal	131	12.7 (2016)	NA
Niger	83	12.0 (2018)	9.8 (2018)
Rwanda	137	2.5 (2017)	9.3 (2017)
Sao Tome and Principe	42	NA	NA
Senegal	63	15.8 (2018)	6.6 (2018)
Sierra Leone	53	5.7 (2017)	13.8 (2017)
Solomon Islands	19	NA	NA
Somalia	75	NA	NA
South Sudan	141	NA	NA
Sudan	86	NA	NA
Timor-Leste	56	10.9 (2016)	NA
Togo	52	9.5 (2017)	26.5 (2017)
Tuvalu	11	NA	NA
Uganda	149	3.5 (2018)	NA
United Republic of Tanzania	52	3.1 (2017)	NA
Yemen	70	NA	NA
Zambia	29	8.1 (2018)	17.7 (2018)