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Education Inequalities in Ethiopia: A macro-level Analysis and its Policy Implications

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Abstract
Globally, inequalities in educational provision are prevalent between genders, various geographical regions, and among different socio-economic backgrounds. Consequently, this study set-out to assess the level of disparity among the Federal Regional States of Ethiopia using Gini-coefficient and Lorenz curve from the statistical data of MoE. Moreover, data were collected from 656 respondents found in the sample regions. The result of the Gini-coefficient indicated that disparity in educational provision has been reduced over the past couple of decades both at primary (0.145 to 0.032) and secondary levels (0.277 to 0.126). Emerging regions are by far lagging behind the central and established regions. The sources of variation were mainly the demand-side variables, especially the economic and contextual related issues like drought and conflicts. Therefore, educational policies designed at the central level are advised to consider the strategies to bridge the existing inequalities through equitable provision of the education system to its citizen.
Key words: Inequality, Lorenz Curve, Education, Equity, demand and supply, Ethiopia

1. Introduction

Despite its multidimensional positive effects at various levels, educational provision is not fairly distributed across the globe. Inequalities are observed between genders, various geographical regions, and among different economic backgrounds (Antoninis, Delprato & Benavot, 2016; Fuentes-Vasquez, 2019; Ainscow, 2016; Freitag & Schlicht, 2009). Consequently, education equity has been global policy agenda to redress the existing gaps (Talib & Fitzgerald, 2015; Ferreira & Gignoux, 2014; Mesa, 2007) in different parts of the world. As part of this commitment, Sustainable Development Goal (SDG) in its fourth goal stipulated to eliminate gender disparity and ensure equitable access to education at various levels of the education

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system by 2030 (CEPAL, 2018; UN, 2018). However, it is not uncommon to witness educational disparities among different nations of the world, geographic areas, social classes, sexes, and various disability groups (Mesa, 2007; Linh, 2012).

Inequality in education attainment is frequently argued as the source of variation in joining the labor market and enjoying decent kinds of work at the individual level. Conversely, those who are unable to increase their skills and productivity are less likely to fit for better-paying jobs and economically stand in disadvantaged positions (Freitag, & Schlicht, 2009; Mesa, 2007; Green, Preston, & Sabates, 2003; Zeng, Pang, Zhang, Medina, & Rozelle, 2014).

In Ethiopia, the Education Training Policy (ETP) was promulgated in 1994 with the strong pledge of improving access, quality, efficiency, and equity of the system. However, the system was successful in boosting the enrolment rates in three folds over the past couple of decades at least at the primary level (Asgedom, et al. 2019: 1). This was considered as transformative and impressive achievement in the history of the Ethiopian Education system (Padmini Iyer, et al. 2020; Asgedom, et al. 2019). In addition, Padmini Iyer, et al. (2020) contends that the system was effective in an attempt to change from a *de facto* 'elite' to a mass system within a relatively short period. However, education equity issues remained challenging to be addressed.

In an attempt to address the quality and equity-related challenges, several educational reforms were underway in the past two decades, of which General Education Quality Improvement Package (GEQIP, 2008-2020) was the major one (Tiruneh, et al., 2021:5; Padmini Iyer et al., 2020; Asgedom, et al. 2019; Tesema & Braeken, 2018). The most recent phase of the package (GEQIP-E) focused on equity issue which has become a serious concern of both the Ethiopian government and the funding agency (especially the World Bank) (Padmini Iyer, et al. 2020). In this regard, the regional states of the Federal government of Ethiopia were not on equal footing in providing educational opportunities for its population.

The regional states and the city administrations are categorized into three based on their educational participation as Emerging (Afar, Somali, B, Gumuz, and Gambela); Established (Tigray, Amhara, Oromia, Southern Nation Nationalities and People (SNNP), and Harari) and Central (Addis Ababa and Dire Dawa city administrations) (Tesema & Braeken, 2018). These regions arguably vary in their provision of educational inputs (teacher development, textbook supply, school improvement grants, and physical services) (Padmini Iyer, et al. 2020). Moreover, they vary in their level of economic development, socio-cultural, and other related factors. In comparison, central and emerging regions have better school infrastructure development services as compared to the emerging regions (Tesema & Braeken, 2018). In contrast, these emerging regions are drought-affected areas, pastoralists who are moving after their cattle in search of pasture and water, and marginalized in terms of basic infrastructure development. However, there is a little study conducted to show the level of variation among these regions in Ethiopia. Hence, this study tries to address the questions, "where do the regional states stand in terms of educational participation?" what are the demand and supply-side variables that determine the

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level of participation of regions? And what alternative strategies should be in place to bridge the existing gap?

2. Literature Review

2.1.Equality-equity controversy: Conceptual debate

Education quality, efficiency, equality, and equity are among the priority policy agendas of different countries across the globe. However, these concepts remain elusive to put precisely in a clear slate (Schleicher, 2018). Some argue that efficiency and quality view as the neo-utilitarianistic outlooks (in economic and philosophical terms) (Benadusi, 2006) in the provision and utilization of educational assets. Similarly, equity is a value-laden concept amenable to various interpretations across the disciplines (Castelli, Ragazzi, & Crescentini, 2012). It sometimes superimposes equality (Castelli, et al., 2012). However, Sociologists argue that 'there is no other valid definition that inequality is synonymous with inequity' (Benadusi, 2006).

The equality-equity conceptual controversy emanates from the abstractness and broadness of the terms. Equality, providing equal treatment for all (Castelli, et al., 2012; Tomlinson, 2001; Onate & Santibanez-Gruber, 2008) does not necessarily reflect the concepts of equity. For instance, others consider education equity as the instrument to maintain social cohesion (Andey Green, et al., 2003), social justice (Fraser, 2005), and education as a fundamental right of citizens (Onate & Santibanez-Gruber, 2008). In this regard, equity goes beyond simply doing fairness to all without acknowledging the prior inequalities (Onate & Santibanez-Gruber, 2008; Castelli, et al., 2012). In other words, promoting equality of treatment is unjust in areas where there are no "equal" starting points for everyone. However, there is a strong contention on the attainment of 'absolute equity' which is impossible to be achieved in real terms.

Others view education equity in terms of horizontal aspect that attempts to treat those who start from the same point (Horizontal Equity), a series of compensatory strategies to address the issues of a minority or disadvantaged groups (Vertical Equity), and a series of activities designed to ensure everyone has similar opportunities for success, commencing from different contexts and resources -Equal Education Opportunity (EEO) (Castelli, Ragazzi, & Crescentini, 2012; Carlisle, Jackson, & George, 2006). It seems that this detailed conception of equity is relevant for designing policies and improving practices. On the other hand, others explain education equity as the opportunity of providing all children with relevant education to realize their full potential and achieve at least a basic level of good quality education irrespective of their family background, gender, or disability status (Tiruneh, et al., 2021). However, this attempt has been contested by frequent drought occurrences, internal displacements, economic, cultural, and academic challenges that hold-back children from disadvantaged groups.

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In general, there are a plethora of definitions on the concepts of equity using various parameters. However, the following summary seems relevant for proper conceptual understanding of the term for this study.

Table 1: Summary of concepts of education equity

Tomlinson (2001)	***Benadusi (2006)***	***Onate & Santibanez-Gruber, 2008)***	***Bendadusi, Fornari & Giancola, 2010)***
Equal opportunity for all	Pure meritocracy	Opportunity to all	Inter-individual equity
Equal treatment for all	Equal treatment	Access to all	Inter-category
Opportunity for success	Inter-individual equality	Equal treatment	Below the minimum threshold
	Minimum threshold	'*Equal*' results	
	Equality between social groups		
	Advantages for the disadvantaged		

For both Bendadusi, Fornari & Giancola (2010) and Tomlinson (2001), equity in education is viewed in terms of providing inputs (opportunity and access), fair treatment within the system (process), and opportunity of success for 'all'. It focuses on the scholastic achievements of students within the education system. Benadusi (2006) and Bendadusi, Fornari, and Giancola (2010) considered inter-individual, inter-category, and minimum thresholds as the fundamental aspects of equity. The category by Benadusi (2006) can be considered along the continuum where meritocracy focuses on the advantaged groups whereas, whereas opportunities for the disadvantaged groups as an intervention strategy for ensuring equity. Despite these divisions, researchers (Castelli, et al., 2012) argue that the views are not mutually exclusive and contradictory. Rather, they are complementing one another along the continuum that could be applied both within and outside of the education system. Consequently, they suggest context-specific pragmatic views that promote fair and equitable treatment of all citizens within the scholastic system.

2.2.Theoretical framework

Social justice theory was advocated by the earlier philosophers like Plato (427BC-347BC) (Zajda, Majhanovich, & Rust, 2006). In his popular book called *The Republic*, he pointed out that 'justice' is among the four virtues of the ideal state. In light of this, this study is framed with social justice theory as advocated by Fraser (2006). The relevance of this theory rests on the idea that redistribution, recognition, and participation as the three pillars of the social justice theory (Fraser, 2006; North, 2006). The redistribution dimension in Fraser view is the redistribution of resources and wealth from rich to poor, urban to rural, and from privileged to less privileged parts of the society in such a way that it can promote equity. In the school context, the theoretical stance of social justice theory denotes school mission statements, educational reform proposals, and job announcements to create culturally responsive schools to leave no child behind (Hytten,

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& Bettez, 2011; Renee, Welner, & Oakes, 2010; North, 2006). On the other hand, the recognition aspect considers the cultural values of the society to address issues related to pluralism. The participation part of social justice theory resides in the core idea of political representation.

Coming to the study context, the Regional States found in Ethiopia are not uniformly endowed with resources, paving the way for inequitable distribution of services, where education is no exception to this. Concomitantly, Ethiopia is a multi-national state where different cultural values inhibit or promote education equity among regions, sexes, urban and rural, rich and poor religions. Consequently, the participation aspect is addressed through policy by taking into account the diverse interests of various groups in the country.

2.3.Conceptual framework

Disparity in education is the result of many interwoven variables. The study pointed out that opportunities in education are influenced by the background of the pupils (material resources, well-being, parental support, health, cultural background) (Castelli, et al., 2012). The economic background of parents has a great impact on the opportunities of children to attend and successfully complete the system. This seems sound specifically in a situation where family income is heterogeneous and the markets are imperfect (Checchi, Daniele, 2003: 156). In such circumstances, poor families could ill-afford both the direct and indirect costs of education which will in turn widen the gap. Inequality both in education provision and participation will reduce social cohesion (Andy Green, et al., 2003; Castelli, et al., 2012; Ainscow, 2016; Schleicher, 2018) and impede social mobility (Asadullah & Yalonetzk, 2011; Checchi, Daniele, 2003) which may lead to intergenerational persistence in poverty (Asadullah & Yalonetzk, 2011; Ajala & Kerebih, 2008; Checchi, Daniele, 2003; Neidhofer, Serrano & Gasparini, 2018).

Others broadly categorized variables contributing to inequality in the education system as household behaviors (Demand side) and government provision of education as a public service (Supply-side) (Checchi, 2003; Harahap, Maipita, & Rahmadana, 2020). On the other hand, Tesfaye (2002) expanded these variables into four as those related to family explained in terms of income, welfare, family size, and parents' level of education. The other is related to the students themselves-their ability, health, nutrition, cognitive power, and gender. Thirdly, he considered the quality of education provided within the system including teaching-learning equipment, curriculum, school infrastructure, electricity supply, drinking water, and toilet facilities. Finally, he considered the rate of return from the education system as a cause of inequality in the education system.

From the discussion made so far, a synthesis was made to conceptualize this study.

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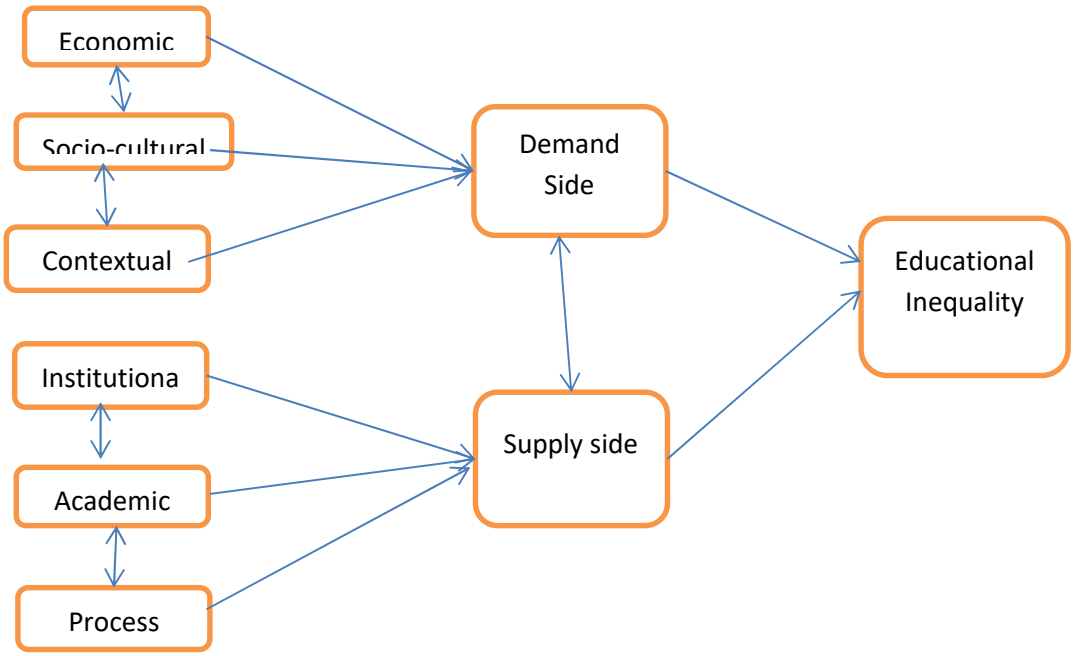

Figure 1 Conceptual framework on variables affecting educational Equity

2.1.4 The study context in focus

Ethiopia is a multi-national state organized into 9 (nine) regional states and two chartered city administrations (Habtu, 2005) to promote a decentralized management system. In addition, the current development has shown that the former Sidama zone was also guaranteed region-hood with the government as the tenth region. This is with a strong belief to exercise self-rule, promoting one's culture, and address the demand of the locality in their close vicinity.

The education system was viewed as the vehicle to realize these efforts as indicated in the outgoing education policy document (ETP, 1994). It is also committed to addressing access, quality, relevance, efficiency, and equity of the education system. The result was found impressive in addressing the access resulting issues over the last three decades. However, regional inequalities remain high among regions as they have variations in human, financial, and material resources in improving infrastructure for improving educational services. This has been also been witnessed in the current Education Road Map (ERM) which is supposed to replace the outgoing education policy which led the country for almost three decades.

3. Methodology

3.1.Sample

For this study, the regional states and the city administrations of the Federal government of Ethiopia are categorized into central, established, and emerging regions as indicated earlier. From the central, both Addis Ababa and Dire Dawa city administrations were considered as a

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sample. In addition, from the established regions, Amhara, Oromia, and South Nations and Nationalities Peoples' Region (SNNPR) were considered. From the emerging regions, Somali and Afar regional states were included in the sample. A total of 33(ThirtyThree Secondary Schools) were proportionally included in the study. They all cover more than 89.6 percent of the total population of the country.

Fig. 2. Regional states of Ethiopia. Source: United Nations Office for the Coordination of Humanitarian Affairs (OCHA).

3.2 Sample Characteristics

A normality test was conducted to ensure whether the sample adequately represents the population using SPSS version-23. A Shapiro-Wilk's test and Kolmogorov-Sminov tests of normality ($p > 0.05$) in both cases show that the sample is approximately normally distributed. In addition, the visual representation of P-P plot, histogram, and box plot also depicted that the sample is nearly similar to the study population indicating that we can go for further analysis. The result is shown in the following tables and diagrams.

Table 2: Normality test result of the instruments

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
AVDR	.022	656	.200*	.997	656	.176

*. This is a lower bound of the true significance.

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a. Lilliefors Significance Correction

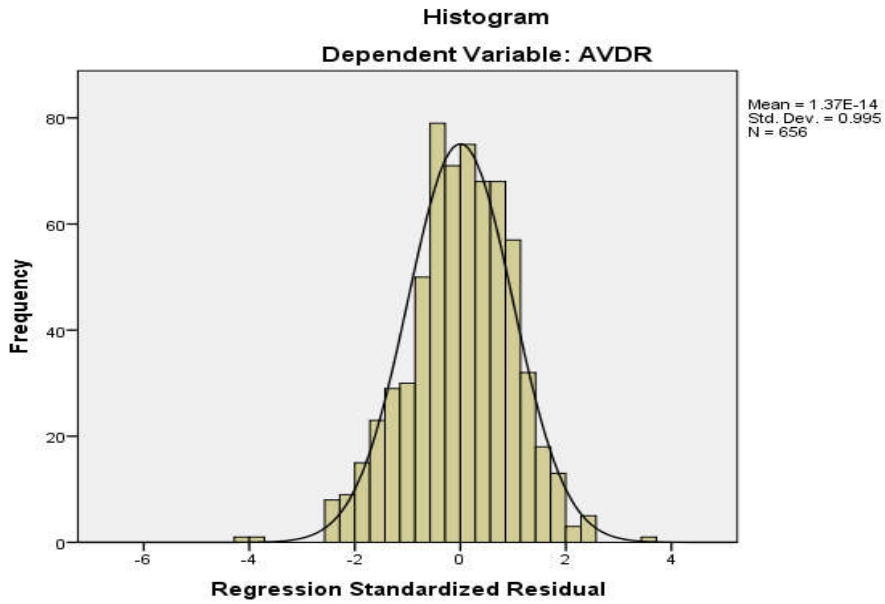

Figure 2 Regression standard Residual

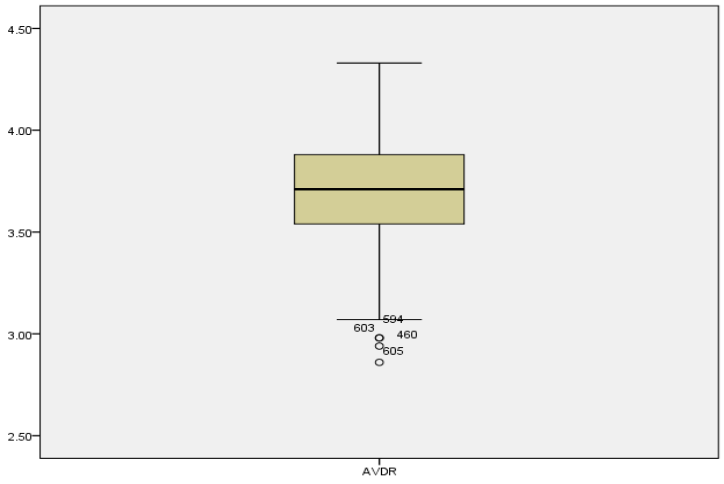

Figure 3 Box-plot

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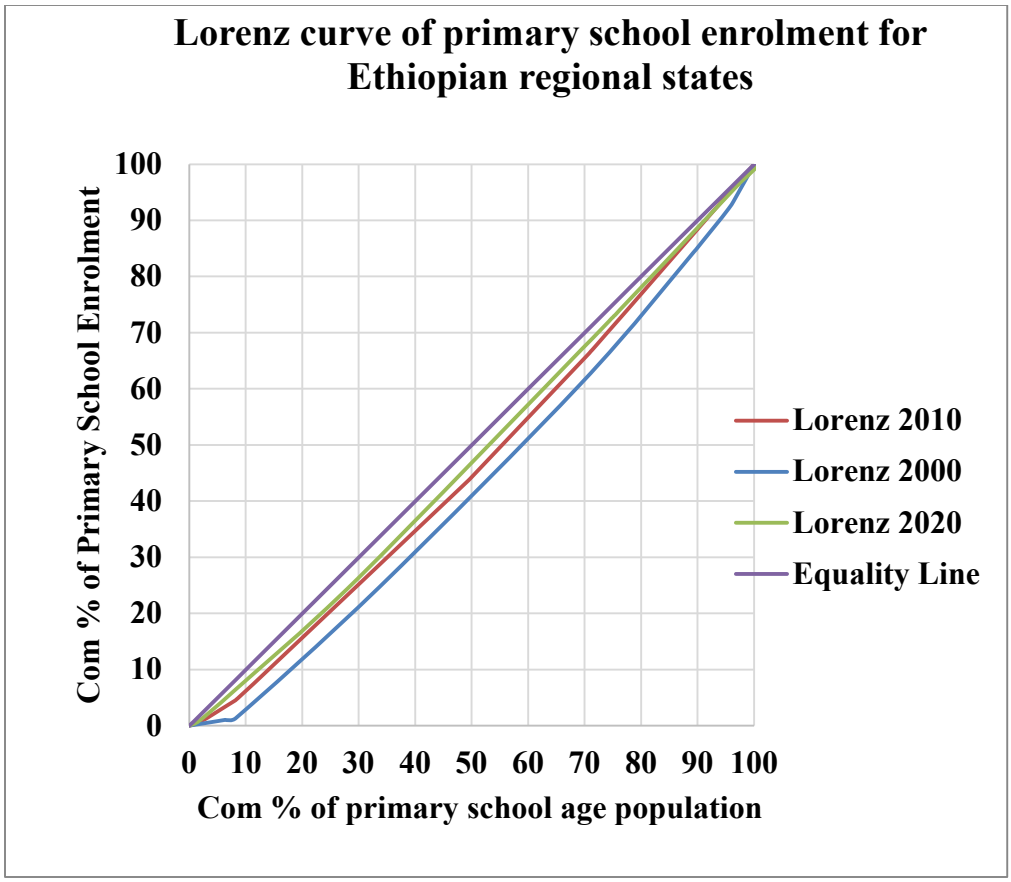

Figure 5: Lorenz curve of primary school enrolment for Ethiopian regional states

3.2.Measures

3.2.1. Enrolment as a measure of disparity

The above regions vary in their level of enrolment. Consequently, Gross Enrolment Ratios (GER) were taken to measure the variability among regions. Three years were taken to see the variation over time among regions in 2000, 2010, and 2020 within ten years intervals.

3.2.2. Variables in the study

Education participation as the measure of disparity is the function of several interwoven and interacting variables (Checchi, 2003; Harahap, Maipita, & Rahmadana, 2020; Tesfaye, 2002; Ainscow, 2016). Explanations were made about these variables in the review and conceptual framework section of this article (Section 2.3). For the sake of this study, two broad categories of independent variables (the demand side and the supply side) that further decomposed into 33 (thirty-three) specific variables.

4. Table 3: Demand and Supply related variables explaining inequality in education

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Demand Side Variables			Supply side variables		
Economic Variables	Socio-cultural related variables	Contextual related variables	Institutional Related variables	Academic related variables	Process related variables
*Cost of educ. *Parent's income *Job opportunity * Child labour	*Parents' awareness to educ. *Cultural Belief *Influence of Religion *Early marriage *Role-model *Abduction	*Internal conflict *Draught *Settlement patterns *way of life *Safe-route *School distance *Migration	*School leadership *Promotion Policy *Punishment *School facilities *Incentive to teachers	*Teachers' competence *Learning environment *Students' motivation *Students' Academic performance *Curriculum relevance	*Teaching method *Insufficient support System *Parents' academic support *Teachers' turn-over *Poor time management *Failure in exams

4.1.Statistics

Gini Coefficient which is originally developed to measure the income variations across the globe at the macro level or the individual level is also highly applicable in the field of education. It compares education participation against the relative school-age population (GER) both for primary and secondary education. The Gini coefficient is computed on EXCEL and the graph of each of the regions is drawn against the equality line. In addition to this, regression analysis was conducted to see the impacts of independent variables on the dependent variable.

5. Results

This section of the study presents the regional disparities in human capital development endeavors in Ethiopia. To measure the level of inequality, the Gini coefficient together with the Lorenz curve was used as summarized in the subsequent tables and figures.

Table 4: Gini coefficient for regional education disparities in Ethiopia in 2020, primary enrolment as indices

S.No	Region	School age popn (SAP)	Enrolments	Gross Enrol Rate	Percentage of SAP	Percentage of Enrolment	Cum %SAP	Cum%Enrl	Gini coefficient
							0	**0**	
1	Afar	334,565	179,231	53.6	1.72	0.88	1.72	0.88	
2	Somali	1,179,675	1,065,934	90.4	6.06	5.22	7.78	6.10	
3	Amhara	4,275,969	4,106,009	96.0	21.97	20.11	29.75	26.21	
4	Oromiya	7,747,783	8,356,150	107.9	39.81	40.92	69.56	67.13	
5	Tigray	1,007,412	1,093,565	108.6	5.18	5.36	74.74	72.49	
6	Diredawa	73,270	80,970	110.5	0.38	0.40	75.12	72.88	
7	Ben-Gumz	224,210	248,070	110.6	1.15	1.21	76.27	74.10	
8	SNNPR	4,049,016	4,515,880	111.5	20.81	22.12	97.08	96.21	
9	Harari	42,777	55,589	130.0	0.22	0.27	97.30	96.48	
10	Addis Ababa	444,515	589,662	132.7	3.03	2.89	100.33	99.37	
11	Gambella	81,779	128,092	156.6	0.42	0.63	100	100	

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National	19,460,971	20,419,152	109.8	100	**0.032**

Note: Order of regions is sorted based on the rank of gross enrolment rates

Table 5: Gini coefficient for regional education disparities in Ethiopia in 2010, primary enrolment as indices

Region	SAP	ERT	GER	%SAP	%ERT	C% SAP	C%ERT	Gini Coefficient
						0	0	
Afar	328,519	99,742	30.36	1.94	0.72	1.94	0.72	
Somali	1,042,566	529,521	50.79	6.17	3.81	8.11	4.53	
Dire	70,217	50,710	72.22	0.42	0.37	8.52	4.90	
Addis	476,863	358,971	75.28	2.82	2.59	11.35	7.48	
Oromiya	6,441,554	5,033,497	78.14	38.10	36.25	49.45	43.73	
Harari	37,933	30,163	79.52	0.22	0.22	49.67	43.95	
SNNP	3,569,527	3,111,527	87.17	21.11	22.41	70.78	66.36	
Gambella	71,273	63,603	89.24	0.42	0.46	71.20	66.82	
Benishangul-Gumuz	157,222	143,191	91.08	0.93	1.03	72.13	67.85	
Tigray	956,491	902,639	94.37	5.66	6.50	77.79	74.35	
Amhara	3,754,733	3,561,857	94.86	22.21	25.65	100.00	100.00	
National	16,906,898	13,885,421		100	100			**0.08**

Table 6: Gini coefficient for regional education disparities in Ethiopia in 2000, primary enrolment as indices

Region	SAP	Enrolment	GER	%SAP	C%SAP	%en't	C%en't	Gini coefficient
					0		0	
Somali	800,695	66,834	8.35	6.312845	6.312845	1.034181	1.034181	
Afar	241,739	22,088	9.14	1.90592	8.218765	0.341787	1.375968	
Amhara	3,220,447	1,507,124	46.80	25.39067	33.60943	23.32106	24.69703	
Oromiya	4,534,325	2,341,195	51.63	35.74955	69.35899	36.22737	60.9244	
SNNP	2,516,197	1,504,351	59.79	19.83822	89.1972	23.27815	84.20255	
Dire Dawa	52,505	32,751	62.38	0.41396	89.61116	0.506785	84.70933	
Tigray	744,617	472,834	63.50	5.870714	95.48188	7.316577	92.02591	
Benshangul-Gumuz	109,717	89,777	81.83	0.865031	96.34691	1.389199	93.41511	
Addis Ababa	397,210	362,921	91.37	3.131686	99.47859	5.615796	99.0309	
Gambella	39,933	37,421	93.71	0.31484	99.79343	0.579048	99.60995	
Harari	26,200	25,207	96.21	0.206566	100	0.39005	100	
National	12,683,585	6,462,503						**0.145**

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The above tables indicate the regional primary school enrolments in the years 2020, 2010, and 2000 respectively. Generally speaking, the trend indicates the existence of improvements in the enrolment trends in the range of 20 years. However, one can see that there exist significant inequalities across the regional states in the primary school enrolment trends. As can be seen clearly in the above tables (see a cumulative percentage), Afar and Somali regions were among the least ranked regions which insignificantly contributed to the human capital development efforts in Ethiopia. On the other hand, most central and established regions are footing at the top with a relatively high cumulative percentage of enrolment rates. The coefficients of Gini indicate that the variation at national wide was about 14.5% during 2000, 8% in the year 2010, and 3.2% in 2020. This implies the trend of disparities across regions has got narrowing down over the last twenty years.

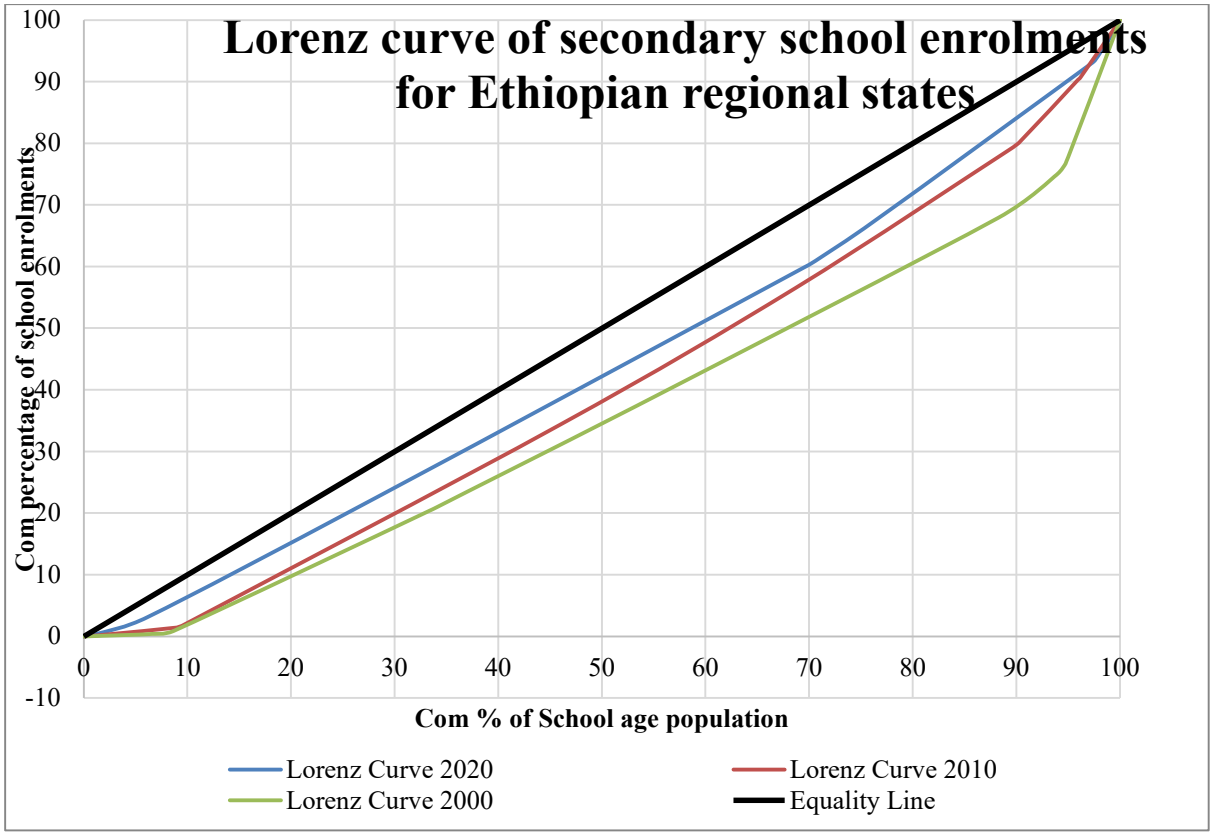

Figure 6: Lorenz curve of secondary school enrolments for Ethiopian regional states

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Table 7: Secondary school enrolment, 2020

S.No	Region	School Age Popn	Enrolments	GER	%of SAP	%Enrl	Com%SAP	Com%Enrl	Gini Coefficient
							0	0	
1	Afar	141979	20223	14.244	1.601	0.583	1.601	0.583	
2	Somali	406672	88619	21.791	4.586	2.556	6.187	3.139	
3	SNNPR	1973598	678938	34.401	22.254	19.583	28.441	22.722	
4	Oromiya	3646043	1289027	35.354	41.113	37.180	69.553	59.903	
5	Bgmuz	105858	41699	39.391	1.194	1.203	70.747	61.105	
6	Tigray	491558	217197	44.185	5.543	6.265	76.290	67.370	
7	Amhara	1868699	894355	47.860	21.071	25.796	97.361	93.167	
8	Gambella	40168	31038	77.270	0.453	0.895	97.814	94.062	
9	Addis Ababab	180226	181068	100.467	2.032	5.223	99.846	99.284	
10	Harari	5133	8969	174.732	0.058	0.259	99.904	99.543	
11	Diredawa	8503	15839	186.275	0.096	0.457	100.000	100.000	
	National	8868437	3466972		100	100			**0.126**

Table 8: Secondary School Enrolment, 2010

Secondary 2010								
	SAP	Enrolm't	GER	%SAP	%ERT	C%SAP	C%ERT	Gini Coefficient
						0	0	
Afar	154005	2017	1.310	2.143	0.291	2.143	0.291	
Somali	492449	8133	1.652	6.854	1.174	8.997	1.466	
Gambella	31861	1821	5.715	0.443	0.263	9.441	1.729	
Oromiya	2617346	225172	8.603	36.428	32.515	45.869	34.244	
Amhara	1638980	154534	9.429	22.811	22.315	68.680	56.559	
SNNPR	1461264	152996	10.470	20.338	22.093	89.017	78.652	
Benishangul-Gumuz	66231	7164	10.817	0.922	1.035	89.939	79.687	
Dire	32989	4670	14.156	0.459	0.674	90.398	80.361	
Tigray	399636	69054	17.279	5.562	9.972	95.960	90.333	
Harari	17249	3010	17.450	0.240	0.435	96.200	90.767	
Addis	272999	63936	23.420	3.800	9.233	100.000	100.000	
National	7185009	692507						**0.192**

Table 9: Secondary School Enrolment, 2000

Region	SAP	Enrolment	GER	%SAP	%Ent	C%SAP	C%ent	Gini Coefficient
						0	0	

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Somali	367772	2397	0.652	6.601	0.419	6.601	0.419	
Afar	113782	2614	2.297	2.042	0.457	8.644	0.876	
Amhara	1370503	110970	8.097	24.599	19.410	33.243	20.286	
Benshangul-Gumuz	46329	4012	8.660	0.832	0.702	34.075	20.988	
SNNP	1077527	94368	8.758	19.341	16.506	53.415	37.494	
Oromiya	1939046	173932	8.970	34.804	30.423	88.220	67.917	
Tigray	314922	40197	12.764	5.653	7.031	93.872	74.948	
Gambella	19322	3011	15.583	0.347	0.527	94.219	75.474	
Dire Dawa	28777	7251	25.197	0.517	1.268	94.736	76.743	
Harari	14590	5845	40.062	0.262	1.022	94.997	77.765	
Addis Ababa	278707	127122	45.611	5.003	22.235	100.000	100.000	
National	5571277	571719		100.000				**0.277**

Figure 7

Principal component analysis of the variables (PCA)

As indicated in section *3.2.2* constructs used to measure education disparity were identified under two broad categories-demand side and supply-side variables. These two broad categories again disaggregated to economic, socio-cultural, and contextual related variables to explain the demand side aspect. On the other hand, the supply side categories are also identified as institutional, academic, and process-related variables. It was also statistically proven that each of the specific variables is measuring the designed construct using principal component analysis (PCA). Hence, six latent variables were extracted from those independent variables. Finally, the total percent explained by each variable as a measure of disparity of education is analyzed using PCA by considering Eigenvalues of greater than 1 (one). KMO and Varimax rotation was applied to the data and the result showed that all the latent variables explain about 93.43% of educational disparity in Ethiopia. The two important components-Institutional and academic factors (1) & Process related variables (2) explain about 55.5% of the total variable. The detail is explained in Table 10 and 11.

Table 10: Principal component analysis (PCA) of variables

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.301	38.352	38.352	2.301	38.352	38.352	1.410	23.496	23.496
2	1.029	17.148	55.501	1.029	17.148	55.501	1.167	19.449	42.945
3	.947	15.780	71.281	.947	15.780	71.281	1.023	17.049	59.994
4	.745	12.412	83.693	.745	12.412	83.693	1.005	16.752	76.746
5	.584	9.737	93.430	.584	9.737	93.430	1.001	16.685	93.430

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6	.394	6.570	100.000

Extraction Method: Principal Component Analysis.

Table 11: Rotated component matrix of variables using Varimax

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Econ_Factors	.014	.046	.042	.025	.997
Socio_cul_factors	.059	.052	.081	.991	.025
Contextual_factors	.155	.133	.971	.088	.046
Institutinal_factors	.939	.125	.078	.092	.016
Academic_factors	.670	.497	.233	-.033	.007
Process_factors	.225	.939	.109	.070	.055

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 5 iterations.

ANOVA Results

As presented both in the review section and data presentation section, the educational disparity in Ethiopia is the result of many interacting variables when analyzed using demand and supply-related variables. To determine which of these variables are significantly contributing to disparity or not Analysis of Variance (ANoVA) was conducted and the outputs are presented. From both the model summary table and the regression it is possible to infer that the latent variables identified are significantly contributing to the disparity of educational participation in regional states of Ethiopia evidenced by $P<0.05$.

Table 12: Model summary of ANoVA

Model Summary[g]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801[a]	.642	.641	.14609
2	.872[b]	.760	.759	.11963
3	.920[c]	.846	.845	.09594
4	.954[d]	.910	.910	.07321
5	.962[e]	.926	.925	.06670
6	.963[f]	.928	.927	.06586

a. Predictors: (Constant), AAV
b. Predictors: (Constant), AAV, APV
c. Predictors: (Constant), AAV, APV, AIV
d. Predictors: (Constant), AAV, APV, AIV, AEV
e. Predictors: (Constant), AAV, APV, AIV, AEV, ASV
f. Predictors: (Constant), AAV, APV, AIV, AEV, ASV, ACV
g. Dependent Variable: AVDR

Table 13: Test of variables using ANoVA

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ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.975	1	24.975	1170.294	.000[b]
	Residual	13.957	654	.021		
	Total	38.933	655			
2	Regression	29.588	2	14.794	1033.766	.000[c]
	Residual	9.345	653	.014		
	Total	38.933	655			
3	Regression	32.931	3	10.977	1192.445	.000[d]
	Residual	6.002	652	.009		
	Total	38.933	655			
4	Regression	35.443	4	8.861	1653.106	.000[e]
	Residual	3.489	651	.005		
	Total	38.933	655			
5	Regression	36.041	5	7.208	1620.474	.000[f]
	Residual	2.891	650	.004		
	Total	38.933	655			
6	Regression	36.118	6	6.020	1387.951	.000[g]
	Residual	2.815	649	.004		
	Total	38.933	655			

a. Dependent Variable: AVDR
b. Predictors: (Constant), AAV
c. Predictors: (Constant), AAV, APV
d. Predictors: (Constant), AAV, APV, AIV
e. Predictors: (Constant), AAV, APV, AIV, AEV
f. Predictors: (Constant), AAV, APV, AIV, AEV, ASV
g. Predictors: (Constant), AAV, APV, AIV, AEV, ASV, ACV

Causes of regional Disparities

As discussed in the methodology section, the regional states are categorized into three: Established Regions, Developing Regions, and Emerging Regions. The sample was drawn from all regions and the analysis was further decomposed to identify major contributing variables to disparity.

Emerging Regions

From the result of the Lorenz curve (Fig 6 &7) it was identified that emerging regions are lagging behind the central (Addis Ababa, Dire Dawa, and Harari) and established regions (Amhara, Oromia, SNNPR, and the Tigray Regional States) both in their educational participation and disparity as they much deviate from the equality line. Consequently, this section presents which of those identified variables are contributing to disparity within regions.

In this regard, the result of ANoVa shows that Economic Factors, ($t=-3.734759$, $p<0.05$) and Contextual Factors, ($t=3.371547$, $p<0.05$) are the demand side related variables that significantly

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contributing to education disparity in the regions. Similarly, Institutional related variables (t=-2.747298, p<0.05) and process-related factors (t=-2.085989, p<0.05) indicated that supply-side variables that significantly contribute to disparity in educational participation. On the contrary, socio-cultural and academic variables are not significantly contributing to regional variations.

Table 14: Factors contributing to regional disparity in Emerging Regions

Dependent Variable: Disparity

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECON_FACTORS	-0.197258	0.052817	-3.734759	0.0003
SOCIO_CUL_FACTORS	0.027206	0.060480	0.449836	0.6539
CONTEXTUAL_FACTORS	0.206285	0.061184	3.371547	0.0011
ACADEMIC_FACTORS	0.084818	0.057230	1.482057	0.1417
INSTITUTINAL_FACTORS	-0.166536	0.060618	-2.747298	0.0072
PROCESS_FACTORS	-0.167453	0.080275	-2.085989	0.0397
C	1.845878	0.283279	6.516119	0.0000
R-squared	0.339152			
Adjusted R-squared	0.296970			
F-statistic	8.040238			
Prob(F-statistic)	0.000001			

Central Regions

Central Regions (Addis Ababa and Dire Dawa) are more urbanized with relatively high educational opportunities. Factors contributing to regional disparities were also analyzed. All the variables did not significantly affect to regional variations as p<0.05 in all cases (Table, ---). It is also evidenced that the graph of the Lorenz curve showed that they are regions with high level of educational participation and almost they are closer to the equality line (See Fig.5 &6)

Table 15: Factors contributing to regional disparity in Centeral Regions

Dependent Variable: Disparity

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECON_FACTORS	-0.012137	0.023252	-0.521965	0.6028
CONTEXTUAL_FACTORS	-0.008785	0.031058	-0.282852	0.7779
SOCIO_CUL_FACTORS	0.039701	0.030337	1.308670	0.1936
ACADEMIC_FACTORS	-0.032466	0.027212	-1.193051	0.2357
INSTITUTINAL_FACTORS	0.016445	0.025654	0.641025	0.5230

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PROCESS_FACTORS	-0.055584	0.034027	-1.633530	0.1055
C	0.425940	0.104633	4.070789	0.0001

R-squared	0.075927
Adjusted R-squared	0.020482
F-statistic	1.369420
Prob(F-statistic)	0.234301

Established Regions

The third category is the educational participation of the established regions. Amhara, Oromia, SNNPR and Tigray Regional States are categorized under this. Except for Tigray region, all three regions were included in the sample. These regions cover the highest percentage of the country's population. The data showed that the Economic variable (Demand Side) is again significantly contributing to disparity in education participation at $P<0.05$ (Table, 16). On the supply side, Academic variables are significantly contributing to variation in educational participation.

Table 16: Factors contributing to regional disparity in Established Regions

Dependent Variable: GER

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECON_FACTORS	0.014524	0.005105	2.844933	0.0047
CONTEXTUAL_FACTORS	-0.009282	0.005989	-1.549960	0.1220
SOCIO_CUL_FACTORS	0.001207	0.005900	0.204549	0.8380
INSTITUTINAL_FACTORS	-0.000763	0.005061	-0.150827	0.8802
ACADEMIC_FACTORS	0.019489	0.004975	3.917548	0.0001
PROCESS_FACTORS	-0.001278	0.006719	-0.190177	0.8493
C	0.293418	0.022209	13.21173	0.0000

R-squared	0.102610
Adjusted R-squared	0.087777
F-statistic	6.917749
Prob(F-statistic)	0.000001

Merging all Regions at the aggregate level

It is important to merge all the data into one package to know which variable/s are contributing significantly contributing to regional variation in education participation in Ethiopia. The data show that Demand-side variables are significantly contributing to these variations. As evidenced from the data Economic Factors ($t=897.857$, $p<0.05$), Socio-cultural factors ($t=1411.785$,

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p<0.05) and Contextual Factors (t=1162.720, p<0.005) identified that demand related variables are more challenging. On the contrary, supply-side variables are not statistically supported as the major contributing factor to disparity at the national level.

Table 17: Factors contributing to regional disparity at the aggregate level

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.002	.002		1.296	.195
	Econ_Factors	.235	.000	.384	897.857	.000
	Socio_cul_factors	.353	.000	.614	1411.785	.000
	Contextual_factors	.412	.000	.540	1162.720	.000
	Institutinal_factors	.000	.000	-.001	-1.494	.136
	Academic_factors	.000	.000	.000	.509	.611
	Process_factors	.000	.000	-.001	-1.258	.209

a. Dependent Variable: Disparity

Discussion

Over the past two decades (2000-2020) Ethiopia has shown significant improvements in educational participation. The participation was higher at the primary level and gets lower as it moves up the ladder. Regional disparities were measured using the Gini coefficient. The computed Gini coefficient at the primary level has shown improvement from 0.145 to 0.032 in 2020. This showed that the gap among regions gets narrowed over the past decades. Similarly, the data computed from the government national report showed that the Gini coefficient results in secondary education (9-12) showed improvements from 0.227 in the year 2000, 0.192 in 2010, and 0.126 in the year 2020.

In comparison, a greater disparity in educational participation is observed at the secondary level than at the primary level. However, the result of the Gini coefficient witnessed that disparity is getting narrower in both cases. Despite the variation, the educational disparity is a serious case to be addressed in the Ethiopian education system.

Concerning the causes of educational disparity, two broad categories were identified as demand-related and supply-related variables. Some of these variables lie within the school systems while others are outside of the school compound (Ainscow, 2016). Regional states also vary in their level of development in general and education participation in particular. Consequently, Central, Established, and emerging regions were recognized by the government (Tesema & Braeken, 2018).

Analysis of Variance pointed out that Economic and Contextual variables were found as the major sources of variation in educational participation. These demand-side variables urge parents and students not to adequately participate their children and youths in the education system. In

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relation to this, the study also supports that uneven distribution of wealth has brought inequalities in students' academic achievement (Hallinger & Liu, 2016; Ainscow, 2016; Matsuoka, 2018; Linh, 2012). This was aggravated by the supply side challenges like Institutional and Process related bottlenecks which hold back the education participation. Another study conducted in USA also confirmed that the quality of teachers and school facilities were found as the major sources of inequality in schools (Best & Winslow, 2015).

In the Central regions, on the other hand, all the identified explanatory variables were not statistically proven to be significant contributors to the disparity in the education system among these regions. This may be explained by relatively balanced infrastructure and economic development of these regions as all are urban the major economic centers of the country where everyone enjoys education participation. Moreover, these regions may attract the attention of the government because of their close vicinity. Parents have also better awareness to finance their children which may help them to sustain their children in the system. These regions are better equipped with infrastructure and attract the attention of many experienced teachers so the gap between regions may get narrower.

Finally, academic and economic factors are variables that contribute to the educational disparity in the Established regions. These regions have better access to development as compared to the Emerging regions. These factors have significantly affected the education system in widening the education gaps among regions. Hence, Demand side variables are more challenging in ensuring the equity of the education system at the national level.

Conclusion

From the presentations and discussions made so far, it is safe to conclude that educational disparity in getting narrower over the past couple of decades as measured by Lorenz curve and Gini coefficients. The causes of this disparity are both demand and supply sides specifically in the Emerging Regions. The demand side problem is more pressing than the supply side. However, this study didn't come up with sufficient statistical evidence for the central regions.

The Way forward

Inequality in education has a global phenomenon. However, the problem is more in developing countries like Ethiopia. It negates citizens' right of enjoying quality education. Therefore, national and regional level governments are strongly advised to channel their investment in such a way that it can reduce disparity than playing otherwise. More specifically, it is important to consider the demand side variable as policy strategies than the supply-related variables by giving due consideration to the emerging regions to narrow the existing gap.

Data availability

This study employed both primary and secondary data obtained from the annual statistical reports of Ministry of Education and respondents respectively. To analyze the level of disparity using Lorenz curve, data from Ministry of Education (MoE, 2001; 2011; 2021) of the Federal Democratic Republic of Ethiopia were used. The compiled data for this study could be accessed from the corresponding author upon demand.

Disclosure

The university will not take any responsibility for the research results beyond reporting purposes.

Declaration of Competing Interest

There is no potential competing interest among the authors. We all as group members confirm that we thoroughly read and approved the manuscript to be submitted for publication purposes. We also confirm that intellectual property rights (IPR) and other ethical principles were adhered to. Finally, the corresponding author is the sole contact person for editorial processes.

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