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The Impact of Education Reforms on Household Adult Welfare Outcomes in

Ethiopia: The 1994 Free Primary Education (FPE) Reform

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Introduction

Over the years levels of education have increased sharply across sub-Saharan Africa (World Bank, 2012). This rise stems from the achievement of universal primary education and gender parity in primary and secondary education (Goal #2, Millennium Development Goals). The elimination of school fees implicit in many free primary education reforms is one specific policy that has contributed to this achievement. Many sub-Saharan African countries have implemented a free primary education reform. Despite this success, many questions persist about the quality, and therefore the economic return of this education. The current study examines the 1994 Ethiopia free primary education reform to evaluate the effect of this reform on individual's education and welfare outcomes.

Research Question:



Main Objectives:

1. Estimates the impact of FPE on individuals' completed years of schooling.
2. Examine the impact of this increase in years of schooling on the welfare of individual households.

Related Literature:

Studies have examined the progress and challenges of free primary education reforms (Oumer, 2009), and its effect on different factors such as school enrolment and quality of education (Deininger, 2003; Nishemura et al., 2008; Grogan, 2009; Lucas and Mbiti, 2012a; Chicoine, 2016a, 2016b; Snilstvert et al., 2016;), fertility (Fort et al., 2016), HIV health outcomes (Behrman, 2015), and gender equality (Lucas and Mbiti, 2012b).

Contribution: However, the connection between increased school enrolment, and the welfare gains of the people is still an open question. Thus, the study contribute to literature by examining the degree to which FPE affects the welfare of individuals

Data

The World Bank LSMS-ISA data for ETH is used. It is a three-wave nationally represented panel data collected in 2011/2012, 2013/2014, and 2015/2016. Study use three-wave panel data, with a total sample of 4,192 individuals from age 20 to 60 years. ESDPRP predicts education as playing a key role in poverty reduction through UPE, which led to inclusion of FPE in the ETH's PRSP. Welfare is measured in terms of poverty as in Darko et al., (2018), including per adult equivalent consumption expenditure, relative deprivation in terms of per adult equivalent consumption expenditure, and poverty gap.

Methodology

Identification Strategy: Explores how exogenous variation in education caused by the 1994 free primary education reform in Ethiopia can be used to create instrumental variables to estimate the causal impact of education on welfare. The strategy is based-on the fact that, exposure to the reform varies by date of birth. I construct dummy variables that indicate which cohorts of individuals were affected by the reform using date of birth. An individual born in 1990 or before was 4 years or older when the reform was implemented in 1994, as shown in below table. Three categories of reform dummy variables were created from this individual dummies: 1)Strongly affected: Individuals who were eight or younger in 1994. 2)Weakly affected: Individuals in the age range of nine to 14 in 1994. 3) Unaffected: Individuals age 15 and older in 1994. I used both difference-in-differences (DID) and instrumental variable (IV) estimators for the IDS. DID is used to estimate the impact of the reform on education, and IV is used to estimate the impact of education on household welfare. The different assumptions underlying the three categories of dummy variables are the identification assumptions.

Birth Year	Age (1994)	Age (2012)	Age (2014)	Age (2016)	Degree of FPE Effect
>=1990	<=4	<=22	<=24	<=26	Strong
1989	5	23	25	27	Strong
1988	6	24	26	28	Strong
1987	7	25	27	29	Strong
1986	8	26	28	30	Strong
1985	9	27	29	31	Weak
1984	10	28	30	32	Weak
1983	11	29	31	33	Weak
1982	12	30	32	34	Weak
1981	13	31	33	35	Weak
1980	14	32	34	36	Weak
>1980	>14	>32	>34	>36	No effect

Notes: Age is measured in years. Cohorts in age range <4 to 8 are strongly affected whereas those in the 9 to 14 range are weakly exposed to the reform. Cohorts above age 14 are not affected by the reform

Empirical Strategy: I conduct DID estimation in a regression framework to predict the impact of the reform on education; and then, I used as the first stage equation in a 2SLS estimation of the return to education. Two DID models is used: Restricted and unrestricted models. Restricted estimation categorizes strongly (age 4 and below to age 8 in 1994) and weakly (age 9 to 14 in 1994) affected cohorts separately into two different treatment dummies. Unrestricted uses individual-specific reform dummies (ages: 4 and below, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14) as a set of treatment dummy variables without imposing any groupings.

The structural model (OLS) estimating the direct linkage between welfare and education:

$$W_{ij} = \beta_0 + \beta_1 S_{ij} + \delta X_{ij} + \mu_{ij}$$

Where W_{ij} is various measures of welfare of individual i in cohort j ; β 's, δ are coefficients, X_{ij} is a vector of time invariant control variables of individual i in cohort j ; S_{ij} is the years of schooling of individual i in cohort j ; μ_{ij} is the residual.

Restricted: I estimate the first stage equation by imposing a group restriction on the reform dummies:

$$S_{ij} = \alpha_0 + \alpha_1 age_i + \alpha_2 agesq_i + \gamma_1 T_{1i} + \gamma_2 T_{2i} + \theta X_{ij} + \varepsilon_{ij}$$

Empirical Strategy Cont'd:

Where T_{1i} is a "treatment dummy" indicating whether an individual belongs to the strongly affected cohort (age 4 and below to 8 in 1994); T_{2i} "treatment dummy" indicates whether the individual belongs to the weakly affected cohort (age 9 to 14 in 1994); age_i and $agesq_i$ account for long term trends in the determinants of years of schooling. age_i is the age of individual households between the ages of 20 to 60; $agesq_i$ is the squared of age_i that explains the non-linear component of the trend; ε_{ij} is the residual of individual i in cohort j ; and $\gamma_1, \gamma_2, \alpha$'s, θ are coefficients. The comparison (control) group for this estimation is the unaffected cohorts (age above 14 in 1994). The assumption for the first stage equation is $E[T_1, X_{ij}] \neq 0$ $E[T_2, X_{ij}] \neq 0$.

The 2SLS restricted estimation of return to education is expressed:

$$W_{ij} = \pi_{10} + \alpha_1 age_i + \pi_{11} agesq_i + \pi_{12} S_{ij} + \sigma X_{ij} + \rho_{ij}$$

Where S_{ij} is the predicted years of schooling from equation (2); ρ_{ij} is the residual; π 's, σ are coefficients.

Unrestricted: the first stage equation is specified as the relationship between years of schooling of an individual i born in year k , and their respective degree of exposure to the reform:

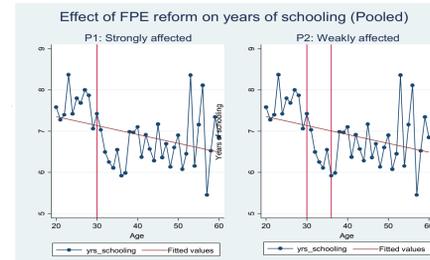
$$S_{ij} = \alpha_0 + \alpha_1 age_i + \alpha_2 agesq_i + \sum_{k=4}^{14} \gamma_{1k} T_{ik} + \theta X_{ij} + \varepsilon_{ij}$$

Where T_{ik} is a set of treatment dummy variables indicating whether individual i is of age k in 1994, $k = 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14$; γ_{1k} is the coefficient of treatment dummy which estimates the impact of the reform on a given cohort. The same omitted group as the restricted estimation is used (unaffected cohorts, age above 14 in 1994). For the 2SLS, the model specification is the same as the restricted except for the different predicted years in schooling.

Conclusion

- Reform increased primary school enrolment, which in turn improved the welfare of households.
- Positive effect of education on strongly exposed cohorts aged 8 and younger in 1994, means the reform affects younger individuals in pre-school (or possibly infants)
- Results on the weakly exposed cohorts aged 9 to 14 could also mean such individuals are either not affected or weakly affected by the reform.
- Suggests cohorts in the 2nd cycle or late stages of primary school at the time of the reform maybe comparable to unaffected cohorts above age 14 in 1994
- Result of the weakly affected is also likely to be caused by the severe famine that occurred in Ethiopia in 1983-1985 and possibly other confounding factors. Revised version of my model controls for all these factors.
- Results of education on the poverty measures indicates the welfare of individuals affected by the reform improved - that FPE led to welfare gains for people of ETH.

Results



Variables	Wave 2: 2013/2016			Wave 1: 2011/2012			Pooled		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Dependent variables (Poverty Measures of Welfare)									
Real Per adult equivalent consumption expenditure	7.964	7.964	7.181	6.905	6.905	5.325	5.965	5.965	5.469
Relative Deprivation in terms of consumption expenditure	5.491	5.491	1.512	4.605	4.605	1.466	3.944	3.944	1.128
Poverty gap	0.229	0.229	0.259	0.201	0.201	0.240	0.198	0.198	0.238
Covariates									
Age(years)	34.90	34.90	10.97	33.90	33.90	10.82	30.35	30.35	9.209
Education (Highest grade)	8.382	8.382	4.706	8.340	8.340	4.643	8.143	8.143	3.907
Age squared	1,339	1,339	834.6	1,266	1,266	815.1	1,006	1,006	646.7
Age in 1994	13.05	13.05	10.78	13.90	13.90	10.82	12.35	12.35	9.209
Treatment 1 (strong)									
Treatment 2 (weak)									
Observations	5,636	5,636	5,636	5,808	5,808	5,808	2,758	2,758	2,758

Variables	Education (1st stage for CE and RD)		Log consumption expenditure (CE)		Log relative deprivation (RD)		Education (1st stage for PG)		Poverty gap (PG)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Age(years)	-0.018	-0.010	0.033***	0.033***	-0.012***	-0.012***	-0.038	-0.029	-0.011***	-0.014***
Age squared	0.001	0.000	-0.000***	-0.000***	0.000	0.000	0.000	0.000	0.000***	0.000***
age <=4 to 8 in 1994	0.795***	0.770***	0.372***	0.370***	-0.133***	-0.133***	0.660*	0.615*	-0.128***	-0.126***
age 9 to 14 in 1994	0.340	0.344	0.0621	0.0621	0.027	0.027	0.352	0.356	0.025	0.025
Constant	-0.304	-0.328	0.207***	0.207***	-0.076***	-0.076***	-0.340	-0.372	-0.067***	-0.067***
R-squared	0.028	0.039	0.028	0.032	0.096	0.095	0.027	0.038	0.016	0.021
F-statistic	22.83	19.54	0.024	0.032	0.096	0.095	22.92	20.12	0.016	0.021
P-value	0	0	0	0	0	0	0	0	0	0

Variables	Log consumption expenditure (CE)		Log relative deprivation (RD)		Poverty gap (PG)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Education	0.036***	0.035***	0.079***	0.080***	-0.014	-0.013**
Age(years)	0.009	0.010	0.001	0.004	-0.004	-0.003
Age squared	-0.000	-0.000	0.000	0.000	0.000	0.000
Constant	8.487***	8.510***	7.851***	7.824***	8.322***	8.366***
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,954	3,833	3,954	3,833	3,954	3,833
R-squared	0.055	0.060	0.130	0.130	0.096	0.095
F-statistic	9.05	10.15	0.029	0.037	0.102	0.101
P-value	0	0	0	0	0	0

Variables	Education (1st stage for CE and RD)		Log consumption expenditure (CE)		Log relative deprivation (RD)		Education (1st stage for PG)		Poverty gap (PG)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Age(years)	-0.039	-0.014	0.028*	0.028*	-0.005	-0.006	-0.005	-0.014**	-0.011**	-0.011**
Age squared	0.001	0.000	-0.000	-0.000	0.000	0.000	0.001	0.000	0.000	0.000
age 4/below	0.761	0.843	0.328***	0.315***	-0.083*	-0.078*	0.545	0.541	-0.130***	-0.128***
age 5	1.232***	1.230***	0.377***	0.382***	-0.139***	-0.139***	1.087**	1.107**	-0.132***	-0.137***
age 6	0.368	0.328	0.434***	0.434***	-0.129***	-0.130***	0.181	0.099	-0.151***	-0.151***
age 7	0.811**	0.778*	0.312***	0.298***	-0.108***	-0.108***	0.600	0.563	-0.111***	-0.110***
age 8	0.853	0.918	0.300***	0.305***	-0.141***	-0.142***	0.419	0.426	-0.112***	-0.111***
age 9	0.368	0.328	0.434***	0.434***	-0.129***	-0.130***	0.181	0.099	-0.151***	-0.151***
age 10	-0.309	-0.326	0.314***	0.249***	-0.109***	-0.109***	-0.237	-0.237	-0.099***	-0.099***
age 11	-0.527	-0.420	0.123*	0.123*	-0.023	-0.025	-0.632	-0.557	-0.041	-0.039
age 12	-0.445	-0.446	0.067	0.067	0.029	0.029	0.438	0.439	0.030	0.030
age 13	-0.245	-0.245	0.154***	0.154***	-0.028	-0.029	-0.324	-0.327	-0.062***	-0.062***
age 14	-0.814*	-0.962**	0.113	0.100	-0.052	-0.042	-0.845**	-0.991**	-0.037	-0.038
Constant	9.912***	10.505***	8.012***	8.063***	8.366***	8.355***	10.513**	11.418**	0.543***	0.537***
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,954	3,833	3,954	3,833	3,954	3,833	4,192	4,065	4,192	4,065
R-squared	0.031	0.043	0.029	0.037	0.102	0.101	0.029	0.041	0.019	0.024
F-statistic	9.05	10.15	0.029	0.037	0.102	0.101	8.949	10.28	0.016	0.021
P-value	0	0	0	0	0	0	0	0	0	0

Variables	Log consumption expenditure (CE)		Log relative deprivation (RD)		Poverty gap (PG)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Education	0.036***	0.035***	0.079***	0.080***	-0.014	-0.013**
Age(years)	0.010	0.011	0.007*	0.006*	-0.005	-0.005
Age squared	-0.000	-0.000	0.000	0.000	0.000	0.000
Constant	8.487***	8.510***	7.851***	7.824***	8.322***	8.366***
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