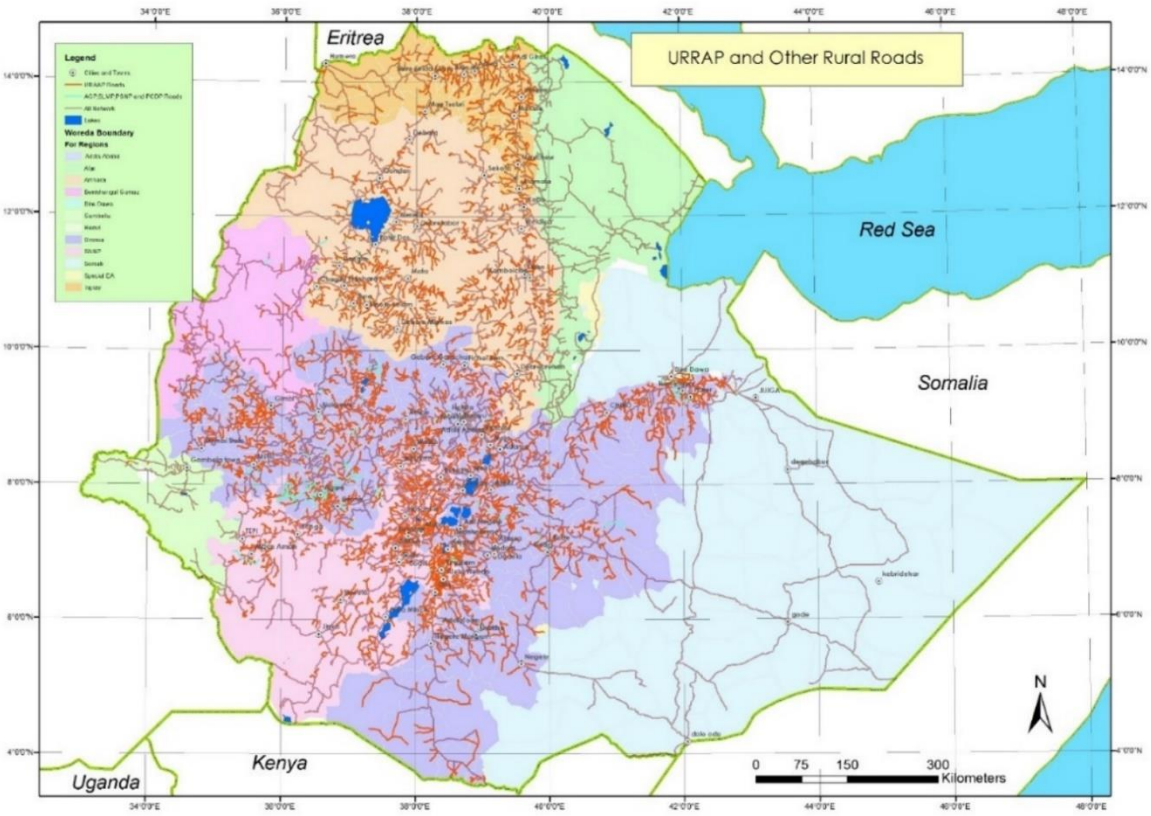
Supplementary Materials (Online)

Figure S1. Recently developed rural roads in Ethiopia



Source: The Ethiopia road database.

Table S1. List of variables

Name	Description	Data source
Consumption	Per adult-equivalent annual consumption in 2016 prices	ESS
Poor	1 if per adult-equivalent annual consumption is lower than Br. 4,360 (in 2016 prices); otherwise 0	ESS
Food insecurity	1 if the household experienced a situation in which they did not have food enough to feed the members during the last 12 months; otherwise 0	ESS
Share of crop for sale	Share of harvested crop for sale	ESS
Fertilizer use	1 if the household used fertilizer during the season; otherwise 0	ESS
Wage job	1 if any household member engaged in wage job during the last 12 months; otherwise 0	ESS
Rural road developed between 2010 and 2014	1 if any all-weather roads developed within the boundary of the community between 2010 and 2014; otherwise 0	The Ethiopia road database
Length of rural road (Kebele/Woreda)	Length of all-weather roads in the community/woreda	The Ethiopia road database
Travel time to town (Kebele)	Travel time from the geometric center of the kebele to the nearest town (in minutes)	The Ethiopia road database
RAI (Woreda)	Share of population within 2km from any all-weather road in the kebele/woreda	The Ethiopia road database, WorldPop
MAI (Kebele)	Sum of the population within 200 minutes from the Kebele center discounted by travel time	The Ethiopia road database, WorldPop
Road density (Woreda)	Length of all-weather roads per population at the Woreda in which the household resides (kilometer per population)	The Ethiopia road database WorldPop
Number of adult equivalent	Number of adult equivalent in the household	ESS
Age of household head	Age of the household head (in years)	ESS
Female-headed household	1 if the household head is female; otherwise 0	ESS
Education level of household head	The highest level of education achieved by the household head: no education, incomplete primary, complete primary, incomplete secondary, complete secondary, post-secondary, adult education	ESS
Marital status of household head	Marital status of the household head: never married, married (monogamous), married (polygamous), divorced, separated, widowed	ESS
Religion of household head	Religion of the household head: orthodox, catholic, protestant, Muslim, traditional, pagan, wakifata, other	ESS
Drought (Kebele)	1 if z-score of NDVI < 0; otherwise 0.	ESS
Log of transfer received	Amount of transfer received by the household during the last 12 months (in 2016 prices)	ESS
PSNP assistance	1 if the household received PSNP assistance during the last 12 months	ESS
PSNP labor	1 if the household participated in PSNP labor activity during the last 12 months	ESS
Population density (Woreda)	Population density in the woreda	Census
Poverty rate (Woreda)	Poverty headcount ratio at the woreda	HICES
No education (Kebele)	Share of adults with no education in the kebele	Census
Share of public piped water (Kebele)	Share of households with access to public piped water in the kebele	Census
Share of electricity (Kebele)	Share of households with access to electricity for lighting in the kebele	Census
Agro-climate zone (Woreda)	Agro-ecological zones: tropic-warm/arid, tropic-warm/semiarid, tropic-warm/subhumid, tropic-cool/subhumid, tropic-cool/semiarid, tropic-cool/humid	HarvestChoice/IFPRI
Region	Region in which the household resides: SNNPR, Amhara; Oromia, Tigray, B/Gumuz, D/Dawa, Harar, Gambella, Afar	ESS

Table S2. Estimation results on the log of household consumption

		Travel time threshold for *REMOTE*			z-score threshold for *DROUGHT*		
	All	>120 mins	>180 mins	>240 mins	< 0	< 0.5	< -1.0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
β5: *ROAD* × *POST*	0.171*	0.141	0.162	0.172*	0.076	0.177	0.132
	(0.099)	(0.106)	(0.099)	(0.101)	(0.168)	(0.130)	(0.103)
β7: *ROAD* × *REMOTE* × *POST*		0.143	0.126	0.121			
		(0.206)	(0.290)	(0.145)			
β5+ β7: Effects on HHs in remote communities		0.280	0.275	0.293***			
		(0.174)	(0.235)	(0.054)			
β7: *ROAD* × *DROUGHT* × *POST*					0.176	0.003	0.268
					(0.201)	(0.186)	(0.252)
β5+ β7: Effects on HHs in drought communities					0.252**	0.180	0.400*
					(0.107)	(0.129)	(0.227)

Note: The unit of observations is the matched sample of rural households in the 2012 and 2016 ESS. The DID models in Equations 2 and 3 were estimated with the natural logarithm of per adult equivalent household annual consumption as the outcome variables. The coefficient estimate for (β5+ β7) indicates the association between rural road development and the outcome among households in remote communities or households in communities hit by the drought. Household characteristics are controlled (see Table S1 for the descriptions of the variables). Cluster robust standard errors in parentheses. *, **, and *** indicate significance level of estimated impacts at 10%, 5%, and 1% levels.

Table S3. Summary of results on assistance

	PSNP assistance	Free food	PSNP or free food
	(1)	(2)	(3)
(A) All households	-0.049	-0.037	-0.065
	(0.040)	(0.065)	(0.089)
By travel time to town			
(B) *REMOTE* = 1 (travel time ≥ 240 minutes)	0.134	0.093	0.216
	(0.099)	(0.119)	(0.178)
(C) *REMOTE* = 0 (travel time < 240 minutes)	-0.063	-0.047	-0.086
	(0.041)	(0.069)	(0.094)
By drought exposure			
(D) *DROUGHT* = 1 (vegetation z-score ≤ -1.0)	-0.049	-0.061	-0.077
	(0.128)	(0.082)	(0.184)
(E) *DROUGHT* = 0 (vegetation z-score > -1.0)	-0.034	-0.020	-0.037
	(0.034)	(0.076)	(0.096)

Note: The unit of observations is the matched sample of rural households in the 2012 and 2016 ESS. The DID models in Equations 2 and 3 were estimated with different outcome variables in the columns: whether the household received the PSNP assistance during the last year (column 1); whether the household received free food aid during the last year (column 2); and whether the household received either the PSNP assistance or food aid during the last year (column 3). The coefficient estimates for (β5+ β7) are reported, which indicates the association between rural road development and the outcome among households in remote communities (row B) or households in communities hit by the drought (row D). Household characteristics are controlled (see Table S1 in the Supplementary Materials for the descriptions of the variables). Cluster robust standard errors in parentheses. *, **, and *** indicate significance level of estimated impacts at 10%, 5%, and 1% levels. Tables in the Supplementary Materials report detailed results.

Table S4. Estimation results on agriculture

		Travel time threshold for *REMOTE*			z-score threshold for *DROUGHT*		
	All	>120 mins	>180 mins	>240 mins	< 0	< -0.5	< -1.0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Share of crop sold							
β5: *ROAD* × *POST*	0.006	0.002	-0.004	-0.006	0.026	0.023	0.014
	(0.022)	(0.025)	(0.023)	(0.022)	(0.034)	(0.031)	(0.025)
β7: *ROAD* × *REMOTE* × *POST*		0.008	0.075	0.160***			
		(0.048)	(0.062)	(0.058)			
β5+ β7: Effects on HHs in remote communities		0.011	0.046	0.154***			
		(0.041)	(0.055)	(0.054)			
β7: *ROAD* × *DROUGHT* × *POST*					-0.042	-0.043	-0.060
					(0.041)	(0.041)	(0.046)
β5+ β7: Effects on HHs in drought communities					-0.016	-0.020	-0.046
					(0.025)	(0.028)	(0.039)
(B) Fertilizer use							
β5: *ROAD* × *POST*	0.008	-0.002	-0.009	-0.019	-0.001	0.037	-0.022
	(0.036)	(0.038)	(0.035)	(0.035)	(0.058)	(0.051)	(0.066)
β7: *ROAD* × *REMOTE* × *POST*		0.051	0.125	0.376***			
		(0.089)	(0.143)	(0.091)			
β5+ β7: Effects on HHs in remote communities		0.048	0.066	0.357***			
		(0.082)	(0.131)	(0.085)			
β7: *ROAD* × *DROUGHT* × *POST*					0.015	-0.065	0.173**
					(0.070)	(0.074)	(0.079)
β5+ β7: Effects on HHs in drought communities					0.014	-0.028	0.151**
					(0.042)	(0.051)	(0.069)

Note: The unit of observations is the matched sample of rural households in the 2012 and 2016 ESS. The DID models in Equations 2 and 3 were estimated with the share of crop sold by the household (A) and the binary indicator about the fertilizer use by the household (B) as the outcome variables. The coefficient estimate for (β5+ β7) indicates the association between rural road development and the outcomes among households in remote communities or households in communities hit by the drought. Household characteristics are controlled (see Table S1 for the descriptions of the variables). Cluster robust standard errors in parentheses. *, **, and *** indicate significance level of estimated impacts at 10%, 5%, and 1% levels.

Table S5. Estimation results on wage jobs

		Travel time threshold for *REMOTE*			z-score threshold for *DROUGHT*		
	All	>120 mins	>180 mins	>240 mins	< 0	< -0.5	< -1.0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) All household members							
β5: *ROAD* × *POST*	0.009	0.003	0.008	0.008	-0.022	-0.008	-0.001
	(0.016)	(0.019)	(0.018)	(0.017)	(0.023)	(0.019)	(0.018)
β7: *ROAD* × *REMOTE* × *POST*		0.023	0.006	0.010			
		(0.028)	(0.037)	(0.058)			
β5+ β7: Effects on HHs in remote communities		0.025	0.014	0.018			
		(0.020)	(0.029)	(0.054)			
β7: *ROAD* × *DROUGHT* × *POST*					0.042	0.032	0.048
					(0.030)	(0.034)	(0.029)
β5+ β7: Effects on HHs in drought communities					0.020	0.025	0.047**
					(0.020)	(0.029)	(0.024)
(B) Only female household members							
β5: *ROAD* × *POST*	0.006	-0.001	0.002	0.003	-0.010	0.000	0.007
	(0.010)	(0.012)	(0.011)	(0.010)	(0.015)	(0.014)	(0.011)
β7: *ROAD* × *REMOTE* × *POST*		0.035**	0.035*	0.045*			
		(0.017)	(0.019)	(0.027)			
β5+ β7: Effects on HHs in remote communities		0.033***	0.035**	0.048*			
		(0.011)	(0.015)	(0.025)			
β7: *ROAD* × *DROUGHT* × *POST*					0.023	0.009	-0.013
					(0.017)	(0.021)	(0.016)
β5+ β7: Effects on HHs in drought communities					0.012	0.009	-0.006
					(0.011)	(0.016)	(0.012)
(C) Only young household members							
β5: *ROAD* × *POST*	0.046**	0.038	0.037	0.038	0.015	0.027	0.031
	(0.023)	(0.027)	(0.024)	(0.023)	(0.041)	(0.031)	(0.024)
β7: *ROAD* × *REMOTE* × *POST*		0.033	0.065	0.104			
		(0.042)	(0.49)	(0.073)			
β5+ β7: Effects on HHs in remote communities		0.072**	0.091**	0.141**			
		(0.032)	(0.042)	(0.070)			
β7: *ROAD* × *DROUGHT* × *POST*					0.046	0.043	0.061
					(0.047)	(0.042)	(0.054)
β5+ β7: Effects on HHs in drought communities					0.061**	0.070**	0.092*
					(0.025)	(0.032)	(0.049)

Note: The unit of observations is the matched sample of rural households in the ESS. The DID models in Equations 3 and 4 were estimated with the following outcome variables: (A) the share of household members who engaged in wage jobs (%), (B) the share of female household members who engaged in wage jobs (%), and (C) the share of young household members who engaged in wage jobs (%). The coefficient estimate for (β5+ β7) indicates the association between rural road development and the outcomes among households in remote communities or households in communities hit by the drought. Household characteristics are controlled (see Table S1 for the descriptions of the variables). Cluster robust standard errors in parentheses. *, **, and *** indicate significance level of estimated impacts at 10%, 5%, and 1% levels.