The End of AIDS: The Economics Effects of Antiretroviral Therapy at Scale in Malawi Preliminary and Incomplete. Please do not cite without permission.

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Abstract

Since 2000, the international community has provided tens of billions of dollars to expand antiretroviral therapy (ART) throughout sub-Saharan Africa. Although previous research has shown positive economic effects for HIV positive individuals and benefits for their families, less is known about whether this impact extends to the broader community. To identify the economic impact of HIV treatment, we use variation in distance to ART-providing clinic between 2004 and 2010 during Malawi's ART expansion. To validate our strategy, we find that distance to ART-providing clinics is not associated with changes in all-cause mortality, but find ART proximity is associated with a 35% decline in illness-related, prime age mortality. We also find that ART proximity increases hours worked by 7% and 11% for males and females, respectively. While treatment increases education expenditure by 13% and 30% for males and females, respectively. We find the first evidence at the national level that HIV treatment expansion, in addition to mortality gains, generates robust economic benefits both for the HIV-positives and those unaffected by the disease.

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Keywords: HIV/AIDS, antiretroviral therapy, economic development, human capital, Malawi. I15, I18, I21, O15, O18.

1 Introduction

Since 2000, the international community has provided tens of billions of dollars to expand antiretroviral therapy (ART) throughout sub-Saharan Africa (PEPFAR 2012; Global Fund 2012). The rollout of ART programs has dramatically improved survival, increasing prime-age adult life expectancy by over 11 years (Bor et al. 2013; Bendavid, et al., 2012; Bendavid & Bhattacharya, 2009). Regarding economic impact among the treated, employment for HIV-positives recovers almost to baseline after 4 years (Bor, et al, 2012) and likelihood of labor force participation and hours worked increases (Thirumurthy, Graff Zivin, & Goldstein, 2007). In addition, treatment spillovers to children in the same household have also been documented, such that child weight-for-age improves, stunting declines, (Lucas & Wilson, 2013), and school attendance increases (Graff Zivin, Thirumurthy, & Goldstein, 2009).

However, less is known about the economic effects of ART scale-up on the overall community. There is one study, most closely related to this one (McLaren, 2010), which uses geographic and temporal variation in ART rollout in South Africa and finds small, but significant positive effects of ART on employment among males. In contrast, the survival of HIV positive individuals after the introduction of ART may flood labor markets, raise dependency ratios, and lower wages. Some have argued that the HIV epidemic could in fact be a net positive for per capita consumption (Young, 2004).

We therefore explore the economic impact of Malawi's rapid HIV treatment scale-up using variation in distance to ART-providing clinic. Given Malawi is one of the poorest nations in the world, highly rural, with a limited road network, distance to clinic is an important indicator of treatment access. Our analysis makes use of national-level data on health clinics date of ART initiation and nationally-representative data sets to measure outcomes at the beginning and again toward the end of ART expansion. To estimate causal effects, we use a difference-in-difference model to compare the differential economic changes that occur for those residing close to ART-providing clinics after treatment initiation compared to changes for those located far from ART-providing clinics.

First, we test whether our measure of HIV treatment access is associated with mortality and HIV prevalence. We find no association between all-cause mortality and ART-proximity, but a 35% differential decline in illness-related, prime age mortality for those near to ART-providing clinics. We also show that HIV prevalence declines more for those closer to ART (especially males). This pattern of simultaneously decreasing mortality and prevalence suggests we are indeed using variation driven by HIV treatment instead of pre-existing trends or mean regression. Turning to economic impacts, we find that ART-proximity increases hours worked by 7% and 11% for males and females, respectively. For certain specifications, we also find marginally significant increases in paid work for males. In addition, ART-proximity raises education expenditure by 13% and 30% for males and females, respectively.

Although there is at least one other study which also finds substantial positive employment spillovers from ART (Bor et al. 2015), their explanation of labor demand increases need not generalize to the national level. That is, specific trends within one region of South Africa could drive their results. We however show that the positive economic benefits of ART extend to the national level. Wagner et al. (2015) also compare employment in PEPFAR focus versus non-focus nations and find large employment benefits for the program, however this uses national level variation. Other studies on spillovers (Baranov and Kohler, 2013; Baranov, Bennett, and Kohler, 2015) find benefits of ART in increased savings, child expenditure, and labor supply. However, this analysis is the only one to explore such a wide range of economic outcomes at the national level and find robust evidence of positive impact.

This paper proceeds as follows: section 2 describes our conceptual framework, section 3 outlines the scale-up of Malawi's ART program, section 4 defines the data used, and section 5 our methods. Sections 6 and 7 analyze results and conclude.

2 Conceptual Framework

With such a large shift in life expectancy (LE) for adults and children, theory predicts unambiguous improvements in human capital formation through two channels (Ben-Porath, 1967; Jayachandran and Lleras-Muney, 2009). For adult increases in LE, longer lives means that adults can enjoy the benefits of greater support from their children for more time. For children (holding adult LE constant), increased LE clearly raises the returns to education, raising incentives for education. When it comes to employment, access to HIV treatment can have effects through multiple channels as well such that effects are ambiguous. On one hand, ART improves labor productivity, making work newly possible for those with advanced disease. In addition, ART reduces care giving and end of life expenses. However, increased LE also may raise the proportion of the population in states of ill health or swamp already high unemployment labor markets with additional job seekers, driving down wages.

3 Context

Malawi is a landlocked nation in southeastern Africa and one of the world's poorest with GDP per capita of $340 (PPP adjusted $918). Although mostly peaceful since independence from Britain in 1964, Malawi remains primarily rural with agriculture accounting for 30% of GDP and over 80% of employment. In 2010, the nation was characterized by high fertility (TFR of 5.7), low nutritional status (47% of children are stunted), and a child mortality rate over 100 deaths per 1,000 live births. HIV/ AIDS represents the largest single cause of adult death (AVERT, 2012). It remains one of the highest HIV-prevalence nations in the sub-Saharan Africa. Prevalence peaked in 1998 at 14.7% and has declined slowly since, with prevalence of 11.8% in 2004 and 10.6% adult 15-49 in 2010 (DHS, 2010). The highest prevalence group in 2010 was 35 to 39 year old with male and female prevalence of 18% and 24% respectively.

3.1 ART expansion

After previous governments refused to acknowledge the scale of the HIV epidemic, Malawi announced that it would provide free treatment to its HIV positive population. In January 2004, before national ART scale-up began, nine facilities in the public sector were delivering medication to approximately 3000 patients. Of these patients, many were required to pay for their medication while few health care workers were trained to provide treatment. By June 2004, ART began to scale-up in public health facilities providing treatment for free, training health care workers, and accrediting facilities to provide ART (Harries et al. 2011). In June, 2010, 396 clinics were (290 static, 106 mobile) and about 360,000 patients were being provided ART. 225,000 adults were alive as of June 2010, most of whom would have died within 1-2 years without treatment (Harries et al. 2011) and almost 700 by mid-2012. Figure 1 shows the geographic expansion in ART-providing clinics over time in Malawi. Figure 2 shows the distribution of dates on which clinics begin providing ART. We observe that the pace of ART introduction was approximately uniform over time, until mid-2011 when many of the smallest clinics began providing ART as well. Table 1 verifies this pattern, showing the characteristics of health facilities providing ART by year of service provision. It shows that the first health facilities to provide ART were indeed the largest, with nearly complete access to basic services such as water, flush toilets, and road access. Over time, we observe smaller and less well-equipped clinics coming online. By mid-2012, 78% of all health facilities were providing ART.

4 Data

This paper uses variation in distance to an ART-providing clinic to identify the effect of HIV treatment on employment (at the intensive and extensive margin), child health and human capital formation. Two waves each of two separate nationally representative data sets from Malawi are used. These include the Malawi Integrated Household Surveys (IHS) collected in 2004/05 and 2010/11 and Demographic and Health Surveys (DHS), collected in 2004 and 2010. The DHS includes measured HIV status for a random one-third of respondents, allowing us to investigate changes in disease prevalence over time. The IHS however contains data on reported mortality in the household over the last two years (including individual's age at death and the reason for death), employment, hours worked, paid work, and educational expenditure (tuition, books, clothing, boarding fees, building charges, parental assoc. fees, and other) in last year. Both include GPS coordinate modification using a random offset of cluster center-point of 0-2 km in urban areas and 0-5 km in rural, with 1% of rural clusters offset by 0-10 km. The IHS also includes data on exact distance from cluster to nearest road, government and agricultural development office (ADMARC). Figures 3 shows the distance (in km) to ART-providing clinics as of 2010 for IHS 2004/05 and 2010/11 households. Figure 4 shows the proximity to ART-providing clinics, which we define as the negative log distance. These figures show that households in each wave of the IHS survey exhibit approximately similar distributions of distances away from 2010-ART providing clinics. Figure 9 shows the distribution of distances to 2010-ART providing clinics for households in the 2004 and 2010 Malawi DHS. Again, we observe similar distributions. Figure 10 shows the distribution of distances of 2010-ART providing clinics for 2010 DHS households. However, it shows the distribution of distances for all clinics, ART-providing clinics, and public ART-providing clinics. Given that nearly all of ART-providing clincis are public, there is little difference between distance to all ART-providing and public ART-providing clinics. We also observe that distance to any clinic is substantially closer than distnace to ART-providing ones.

5 Methods

The causal effect of ART on HIV positives, their households, and their communities is identified by comparing changes in outcomes for households located close to versus farther away from ART-providing clinics before and after ART's introduction. The primary threat to causal identification is that the expansion of clinics occurs in a way that covaries with unobserved characteristics correlated with positive economic outcomes. If that is the case, any beneficial estimates we obtain may be produced by preexisting trends such as better governance, political capture of ART programs by higher income areas, or the distribution of health facilities as a reflection of economic capacity. We control explicitly for this variation by adding additional sociodemographic and distance covariates into all models and by examining the characteristics of ART clinics as expansion progresses. Our difference-in-difference specification is the following:

$$Y_{ict} = \alpha + \beta * 2010 + \gamma * dist_{c,2010} + \delta(2010 * dist_{c,2010}) + \tau * oth.\ dist_c + \mathbf{X}_{ict}\rho + \lambda_r + \mu + \epsilon_{ict} \quad (1)$$

for individual i, cluster c, and time $t = [2004, 2010]$, where δ represents the effect of ART proximity after ART-expansion. $dist_{c,2010}$ represents $1\{\leq$ median dist. to 2010 ART-providing clinic$\}$ or proximity to 2010 ART-providing clinic (-log[$\text{dist}_{c,2010}$]). For IHS data, $oth.\ dist_c$ refers to distance to nearest road, government and agricultural development (ADMARC) office. $\mathbf{X}_{ict}$ represents individual and household characteristics such as age, age^2, marital status, and HH size. $\lambda_r = 1\{\text{urban}\}$ and region dummies. μ refers to monthly dummies, which are particularly useful to control for seasonality in hours worked and because the IHS was collected over a year, while the DHS in a shorter timeframe.

6 Results

6.1 Mortality and HIV prevalence

First we explore whether variation in distance to 2010 ART-providing facility is associated with changes in health that are expected if proximity facilitates access to antiretroviral medication. We expect to observe reduced HIV-related mortality, but not necessarily any relationship with all-cause mortality. To proxy HIV-related mortality, we explore reported household mortality in the last two years when cause of death was illness-related and for adults aged 18-54. We therefore estimate equation (1) for both reported all-cause mortality by household and illness-related, prime age mortality. Tables 2 and 3 show the differential change in all-cause and illness-related prime age mortality in areas near to ART versus those close, before and after ART's introduction. Columns (1)-(3) use the binary measure of distance, greater than or less than the median from an ART-providing clinic. Columns (4)-(6) use the proximity measure of ART distance and is therefore a continuous variable. These tables show us that there is no consistent relationship between all-cause mortality and ART-proximity, but a robust association between proximity to ART and illness-related, prime age mortality decline. Being closer than the median distance of 8 km compared to greater than 8 km leads to a differential decline in mortality of 70%. One unit closer in log distance represents about a 4km change, and that decreases illness-related, prime age mortality by 35%.

We also explore the relationship between distance to ART and HIV prevalence using the subset of DHS respondents that had their HIV status tested. To do so, we split households into terciles of distance to ART and examine prevalence in each tercile in 2004 and 2010. Figures **??** and 6 show HIV prevalence for males and females respectively, adjusted for location (running equation 1 but only using urban/rural and region dummies). We observe for both, and especially for males a differential decline in HIV prevalence in households close to ART-providing clinics in 2010 compared to households farther from ART. The combination of these results, differentially declining mortality and HIV prevalence (among males) for those nearer to ART indicates that these changes are being driven by ART itself instead of pre-existing trends such as mean regression that would be characterized by declining prevalence with greater differential mortality in areas near ART.

6.2 Employment and Educational Expenditure

Given our first stage results, we turn to exploring the theoretically ambiguous effects of ART on employment. We estimate equation (1) with both hours worked and binary paid employment as dependent variables. Tables 8 and 9 show the impact of ART on hours worked for males and females, respectively. The results show that using the continuous proximity measure of distance to ART, treatment increases hours worked among all adults by 7% and 11% for males and females. Tables 6 and 7

For education expenditure, tables 13 and 14 show the effect of ART proximity on educational expenditure. For investment in children, the theoretical effect is unambiguous, we should observe an increase for those that are HIV positive. These tables show a 13% and 30% increase in education expenditure for males and females, respectively. This is larger than would be expected for improvements accruing exclusively to families affected by HIV and therefore suggest spillovers to the wider community.

7 Conclusion

We use variation in distance to ART-providing clinic to explore impact on work and educational expenditure. First, we validate that this variation is associated with health in ways that would expected if caused by HIV treatment. And indeed, we find proximity to ART associated with differentially lower mortality and HIV prevalence. For our main outcomes, we find that ART raises hours worked and educational expenditure by a substantial margin. Although we are not controlling for all possible sources of variation, these results provide robust evidence on the beneficial economic impact of HIV treatment at scale, the only paper to find such effects using nationally-representative data.

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8 Tables and Figures

8.1 ART expansion

Figure 1: **Expansion of ART-provision over time within Malawi**

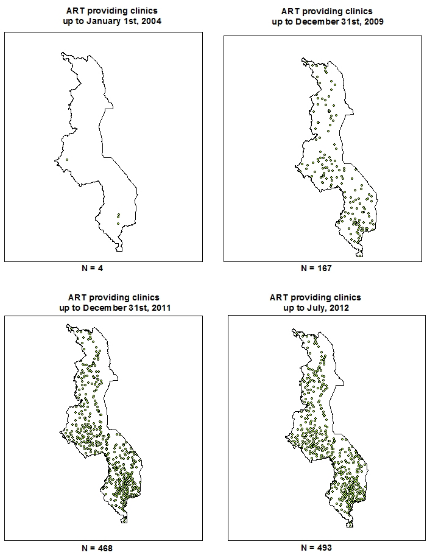

Table 1: **Characteristics of clinics by year of ART service start**

Year Start	N	Beds	Pop.	Rooms	Water	Toilet	Road	Public
pre-2004	24	336	46326	14.5	100%	100%	93%	87%
2005	56	182	57744	6.9	100%	100%	84%	71%
2006	60	72	47855	4.52	93%	85%	56%	68%
2007	20	13	30056	2.4	70%	30%	30%	55%
2008	55	17	30454	2.1	76%	46%	33%	84%
2009	45	16	20853	1.9	74%	47%	38%	95%
2010	38	18	21209	1.9	58%	24%	42%	97%
2011	344	11	20972	1.7	59%	31%	35%	97%
2012	35	7.5	20415	1.625	63%	13%	43%	94%
No ART	194	7.53571	12859	1.1	46%	25%	23%	0%

Data: Malawi Ministry of Health.

Figure 2: **Start dates for ART providing clinics**

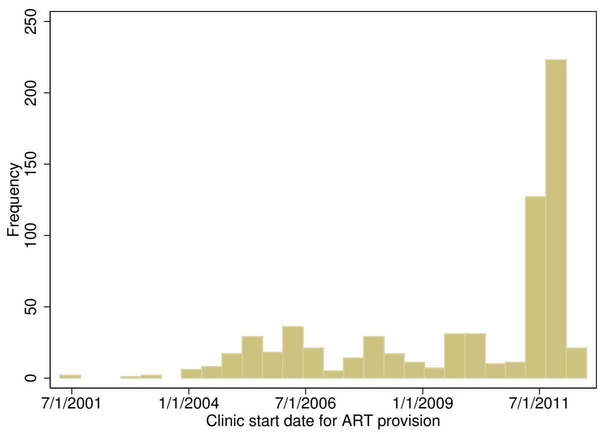

Figure 3: **Distance to 2010 ART providing clinics for IHS 2004 and 2010 HH's**

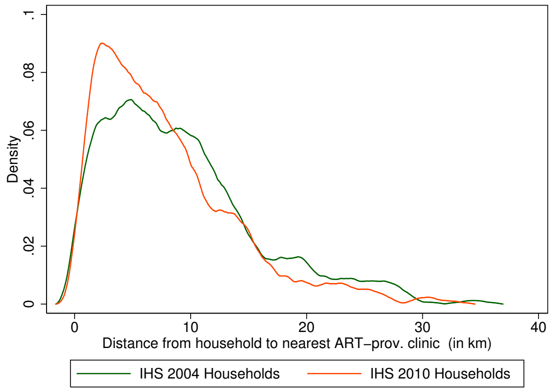

Figure 4: **Proximity (-log dist.) to 2010 ART providing clinics for IHS 2004 and 2010 HH's**

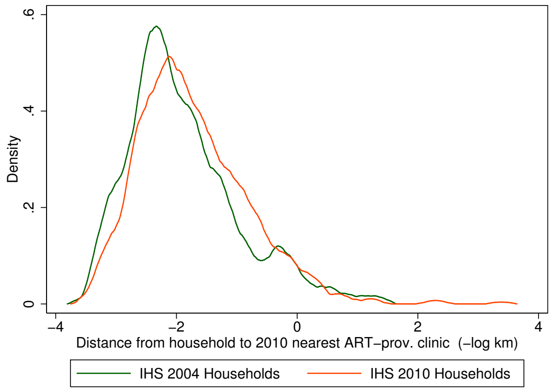

Table 2: **Effect of distance to ART-providing clinic on all-cause mortality (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	-.004	.004	.004	-.010	-.005	-.005
	(.011)	(.011)	(.011)	(.006)*	(.006)	(.006)
2010	-.095	-.094	-.094	-.084	-.082	-.084
	(.009)***	(.009)***	(.009)***	(.012)***	(.012)***	(.012)***
Near*2010	-.003	-.003	-.004	.006	.007	.007
	(.012)	(.012)	(.012)	(.006)	(.006)	(.006)
Urban [0/1]		-.027	-.026		-.025	-.024
		(.007)***	(.007)***		(.008)***	(.008)***
HH size			.008			.008
			(.001)***			(.001)***
Obs.	23147	23119	23097	23147	23119	23097
R^2	.103	.104	.106	.103	.104	.106
Mean '10	.0566					
Controls:						
Distance	X	X	X	X	X	X
Location		X	X		X	X
Socio-demo			X			X

Malawi IHS 2004-05 and 2010-11. Deaths in HH in last 2 years. Clustering at PSU level. (* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$).

8.2 Mortality effects

Table 3: **Effect of distance to ART-providing clinic on illness-related prime-age mortality (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	.012	.010	.010	.006	.005	.005
	(.005)**	(.005)**	(.005)**	(.002)**	(.002)**	(.002)**
2010	-.018	-.018	-.018	-.035	-.035	-.036
	(.004)***	(.004)***	(.004)***	(.006)***	(.006)***	(.006)***
Near*2010	-.012	-.012	-.012	-.006	-.006	-.006
	(.006)**	(.006)**	(.006)**	(.003)**	(.003)**	(.003)**
Urban [0/1]		.002	.003		.002	.003
		(.004)	(.004)		(.004)	(.004)
HH size			.004			.004
			(.0008)***			(.0008)***
Obs.	23147	23119	23097	23147	23119	23097
R^2	.028	.028	.03	.028	.028	.03
Mean '10	.0171					
Controls:						
Distance	X	X	X	X	X	X
Location		X	X		X	X
Socio-demo			X			X

Malawi IHS 2004-05 and 2010-11. Deaths from illness, ages 18-54 in HH in last 2 years. Clustering at PSU level. (* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$).

Table 4: **Effect of distance to 2010 ART-providing clinic on HIV prevalence among 35 to 54 and 40 to 54 year olds (DHS).**

	< Median Distance to clinic		Proximity	
	35-54	40-54	35-54	40-54
Near ART clinic	-.006	-.011	-.018	-.026
	(.022)	(.026)	(.015)	(.018)
2010	-.001	.004	.054	.074
	(.017)	(.020)	(.034)	(.040)*
Near*2010	.018	.020	.024	.032
	(.025)	(.030)	(.016)	(.020)
Intercept	-.537	.475	-.521	.707
	(.355)	(.851)	(.360)	(.861)
Mean '04	.167	.153		
Obs.	5341	3316	5233	3248
R^2	.268	.249	.268	.249

Data: Malawi DHS 2004 and 2010. Clustering at the DHS PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

8.3 HIV prevalence effects

Figure 5: **Male HIV prevalence by terciles of distance to ART-providing clinics 2004 to 2010 DHS, adjusted by location.**

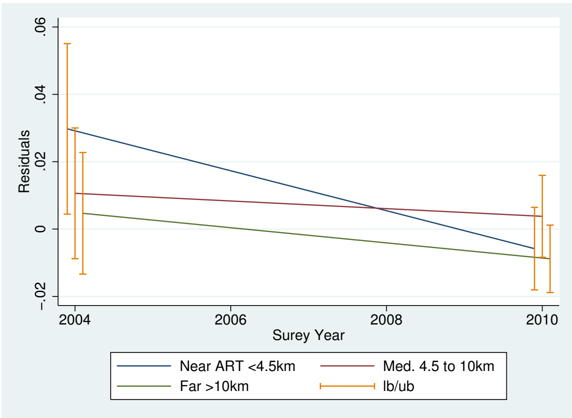

Figure 6: **Female HIV prevalence by terciles of distance to ART-providing clinics 2004 to 2010 DHS, adjusted by location.**

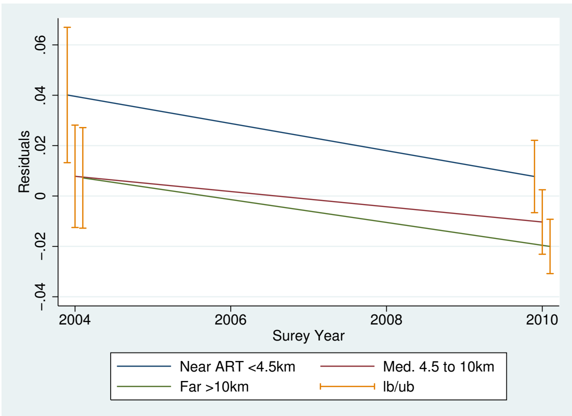

Table 5: **Mean of dependent variables by year (IHS)**

Dep Var.:	2004-05	2010-11
Hours Worked	29.36	18.96
Paid Work	.168	.137
Educ. Exp.	468.29	900.94

Malawi IHS 2004-05 and 2010-11. Education expenditure inflation adjusted using World Bank GDP price deflator.

8.4 Employment effects

Figure 7: **Distribution of hours worked, males, IHS 2004-05 and 2010-11**

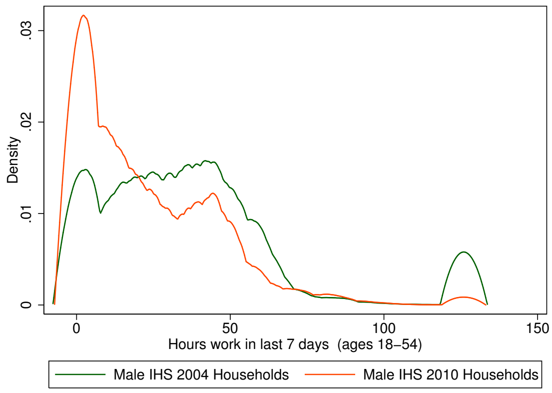

Figure 8: **Distribution of hours worked, females, IHS 2004-05 and 2010-11**

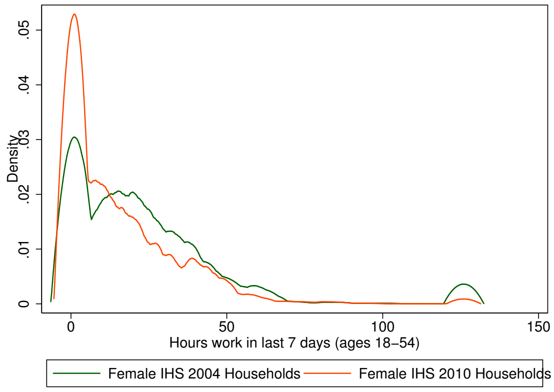

Table 6: **Effect of distance to ART-providing clinic on hours worked for males (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	2.047	-.285	-.024	.951	-.666	-.560
	(.959)**	(.951)	(.933)	(.504)*	(.545)	(.529)
2010	-15.171	-11.550	-12.230	-11.760	-8.109	-8.652
	(.853)***	(.838)***	(.820)***	(1.336)***	(1.242)***	(1.227)***
Near*2010	1.478	1.381	1.412	1.482	1.516	1.588
	(1.222)	(1.131)	(1.112)	(.636)**	(.610)**	(.596)***
Obs.	20905	20493	20493	20905	20493	20493
R^2	.559	.615	.619	.559	.615	.619
Mean '10	22.9					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 18-54. Hours worked in last 7 days. Clustering at the PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 7: **Effect of distance to ART-providing clinic on hours worked for females (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	-1.844	-1.108	-.800	-1.441	-1.126	-.964
	(.882)**	(.864)	(.822)	(.442)***	(.477)**	(.455)**
2010	-8.519	-5.727	-6.369	-4.076	-1.924	-2.563
	(.780)***	(.769)***	(.728)***	(1.053)***	(.989)*	(.961)***
Near*2010	2.038	1.400	1.406	1.880	1.704	1.706
	(1.043)*	(.988)	(.936)	(.537)***	(.521)***	(.500)***
Obs.	22008	21734	21734	22008	21734	21734
R^2	.431	.474	.483	.431	.474	.484
Mean '10	15.24					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 18-54. Hours worked in last 7 days. Clustering at PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 8: **Effect of distance to ART-providing clinic on paid work [0,1] for males (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	.089	.020	.021	.059	.018	.018
	(.018)***	(.018)	(.018)	(.009)***	(.010)*	(.010)*
2010	-.089	-.086	-.088	-.029	-.041	-.043
	(.015)***	(.015)***	(.015)***	(.024)	(.023)*	(.022)*
Near*2010	.029	.022	.020	.026	.019	.020
	(.022)	(.021)	(.021)	(.011)**	(.011)*	(.011)*
Obs.	20415	20367	20367	20415	20367	20367
R^2	.262	.327	.329	.271	.328	.331
Mean '10	.22					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 18-54. Dependent variable is binary indicator for paid work in the last 12 months. Clustering at the PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 9: **Effect of distance to ART-providing clinic on paid work [0,1] for females (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	.036	.002	.002	.036	.016	.016
	(.009)***	(.008)	(.008)	(.006)***	(.006)***	(.006)***
2010	-.037	-.034	-.037	-.003	-.018	-.021
	(.006)***	(.006)***	(.006)***	(.018)	(.016)	(.016)
Near*2010	.025	.014	.014	.013	.006	.005
	(.012)**	(.010)	(.010)	(.008)*	(.007)	(.007)
Obs.	21709	21673	21673	21709	21673	21673
R^2	.081	.132	.134	.096	.135	.136
Mean '10	.06					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 18-54. Dependent variable is binary indicator for paid work in the last 12 months. Clustering at the PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 10: **Effect of distance to ART-providing clinic on employment for males (DHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART. clinic	-.055	-.029	-.026	-.034	-.014	-.011
	(.018)***	(.018)	(.017)	(.009)***	(.009)	(.008)
2010	.100	.104	.128	.125	.117	.144
	(.014)***	(.014)***	(.013)***	(.023)***	(.022)***	(.020)***
Near*2010	.019	.015	.017	.009	.005	.005
	(.021)	(.021)	(.019)	(.011)	(.011)	(.010)
Obs.	10431	10431	10430	10191	10191	10191
R^2	.86	.862	.887	.86	.862	.888
Controls:						
Location		X	X		X	X
Socio-demo.			X			X

Data: Malawi DHS 2004 and 2010. Dependent variable is binary indicator for work within the last 12 months. Clustering at the DHS PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 11: **Effect of distance to ART-providing clinic on employment for females (DHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	-.025	-.004	-.007	-.025	-.004	-.007
	(.014)*	(.014)	(.013)	(.014)*	(.014)	(.013)
2010	.104	.099	.098	.104	.099	.098
	(.030)***	(.029)***	(.026)***	(.030)***	(.029)***	(.026)***
Near*2010	-.013	-.014	-.013	-.013	-.014	-.013
	(.015)	(.015)	(.013)	(.015)	(.015)	(.013)
Obs.	33342	33342	33331	33342	33342	33331
R^2	.691	.693	.714	.691	.693	.714
Controls:						
Location		X	X		X	X
Socio-demo.			X			X

Data: Malawi DHS 2004 and 2010. Dependent variable is binary indicator for work within the last 12 months. Clustering at the DHS PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 12: **Effect of distance to ART-providing clinic on employment by HIV status (DHS)**

	Male HIV+	Male HIV-	Female HIV+	Female HIV-
	(1)	(2)	(3)	(4)
Near ART clinic	-.003	-.028	-.004	-.014
	(.044)	(.020)	(.053)	(.028)
2010	.107	.133	.150	.130
	(.036)***	(.014)***	(.048)***	(.022)***
Near*2010	-.029	.018	.023	-.019
	(.045)	(.022)	(.061)	(.032)
Intercept	.501	.134	-.012	.084
	(.170)***	(.066)**	(.220)	(.084)
Obs.	773	8128	1279	8798
R^2	.946	.886	.775	.71

Data: Malawi DHS 2004 and 2010. Clustering at the DHS PSU level.
(* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$)

Table 13: **Effect of distance to ART-providing clinic on education expenditure for males (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	490.4	62.3	50.4	396.6	105.0	92.5
	(127.4)***	(99.8)	(95.5)	(94.8)***	(76.0)	(75.2)
2010	125.5	229.9	194.7	517.4	441.9	423.2
	(41.2)***	(41.7)***	(45.3)***	(304.4)*	(276.0)	(276.3)
Near*2010	158.4	93.2	94.0	176.3	94.2	102.9
	(167.9)	(154.7)	(150.2)	(127.1)	(116.3)	(114.8)
Obs.	15537	15524	15524	15537	15524	15524
R^2	.07	.1	.1	.09	.1	.1
Mean '10	806					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 5-17. Dependent variable is education spending and adjusted for inflation in 2010-11. Clustering at the PSU level. (* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$).

8.5 Education expenditure effects

Table 14: **Effect of distance to ART-providing clinic on education expenditure for females (IHS)**

Exp. Var.:	Dist. < Median			Proximity		
	(1)	(2)	(3)	(4)	(5)	(6)
Near ART clinic	548.4	-50.4	-55.9	424.1	46.6	37.4
	(133.9)***	(119.3)	(116.6)	(96.8)***	(82.5)	(81.7)
2010	132.2	251.6	210.6	956.9	932.5	889.9
	(49.4)***	(43.7)***	(50.6)***	(371.3)***	(336.7)***	(335.5)***
Near*2010	347.3	326.1	313.7	363.3	291.7	295.1
	(191.8)*	(175.5)*	(177.6)*	(162.6)**	(146.9)**	(148.4)**
Obs.	16006	15991	15991	16006	15991	15991
R^2	.08	.2	.2	.1	.2	.2
Mean '10	992					
Controls:						
Distance	X	X	X	X	X	X
Socio-demo.		X	X		X	X
Month			X			X

Data: Malawi IHS 2004-05 and 2010-11. Ages 5-17. Dependent variable is education spending and adjusted for inflation in 2010-11. Clustering at the PSU level. (* $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$).

9 Appendix

9.1 Data background and regressions appendix:

— To do: —winsorize hours worked instead of using setting max arbitrarily and see if results differ.... – add educational controls for IHS...

9.2 Geographic controls

DHS - no geographic controls

IHS geographic controls: 2010-11 - has information on distance from household to nearest road, population center ¿20,000, admarc center, district boma, tobacco auction house, border post. However, IHS 2004-05 provides information on distance at the community level, not the household level, to nearest road, admarc center, and district boma. It also contains information on distance to nearest health clinic.

9.3 More distance distributions

Figure 9: **Distribution of distances from household to 2010 ART-providing clinic (in km) for DHS 2004 and 2010**

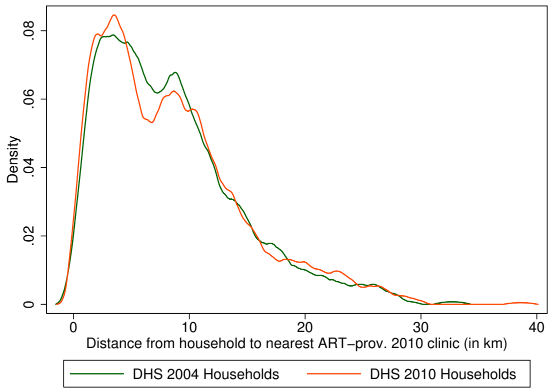

Figure 10: **Distribution of distances from households to any clinic and ART-providing clinic (in km) for DHS 2010**