PEPFAR Funding Associated With An Increase In Employment Among Males in Ten Sub-Saharan African Countries

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Technical Appendix

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Part 1: Regression Specifications

Exhibit 3 Regression Specification:

To formally estimate the impact of PEPFAR on employment outcomes, we estimate the following linear probability model

$$(1) \qquad Y_{ict} = \delta + \sigma PEPFARxPost_{ict} + \gamma_t \sum_{t=1999}^{2012} Year \quad + \beta_c \sum_{c=2}^{21} Country_c + \varepsilon_{ict}$$

where Y is an employment outcome for individual *i* in country *c* at time *t*, δ is an intercept, *PEPFAR* represents whether country *c* was a PEPFAR focus country, *Post* represents whether the time period is pre- or post-2004, and therefore *PEPFARxPost* is an interaction term that is set to one if both the country is a PEPFAR country and the year is post-2004. *Year* is a dummy variable for each year and country is a dummy variable for each country, which represent time invariant year and country specific characteristics, respectively. Standard errors are clustered at the country level and all regressions are weighted by each country's contribution to the total population of the 21 nations (10 focus and 11 non-focus PEPFAR) under study. These nations constitute about 70% of sub-Saharan Africa's total population in 2003. The coefficient of interest is σ, which represents the difference-in-differences estimate of the PEPFAR program.

We estimate equation 1 for different age groups (15-24, 25-34, 35-44, 45-54). As described in the text, if prevention effects dominate we would expect PEPFAR to have larger effects at younger ages since this is when most new HIV incidence occurs. If the improved health effects of ART dominate this will have a greater impact on people at later stages of the illness who are generally older. Therefore, a larger effect at older ages is indicative of improved health and increased ability to work. On the other hand, a decrease in employment at older ages may be suggestive of two effects. First, this could indicate that the increase in life expectancy caused by ART saturated the labor market. Second, this could indicate that ART may keep people alive, but in a less productive state, therefore reducing the average ability to work at the population level. The full regression results for this model can be seen in Exhibit A12.

Heterogeneity by Baseline HIV Prevalence Regression Specification:

To further isolate for the effect of PEPFAR on employment, we investigate how PEPFAR affected countries with higher baseline HIV prevalence differently than countries with a lower baseline prevalence. We would expect, if the employment changes we observe are driven by PEPFAR, that countries with a higher burden of HIV would benefit more from PEPFAR. To test this hypothesis, we also employ a triple-difference estimation strategy that uses variation in PEPFAR focus versus control countries, timing in PEPFAR initiation, and HIV prevalence before PEPFAR's initiation. That is, we estimate PEPFAR's effect on employment by comparing differences over PEPFAR status (focus versus non-focus), time (pre versus post PEPFAR initiation), and HIV prevalence in 2003 before PEPFAR. If the employment effects we observed above are indeed driven by HIV related interventions, we would expect differentially larger effects in nations with higher baseline HIV prevalence. Therefore the specification includes the triple interaction of PEPFAR status, baseline HIV prevalence, and post-program initiation. Also included in this specification are the two pairs of double interactions vary over time within country, and year and country fixed effects. We therefore estimate the following linear probability model.

(2) $$Y_{ict} = \delta + \sigma PEPFARxPost_{ict} + \pi PEPFARxPostxPrev_{ict} + \theta PrevXPost + \gamma_t \sum_{t=1999}^{2012} Year_t + \beta_c \sum_{c=2}^{21} Country_c + \varepsilon_{ict}$$

where *PEPARxPostxPrev* is the triple difference term of interest, and π is the main estimate of interest. If π is positive it indicates that countries with a higher baseline prevalence experienced a greater employment benefit from PEPFAR. It is important to note that most triple difference models include each component of the triple interaction, as well as each double interaction independently. In our case, we do not include the *PEPFAR* variable, *Prev* variable, or the *PEPFARxPrev* interaction independently because these terms do not vary within country over time, so this variation is captured with country fixed effects. Moreover, we do not include the *Post* variable since the variation in this term is captured with the year fixed effects. The full regression results for this model are presented in Exhibit A5

Cumulative PEPFAR Funding Regression Specification:

In addition to exploring PEPFAR's effects using a binary measure of a nation's PEPFAR designation, we also investigate the association between cumulative PEPFAR funding per capita and employment. Specifically, we use variation in per capita cumulative PEPFAR outlays by focus nation between fiscal years 2004 to 2011 (where 2003 population between ages 15 and 64 is used to calculate per capita values) to identify how PEPFAR spending affects work. To estimate this effect we employ the following specification:

$$(3) \quad Y_{ict} = \delta + \sigma CumFunding_{ct} + \gamma_t \sum_{t=1999}^{2012} Year_t + \beta_c \sum_{c=2}^{21} Country_c + \theta LowGlobalFund_{ct} + \alpha MedGlobalFund_{ct} + \Phi HighGlobalFund_{ct} + \varepsilon_{ict}$$

where $CumFunding_{ct}$ represents cumulative per capita funding by nation and post PEPFAR initiation and is mechanically set to zero pre-PEPFAR. Country-level cumulative per capita funding from 2002 to May 2013 for HIV from the Global Fund for AIDS, Tuberculosis, and Malaria is controlled for by separating nations into funding terciles and adding binary indicators for low, medium, and high per capita Global Fund funding to equation (4) (Duran and Silverman, 2013). Our coefficient of interest σ represents the effect of an additional hundred per capita PEPFAR dollars on employment. All other variables are defined as above. The full regression results for this model are presented in Exhibit A6.

Part 2: Appendix Exhibits

Exhibit A1. DHS Surveys Included

Focus Countries	Pre-Years[1]	Post-Years[2]
Ethiopia	2000	2005, 2011
Mozambique[#]	1997*, 2003	2011
Nigeria[#]	1999, 2003	2008
Uganda[#]	1995*, 2000-01	2006, 2011
Zambia[#]	1996*, 2001-02	2007
Cote d'Ivoire[#]	1994*, 1998	2011
Kenya[#]	1998, 2003	2008-09
Namibia	2000	2006-07
Rwanda	2000	2005,2007, 2010
Tanzania[#]	1996*, 1999	2004-05, 2010

Control Countries	Pre	Post
Benin[#]	1996*, 2001	2006
Burkina Faso[#]	1998, 2003	2010
Cameroon[#]	1991*, 1998	2004, 2011
Gabon	2000	2012
Ghana[#]	1998, 2003	2008
Guinea	1999	2005
Madagascar[#]	1997*, 2003-04	2008-09
Malawi	2000	2004, 2010
Mali[#]	1995-96*, 2001	2006
Niger	1998	2006
Zimbabwe	1999	2005-06, 2010-11

[1]Pre-years indicate years that are pre-2004, the year PEPFAR was implemented

[2] Post-years indicate years that are post-2004, the year PEPFAR was implemented.

[#]Country used in analysis testing parallel trends

*Year used only for parallel trends analysis

Exhibit A2. DHS Surveys Included With HIV Testing Data

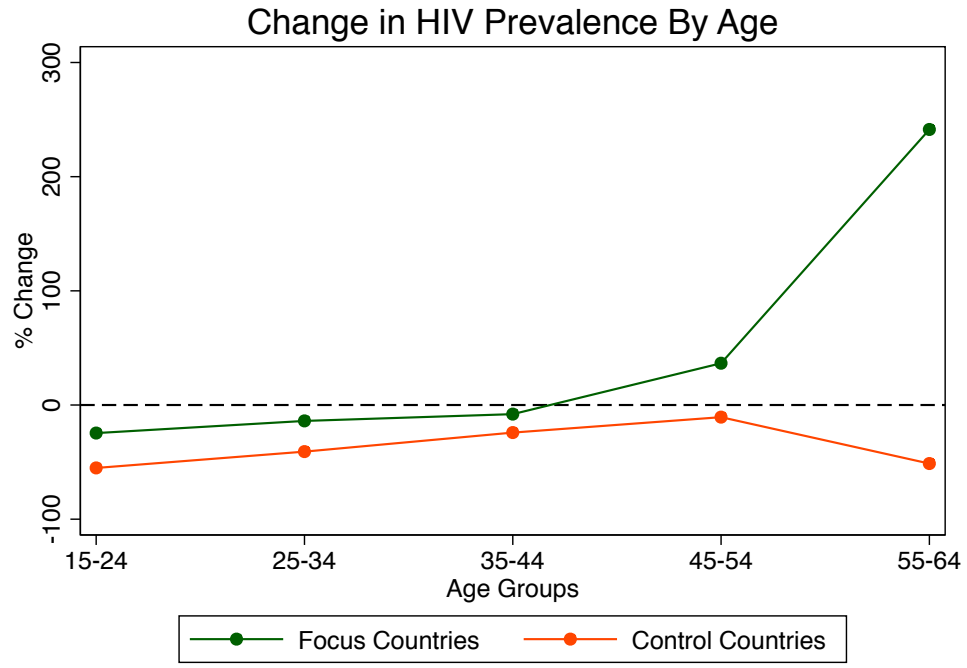
Focus Countries	Pre-Years[1]	Post-Years[2]
Ethiopia	2005	2011
Cote d'Ivoire	2005	2011
Kenya	2003	2008-09
Rwanda	2005	2010
Tanzania	2003	2007, 2011

Control Countries	Pre	Post
Burkina Faso	2003	2010
Cameroon	2004	2011
Malawi	2004	2010
Zimbabwe	2005	2010

[1]Pre-years indicate years that are pre-2004, the year PEPFAR was implemented. To increase sample size, for countries with a survey year in 2004 or 2005 AND in 2010 or 2011, 2004-5 were interpreted as pre-years.

[2] Post-years indicate the second round of surveys after PEPFAR was implemented.

Exhibit A3. Change in HIV Prevalence from Pre-PEPFAR to Post-PEPFAR, By Age



This figure measures the percent change in HIV prevalence from pre-PEPFAR to post-PEPFAR for each 10-year age group. We measure prevalence using DHS data, which includes HIV test results from a subset of households, countries, and years used in our analysis (See Appendix Exhibit A2 for country list). A larger percent increase at older ages for focus countries would suggests that PEPFAR contributed to extended life for HIV positive people. We see no evidence of a larger percent decrease in prevalence at younger ages which suggests that PEPFAR was not associated with reduced HIV incidence. Ages older than 49 only include males. Due to limitations in survey waves, we classify 2004 and 2005 as pre-periods to include more countries in the analysis.

Exhibit A4: The Impact of PEPFAR on Employment in Last 12 Months
(Only countries with two pre-periods where parallel trends are verified)

	Dependent Variable: Worked in Last 12 Months				
	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
	Panel B: Males				
PEPFAR X Post	0.0837**	0.124	0.0459***	0.0119	0.0354**
	(0.0339)	(0.0749)	(0.0148)	(0.0109)	(0.0146)
Observations	134304	49349	36005	26280	17239
	Panel C: Females				
PEPFAR X Post	-0.0336	-0.0411	-0.0357	-0.0298	-0.0223
	(0.0391)	(0.0428)	(0.0377)	(0.0331)	(0.0330)
Observations	338037	135946	105529	69360	25591

Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effect

Weighted By Population

Exhibit A5. Differential Effect of PEPFAR on Employment by Baseline HIV Prevalence (Males Only)

	(1) All	(2) 15-24	(3) 25-34	(4) 35-44	(5) 45-54
PEPFAR X Post	0.0269	-0.0155	0.0437	-0.0269	-0.0393*
	(0.0519)	(0.105)	(0.0298)	(0.0193)	(0.0224)
PEPFAR X Post X 2003 Prevalence	1.244	2.949**	0.184	0.944***	1.555***
	(0.734)	(1.409)	(0.444)	(0.276)	(0.324)
Post X 2003 Prevalence	-0.612	-1.127	-0.300	-0.514***	-0.621***
	(0.530)	(0.944)	(0.257)	(0.178)	(0.174)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	228395	86787	61147	43779	28796
R-squared	0.030	0.074	0.025	0.037	0.044

Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects

Weighted By Population

Exhibit A6. Association between cumulative PEPFAR per capita funding and employment (controlling for per capita HIV funding from the Global Fund for AIDS, Tuberculosis, and Malaria as categorical variables)

	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
			Panel A: Males		
Cumulative					
PEPFAR	0.0914**	0.1867***	0.0248	0.0208	0.0517*
Funding	(0.036)	(0.065)	(0.022)	(0.022)	(0.0003)
Low Global	-0.1095	0.1724	-0.0026	0.0694	0.0517
Fund X Post	(0.081)	(0.140)	(0.043)	(0.044)	(0.066)
Medium Global	-0.0834	0.2283	0.0120	0.0609	0.0398
Fund X Post	(0.095)	(0.133)	(0.053)	(0.052)	(0.074)
High Global	-0.3056*	-0.2526*	-0.0622	-0.0053	-0.0273
Fund X Post	(0.154)	(0.124)	(0.086)	(0.034)	(0.049)
Observations	228395	86787	61147	43779	28796
R-squared	0.849	0.672	0.94	0.978	0.971
			Panel B: Females		
PEPFAR X Post	0.015	0.0057	0.0293	0.0117	0.0274
	(0.042)	(0.047)	(0.035)	(0.037)	(0.032)
Low Global	-0.049	-0.126	-0.118	-0.047	0.0132
Fund X Post	(0.055)	(0.098)	(0.094)	(0.094)	(0.049)
Medium Global	-0.1224*	-0.2093*	-0.2084*	-0.1155	-0.10018
Fund X Post	(0.071)	(0.12)	(0.119)	(0.117)	(0.069)
High Global	-0.161*	-0.197*	-0.186*	-0.078	-0.0265
Fund X Post	(0.082)	(0.102)	(0.093)	(0.094)	(0.094)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	553317	226158	171552	112533	41463
R-squared	0.634	0.494	0.714	0.775	0.789

Standard errors clustered at the country level in parentheses

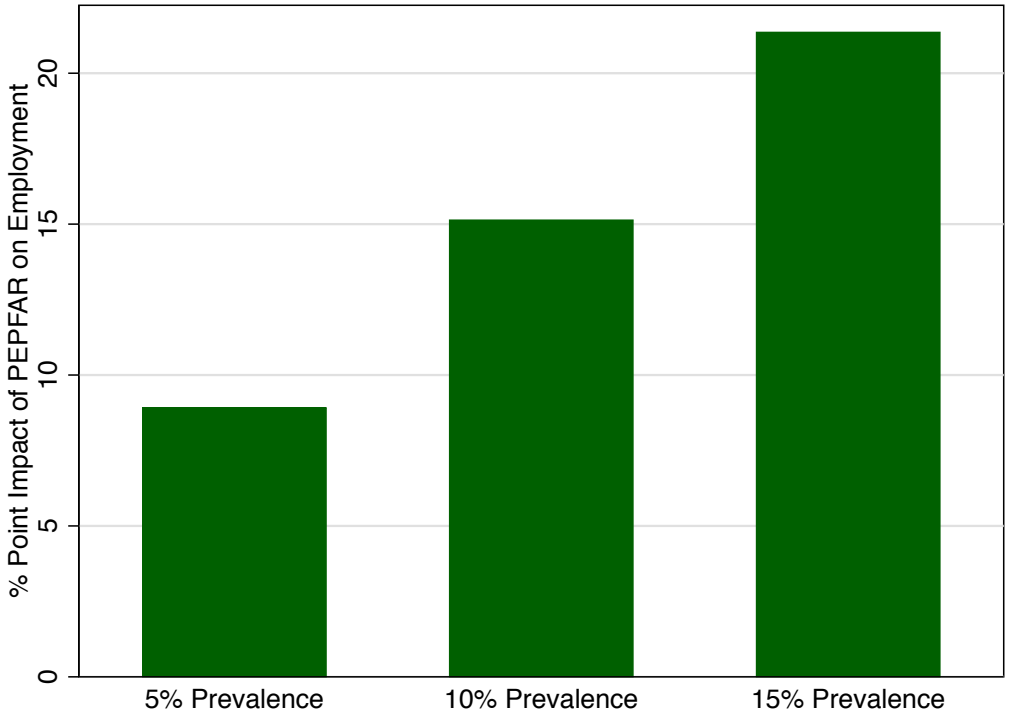
* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects, per capita funding in $100's

Weighted By Population

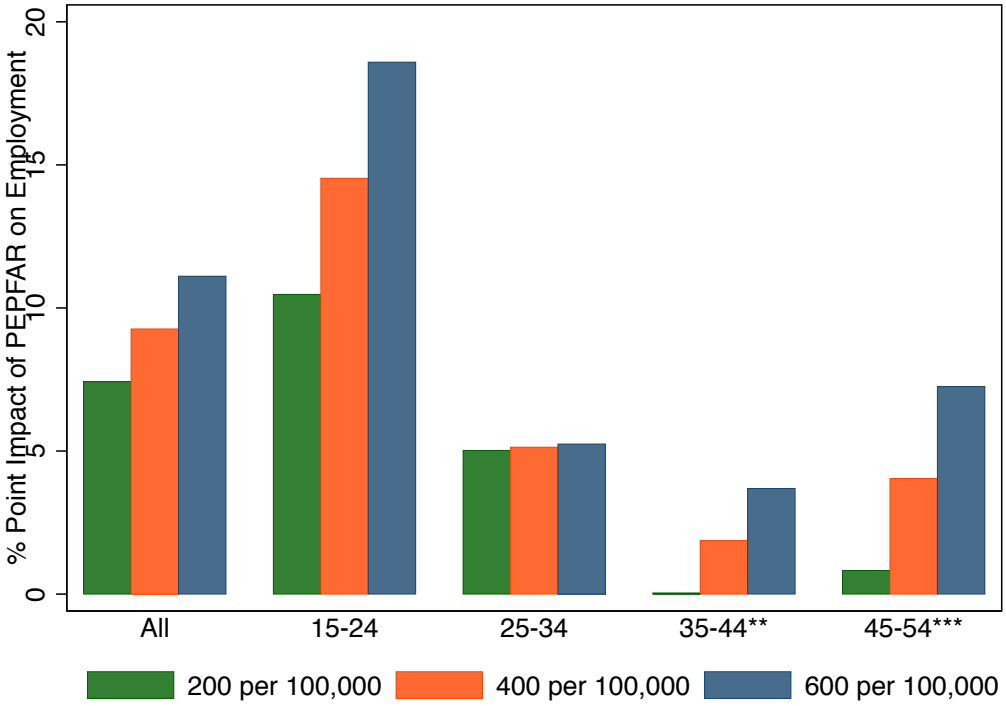
Sources: Cumulative HIV Global Fund funding 2002-2013 data come from Duran and Silverman (2013) and population data from the World Bank.

Exhibit A7: Differential Effect of PEPFAR on Employment by Baseline HIV Prevalence (Males Only)



Notes: Estimates are from recycled predictions based off of regressions from equation 2. Each bar represents the predicted effect of PEPFAR on employment from regression estimates. Low, medium, and high funding represent the 25th, 50th, and 75th percentile of cumulative PEPFAR funding.

Exhibit A8. Differential Effect of PEPFAR on Employment by Baseline HIV Mortality Per 100,000 (Males Only)



Notes: Estimates are from recycled predictions based off of regressions interacting baseline (2003) mortality rate with the main PEPFAR X POST difference-in-difference term. Estimating equation is identical to equation 2 but with mortality rate instead of prevalence. Each bar represents the predicted impact on employment from regression estimates. Regressions were run separately for each age group. 2003 mortality estimates were retrieved from the UNAIDS/AIDSinfo database.
** p<.05, *** p<.01

Exhibit A9: Association between change in male labor force participation by PEPFAR focus nation and cumulative per capita PEPFAR funding

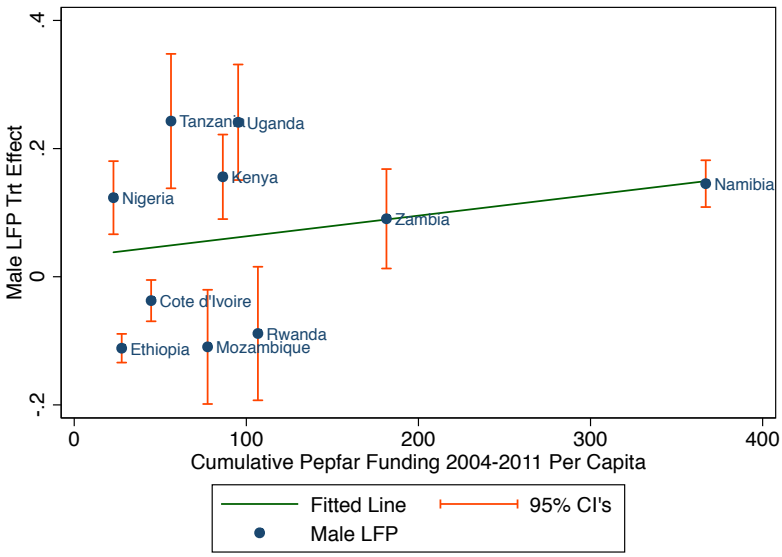


Exhibit A10. Impact Of Removing Each Country Individually On Estimate Of PEPFAR Of Employment In The Last 12 Months (All Ages Combined)

Country Removed	Males	Females
Benin	0.0991***	-0.0590*
Burkina Faso	0.111***	-0.0501
Cameroon	0.114***	-0.0431
Cote d'Ivoire	0.101***	-0.0629*
Ethiopia	0.0913**	-0.0181
Gabon	0.0994***	-0.0557
Ghana	0.0825**	-0.0749**
Guinea	0.104***	-0.0473
Kenya	0.0910**	-0.0487
Madagascar	0.101**	-0.0484
Malawi	0.120***	-0.0317
Mali	0.0896**	-0.0675**
Mozambique	0.0943**	-0.0426
Namibia	0.0986***	-0.0570
Niger	0.0987***	-0.0597*
Nigeria	0.114***	-0.0769**
Rwanda	0.0948**	-0.0604*
Tanzania	0.118***	-0.0519
Uganda	0.0820**	-0.0857**
Zambia	0.0994***	-0.0557
Zimbabwe	0.0782**	-0.0551

Exhibit A11: Change in male employment by country

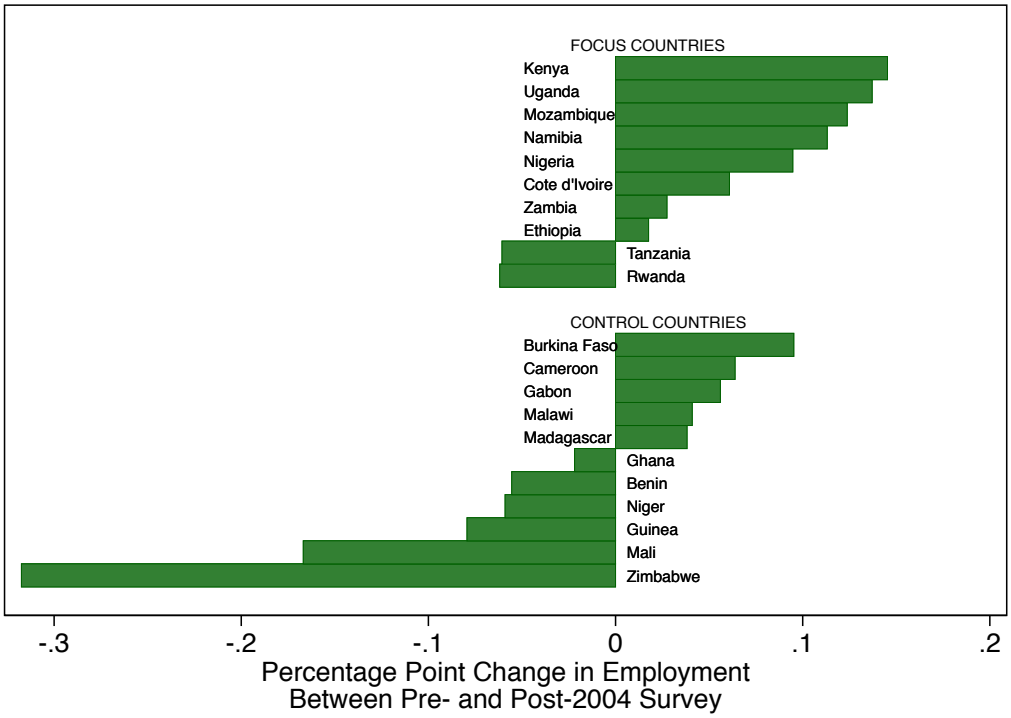


Exhibit A12. The Impact of PEPFAR on Employment Status
(Full regression results from Exhibit 3 in the main paper)

	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
			Panel A: All		
PEPFAR X Post	0.0272	0.0423	-0.00373	-0.00591	0.0233
	(0.0278)	(0.0395)	(0.0227)	(0.0192)	(0.0212)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	781712	312945	232699	156312	70259
R-squared	0.096	0.081	0.128	0.149	0.141
			Panel B: Males		
PEPFAR X Post	0.0994***	0.165**	0.0545***	0.0259*	0.0465***
	(0.0339)	(0.0718)	(0.0148)	(0.0126)	(0.0147)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	228395	86787	61147	43779	28796
R-squared	0.029	0.073	0.025	0.036	0.042
			Panel C: Females		
PEPFAR X Post	-0.0557	-0.0650*	-0.0647*	-0.0579*	-0.0512
	(0.0335)	(0.0345)	(0.0343)	(0.0306)	(0.0332)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	553317	226158	171552	112533	41463
R-squared	0.061	0.060	0.071	0.090	0.102

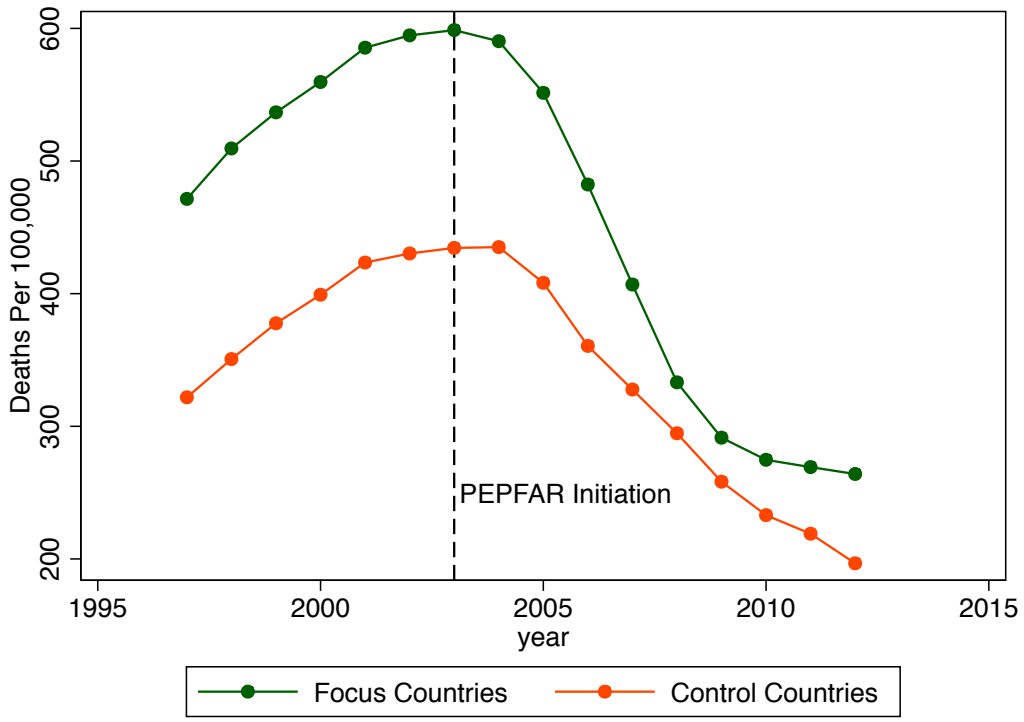
Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects

Weighted By Population

Exhibit A13. Association between PEPFAR Initiation and HIV Related Mortality



Mortality estimates were retrieved from the UNAIDS/AIDSinfo database.

Table A14. The Impact of PEPFAR on Employment Status for Males, By Occupation Type

	(1) All	(2) 15-24	(3) 25-34	(4) 35-44	(5) 45-54
			Manual Labor		
PEPFAR X Post	0.0585	0.0267	0.0681	0.0210	0.114*
	(0.0824)	(0.0835)	(0.0565)	(0.0476)	(0.0557)
Observations	77337	43614	16917	9630	5726
			Agriculture		
PEPFAR X Post	0.151**	0.155*	0.126**	0.0574	0.0880**
	(0.0638)	(0.0826)	(0.0444)	(0.0354)	(0.0385)
Observations	137072	60859	30557	23203	17057
			Domestic Services		
PEPFAR X Post	0.0151	0.00616	0.0370	-0.0345	0.106
	(0.0229)	(0.0122)	(0.0643)	(0.140)	(0.0940)
Observations	42044	32849	4731	2094	1725
			Sales and Professional Services		
PEPFAR X Post	0.145**	0.113*	0.107***	0.0598*	0.121***
	(0.0520)	(0.0555)	(0.0276)	(0.0289)	(0.0391)
Observations	84325	41521	19814	13013	7946

Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects

Weighted By Population

Table A15. The Impact of PEPFAR on Employment Status for Females, By Occupation Type

	(1) All	(2) 15-24	(3) 25-34	(4) 35-44	(5) 45-49
			Manual Labor		
PEPFAR X Post	-0.0670	-0.0678	-0.0858	-0.0886	-0.0506
	(0.0501)	(0.0420)	(0.0526)	(0.0559)	(0.0609)
Observations	231017	123356	60913	33404	11852
			Agriculture		
PEPFAR X Post	-0.0473	-0.0445	-0.0620	-0.0574	-0.0613
	(0.0616)	(0.0552)	(0.0686)	(0.0625)	(0.0612)
Observations	374142	169167	106522	69810	27116
			Domestic Services		
PEPFAR X Post	0.00577	0.00705	0.000674	-0.00681	-0.0123
	(0.0185)	(0.0164)	(0.0260)	(0.0270)	(0.0225)
Observations	197747	112745	48531	25768	9215
			Sales and Professional Services		
PEPFAR X Post	-0.00494	-0.00353	-0.0289	-0.0444	0.00975
	(0.0302)	(0.0230)	(0.0419)	(0.0373)	(0.0354)
Observations	316268	144942	93740	56513	19516

Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects

Weighted By Population

Table A16. The Impact of PEPFAR on Employment Status, By Urban/Rural Residency

Rural					
Male					
	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
Pepfar X Post	0.112***	0.205**	0.0686***	0.0334**	0.0493**
	(0.0353)	(0.0734)	(0.0158)	(0.0147)	(0.0197)
Observations	149225	55438	38919	29268	20047
Female					
Pepfar X Post	-0.0672*	-0.0698*	-0.0792*	-0.0627	-0.0603
	(0.0387)	(0.0385)	(0.0389)	(0.0380)	(0.0398)
Observations	367235	143679	114063	78497	29906
Urban					
Male					
Pepfar X Post	0.0688*	0.0844	0.0257*	0.0104	0.0357***
	(0.0353)	(0.0734)	(0.0134)	(0.00932)	(0.00849)
Observations	79170	31349	22228	14511	8749
Female					
Pepfar X Post	-0.0287	-0.0485*	-0.0265	-0.0338	-0.0216
	(0.0243)	(0.0269)	(0.0206)	(0.0211)	(0.0242)
Observations	186082	82479	57489	34036	11557

Standard errors clustered at the country level in parentheses

* p<.10 ** p<.05 *** p<.01

Includes Country and Year Fixed Effects

Weighted By Population

Exhibit A17. The Impact of PEPFAR on Employment using a Probit Specification (Probit Coefficients)

	Dependent Variable: Worked in Last 12 Months				
	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
	Panel A: Males				
PEPFAR X Post	0.33684**	0.42770**	0.32430**	0.2821*	0.45719***
	(0.1419)	(0.2)	(0.1293)	(0.1698)	(0.1529)
Observations	228395	86787	61147	43779	28796
	Panel B: Females				
PEPFAR X Post	-0.15486	-0.16198*	-0.2124*	-0.23939*	-0.19436
	(0.0993)	(0.0915)	(0.128)	(0.1261)	(0.1372)
Observations	553317	226158	171552	112533	41463

Notes: Standard errors clustered at the country level in parentheses,

* p<.10 ** p<.05 ***p<.01, Includes Country and Year Fixed Effects.
Weighted by population.

Age groups correspond to age at time of the survey

Exhibit A18. The Impact of PEPFAR on Employment using a Probit Specification (Marginal Effects)

	Dependent Variable: Worked in Last 12 Months				
	(1)	(2)	(3)	(4)	(5)
	All	15-24	25-34	35-44	45-54
	Panel A: Males				
Marginal Effects	10.4	16.8	7.7	1.5	2.8
	(.00647)	(.0123)	(.0129)	(.00508)	(.0072)
	Panel B: Females				
Marginal Effects	-6.2	-5.7	-8.2	-8.6	-6.96
	(.0042)	(.0047)	(.0083)	(.011)	(.0164)

Notes: Change in probability of work in the last 12 months is calculated using the CLARIFY software package which simulates parameters from 100 runs of the probit model using Monte Carlo simulation (1). Standard errors in parentheses. Includes Country and Year Fixed Effects. Weighted by population. Age groups correspond to age at time of the survey. To calculate marginal effects in Exhibit we follow Ai and Norton (2003)(2), who explain that the interaction term effect in nonlinear models is equal to the cross derivative of the expectation of the outcome and not the commonly calculated marginal effect of the interaction term. That is, Ai and Norton show that the interaction effect in nonlinear models is conditional on the values of other independent variables, unlike linear models nor does the interaction term's sign necessarily determine the sign of the interaction effect. We employ the CLARIFY software in Stata to correctly estimate the magnitude of the interaction effect with a probit model. This is executed by simulate parameters from each estimation of our main specification with a probit functional form to explore the change in probability of work, while setting country and year to 0 and therefore obtaining the change in probability of work for an individual resident in a PEPFAR focus nation after the program's introduction, while controlling for individual country and year fixed effects.

Part 3. Plausibility of estimated effect on employment

The 13% increase in male employment is rather large considering that the HIV prevalence rate was around 7.8% in focus nations at baseline. However, when we take into account the fact that PEPFAR funding was a stimulus that constituted 6% of the combined GDP of PEPFAR countries used in our analysis, this result is plausible. Below we conduct a series of calculations to show that the expected effect on employment based on estimates from prior research is well within our estimated confidence interval. We first calculate the expected health effects to the HIV positive population as:

$$\Delta Employment_{ART} = \%Benefit * \%HIVpos * \Delta pr(emploment)$$

Where $\Delta Employment_{ART}$ is the expected population level employment change as a result of PEPFAR induced ART initiation, $\%Benefit$ is the share of the HIV positive population that received care through PEPFAR, $\%HIVpos$ is the share of the population in PEPFAR countries that are HIV positive in 2003, and $\Delta pr(emploment)$ is the percent change in the probability of being employed after treatment initiation. To estimate the share of the HIV positive population that benefits from PEPFAR we use data from PEPFAR's website (http://data.pepfar.net/) on how many people received care divided by the number of HIV positive people in 2003 across PEPFAR countries, which are from the World Bank's World Development Indicators Data. We estimate that 40% of the HIV positive population received care through PEPFAR and 7.8% of the population is HIV positive, which means that 3.12% of the total population across all PEPFAR countries received care through PEPFAR. For the change in employment probability after PEPFAR initiation, we use estimates from Thirumurthy et al. (2008)(3), who estimate a 20% increase in employment. This gives a .624% increase in population level employment as a result of PEPFAR's health effects on the HIV positive.

To estimate the stimulus effect on population level employment, we use the following equation:

$$\Delta Employment_{Stimulus} = \%GDP * Multiplier * \ OkunRatio$$

Where $\Delta Employment_{Stimulus}$ is the change in the population level employment due to the PEPFAR stimulus, $\%GDP$ is the share of the combined GDP among PEPFAR countries that is

made up by cumulative PEPFAR funding, $Multiplier$ is the multiplier effect of the stimulus, and $OkunRatio$ is the relationship between the change in GDP and the change in employment identified in Okun's Law. Using data from the Center for Global development and the World Bank Development Indicators, we estimate that PEPFAR constituted roughly 6% of total GDP across the 10 focus countries (See Table A3.1).

Table A3.1. PEPFAR Cumulative Funding as a Percent of 2003 GDP

	Outlays FY 2004-2011 (in 1000s)	GDP 2003	Outlays FY 2004-2011 as % of 2003 GDP
Nigeria	1625354	81267700	2.00
Cote d'Ivoire	414395	15877203	2.61
Namibia	411059	6304585	6.52
Tanzania	1083495	12215276	8.87
Kenya	1583180	16842340	9.40
Ethiopia	1001547	9584181	10.45
Mozambique	807885	5563946	14.52
Uganda	1228358	7935129	15.48
Zambia	1006492	6464303	15.57
Rwanda	507417	2213861	22.92
Total	**9669182**	**162054666**	**5.96**

Source: Author's calculations, The Emergency Plan for AIDS Relief, Summary financial status as of September 30, 2011. http://www.pepfar.gov/documents/organization/184791.pdf and World Bank Development Indicators.

We use a multiplier effect of 1.6 based off of Ilzetzki et al. (2013) and a 1 to 1.75 Okun's Law ratio between employment growth and GDP based off of Ola-David and Oluwatobi (2012,)(4, 5). This means that a 1% increase in GDP results in a .57% increase in employment. This gives an expected stimulus effect of PEPFAR of .06*1.6*.57 = 5.5%. Adding the effect of the stimulus with the effect of ART initiation gives a total expected effect of roughly 6.1%, which is well within our confidence interval (3.7%-22.1%).

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