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

Zachary Wagner[1], **Jeremy Barofsky**[2], and **Neeraj Sood**[2,3,4]

[1]School of Public Health, University of California, Berkeley

[2]Schaeffer Center for Health Policy and Economics, University of Southern California, Los Angeles

[3]School of Pharmaceutical Economics and Policy, University of Southern California, Los Angeles

[4]National Bureau of Economic Research

Abstract

The President's Emergency Plan for AIDS Relief (PEPFAR) has provided billions of US tax dollars to expand HIV treatment in sub-Saharan Africa. This investment has generated significant health gains, but much less is known about PEPFAR's population-level economic effects. We use a difference-in-differences approach to compare employment trends between 10 countries that received a large amount of PEPFAR funding against 11 countries that received little or no funding. We find that PEPFAR was associated with a 13% increase in employment among males (95% CI; 3.7%-22.1%), but observe no change in employment among females. In addition, we show that increasing PEPFAR per capita funding by $100 was associated with a 9.1 percentage point increase in employment among males. This rise in employment generates economic benefits equal to half of PEPFAR's cost. These findings suggest that PEPFAR's economic impact must also be taken into account when making aid allocation decisions.

A. Introduction

As of 2010, HIV/AIDS was the leading cause of death and disability among working-age adults in sub-Saharan Africa (1). Along with these devastating health consequences, the epidemic has had severe economic effects, by some estimates, reducing average growth rates in sub-Saharan Africa by 2-4% (2). To combat this burden, the international community nearly tripled total assistance for health over the 2000s (3), with the largest component coming from the US President's Emergency Plan for AIDS Relief (PEPFAR). PEPFAR was established in 2003 to provide funding for AIDS treatment, care, and prevention for countries devastated by the epidemic. From 2003-2013 Congress authorized $54 billion to fund programs in developing nations, mostly in sub-Saharan Africa (4). The bulk of PEPFAR assistance was aimed at increasing access to antiretroviral therapy (ART) and the program provided treatment to 6.7 million HIV-infected patients by 2013 (5, 6). The expansion of PEPFAR has produced significant health returns in the form of increased life expectancy (7) and decreased mortality (8, 9). However, although potentially important, most evaluations of PEPFAR have failed to measures its economic effect. Consequently, the

economic impact of ART is often overlooked in cost-effectiveness analyses and aid budget decisions.

Understanding the effect of PEPFAR on economic outcomes is important for US policy makers for several reasons. First, after its reauthorization in 2009, the US government required PEPFAR to transition from an emergency response program to “strengthening the capacity of partner countries” and promote sustainable country-level health programs (10). Positive economic impacts of PEPFAR would help in the effort to make countries capable of sustainably financing their own health systems. Second, Africa represents a small, but rapidly growing US export market, with exports to sub-Saharan Africa increasing 250% in the last decade (11), meaning that economic improvements in Africa can benefit the US economy indirectly. Third, amid financial crisis and budget austerity in the U.S., spending on aid for health and HIV treatment has stagnated (12). Given this environment, understanding the magnitude of PEPFAR's impact beyond health benefits is imperative for the efficient allocation of scarce aid resources.

Although PEPFAR constitutes the “largest health initiative ever initiated by one country to address a disease” (13), there are no empirical evaluations of its economic impact at the population level. Prior PEPFAR evaluations have synthesized results from previous micro-level studies (14), investigated PEPFAR's effect on the provision of maternal health services (15), described operational capacity, management, and financing qualitatively (13), or described program financial flows (4). Other economic evaluations of ART investigate effects on HIV patients only using modeled effects (16), or are specific to one nation (17). This study is the first to measure the impact of PEPFAR on employment outcomes throughout sub-Saharan Africa. It is also the first to explore the effect of any ART program on economic outcomes at the population level. We use a difference-in-differences approach to measure changes in employment between 10 countries in sub-Saharan Africa that received a very large amount PEPFAR funding (focus countries) compared to 11 countries in sub-Saharan Africa that received little or no PEPFAR funding (control countries). This empirical strategy is consistent with prior work that found large reductions in mortality as a result of PEPFAR (8, 9). The study results will elucidate the extent to which ART in particular and health aid generally can foster economic improvements within receiving nations.

B. Background on The Impact of HIV Treatment on Population Outcomes

A priori, PEPFAR's effect on population-level economic outcomes is ambiguous. On the one hand, there are several reasons why PEPFAR could improve economic outcomes. First, ART has been shown to create economic benefits for HIV positive individuals and their families through greater labor productivity (7, 18). Second, improved health and productivity for HIV positive individuals could also have spillover effects to HIV-negative individuals through increased consumption, reduced time caring for HIV positive individuals, and delayed household end-of-life expenses. There is also evidence that benefits to HIV positive individuals may get passed on to children in the form of better nutrition and increased schooling, which could improve economic outcomes of future generations (19-23). Third, ART reduces infectiousness of HIV positive individuals, which is likely to

decrease new HIV incidence (24, 25). Fourth, the extension in life expectancy produced by the introduction of ART raises incentives for people to invest in their own human capital and increase savings since they are more likely to live long enough to reap the benefits (26).

However, there are some reasons why ART expansion may negatively impact economic outcomes at the population level. First, although the increase in life expectancy produced by ART (approximately 11 years, (7)) has great value, if these life expectancy gains increase the share of the population living in an unproductive state (i.e. too sick to work), ART may negatively affect per capita economic growth and increase the national dependency ratio. Second, if there is chronic unemployment and jobs are limited, the increase in labor supply produced by longer life expectancy and reduced morbidity could raise unemployment and drive down wages (27, 28).

C. Study Data and Methods

1. Data and Sample

Initially, 15 countries were selected as PEFAR “focus countries”, which have received the vast majority of PEPFAR funding (4). Although criteria for “focus country” selection were loosely based on HIV prevalence, government capacity, country income, and willingness to partner with the US, these criteria only partially explain country selection. For example, some countries with relatively low prevalence were selected (e.g. Ethiopia at 2%), whereas others with very high prevalence, democratic governance, and low income were not (e.g. Malawi at 15%). This highlights that although country selection was not random, the process was not necessarily associated with differential trends in health and employment outcomes, an important assumption of our analysis.

For this analysis, all countries in sub-Saharan Africa with a Demographic and Health Survey (DHS) wave prior to 2004 (pre) *and* in 2004 or later (post) are included. This included 21 countries in total, 10 PEPFAR focus countries and 11 control countries, consisting of over 750,000 respondents comprised of men aged 15-54 and women aged 15-49 (Appendix Exhibit A1). This excludes five PEPFAR focus countries, two of which are in sub-Saharan Africa (Botswana, South Africa, Guyana, Vietnam, and Haiti). DHS surveys are nationally representative household surveys conducted roughly every five years across over 70 low- and middle-income countries (29). For the main analysis, years 1998-2012 are included. In addition, we utilize the World Bank's World Development Indicators to understand baseline differences in national characteristics not measured in the DHS that may affect employment trends between focus and non-focus countries (26). We also estimate the effect of receiving more PEPFAR funding using data compiled by the Center for Global Development (4).

2. Outcome Measures

The main outcome variable used in this analysis is generated from a DHS question asking respondents if they “had done any work (aside from household work) in the past 12 months”. This does not include non-market labor such as domestic duties. We created a binary variable set to one if respondents answered yes to this question and to zero if they answered no.

3. Statistical Methods

3.1 Change in Employment—We employ a difference-in-differences model to compare the differential change in employment between PEPFAR focus and control countries before and after the introduction of the program. We control for time and country-level fixed effects and weight our regressions by each nation's contribution to the population of sub-Saharan Africa represented in our sample of 21 focus and non-focus nations. This estimation strategy is identical to that implemented in Bendavid, et al. (2012)'s analysis of PEPFAR's effect on adult all-cause mortality (9). We estimate a linear probability model to identify the differential impact of PEPFAR on employment between focus and control countries. We run each analysis separately for males and females since the two genders have different employment and HIV transmission characteristics, and thus may be affected by PEPFAR differently. Standard errors are clustered at the country level in all analyses.

The fundamental assumption underlying this method is that control countries exhibited the same employment trends that focus nations would have experienced absent program implementation. Although this assumption cannot be formally tested, analysis of employment trends prior to 2004 helps shed light on how focus and control country trends compare. We investigate pre-PEPFAR employment between focus and control countries using all countries in the sample that had at least 2 survey waves prior to 2004, which included 7 focus countries and 6 control countries (indicated with “#” in Appendix Exhibit 1).

3.2 Baseline HIV Burden and Cumulative PEPFAR Funding—To further isolate the effect of PEPFAR on employment, we investigate how PEPFAR affected countries with higher baseline HIV burden and higher levels of funding differently. In a dose-response relationship, we expect that, if the employment changes we observe are driven by PEPFAR, countries with a higher HIV disease burden at baseline would benefit more from its introduction. Similarly, countries that receive more per capita funding should have larger employment gains (See Appendix for analytical details). A finding that countries with higher prevalence and higher funding experienced greater employment increases would add confidence that PEPFAR, and not some unobservable confounder, was likely to be causally linked to employment changes.

4. Limitations

This work is limited in a number of ways. First, it is possible that PEPFAR selection criteria were correlated with employment outcomes in some unobserved time-variant way. Although employment trends were similar prior to PEPFAR, we further isolate the PEFPAR effect by assessing whether countries with higher baseline HIV prevalence benefited more from PEPFAR funding. Second, the measure used for employment does not capture key employment characteristics such as hours worked and wages, which would add additional richness to the analysis, but is not available in the DHS data. Third, HIV testing data is only available for a subset of respondents in a subset of countries and years. Therefore we cannot estimate changes in prevalence for the full set of countries, nor can we use these data to estimate heterogeneity by HIV status.

D. Study Results

1. Descriptive Statistics

Exhibit 1 presents unadjusted mean characteristics of countries by PEPFAR status prior to PEPFAR implementation (i.e. pre-2004). Employment characteristics are from the same DHS sample included in this analysis and all other 2003 country level characteristics are from the World Bank's World Development Indicators. Sampled households in PEPFAR countries had a lower employment rate in the prior 12 months for both males and females and a lower rate of employment for the youngest age cohort, 15-24. PEPFAR countries also tended to be larger, poorer, and to have a slightly lower life expectancy in 2003. PEPFAR countries also had slightly higher baseline HIV prevalence.

2. Mortality

We confirm results by Bendavid and Bhattacharya (2009) and show that there was a decrease in HIV related mortality among focus countries used in our analysis relative to control countries after PEPFAR implementation (Appendix, Exhibit A13) (30).

3. Employment

Exhibit 2 shows employment trends by focus and control countries and before and after the initiation of PEPFAR. First, we observe that pre-PEPFAR employment trends were similar for both males and females between focus and control countries that had at least two pre-2004 survey waves. This adds confidence to the validity of the parallel trends assumption inherent to our difference-in-differences model. In addition, this exhibit illustrates that employment trends among males in focus nations, while similar to control nations before PEPFAR, exhibit a substantial increase after program initiation compared to control countries. For females, no such increase is observed and indeed, if anything, we observe a slight decline in female employment among focus countries compared to control countries.

Exhibit 3 presents our main regression results. Panel A shows results for males and Panel B for females. The effect of PEPFAR on the probability of employment in the last 12 months represents the change in the employment rate after PEPFAR initiation for PEPFAR countries relative to control countries (i.e. the difference-in-differences coefficient) and is presented for all ages and by 10-year age groups. Reflecting exhibit 2, panel A indicates that PEPFAR focus nations experienced a differential increase in employment among males equal to 9.9 percentage points (13%; 95% CI 3.7%-22.1%). Younger males exhibit the biggest employment gains, with the employment rate for 15-24 year-olds in focus countries increasing by 16.5 percentage points compared to control countries. The oldest age group (45-54) exhibited employment gains of 4.65 percentage points. For females, panel B indicates no statistically significant change in employment following PEPFAR initiation when all ages are combined. However, we observe negative point estimates and significance at the 10% level for the youngest three age cohorts, suggesting female employment reductions coinciding with PEPFAR initiation for these age groups. The coefficient for all female age groups combined constitutes a 5.6 percentage point decline in employment, which is relatively stable by age group. With both males and females combined, we find the

effect to be an insignificant 2.7 percentage point increase (Appendix, Exhibit A12) (30). Results were nearly identical when we estimate the marginal effects from a probit model (Appendix, A17 and A18) (30).

We also looked at results separately for rural/urban residency and occupation type (manual labor, agriculture, domestic services, and sales/professional services) (Appendix, Exhibits A14-A16) (30). In rural areas the effect for males was about 40% larger and for females it was more negative. For males, most of the benefit in employment is coming from the agriculture and sales/professional services sectors. For females, there is no effect for any of the occupation types.

4. Heterogeneity by Baseline HIV Prevalence and Cumulative PEPFAR Funding

We estimate that the PEPFAR effect is stronger at higher levels of baseline HIV prevalence, although this result does not quite reach statistical significance ($p=0.106$). However, results are statistically significant when run separately for three of the four age groups: 15-24, 35-44, and 45-54 (Appendix, Exhibit A5 and A7) (30). We find similar results when we run the same analysis using 2003 HIV related mortality instead of prevalence to measure disease burden (Appendix, A8) (30). We also find that higher levels of PEPFAR cumulative per capita funding were associated with greater employment gains (Appendix, Exhibit A6 and A7) (30). Specifically, for each US$100 per capita increase in PEPFAR cumulative funding between 2004 and 2010, employment among males increased by 9.1 percentage points ($p<.05$; Appendix, Exhibit A6) (30). Overall, these results help to validate our main results in Exhibit 3.

5. Sensitivity Analysis

We conduct a series of sensitivity analyses to test the robustness of our results. First, since we could only test the parallel trends assumption for 13 of our 21 countries we conduct the same analysis from Exhibit 3 restricting to only these 13 countries (Appendix, Exhibit A4) (30). We find that point estimates are nearly identical to Exhibit 3.

Next, we test the sensitivity of our results to exclusion of each country individually. If exclusion of one country dramatically changes our estimate, this country may be an outlier. To do this, we exclude each country individually and re-run our main analysis from Exhibit 3. We find that exclusion of any one country did not dramatically change our results (Appendix, Exhibit A10) (30).

Finally, we assess the change in male employment from pre-to post-PEPFAR initiation for each country separately (Appendix, Exhibit A11) (30). We find that 8 of the 10 focus countries experienced an increase in male employment, with 5 of these countries showing increases of over 9 percentage points. Only 5 of 11 control countries experienced an increase in male employment with only one reaching 9 percentage points. This indicates that the increase in male employment following PEPFAR implementation is consistent across countries.

E. Discussion

This study is the first to explore the impact of PEPFAR on employment outcomes in sub-Saharan Africa. We show that employment among males increased by 9.9 percentage points (13%) with much of this effect occurring among 15-24 year olds. However, female employment does not increase and, if anything, we find imprecisely estimated evidence that PEPFAR was associated with a decline in female employment. We also show that PEPFAR was associated with a larger increase in male employment in countries with a higher pre-PEPFAR HIV burden and that greater per capita PEPFAR funding coincided with larger increases in male employment. Both of these findings provide confidence that our estimated effect is due to PEPFAR and not some unobservable confounder.

Three results from our analysis merit further discussion. First, an increase in male employment coinciding with a decrease in female employment could be indicative of intra-household substitution of labor in households affected by HIV. In other words, females might enter the labor force when male household members contract HIV and become too sick to work. Then, as HIV positive males initiate treatment as a result of PEPFAR, females – a group with generally lower returns to market labor – are able to cease employment. It is also important to note that non-market employment (i.e. household duties and subsistence agriculture activities) is omitted, which could also explain the lack of effect for females. PEPFAR may have coincided with more domestic female productivity, which is not captured in this analysis.

Next, our finding that younger males exhibited the largest employment gains could be explained by several factors. First, younger males exhibit substantially lower baseline employment rates (around 50% compared to almost 90% among all other age groups), which implies that older males are constrained with close to universal male employment. Second, the economic effects of PEPFAR come not only from gains in health, but also from a large economic stimulus created by injecting billions of dollars into these low-income nations. PEPFAR outlays from 2004-2011 constitute roughly 6% of total GDP across the 10 focus countries (See Appendix, A3.1 for country breakdown) (30). Although roughly one third of PEPFAR spending goes toward drug procurement, much of the rest is used to pay for health system support and labor to provide HIV care (6). For example, PEPFAR explicitly intends to train and employ 140,000 new health care workers (31). Therefore, PEPFAR also constitutes an investment that provides jobs for low- and medium-skilled workers and generates economic stimulus benefits through health-system expansion. This stimulus may disproportionately increase employment for younger males who have more room for employment growth. Third, ART reduces morbidity most for those with advanced disease. This is likely to increase employment among older populations the most since they are more likely to be in an advanced disease state. However, the expansion of PEPFAR also prevents mortality, which could result in keeping older HIV positive people alive longer but in an unproductive state since health improvements after ART are neither complete nor immediate. Previous research indicates that employment recovery after ART initiation requires four years to reach 90% of the previous level (32). Slow employment response and a longer duration in an unproductive state among the older treated population may counteract PEPFAR's morbidity benefits and attenuate the employment benefits observed

among older cohorts. This is less likely in younger cohorts since they are less likely to be in an advanced disease state.

Third, our finding of a 13% increase male employment is rather large considering that the HIV prevalence rate was only around 7.8% in PEPFAR 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, this result is plausible (See Appendix, Part 3 for full description) (30). Using data on the share of the population that benefited from PEPFAR and the expected increase in employment after ART initiation (18), we can estimate the expected health effects of PEPFAR (.6% increase). Then, we estimate the stimulus effect by assuming a multiplier effect of 1.6 (33) and a 1 to 1.75 relationship between employment growth and GDP (34), which gives a 5.5% increase employment as a result of the stimulus. Combining these two estimates gives an expected increase of 6.1%, which is well within our confidence interval (95% CI; 3.7%-22.1%). However, this suggests our main estimate may be more of an upper bound.

This paper provides two main contributions to the literature. First, to our knowledge only one other paper, using data from South Africa (unpublished), explores the economic effect of ART's expansion at the population level (17). Consistent with our analysis, the author finds a population-level increase in male employment after a clinic opens between 3 and 15 miles away from a respondent, but no change in employment for females. However, this paper estimated an increase in male employment of 3.3 percentage points, a substantially smaller effect than our estimate. This discrepancy in effect size may exist since our analysis covers a larger geographic area and is over a longer time horizon, which allows more time for employment to rebound among ART initiators and PEPFAR's stimulus to improve the economy overall (32). However, it is also possible that the effect of PEPFAR on employment in South Africa was simply smaller, and exclusion of South Africa in our analysis may have resulted in an overestimate of the general effect. Second, contrary to other papers which suggest that increases in life expectancy result in no effect or decreased per-capita productivity (27, 28), we show that even though PEPFAR produces significant life expectancy gains, extending life was also associated with substantial economic benefits.

F. Policy Implications

This study has important implications for global health policy. First, in addition to its sizable health benefits, our results show that PEPFAR's population-level economic impact must be taken into account when making resource allocation decisions on foreign aid. Combining our estimated increase in male employment (9.9 percentage points) with the male share of the population in each country, and assuming the average wage is equivalent to per capita GDP, we estimate that PEPFAR's economic benefits constitute 52% [15%, 89%] of its costs. This analysis excludes benefits in the form of orphan care costs averted and delayed end of life care, but adding these would only increase PEPFAR's measured benefits. Focusing exclusively on program health benefits without quantifying economic impact means underestimating PEPFAR's effects. Given the ongoing debate on how scarce public health funding should be spent post-2015, better understanding of the magnitude of these ancillary benefits will help guide policymakers toward the most efficient use of resources. Second,

after its reauthorization in 2009, the US government required PEPFAR to transition from an emergency response to a program that strengthens partner-country health system capacity (10). Our results suggest that the expansion in employment coinciding with PEPFAR implementation could help countries sustainably finance their own health systems and reduce the need for future aid. However, given the magnitude of the HIV burden and the measured benefits from treatment, any reduction in aid now will serve to rollback the human capital investments that PEPFAR currently allows. Third, health aid to Africa is often thought of as a humanitarian effort with little additional benefit to the donor countries. This work shows that not only does aid provide much needed relief to recipient countries, but it can also help stimulate employment growth.

PEPFAR constitutes one of the largest and most important humanitarian projects ever undertaken by the US government. Even though it was designed to provide emergency relief from the AIDS epidemic, we find that PEPFAR also represents an investment in human capacity with substantial economic dividends. This analysis characterizes the magnitude of these dividends in one domain and over a relatively short timespan. If the international community retains its commitment to expand access to antiretroviral therapy, future research will be able to more fully identify the complementary relationship between health improvement and poverty reduction.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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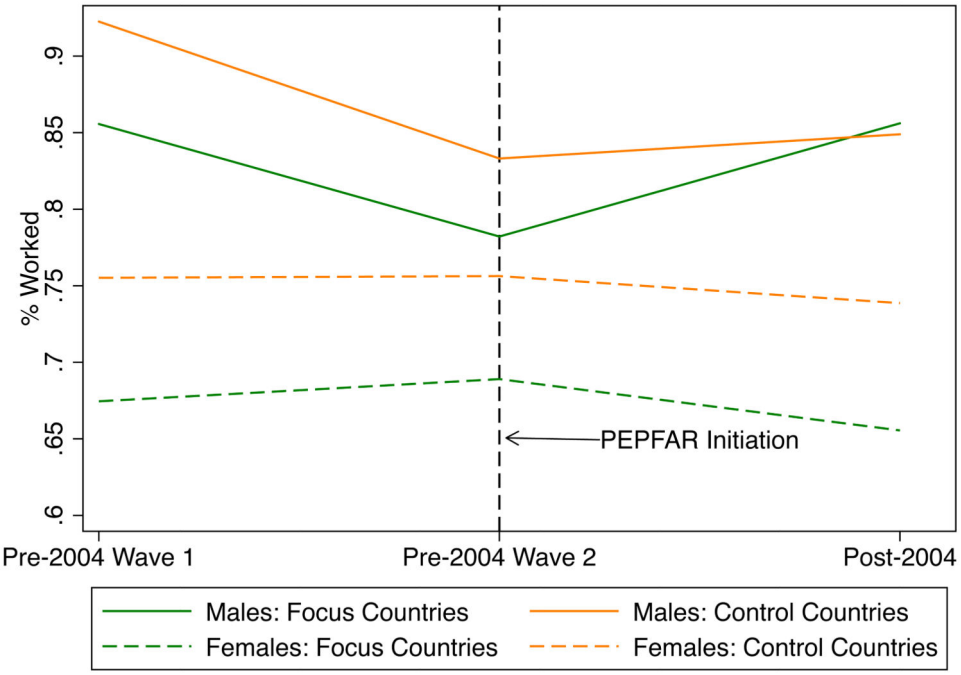

Exhibit 2. Employment Trends over Time

Source: Authors' Analysis

Notes: Pre Periods include the two most recent Demographic and Health Survey years prior to 2004. All countries that had two Demographic and Health Surveys are included. PEPFAR Focus Countries include Mozambique, Nigeria, Uganda, Zambia, Cote d'Ivoire, Kenya, and Tanzania. Control countries include Benin, Burkina Faso, Cameroon, Ghana Madagascar, and Mali.

Exhibit 1
Summary Statistics By PEPFAR Status

Source: Authors' Analysis

DHS Data (Pre-2004)		
	Control Countries	PEPFAR Countries
Employment Rate (15-64)	73.8%	65.7%
Employment Rate (15-24)	58.9%	50.1%
Employment Rate (Male)	85.5%	77.0%
Employment Rate (Female)	69.5%	62.2%
World Bank Development Indicators (2003)		
	Control Countries	PEPFAR Countries
HIV Prevalence	5.2%	7.8%
GDP (Millions)	6090	16400
Population (Thousands)	12200	36100
GDP Per Capita	963.13	710.87
Life Expectancy	52.94	50.32

Notes: DHS=Demographic and Health Survey

Exhibit 3

The Impact of PEPFAR on Employment

Source: Authors' Analysis

	Age Groups				
	(1) All	**(2) 15-24**	**(3) 25-34**	**(4) 35-44**	**(5) 45-54**
	Panel A: Males				
Effect of PEPFAR on Probability of Employment in Last 12 Months	0.0994***	0.165**	0.0545***	0.0259*	0.0465***
Observations	228395	86787	61147	43779	28796
	Panel B: Females				
Effect of PEPFAR on Probability of Employment in Last 12 Months	-0.0557	-0.0650*	-0.0647*	-0.0579*	-0.0512
Observations	553317	226158	171552	112533	41463

Notes: Each column in each panel represents a separate regression for different age groups. “The Effect of PEPFAR on Probability of Employment in Last 12 Months” represents the difference-in-differences coefficient (PEPFAR X POST) in the regression model (See Appendix for details). This is the difference in changes in employment from Pre-2004 to Post-2004 between PEPFAR and Control countries. Standard errors were clustered at the country level. All models include country and year fixed-effects and are weighted by country population.

* p<.10

** p<.05

*** p<.01