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Causal effects of HIV on employment status in low-income settings

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ABSTRACT

This paper estimates the causal impact of being HIV positive on individual employment status using a recursive bivariate probit with male circumcision as the instrument to overcome the endogeneity arising from simultaneity bias. The results show that being HIV positive reduces the probability of being employed by 5 percentage points among males in Uganda. The effect is greater for individuals employed in manual labor than non-manual labor. When limiting the sample to mainly individuals employed in subsistence agriculture, we find a 4 percentage point reduction in the likelihood of employment, suggesting that the effect occurs primarily through reductions in labor supply as opposed to demand. This is supported by additional analysis using univariate probit regressions to assess the association between different levels of HIV illness (as measured by CD4 cell count) and the likelihood of employment. The magnitude of the association increases as CD4 cell count decreases. Having a CD4 cell count of 200 per mm^3 or below is associated with a 9 percentage point reduction in employment compared to individuals with CD4 cell counts above 200 per mm^3.

1. Introduction

HIV/AIDS is a leading cause morbidity and mortality in sub-Saharan Africa, where 25 million people are living with the disease. Antiretroviral therapy (ART) has been shown to reduce mortality among those infected, and global health policies such as the UNAIDS "3 by 5" campaign (to provide ART to 3 million people living with HIV/AIDS in low- and middle-income countries, LMICs, by 2005) have promoted the provision of ART.[1] As a result of action around initiatives like this, AIDS related deaths fell by 39% in sub-Saharan Africa between 2005 and 2013 (UNAIDS, 2014). In 2015, the World Health Organization (WHO) adopted a "treat all" approach, recommending that countries treat all HIV-infected individuals with ART as soon after diagnosis as possible. Despite this, the proportion of people living with HIV in Sub-Saharan Africa on ART remains approximately 50% (World Bank, 2017a).

In addition to the reduction in mortality that results from increases in ART uptake, there are also improved employment outcomes in terms of labor market participation and productivity (Larson et al., 2008; Thirumurthy et al., 2008, 2011; Habyarimana et al., 2010; Rosen et al., 2010). However, due to the cost of ART, low budgets for health care and human resources constraints, the scale up of ART coverage remains slow (Kinsman, 2010). Decisions around how to allocate health system resources, e.g., to ART scale up or to other interventions for HIV/AIDS (e.g., prevention or cure, should one become available) or other illnesses are generally made on the basis of costs and health effects, but health is not the only thing that is socially valuable. Recognising that decision makers are often interested in a broader range of outcomes, the Second Panel on Cost-Effectiveness in Health and Medicine has recommended quantifying the impact across different sectors including the labor market (Sanders et al., 2016). It is therefore important to understand the causal effect of HIV on employment.

Estimating a casual effect of HIV/AIDS on employment is challenging, and requires careful consideration of three interrelated issues. The first concern is justification bias where respondents seek to justify their reduced labor supply via ill health or because government or insurance programs involve financial incentives to report being unhealthy (Currie and Madrian, 1999; Bazzoli, 1985). The second is simultaneity bias, which arises when the outcome and treatment variable of interest affect the other concurrently. The third concern is omitted variable bias, where health and employment are jointly determined by an unobserved variable (Lindeboom, 2006). Consequently health status should be treated as an endogenous variable in labor supply equations.

The sectoral pattern of employment growth and productivity growth have been shown to be important for poverty reduction

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[1] ART has also been shown to lead to greater private preventative behavior in Zambia (Wilson, 2016).

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(Gutierrez et al., 2007), and we explore this by evaluating the effect of HIV on employment among manual versus non-manual laborers. As the labor demand side should not be a factor for those who practice subsistence agriculture, we estimate the effect on that subsample in an effort to identify the labor supply side impact. Another issue concerns the disease pathway, in particular, whether the severity of disease has an impact on employment. If the effect occurs largely on the supply side, we would expect the effect size to be greater as disease becomes more severe. Information on this is important for the optimal prioritization of HIV policy and care, and can possibly be captured through analysis of different observed levels of CD4 count. CD4 cell count is affected by both duration of HIV-infection and treatment with ART (Mermin et al., 2004; Girardi et al., 2001; Samet et al., 2001). CD4 cells are white blood cells that play an important role in fighting infections. HIV-negative individuals typically have CD4 cell counts of above 500 cells/mm3 (Hughson, 2017). HIV uses CD4 cells to replicate, resulting in the destruction of these cells over time following infection. In the absence of ART, CD4 cell count declines over time as the virus replicates subsequently leading to AIDS over the course of 6–10 years. As the illness progresses flu-like symptoms may be present, as well as diarrhea, fatigue and balance issues among others that may affect an individual's ability to maintain employment.

The effect that HIV has on individual employment, as well as the labor market more broadly, has been the subject of previous investigation in both low- and middle-income countries. At the microeconomic level, Fox et al. (2004) assess the productivity of HIV-positive workers on a tea estate in Kenya using a retrospective cohort study design. McKelvey (2010) uses cross-sectional household data from 13 other countries in Sub-Saharan Africa to analyse the effect of circumcision on HIV status and HIV status on employment status. Levinsohn et al. (2013) use a propensity score matching approach to examine the impact of HIV/AIDS on employment in South Africa, a middle-income country. At the macroeconomic level, male circumcision has been used as an instrument to evaluate the impact of HIV/AIDS on economic growth and savings in African nations (Ahuja et al., 2009), the skill premium in Sub-Saharan Africa (Marinescu, 2014) and the impact of self-reported HIV status on employment status across countries (McKelvey, 2010). Few studies explore the pathway through which this effect occurs. Thirumurthy et al. (2013) analyse the impact of severity of disease using data from Kakyerere parish in Mbarara District, Uganda, and find that higher CD4 count is associated with more days worked over the course of a past month. We build upon this by using national data.

This paper estimates a causal effect of HIV status on employment, which is achieved by using an instrumental variable in a recursive bivariate probit model using recent, publically available household survey data from Uganda. We use data from the 2011 Uganda AIDS Indicator Survey, the only Demographic and Health Survey to collect CD4 cell count in addition to biometric HIV status. The instrument, male circumcision has been shown in the medical literature to substantially decrease the probability of HIV infection. In 2007, clinical evidence from three major trials undertaken in South Africa, Kenya and Uganda showed the efficacy of male circumcision in protecting against HIV infection to be a risk reduction of 60% (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007). The IV strategy overcomes simultaneity bias arising from the effect that employment status has on the likelihood of becoming HIV infected, and, unlike the control function and propensity score matching approach applied by Levinsohn et al. (2013), this approach does not rely on selection on observables (Jones, 2017). Unlike McKelvey (2010), who considers 13 countries, we focus on Uganda, using data from the 2011 Uganda AIDS Indicator Survey (UAIS). The pathway through which HIV might affect employment is explored by assessing the association between different levels of HIV illness (as measured by CD4 cell count) and employment outcomes. We further address the question of whether the effect occurs on the supply or demand side by evaluating the effect by employment sector and for agricultural manual laborers only.

Over 90%, the majority of Uganda's labor force is informally employed and more than half of individuals are self-employed. Most (66% of males and 77% of females) work in agriculture, forestry and fishing, almost a quarter (24% of males and 19% of females) are employed in service, and the remainder are employed in manufacturing (Uganda Bureau of Statistics, 2013). Uganda is broadly representative of low-income countries in the region, with a labor force participation rate of 78% (compared to the region average of 76%) and an ART coverage rate of 57% (compared to the region average of 51%) (World Bank, 2017a). The prevalence of HIV within low-income countries in Sub-Saharan Africa ranges from less than 1% in Madagascar to 15% in Zimbabwe, and is 7% in Uganda (World Bank, 2017b). The Ugandan government has made employment a central focus in its plans to continue to grow the economy, and as agriculture is the primary employment sector, the government has committed to improving productivity in that sector (Safavian et al., 2017). An estimate of the effect of HIV on employment can help guide policy makers making decisions around where to target resources to achieve this aim.

2. Data and sample

2.1. Data

The data used for empirical analysis were collected in 2011 in Uganda via the 2011 UAIS, a nationally representative dataset that contains biometric HIV data in addition to information on employment status. Interviews and HIV tests were conducted by trained interviewers among all men and women aged 15–59 in each of 11,750 randomly selected households.

The binary outcome variable employment status is 'currently employed.' 'Currently employed' is defined as having done work in the past seven days and includes individuals who are regularly employed and were absent from work for leave, illness, vacation, or any other such reason in the past seven days.[2] This matches the International Labor Organization's definition of employment, which includes all individuals in a specified age group who were engaged either in paid employment or self-employment over the period of a week (or day, whichever is specified) (World Bank, 2015). Individuals who respond that they have not been in employment over the last week may therefore be unemployed or have withdrawn from the labor market.

The treatment variable is HIV status. Data on this was collected biometrically via a rapid test during the survey, and the results were later confirmed in laboratory. The HIV test uptake rate was 96% (1% of interviewed respondents refused the HIV test and 3% were not interviewed). CD4 cell count tests were done in the central laboratory for individuals who tested HIV-positive.[3] Population based surveys are considered the gold standard for

[2] This variable is a combination of two responses from the survey: "Have you done any work in the last seven days?" and "Although you did not work in the last seven days, do you have any job or business from which you were absent for leave, illness, vacation or any other such reason?" Individuals were coded as 1 they answered "yes" to either of the questions and 0 otherwise.

[3] CD4 results are available for 81% of males in the sample. The shortfall is largely made up of individuals who tested HIV-negative on the home-based rapid test and HIV-positive in the central laboratory, although some may be due to logistical problems such as samples reaching the central laboratory too late to be tested for CD4 (Uganda Ministry of Health, 2012).