



# HIV, wages, and the skill premium<sup>☆</sup>



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## ABSTRACT

The HIV epidemic has dramatically decreased labor supply among prime-age adults in Sub-Saharan Africa. Using within-country variation in regional HIV prevalence and a synthetic panel, I find that HIV significantly increases the capital–labor ratio in urban manufacturing firms. The impact of HIV on average wages is positive but imprecisely estimated. In contrast, HIV has a large positive impact on the skill premium. The impact of HIV on the wages of low skilled workers is insignificantly different from 0, and is strongly dampened by competition from rural migrants. The HIV epidemic disproportionately increases the incomes of high-skilled survivors, thus increasing inequality.

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## 1. Introduction

The HIV/AIDS epidemic represents one of the greatest public health crises of the past several decades. Since HIV was recognized by the Centers for Disease Control and Prevention in 1981, prevalence has risen worldwide, but particularly in Sub-Saharan Africa, which accounts for about two-thirds of current HIV infections (UNAIDS, 2008). Across Sub-Saharan Africa, HIV prevalence among adults aged 15–49 is estimated to be 5.0% (UNAIDS, 2008). In 2007, 22 million people in Sub-Saharan Africa were infected with HIV, and about 1.5 million died from AIDS (UNAIDS, 2008). The

burden of disease is particularly large in southern Africa, where, in some areas, more than half of adults are infected.<sup>1</sup>

Because the bulk of HIV infections are sexually transmitted, HIV disproportionately affects prime-age adults. In particular, in most countries, HIV prevalence is highest among women in their 30s and men in their 30s and early 40s (Mishra et al., 2009). In the absence of treatment, HIV-infected patients are expected to live about 10 years from the time of infection. For much of that period, they remain asymptomatic; however, patients eventually become very sick with AIDS before death, usually for about one year.

Together, the HIV rates and the age profile of infection imply large increases in both morbidity and mortality among prime-age adults in Sub-Saharan Africa, and particularly in southern Africa. AIDS – by changing population composition, risks, and decision-making – has potential spillovers on other sectors, including education and fertility (e.g., Fortson, 2009, 2011; Juhn et al., 2008). The economic effects of the epidemic are potentially staggering, and economists have devoted considerable effort to estimating and forecasting the economic effects of HIV/AIDS. Motivated by evidence from the Black Death which found that the disease raised

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<sup>1</sup> Prevalence is particularly high in Botswana (23.9%), Lesotho (23.2%), South Africa (18.1%), and Swaziland (26.1%) (UNAIDS, 2008).

wellbeing among survivors, Young (2005) develops a model of the HIV/AIDS epidemic showing that future generations of Africans may benefit from AIDS-related reductions in population size, and, in particular, that wages of surviving workers may increase. However, Kalemli-Ozcan (2012) and Santaaulàlia-Llopis (2008) each develop models which support the opposite prediction – that HIV will reduce wellbeing in Sub-Saharan Africa. Complementing the theoretical predictions, several studies have assessed the empirical relationship between GDP and HIV in Sub-Saharan Africa (see, for example, Bloom and Mahal, 1997; Bonnel, 2000; Ahuja et al., 2009). These studies find no significant impact of HIV on economic growth, though they are generally powered to detect only very large effects.

Several studies have also assessed the impact of HIV and antiretroviral (ARV) treatment on labor supply and worker productivity, generally finding moderately sized effects in the short-term (e.g., Thirumurthy et al., 2008; Fox et al., 2004; Larson et al., 2008). Looking at the medium-term effects of ARV treatment, Habyarimana et al. (2010) find that, as much as four years out, firm provision of ARV treatment led to reductions in worker absenteeism. Thirumurthy et al. (2011) show that ARV treatment increases employment and income as far as two years out.

This paper focuses on the impact of HIV on wages. It uses data from the World Bank's Africa Regional Program on Enterprise Development (ARPED) and the World Bank's Enterprise Surveys. These surveys cover urban manufacturing firms and their workers. I calculate regional HIV prevalence from the Demographic and Health Surveys. I then link wage data from manufacturing firms and their employees to regional HIV prevalence estimates.

I develop a simple model to predict the impact of AIDS mortality on wages at the market level. All other things equal, AIDS mortality decreases labor supply. In the short run, as long as the capital stock does not fully adjust downwards, higher mortality leads to an increase in wages and the capital–labor ratio. In the long run, once capital has fully adjusted, there should be no effect on wages. If the production function is Cobb–Douglas, the short-run wage elasticity of AIDS (i.e. the change in wages resulting from the change in labor supply due to AIDS mortality) is equal to the capital share.

However, because the wage data I use covers the urban manufacturing sector only, the estimated short-run wage elasticity of AIDS could be smaller than the capital share. Suppose that these urban manufacturing firms pay wages that are higher than in most other sectors, and above market-clearing levels. If so, they do not need to increase their wages much (if at all) in order to attract new workers and replace those lost to AIDS. Effectively the labor supply to urban manufacturing firms will decline less than the overall labor supply. This means that the short-run wage elasticity of AIDS could be lower than the capital share when estimated on urban manufacturing firms only. Additionally, this raises the possibility for the HIV epidemic to be associated with an increase in the skill premium. Indeed, high paying manufacturing firms can fairly easily replace low skilled workers who die of AIDS by workers from other urban sectors or from rural areas while barely increasing their wages (see discussion of dual labor markets in Fields, 2005). By contrast, high skilled workers who die of AIDS will be harder to replace without increasing wages, since they cannot be easily recruited from outside the manufacturing sector. If the supply of low skilled workers to urban manufacturing firms declines less than the supply of high skilled workers, the impact of HIV on the wages of high skilled workers will be higher than on the wages of low skilled workers. Therefore, I expect a positive association between HIV and the skill premium.

The empirical specifications use within country variation in HIV prevalence to identify the impact of HIV on outcomes both in levels and in growth rates. Consistent with theoretical expectations, I find that higher HIV rates are associated with significantly higher

capital–labor ratios. However, HIV has no significant impact on labor productivity. The estimated wage elasticity of AIDS is positive but not always significantly different from 0. In contrast, higher HIV prevalence is consistently significantly associated with a higher skill premium: a 10% increase in HIV prevalence is associated with a 1.5 percentage point greater increase in the wages of workers with 14 years of education or more, as compared to workers with 10 years of education or less. The impact of HIV on workers with 10 years of education or less is not significantly different from 0. Next, following a previous paper in the literature (Ahuja et al., 2009), I instrument regional HIV prevalence with the male circumcision rate in growth rate equations. The IV results are similar to OLS results, and the IV specifications are not underidentified. This provides further evidence for a causal impact of HIV on the capital–labor ratio and the skill premium. Finally, I present additional evidence consistent with dualism in the labor market. First, I show that the positive association between HIV and the skill premium does not hold in small firms, i.e. those firms that are less likely to pay above market-clearing level wages to start with. Second, I show that recent migration from rural areas is an important factor that modulates the impact of HIV on the wages of the least skilled workers. Indeed, the impact of HIV on low-skilled workers' wages is estimated to be positive and significant in the absence of rural–urban migration, but this impact declines significantly as rural–urban migration increases.

This paper is closest in its specific theme to Young (2005), who calibrates a model that formalizes the impact of HIV on wages. However, from a theoretical and econometric perspective, this paper is closest to Borjas (2003) and Acemoglu et al. (2004). Both of these studies analyze the impact of an increase in labor supply on the wages of different groups in the US labor force. This paper makes three key contributions to the literature on the impact of the HIV epidemic on wages and labor market outcomes more broadly. First, the previous literature investigating the impact of HIV on outcomes such as GDP growth and the capital/labor ratio relied on country-level data. Thus, unobserved differences in labor market trends across countries could bias the results. In contrast, my analysis uses within-country variation in HIV prevalence as a source of identification, both in the cross-section and over time. Second, this paper uses a broad sample of Sub-Saharan African countries to investigate the impact of the HIV epidemic on market-level outcomes such as wages and labor productivity. The previous literature has used solid identification strategies to analyze the impact of HIV on workers' productivity and income at the micro level. However, each of these papers is based on variation within a single, small geographic area and over a relatively short period of time. Most importantly, this strand of literature typically concentrates on worker-level outcomes for HIV-positive workers, while I focus on market-level outcomes. This distinction is fundamental. In particular, the impact of HIV on workers' income and productivity is theoretically negative for HIV-infected workers, and the literature on the topic upholds this theoretical expectation. By contrast, the short-run impact of the HIV epidemic on wages at the market-level is theoretically positive if only AIDS mortality is taken into account, and becomes ambiguous when also taking into account the decline in productivity for HIV-infected workers. It is therefore of great interest to analyze the impact of the HIV epidemic on labor markets empirically, and such an analysis complements the studies of the impact of HIV infection on individual labor supply and income. To perform this analysis within a broad sample of countries, the data set I use is unique. Indeed, the Enterprise Surveys and ARPED data I use are, to my knowledge, the only available micro datasets that provide standardized information on wages in a large sample of Sub-Saharan African countries. The Demographic and Health Surveys, the only other survey that is comparable in the range of

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