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Health and Growth in Africa

Germano Mwabu

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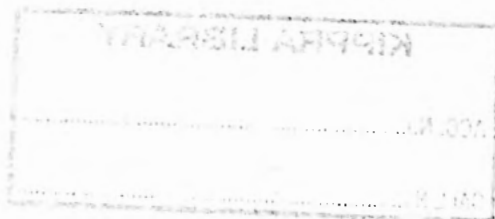
Health and Growth in Africa

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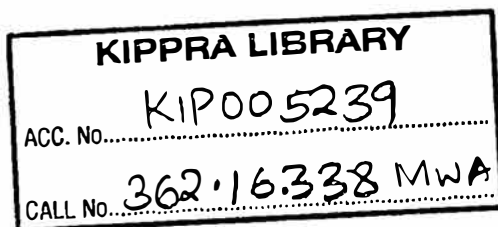
Abstract

The paper examines the relationship between health status and economic growth in Africa over the period 1960-2000. Between 1960 and 1970s, health status in many African countries expanded rapidly, slowed down in the 1980s, and declined in the mid-1990s. Except for the 1980-95 period, when health indicators in Africa improved as growth declined, their trend in other periods mimicked economic performance in the region. By the end of 1990s, health indicators for many African countries were approaching or already below the indicators for the 1970s.

The slow-moving HIV/AIDS infection rate, which reached alarming proportions in the mid-1990s is the main factor responsible for the sharp decline in the health status of most African countries over the past decade. The effects of HIV/ AIDS were compounded by widespread poverty in the continent, occasioned by low or negative growth rates, starting in the 1980s. Surprisingly, measured growth burden of HIV/AIDS in Africa tends to be modest, even though the continent has the highest HIV/AIDS incidence in the world.

Based on a review of admittedly limited microeconomic literature on the relationship between health and income, the paper concludes that accumulation of health human capital in Africa has been good for growth in the continent and the vice-versa. There is some evidence that in countries where growth occurred, it facilitated production and financing of better health, which in turn promoted growth. The paper further suggests that health human capital, which is intertwined with education human capital, is a key factor in explaining economic performance in Africa vis-à-vis other world regions, and in designing policies for attacking poverty in the continent.

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1. Introduction

The paper documents co-movements in health status and economic growth in Africa over the past four decades. In analyzing the relationship between health and economic growth, an effort is made to assign causality from health to income and the vice versa. Although the data sets used in the analysis have many gaps, it is possible to conclude that there is a two-way causality in the health-income relationship. The two-way relationship necessarily implies that the effect of a third factor on income is transmitted to health and conversely. Therefore, low (high) levels of health and economic growth should be observed together. An important third factor in this relationship is education. An improvement in education that increases income improves health also. The third factor in this case, affects health status through economic growth. However, to the extent that education has an independent impact on health status, its health effects are understated in models in which health is conditioned on economic growth. In other words, health effects of economic growth are overstated in such models.

The linkages between health, education, growth and welfare are particularly noticeable in Sub-Saharan Africa, when the region is viewed vis-à-vis other world regions. Sub-Saharan Africa ranked last in health outcomes, in education achievements, and in welfare indicators in virtually all of the decades during the period 1960-2000 among world regions (Schultz, 1995, 1999; World Bank, 2000).

In recent welfare literature (e.g., World Bank, 2000), poverty status of the population has been widely used as a summary measure of welfare in a region. A poverty index reflects effects of growth and distribution on the well-being of the population. It also reflects, albeit imperfectly, the extent of human capital accumulation of the population. Unlike physical capital, which improves the standard of life by increasing consumption opportunities, human capital has an additional appeal in

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that it improves the quality of life directly. The headcount index (the percent of population below the poverty line) is the statistic commonly used to compare social welfare across regions. In 1998, Sub-Saharan Africa had the highest poverty rate in the world (Table 1).

Table 1: Population living on less than US$ 1 a day, 1998

Region	Headcount ratio (%)
East Asia and Pacific, including China	11.3
Europe and Central Asia	5.1
Latin America and the Caribbean	15.6
Middle East and North Africa	1.9
South Asia	40.0
Sub-Saharan Africa	46.3

Source: Derived from World Bank (2000), page 23

Table 1 shows that Sub-Saharan Africa has the highest poverty rate in the developing world, with nearly 50% of its population below the poverty rate in 1998. In some African countries (Ali and Thorbecke, 2000), poverty rates exceeded 70% in the 1990s. Since poverty incidence at a particular date reflects previous economic growth rates and patterns of income distribution, which in turn are outcomes of factor accumulation and productivity, the poverty situation in Africa can partially be accounted for by the growth in human capital in the region over the past four decades. There is evidence from the industrialized world that up to 30% of economic growth can be accounted for by human capital accumulation, particularly improvements in nutrition and health (Mayer, 2001). Table 2 shows the evolution of health capital in Africa (as measured by life expectancy) vis-à-vis other regions over the period 1970-2000.

Table 2: Life expectancy in Africa relative to other world regions, 1970s-2000

Country	1970-75	1995-2000
South Africa	53.7	56.7
Swaziland	47.3	50.8
Botswana	53.2	44.4*
Zimbabwe	56.0	42.9*
Ghana	49.9	56.3
Kenya	51.0	52.2
Nigeria	44.0	51.3
Sudan	43.7	55.0
Tanzania	46.5	51.1
Uganda	46.4	41.9*
Democratic Republic of Congo	46.0	50.5
Zambia	47.2	40.5*
Malawi	41.0	40.7*
Rwanda	44.6	39.4*
Burundi	44.0	40.6*
Developing countries	55.5	64.1
Sub-Saharan Africa	45.3	48.8
World	59.9	66.4

Source: UNDP, 2001

The asterisks in Table 2 show countries in which life expectancy over the period 1995-2000 was lower than in 1970-75. Over 40% of the African countries at the end of 1990s had lower life expectancy than in the early 1970s. Because of HIV/AIDS, some countries have experienced a sharp reduction in life expectancy over the past twenty years (Bloom and Canning, 2004). Table 3 indicates declines in life expectancy in selected African countries over the period 1977-1999.

Table 3: Changes in life expectancy in selected African countries, 1977-1999

Country	Fall in life expectancy, years (1977-99)
Botswana	-21
Zimbabwe	-16
Zambia	-13
South Africa	-10
Lesotho	-9
Kenya	-8
Uganda	-6
Period mean	-11.9

Source: Derived from Birdsall and Hamoudi (2001), Table 3

In Botswana, which is one of the countries most hit by HIV/AIDS pandemic, life expectancy fell by 21 years between 1977 and 1999. Birdsall and Hamoudi (2001) show that the decline in life expectation at birth in a given time period is associated with reduction in education attainment in subsequent periods. In the case of African countries (Table 2 above), they estimate substantial reductions in education attainment over the period 2006-2011. The reduction in educational attainment associated with life expectancy occurs due to one or more of the following (Birdsall and Hamoudi, 2001):

- The death of skilled personnel, especially teachers (typically associated with HIV/AIDS) affects the rate at which education systems are able to train the next generation;

- The foreshortening of life span due to premature deaths decreases expected return to schooling, reducing demand for education;

- To the extent that positive externalities to education exist, the loss of the already educated people reduces economic growth, a situation

which, *ceteris paribus*, erodes government's fiscal resources, and weakens its ability to finance public education systems;

• To the extent that physical and human capital are complementary in accumulation, loss of educated labor is likely to affect production of school equipment and machinery that is needed to train specialized categories of personnel such as doctors, engineers and other scientists.

The feedback health effects of reduced educational attainment (due to a fall in life expectancy) can be substantial. For example, for African countries depicted in Table 3, a reduction in education of mothers over the period 2006-2011 would, other things being equal, increase infant mortality rate (see e.g., Schultz, 1994), setting in motion a downward spiral in health status.

Since the co-movement between health and education is so strong (Fuchs, 1996), it is appropriate to discuss these two forms of human capital together. Table 5 shows education attainment in Africa relative to other regions over the period 1960-1990.

Table 4: Average years of schooling in Africa relative to other world regions, 1960-1990

	Average years of schooling among population aged 24 years or more						
Region	1960	1965	1970	1975	1980	1985	1990
Sub-Saharan Africa	1.0	1.2	1.5	1.8	2.0	2.2	2.5
Latin America & Caribbean	3.3	3.2	3.8	4.0	4.2	4.3	4.5
East Asia	4.0	4.3	4.8	5.5	5.8	6.3	7.2
Industrialized countries	6.5	6.8	7.2	7.6	8.2	8.5	8.8

Source: Constructed from Birdsall and Hamoudi (2001), Figure 1

From Table 4, it can be seen that although education levels in Africa lagged behind other regions over the period shown, the education gaps

remained relatively constant except between Africa and East Asia, where by 1990 the gap had widened considerably, and between industrialized countries and East Asia, where by the same time, it had narrowed noticeably, with East Asia nearly catching up with industrialized countries. In the case of East Asia and Africa, the latter had fallen further behind by 1990. The gap between Africa and East Asia in terms of economic growth and health status had also widened accordingly (World Bank, 2000).

Table 4 is not a true reflection of educational attainment in the regions, especially in Africa, where actual years of schooling in a given period differ considerably from eventual education outcomes (due to high rates of repetition in the region). Moreover, even ignoring the problem of repetition, actual years of schooling are not a good measure of stocks of education because actual years represent a snapshot of an on-going process of educational investments by families. A better measure of educational investment is the "expected years of school enrollment." This composite variable is a measure of exposure to schooling, rather than years of schooling completed (Schultz, 1995, p.17). We assume that this measure is strongly correlated with education human capital. It is constructed by multiplying the gross enrollment rate at each school level (or age), by the number of years of study at that level (or age bracket),

Table 5: Expected years of schooling enrollment per school-aged child during the 1960s and 1970s

Region	Expected enrollment per child (Years)	Ratio of female-to-male years of enrollment
World	8.9	0.91
Africa	5.7	0.73
Latin America	8.0	1.03
East and Southeast Asia	9.4	1.00
West and South Asia	7.3	0.59
High income countries	12.0	1.02

Source: Extracted from Schultz (1995)

and summing over the levels (Schultz, 1995). Table 5 shows expected years of schooling enrollment per child in Africa during the 1960s and 1970s relative to other world regions.

As in Table 4, it can be seen from Table 5 that Africa's educational investments in the 1960s and 1970s were lower than in other regions. The expected school enrollment per child in Africa during the period was 5.7 years compared with 9.4 years in East and Southeast Asia. As in Table 5, within the developing world, the largest educational investment gap in the 1960s and 1970s was between Africa and East Asia. However, Table 6 shows much higher levels of educational stocks for Africa in the 1960s and 1970s than indicated in Table 5. Except in West and South Asia, it is evident from Table 6 that female educational achievements in Africa lag men's achievements much more than in other regions, despite the large health benefits associated with women's schooling.

The link between education and health in Africa in the 1970s is suggested by a relationship between fertility and schooling of women (Table 6). An added year of schooling, for example, is associated with 5 to 10 percent reduction in child mortality (Schultz, 1995). Women's capacity to avoid unwanted pregnancy is one indicator of women's health. Indeed, capacity to control fertility is also a measure of population health because it has a strong bearing on infant mortality. More generally, fertility and infant mortality rates are positively correlated, with life expectancy declining as fertility and infant mortality rise.

Table 6 shows the relationship between total fertility rates in the 1970s in Africa vis-à-vis other regions by level of schooling of women. Total fertility rate, derived from survey data, is the average number of children that would be born alive to a woman during a lifetime, if during her childbearing years she were to bear children at each age in accord with the estimated age-specific birth rates in the five years before the survey (Schultz, 1995).

Table 6: Total fertility rates in Africa relative to other regions by education of women, 1970s

Region	Total fertility rate
Africa	
0 years of schooling	7.0
1-3 years	7.2
4-6 years	6.2
7 or more years	5.0
Difference in fertility rates between least and highly educated mothers (fertility at 0 years minus fertility at 7 or more years)	-2.0
Latin America	
0 years of schooling	6.8
1-3 years	6.2
4-6 years	4.8
7 or more years	3.2
Difference in fertility rates between least and highly educated mothers (fertility at 0 years minus fertility at 7 or more years)	-3.6
Asia and Oceania	
0 years of schooling	7.0
1-3 years	6.4
4-6 years	5.8
7 or more years	3.9
Difference in fertility rates between least and highly educated mothers (fertility at 0 years minus fertility at 7 or more years)	-3.1

Source: Extracted from Schultz (1995)

Table 6 shows that in 1970s, Africa and Asia had the same health status, as measured by the total fertility rate (TFR). In both regions, the TFR was around 7 children. However, in Africa education of women reduced fertility rate more slowly than in Asia, which suggests that even with the same level of educational investments in the two regions, Africa

would, other things being equal, have a lower level of health status than Asia. The table suggests existence of factors unique to Africa (the Africa dummy puzzle in some previous studies, e.g., Bloom and Sachs, 1998) which affects the way women's education influences fertility in the region. These unobservable factors probably include cultural norms and other institutional determinants of demographic changes.

In summary, patterns and levels of human capital investment in Africa over the period 1960-1990 are responsible for both the health and welfare outcomes observed in the continent at the close of the 1990s. That is, health investments in the preceding three decades (1960-90) can account for growth rates and poverty rates experienced in Africa during the last decade of the 20th century (1990-2000). Indeed, Mayer (2001) has documented such long-term effects of health on income in South America for the period 1950-90. Furthermore, to the extent that health status is affected by incomes, the health investments of the 1960-90 period can explain (of course partially) the downward trend in health status observed in Africa over the period 1990-2000. However, existing data in Africa do not permit computations of these long-term impacts of health on economic growth and the vice versa. To undertake such computations, time series data are required on incomes and health status of individuals over a cross-section of countries. Such data are not currently available.

2.   Effects of Income on Health

In this section, we attempt to answer two questions. First, how does income affect health status? Second, what does evidence reveal about effects of income on health in Africa? These are theoretical and empirical questions that require large data sets and intensive use of statistical techniques to answer, as well as a fair amount of theorizing. To start to explore these questions, we address measurement issues first. Health is part and parcel of human beings (Schultz, 1961). Thus, its measurement must necessarily be undertaken at the individual level. Indeed, aggregate indicators of health status such as life expectancy and mortality rates are proxies for aggregate health of individuals.

Measures of health status at the individual level include nutritional status (Fogel, 1997; Schultz, 1997), fertility rate (Schultz, 1976), physical functioning of individuals as indicated by performance in Activities of Daily Living (ADL) (Strauss *et al*, 1993) and age- and gender-specific survival probabilities (Mayer, 2001). All the individual-level measures have the advantage, over the mortality rates for example, in that they provide information about health status of the living (Strauss *et al*, 1993). All these measures are correlated with aggregate proxies for health status. For example, life expectancy (mortality rate) increases (decreases) with nutritional status, as measured by body mass index, height-for-age or weight-for-age. As a further example, life expectancy or mortality rate increases (decreases) with improvements in ADL measures.

The ADL measures derive from questions or direct observations, where possible, that seek to determine whether one's health limits specific activities such as bending, walking uphill, bathing, among others (Strauss *et al*, 1993). The ADL are designed to measure adult health, and typically show proportions of the (elderly) population (by age, education, residence location etc.) with limitations in performing specific activities.

Having looked at how health can be properly measured, we return to conceptual issues in the causality from income to health, before turning to African evidence on the issue. Health, which is defined as "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity" (WHO, 1974), has a unique characteristic of being specific to each person. As such, it cannot be produced or enhanced by one person on behalf of another.

Following previous work on health production (Anand and Chen, 1996) and household economics literature (Becker, 1991; Strauss and Thomas, 1995), we assume that an individual's health is self-produced (accumulated) using market and non-market inputs. The market inputs include medical and non-medical goods (e.g., professional medical care, drugs, housing, clothing, etc) and non-market goods (own time, genetic endowment, and non-tradable environmental goods such as climate and social infrastructure).

Lacking in the above simple health production function is a description of an incentive system that guides health production decisions of individuals. Schultz (1999) has developed a comprehensive framework for examining the determinants and consequences of accumulating health human capital by households and individuals, including feedback relationships from income to health and the vice versa. In this framework, GDP per capita (a proxy for household income) plays several roles in influencing health. First, it increases demand for purchased inputs that individuals use to produce health, so that other things being equal, health status increases with GDP per capita. The purchased inputs affect health with a time lag. It should be noted that income here is a proxy for purchased health inputs. The second role of income in the framework is to relax the borrowing constraints of households, enabling them to credit-finance higher levels of health. Third, GDP per capita serves as a proxy for unmeasured factors that are associated with health status, and therefore with labor productivity. In this last case, health effects of income

are difficult to disentangle. The framework provides examples of instruments (commodity prices, health system access factors, terms of trade) to use in a regression analysis of effects of income on health. Results from this sort of analysis would reveal effects of income on health.

A regression framework of the above type has not been estimated for Africa. To emphasize, there are two novelties in Schultz framework. First, aggregate health measures are based on health status of individuals. Second, in a health-income relationship, the framework facilitates interpretation of the coefficient on income that is consistent with household economics models. Since, the ideal measures of health indicators described above can roughly be approximated by standard health indicators such as mortality and life expectancies, we report effects of income on these measures based on recent work on the subject in Africa.

Table 8 shows effects of income on infant mortality, crude death rate, crude birth rate, total fertility rate, and life expectancies of men and women in Africa for the period 1980-95. The results were obtained by estimating a random effects model (using generalized least squares) for all the 53 African countries. A panel of observations for each country were collected for 1980, 1990 and 1995. The data on health status indicators, income, and other covariates were obtained primarily from the African Development Report 1997 (African Development Bank, 1997) and from the Human Development Report 1997 (United Nations Development Programme, 1997); see Mwabu (2001, p. 325) for other sources. A double-log linear model of health status on income was estimated, controlling for primary and secondary school enrollments, real exchange rate, official development assistance, and total government expenditure. The coefficients on income in the table below, all of which are statistically significant, are income elasticities of the various dimensions of health status shown in the table.

Table 7: Effects of income on health in Africa, 1980-95

Health status indicator in log form	Coefficient of log income(1)	Sample means of health status indicators (2)		
		1980	1990	1995
Infant Mortality Rate	-0.218	120.35	93.37	85.92
Crude Death Rate	-0.175	45.21	42.91	39.79
Crude Birth Rate	-0.059	17.33	14.41	13.36
Total Fertility Rate	-0.058	6.29	6.04	5.59
Female Life Expectancy	0.078	50.36	55.06	55.18
Male Life Expectancy	0.083	47.84	51.72	52.10
Number of countries	42	50-52	53-53	51-52

Source: Mwabu (2001), Table 1, p. 326 (Column 2) and Table 4, p. 331 (Column 1)

From column 2 of Table 7, it can be seen that health status in Africa improved over the period 1980-95, as noted in the introduction section. However, during that period, African economies were under great stress and in many of these economies per capita incomes deteriorated (World Bank, 1999). In virtually all of them, economic growth declined with the notable exceptions of Botswana and some island economies. The estimated income effects shown in column (1) of the table indicate that since growth declined over the period analyzed, health status should have fallen, if indeed, income was an overriding determinant of health. Delayed effects of previous investments in health and health systems, might account for improvements in health status observed during periods of declining growth. In Table 7 (column 1), the effect of income on infant mortality rate is likely to be estimated consistently and without bias because income is exogenous in that model, as infants are not part of the labor force. Therefore, the feedback effects from health to income discussed earlier are absent.
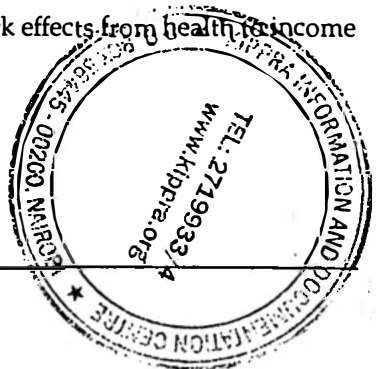
However, in line with the earlier discussion, income is endogenous in the other equations (crude death rate, birth rate, etc). Therefore, the income coefficients there should be interpreted with caution. Using terms of trade or export commodity prices (which are likely to be available for a number of African countries) as instruments for income can reveal the extent of bias in the results reported in column (1). The results, however, provide some indication of health effects of income in Africa given the state of data in the continent.

In Table 8, we show effects of income on health in a similar study (Cornia and Mwabu, 2000). That study covered a much longer time span, 1960-95. The data set for the study was derived from UNICEF (1995), UNDP (1995, 1997), World Bank (1983, 1993, 1997), and IMF (1990). The data covered 40 Sub-Saharan countries with a population of more than one million people in 1995. For each of the 40 countries, panel data were collected on health status indicators, income and other covariates of interest for five years, namely: 1960, 1970, 1980, 1990 and 1995. The effect of income on health was estimated using generalized least squares method with random effects (Cornia and Mwabu, 2000). The other variables included in the regression (but not shown below) were the time trend, adult female literacy rate, period dummy (1 for the period 1980-95 and 0 for the period 1960-70) and an interaction of income with

Table 8: Effects of income on health in Africa, 1960-95

Health status indicator in log form	Coefficient of log income
Infant Mortality	-0.117
Under-five Mortality	-0.144
Maternal Mortality	-0.256
Female Life Expectancy	0.005
Sample size	133

Source: Cornia and Mwabu (2000), Table 2.3, p. 33

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the time trend. The estimated health effects of income (which are statistically significant) except for life expectancy are shown in Table 8.

The results presented in Tables 7 and 8 are not strictly comparable because they are based on different data sets and different specifications of health production functions. As already indicated, Table 8 is based on a subset of Sub-Saharan African countries, which are poorer than Africa as whole (Northern Africa, the richest region and the most advanced in terms of health development is excluded from the sample). However, in the two tables, the qualitative result that economic growth enhances health production persists. As before, income is conceptually exogenous in the infant and under-five equations (infants and under-fives are outside the labor market), and endogenous in the last two equations because of the feedback effects discussed previously. Under the circumstances, it is not clear whether even if the income variable were to pass standard exogeneity tests, IV estimation methods should not be used.

The two sets of results (Tables 7 and 8) are valuable, at least from the policy perspective, because they indicate that the effect of income on child health in Africa is sensitive to model specifications, the time periods covered by the sample countries, and by composition of country samples. Therefore, in basing policy on results of the type discussed above, it is important to be clear about the nature of samples and model specifications underlying the results. That is, in policy analysis, the data and model specifications underlying empirical results should be thoroughly reviewed.

3. Effects of Health on Income

This section examines the relationship between health and income in the African context. At the micro level, the issue at hand concerns the effect of individual's health on household income, and at the macro-level, the impact of population health on economic growth. The issue here relates to one of the feedback effects in Schultz's (1999) model of the determinants and consequences of accumulating health human capital; that is, the feedback effect from health status to labor productivity (wages). We have already examined, in Section 2, the effects of the feedback channel from income to healthcare consumption, and then to health status.

As in Section 2, we clarify analytical concepts before turning to African evidence as to effects of health on income. The analytic concept remains the production function, or its proxy, the wage function. In Section 2, the production function describes the use of market and non-market inputs by individuals or households to produce health. In this Section, the production function describes use of health human capital by individuals or households to increase their productivity in market and non-market settings. At the macro level, an aggregate production function describes how national income grows with the stock of health human capital of the population, conditional on other covariates. Pritchett and Summers (1996) best summarize this health-driven income growth with the phrase, "wealthier is healthier", stressing the presumption of the causality from health to wealth.

The macroeconomic literature of the effects of human capital on growth is voluminous, and no attempt will be made to survey it here (see e.g., Barro and Sala-i-Martin,1995). However, it should be noted that the macroeconomics literature in this area focuses primarily on effects of education on growth. Notable exceptions include the relatively recent work by Bloom and Sachs (1998), Gallup and Sachs (2000) on economic

burden of malaria and the related literature (see e.g., McCarthy *et al*, 2000).

Since education human capital and health human capital are closely related (Fuchs, 1996), by focusing on growth effects of education, the growth literature is also indirectly analyzing the health effects. However, there is tension in the growth literature as to whether effects of health on income should be analyzed at the macro or micro level (Bloom and Sachs, 1998; Schultz, 1999; and Malaney, 2000). There are at least two reasons for focusing quantitative analysis of the impact of health on growth at the micro level in Africa.

First, aggregate data on health and growth in Africa is of questionable quality in many countries so that the estimated growth effects of health are likely to suffer from biases arising from measurement errors. Indeed, Schultz (1999) has pointed out that the estimated effects of education on growth are too high vis-à-vis the returns to schooling obtained using micro level data. Similarly, the effect of malaria on aggregate growth in Africa reported by Bloom and Sachs (2000) is unbelievably large. Bloom and Sachs (2000) conclude from aggregate evidence of the effects of malaria on economic performance that African incomes are one third of countries' that have not had malaria over the previous four-to-five decades, a finding that attributes nearly 70% of the loss of African wealth to malaria over the period indicated. Much lower economic burdens of malaria in Africa are reported from microeconomic evidence (Shepard et al., 1991; Malaney, 2000). The second reason in favor of microeconomic analysis here, is that macroeconomic analysis of effects of health on growth necessarily leads to broad, often unwarranted generalizations which can lead to harmful policies. In view of noise in aggregate data in Africa, it appears prudent to analyze high quality micro data, when available, and then build country by country evidence of effects of health on growth. This approach is reinforced by doubts in growth literature as to whether the problems with results obtained from aggregate analysis

are due to mis-specifications of the estimated relationships or to poor data.

We now turn to microeconomic evidence of effects of health on incomes in Africa. The evidence is taken from Schultz's (1999) estimates of wage returns to health human capital in Ghana and Cote d'Ivoire. The estimates were obtained from large, well-known nationally representative data sets (Living Standard Measurement Surveys) collected by the World Bank in the 1980s (Gross and Glewwe, 1998). The effects of Body Mass Index (BMI) on wages were estimated, controlling for education of the individual, migration from birth place, and height. Also included in the estimated equations were ten regions of birth, eight to ten ethnic groups, five age dummies, and the season in which data were collected to capture seasonal cycles in agricultural wages. Table 9 shows effects of health (proxied by Body Mass Index) on income (proxied by market wage) in Ghana and Cote d'Ivoire in the 1980s, estimated with instrumental variable methods (all the coefficients are statistically significant).

Table 10: Effects of health on income in Ghana and Cote d'Ivoire, 1985-89

Log of hourly wage (by country, gender and sample dates (with sample sizes in parentheses)	Coefficient on BMI (Weight in kilograms to height in meters squared)
Cote d'Ivoire (LSMS: 1985-1987)	
Log Male Wages (1692)	0.159
Log Female Wages (1180)	0.095
Mean	0.127
Ghana (LSMS: 1987-1989)	
Log Male Wages (3414)	0.0793
Log Female Wages (3400)	0.0981
Mean	0.0887

Source: Extracted from Schultz (1999), Table 1, p.75 (means are own calculations)

Table 9 shows that on average, the effect of health on income in Cote d'Ivoire (in the period indicated) was larger than in Ghana. However, Ghanaian women received higher wage returns from their health human capital than their female counterparts in Cote d'Ivoire and than their male counterparts in Ghana. In contrast, wage returns to men's health capital in Ghana are only a half of the returns in Cote d'Ivoire.

Specifically, a unit increase in BMI is associated with 15.9% increase in wages in Cote d'Ivoire, compared to an increase of 7.93% in Ghana. However, results on returns to height (not shown above) indicate that both men and women in Ghana benefit more in the labor market from height improvements than in Cote d'Ivoire. These differences in returns to the two forms of health capital are due to the fact that height essentially measures long-term investments in health, whereas the BMI, is a proxy for short-term nutritional status, as weight (and therefore BMI) can vary substantially over a short duration.

The results in Table 9 have several policy implications. First, they indicate that investments in health would improve household incomes in the two countries. Second, such investments would affect growth rates and income distribution differently in the two countries. For example, investments in programs aimed at increasing weights of workers would yield a higher growth rate in Cote d'Ivoire than in Ghana, and benefit male workers in Cote d'Ivoire relatively more than other workers. Further, Ghanaian women would benefit from such programs more than their male counters in Ghana. Therefore, although the qualitative growth effects of better health are generalizable even to countries outside the West Africa region, size and distributional effects cannot be generalized even across the two countries studied.

There are two other studies in Africa as to effects of health/ nutrition on income that need to be considered here: the Strauss (1986) study in Sierra Leone and Audibert's (1986) work in Cameroon. Strauss (1986) estimated the effects of nutrition (proxied by calorie consumption) on labor

productivity in Sierra Leone and found that the effects were largest amongst the lowest income households. Again, as in Cote d'Ivoire and Ghana, this study suggests that investment in nutrition would affect household incomes differently. In particular, the finding of the study suggests that investments in nutrition programs would likely be pro-poor. Audibert (1986) estimated effects of health status on rice production in Cameroon, and found that families without schistosomiasis infections were more productive that families that were infected. The author found that a 10% increase in the prevalence of schistosomiasis resulted in a 4.9% reduction in rice production. The two studies provide evidence that better health and nutrition can improve incomes in non-market settings in Cameroon and Sierra Leone and are to be contrasted with Schultz's study that demonstrates the same effects in market contexts in Cote d'Ivoire and Ghana. Analysis of household data collected in the 1980s in selected African countries show that investments in health and nutrition are associated with higher household incomes and, by extension, with stronger performance of economies. However, long-term growth effects of these investments cannot be assessed with the types of household surveys that are currently available. To undertake such analysis, panel household data collected over several decades are needed.

4.   Health and Development

In Sections 1-3 of the paper, health and income (and also education) have been treated as if they are the primary ends of African development. Development is a general and sustained improvement in people's living standards. These are standards as to quantity and quality of healthcare, nutrition, education, housing, environmental goods, basic freedoms, cultural goods, among others. Therefore, development involves much more than economic progress, which, as we have seen, is both a cause and a consequence of health human capital.

However, health has two attributes that make it central in achieving other ends of development. First, by preventing premature death, good health expands the horizon over which other ends of development such as better housing, political freedoms, peace, family formation and education can be realized and enjoyed. We have shown, for instance, that foreshortening of life expectancy by HIV/AIDS pandemic in Africa is expected to substantially reduce educational attainment in the continent over the next decades. The second fundamental attribute of health (shared with education), and which is related to the first, is that it is part and parcel of human beings (Schultz, 1961). This attribute makes human capital, more generally, both an end and a means in the development process. Few other economic goods can claim such a status.

As an end, health human capital is beneficial in itself, a quality that is sufficient to justify expenditure on it by individuals irrespective of its productivity-enhancing role. Government expenditure on health human capital are justified by negative social externalities associated with certain diseases. For example, since healthy people are at risk of being infected by individuals with contagious diseases, governments should spend resources to eradicate or control such diseases.

As a means, health human capital serves to create wealth, which enables

societies to achieve non-economic ends such as preservation of cultural values. As a factor of production, health human capital plays a critical role in empowering people to acquire skills essential for the development of new technologies. Technological change is one of the key processes underlying economic development (Boserup, 1995). Sickly people cannot learn effectively or engage in vigorous activities. Therefore, production of health human capital is essential for transformation of a country from a low to a high productivity economy. The enhanced productivity in turn leads, *ceteris paribus*, to higher current and future standards of living.

5. Conclusion

The paper has examined the relationship between economic growth and health status in Africa over the period 1960-2000. Between 1960 and the 1970s, health status in Africa expanded rapidly before entering a slow growth phase over the period 1980-95. After 1995, health human capital began to fall, and by the end of 1990s, health indicators for many African countries were approaching or already below the indicators for the 1970s. The negative cumulative health effects of HIV/AIDS, which reached alarming proportions in the mid-1990s (Bonnel, 2000), is the main factor responsible for the sharp declines in the African health status over the past decade. The effects of HIV/AIDS were compounded by widespread poverty in the continent in the 1990s (Greener *et al*, 2000). Although absolute poverty in Africa fell slightly between 1987 and 1998 (World Bank, 2000), the poverty rate in Africa is the highest in the world (46% in 1998). The HIV/AIDS pandemic impacted negatively on both growth and health status.

The HIV/AIDS exceptional effect on growth and health human capital in Africa has to do with several aspects of the disease (Bonnel, 2000). First, it affects the adult population in its most productive years. Second, it strikes at the most educated individuals, therefore eroding a country's capacity to train the next generation of workers, including health professionals. Third, it destroys social capital of communities by over-stretching extended family systems, which are forced to care for large numbers of AIDS orphans (Lundberg *et al*, 2000). Fourth, the long incubation period of the disease tends to deceive policy makers not to undertake urgent control measures in the early stages of the epidemic. In many African countries, nothing concrete was done to treat or prevent the disease until in the 1990s when a large number of people were already infected.

A surprising aspect of macroeconomic effects of HIV/AIDS in Africa is that these effects have been estimated to be rather modest, in the order of 0.1-0.3% reduction in growth rate per year (Bonnel, 2000), even though the continent has the highest HIV/AIDS incidence in the world (see Lundberg *et al*, 2000; Saitoti, 2002). The microeconomic evidence of growth effects of HIV/AIDS in Africa is virtually non-existent (see Lundberg *et al*, 2000; Ainsworth and Over, 1994; and World Bank, 1999 for an analysis of social and economic effects of HIV/AIDS in Africa).

Based on review of previous studies on Africa, we provide micro level evidence in support of a causality relationship running from health to income and the vice versa. Further, we review microeconomic and econometric concepts that facilitate interpretation of the causality relationships studied. The evidence provided and discussed in the paper shows that accumulation of health human capital in Africa has contributed to the continent's economic performance. Moreover, where growth has occurred, it has facilitated production and financing health capital. It can be concluded, from the analysis undertaken in the paper, that one of the reasons why Africa lags behind other world regions in terms of welfare indicators is that its stock of health human capital is exceptionally low. Policies that would succeed in increasing this stock and using it efficiently would contribute significantly to poverty reduction in Africa. We find further that sizes of growth and health effects that have been documented for a few African countries, including their distributional consequences, cannot be generalized to the whole continent. As new, nationally representative data sets become available in the Africa region, opportunities will be created to accumulate similar evidence for other countries in the region. It is hoped that the household level evidence will be used to portray a picture of the relationship between growth and health in the continent that is based on microfoundations.

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