Social Value of Research and Technical Skills: Does It Justify Investment in Higher Education for Development?

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Abstract

Evidence assembled from household surveys collected from 1985 and 1998 from Ghana, Côte d'Ivoire, Kenya, and South Africa indicates that higher wages compensate individuals in these African countries for enrolling in school. It is commonly believed that wage returns to schooling are highest at the primary levels and decrease thereafter at higher school levels, but the data from Africa summarized here indicate the opposite, with private wage returns being highest at the secondary and higher education levels. There appear to be sufficient financial incentives today to motivate students to enroll in higher education, and any public subsidies should be allocated only to those students who come from poor families and whose parents are relatively least educated, relative to their generation. If students in higher education in Africa from upper-income families paid tuitions which were equal to half the public subsidies for their schooling, these revenues would finance fellowships for disadvantaged students and also provide the resources and incentives to expand higher education into those fields where trained manpower is scarcest today in Africa. They would thus create the conditions for greater self-governance of higher education while fostering a responsible separation from political power.

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Résumé

Les résultats provenant des études domestiques, collectés de 1985 à 1998 au Ghana, en Côte d'Ivoire, au Kenya, et en Afrique du Sud indiquent que dans ces pays, les salaires élevés servent de compensation aux individus, pour qu'ils puissent s'inscrire à l'école. L'on croit généralement que les retours de salaire pour la scolarité sont plus élevés au primaire et diminuent au niveau secondaire, mais les données sur l'Afrique résumées ici prouvent le contraire, et montrent que les retours privés sur salaire sont plus élevés au niveau du secondaire et du supérieur. Il semble y avoir aujourd'hui suffisamment de mesures incitatives pour motiver les étudiants pour qu'ils intègrent l'enseignement supérieur et toutes les subventions publiques doivent être attribuées uniquement aux étudiants issus de familles pauvres et dont les parents ont reçu un niveau d'éducation relativement faible par rapport à ceux de leur génération. Si les étudiants africains de l'enseignement supérieur de familles aisées payaient des droits de scolarité correspondant à la moitié des subventions publiques, ces revenus ainsi engrangés pourraient alors financer des bourses pour les étudiants défavorisés, mais également fournir des ressources et des mesures incitatives pour développer l'enseignement supérieur dans les domaines où il existe peu de main-d'œuvre qualifiée sur le continent. Ils permettraient ainsi de créer des conditions adéquates pour une meilleure auto-gouvernance de l'enseignement supérieur, tout en assurant une séparation raisonnable d'avec le pouvoir politique.

Introduction

In the last two decades, many countries in Africa have had difficulty building or even maintaining high-quality university training and allied research institutions. Opinion is divided on how to refocus resources and determine priorities to improve the prospects for higher education. To assess how well resources are allocated to higher as well as lower levels of education, I first illustrate how the economic returns of schooling for adults who have obtained more schooling in the past are calculated and then describe how these returns to higher education are currently distributed by social and economic classes in Africa. Recent household surveys from several African countries are analyzed to approximate the efficiency of returns to higher education, which appear substantial and are larger among younger than older Africans, suggesting that they may be rising over time. The distribution of these returns to higher education, however, is inequitably concentrated among upper-class families. Thus, the policy dilemma facing Africa is that workers with postsecondary schooling are being well rewarded in relative terms for their investments in education but that these rewards, which are highly subsidized by the public sector in Africa,

are captured predominantly by the relatively rich. The challenge for Africa is to design institutions to increase the opportunities for higher education but distribute these benefits more widely.

What are the options for improving the personal distribution of benefits from public expenditures on higher education, and are there examples of "best practices" which might be replicated in Africa to return more of the benefits to the children of the poor? Can poor societies achieve a more equitable access to higher education by quotas, targeted subsidies, scholarships, or student loans? Has the effort to reduce the educational gap between men and women been successful? If efforts to achieve gender equality are subject to diminishing returns, how should priorities now be modified in light of the progress made? And where do policies need to be strengthened because the objectives have not been adequately realized? How does the globalization of trade and capital markets, along with the decreasing cost of immigration, particularly for educated workers, change the landscape and modify the maneuverability of national educational policy in Africa and other regions with low?

This is a long agenda and I will touch only on the two salient economic criteria of performance for public policy, that of *efficiency* (increasing outputs for a given level of public and private inputs) and that of *equity* (increasing the private benefit from those outputs relative to the private costs among the poorer strata of society). These strata include families residing in rural areas and remote towns, and children born into families in which economic resources are least adequate, and to parents who are themselves the least educated in their generation. My neglect of the political questions is not because I think they are less critical than the economic but as a reflection of my personal comparative disadvantage to clarify how the political realities contribute to, and affect progress in, the education sector in Africa. The political institutions needed to advance a more efficient and equitable higher educational system on the African continent are likely to be paramount but are neglected here for the reason noted.

Schooling, Wages, and Educational Priorities

There is not likely to be agreement on the criteria by which to set priorities in education, and higher education is particularly complex. Higher education performs many functions. The outputs are often difficult to measure and value in comparable terms, and those with a large stake in higher education—politicians, administrators, teachers, researchers, students, and the parents of possible students—often have conflicting objectives. Where does one start?

Since the 1960s, it has become increasingly common to analyze the structure of wages between workers with more and less schooling and to view these wage differentials as private productive pay-offs for attending school.[1] Private and social costs of schooling can be deducted from the benefits associated with wage differentials, properly discounting both costs and benefits to some initial point when it is decided whether or not the child will continue to enroll in school. About half of the private costs of attending school is the value of the time that students spend in school and in preparation for school, which their families forego to keep them enrolled and matriculating through the school system.

Mincer (1974) proposed a rough approximation for estimating the internal rate of return that an individual gets back in higher adult wages on the opportunity costs he incurs as a student attending school, expressed in present discounted terms of relative units of the market wage rate. Mincer noted that this return could be estimated by fitting a logarithmic-wage function using standard regression methods (that is, ordinary least squares) to individual data from a random household survey that collected information on the wages of workers, along with their age, sex, schooling, within a single labor market. By assuming that the productive value of a student's time throughout the year he or she enrolled in school equaled the sum of the student's foregone wages and the direct private costs of schooling (e.g., books, travel, tuition, school clothes or uniforms, etc.), then the percentage gain in wages which is associated with an additional year of a worker's schooling approximates the family's internal rate of return to schooling, holding constant for a quadratic approximation for the effects of postschool experience on the log wage.

Although Mincer examined only the first public use sample from the 1960 U.S. census, his choice of a semi-log functional form fit to cross sectional data on schooling years and postschooling experience of males has become the benchmark throughout the world for summarizing wage structures and interpreting school returns (Mincer, 1974, Table 5.1). Scores, if not hundreds, of household surveys from all regions of the world have been examined using his simplified model specification. Estimates of private returns to schooling are inevitably compared with returns to long-term physical capital investments, such as bonds.

There are nonetheless many differences between human capital and financial instruments, notably the lack of liquidity or marketability of human capital that alters its collateralization and risk; and undoubtedly many students and families receive substantial consumption benefits from education which increase their private demands for schooling.

Empirical estimates of the share of the student's opportunity costs in the family's private total costs of school attendance tend to be on the order of one half or more in low-income countries, rising perhaps for higher education (Psacharopoulos & Woodhall 1985). Thus, Mincer's (1974) approximation of private schooling returns implicitly assumes that the private opportunity costs of schooling are equal to the wage received by other children with the student's initial level of schooling and age. If school occupies half of the time of a student in any particular year, other private costs of attending school are attributed to the other half of the child's annual productive value of time. Unfortunately, household surveys have not been notably successful in measuring what a child's working time is actually worth to a family, for most children labor as unpaid family workers, and all parents are not effective in extracting the entire working effort of their children when they are not enrolled in school.

From a society's viewpoint, moreover, the educational system consumes public resources to provide school structures, teacher salaries, school supplies, and administrative expenses, even though the public sector may offset some of these outlays with school and examination fees, local taxes earmarked for education, and income and wage taxes paid by the students as working adults. These wage taxes are likely to increase, because more educated workers allocate more of their time to work in a "covered" job from which the government can deduct taxes and because better educated workers are paid more per hour worked. It should be recalled, however, that governments in low-income countries tend to collect a relatively small share of their revenues from personal income, wage, or consumption taxes (e.g., VAT) and, hence, do not in fact recover much of the costs of public education from such taxes (Burgess 1997).

If these public costs and revenue returns to schooling are added to the private costs and wage returns on which Mincer's *private wage return* formulation is based, a *social return* to schooling can be calculated. It is expected that such social returns to schooling, neglecting elusive social externalities which are discussed later, would be lower than the Mincerian private wage returns and that this gap between private and social returns tends to be especially large for higher education in low income countries (Psacharapoulos & Woodhall 1985). Although the public costs of higher education tend to be somewhat larger than those of primary and secondary education in high-income countries, the public subsidies for a year of higher education in low-income countries can be 10 to 40 times larger than typical primary or secondary school public subsidies per year of enrollment (Psacharapoulos & Woodhall 1985).

If the social benefits of schooling which are not privately realized by students and their families exceed the social costs of schooling, there is an efficiency argument for society to subsidize more of the costs of schooling or

increase public net educational expenditures. But if the former argument does not hold and the total social (including private) returns exceed the costs of borrowing capital to the government, then the justification for additional public spending should be considered in the context of a specific failure in the market for schooling that has led to the suboptimal private investment in schooling. One possibility is that either imperfect information about prevailing returns or credit constraints limit the poor's ability to invest in their human capital.

In this second situation, where the private returns appear themselves sufficient to call forth additional private investment in education, it is particularly important that public subsidies reduce the inequality of educational attainments. It is widely noted that public subsidies for education tend to be much less equal at the level of higher education than they are at the primary and secondary education levels (Colclough 1997; Hinchliffe 1993; Jimenez 1987; King 1997; Tilak 1997). Thus, private returns may strengthen an efficiency argument for public investment in higher education, but special policy instruments are needed to avoid public expenditures on higher education if it will cause a more unequal distribution of income in the future.

Social Externalities of Schooling

From the earliest application of this cost-benefit framework to the assessment of the productive contribution of education to the economy, it has been observed that education is desired by families and by society for many reasons in addition to its capacity to raise the productivity of a worker. Human capital offers only one perspective on education, although one that can be quantified and monitored over time. Those who are engaged in producing education, in designing tests to measure students' comprehension, or in evaluating the accomplishments of the broader educational system for society do not necessarily find the concept of human capital an attractive one, for it assigns a private value to education based on its apparent productivity in the wage labor market. There are many who see education as a merit good, which all people deserve to receive and which a good society should be willing to sacrifice for all to receive. Nonetheless, the question remains as to how to set social priorities: How much and what kind of schooling should a country produce, given its available resources?

Social externalities from education are benefits that are not realized in terms of private human capital or consumption benefits accrued by those who make the sacrifices to obtain the education, nor are they realized in increased output and profits by firms which employ the more educated worker. It is plausible that mass education should be seen as the backbone of a functioning democ-

racy, as well as an engine of modern economic growth (World Bank 2000). Social externalities of education which are not captured in the profits of private firms are one hypothesized mechanism to account for "endogenous growth" which can coexist with competitive markets and account for increasing returns (Lucas 1988; Romer 1986). However, few empirical studies have succeeded in measuring these social external benefits of education or even in suggesting the context in which they are expected to be most salient—for example, at the level of the nation-state, city, or local community.

Particular types of scientific education and allied research and development activities have been linked to the generation of social external benefits because they produce productive knowledge which may diffuse relatively freely in society. This knowledge may not be produced in sufficient amounts if left to private market incentives alone. The product of these allied training and research activities may also be most valuable in a limited geographic area and, therefore, provide solutions to local problems which are not readily transferred to neighboring regions without considerable investments to adapt them to new conditions. Consequently, to realize the benefits of these activities, they should be initiated close to where they will be used.

Two examples illustrate the special nature of these forms of higher education which are likely to engender social externalities. Agricultural sciences and biotechnology develop new inputs for the farmer, such as high-yielding varieties, which raise outputs and reduce the cost of production, thus contributing to reducing the relative price of agricultural commodities for the consumer. But these new agricultural inputs are often narrowly adapted to a specific latitude (that is, length of day), climate, and local pests. For similar reasons, public health research may help control endemic and epidemic diseases which specialize in climate, parasitic vectors, and population density and thus become localized. Consequently, they may require locally designed control interventions and policy evaluation studies.

These two types of higher education, in agriculture and public health, combined with applied research may be associated with a social externality, not only because they may have their greatest benefit for a specific segment of the world's population but also because the benefits are not readily appropriated through the sale of a product or service which would encourage optimal levels of production or consumption. Small-scale farmers and dispersed consumers may gain individually from the farmer's adoption of new plant and animal varieties but cannot normally coordinate actions to accomplish the investments in the development and diffusion of these new inputs.[2] In the case of disease control, preventive measures may benefit third parties through reducing their exposure to communicable disease. For example, coordinated mass vaccina-

tion or mosquito eradication campaigns can reduce a disease within portions of the population who do not personally incur the private costs of adopting preventive measures. These social externalities are typically cited to justify public expenditures and subsidies for such campaigns against communicable diseases. These types of agricultural and public health research and development efforts are thus subsidized by the public sector. But even in this case, researchers in these critical fields could be trained in another location where the training costs are lower, perhaps because of economies of scale and other complementary factors. When they complete their education, they would be assigned to a government-subsidized research institution located in the geographic region where these local externalities are expected to be most substantial. The example of the Consultative Group on International Agricultural Research (CGIAR) family of International Agricultural Research Centers is one institutional response to this situation, and the World Health Organization (WHO) or Centers for Disease Control (CDC) also support such regional field research centers devoted to the development and evaluation of disease control technologies in different geographic areas, including Africa. The International Center for Diarrhoeal Disease Research in Bangladesh (ICDDR,B) in Dhaka and Matlab is a well-known example where biological and social sciences have been combined.

In the more general case of higher education, there is scant evidence confirming the quantitative importance of social external return to education in high-income countries, where theory suggests it should be most salient and where data should be sufficient to detect its impact.[3] Nor do I know of studies of the social externalities of higher education in low-income countries, even in the plausible specific fields of agricultural science and public health. Are we left to rely on the intuition of educational leaders and of economic and political elites?

A growing number of low-income countries, including many in Africa, collect surveys from a random sample of households, which include standard data modules on education, wages, earnings, and other socioeconomic characteristics of workers. This data can illuminate the productivity of different groups of workers in the wage labor force and thus begin to clarify one source of private investment incentives for expanding different branches of education. In the future it may then be possible to combine wage benefits of schooling and more accurate information on the public costs of schooling to infer social returns. At the moment, however, the foundation of scientific evidence for general social externalities to higher education is weak. The case should therefore be initially based on wage returns and revised as further information on consumption benefits, public costs, and externalities become available. The best documented

examples of social externalities associated with schooling involve basic education and its consequences on home production processes which first benefit the family but also spill over to benefit other members of the society. Most of the examples I know involve the formation of human capital in children. It can be argued that societies should not necessarily always encourage more investment in future generations, for this typically involves the sacrifice of consumption of the current, relatively poor, generation for the benefit of a future generation which should enjoy a higher standard of living. But most societies nonetheless view such human capital investments in children as a state-assisted activity. Most micro-empirical studies of child development find that increases in the schooling of the mother are associated with improvements in child developmental outcomes and also find that these effects tend to be larger than those associated with the same increases in the years of schooling of the father. This holds true whether the development indicator is birth weight, child survival, good nutritional status as proxied by height or weight-for-height at a given age, age of entry into school, school enrollment adjusted for age, and years of schooling completed upon reaching adulthood (Schultz 2002).[4]

The other potential externality of schooling relates to fertility, which is inversely related to women's schooling. On balance, the evidence suggests that increments to the schooling of men, holding constant only for the educational attainment of women, are associated with *increases* in fertility in many poor agricultural countries (Schultz 1994). The social cost of high fertility and rapid population growth are not easy to quantify with available scientific methods (National Research Council, 1986), but many countries have concluded that their society stands to gain in the long run by slowing rapid population growth. This conclusion would justify assigning a higher priority to basic education, especially education. All human capital intergenerational externalities of schooling favor society promoting the schooling of females, but most studies have concentrated on the effects of primary and secondary education. Higher education is not generally stressed as a means for promoting these goals of slowing population growth and increasing the accumulation of child human capital.

What to Infer from Wage Differences by Schooling?

Many scholars of developing countries are skeptical that wage differentials are a satisfactory indicator of the relative productivity of heterogeneous labor or even a sign of the economic scarcity of different classes of workers in the private wage sector. For example, a World Bank analysis of Côte d'Ivoire reports earnings differentials which that imply each year of schooling of a worker is associated with his or her receiving on average a 23% increment in earnings,

after holding constant for the sector in which the worker is employed (formal or informal, government, public enterprise, or private firm). The authors conclude their discussion of their estimated wage function by attributing the high private rate of return to imperfections in the labor market. They caution that it is "reasonable to link this result to rigidity in salary scales." And without offering further evidence, the authors conclude that "there is probably considerable room for reduction in wages and salaries throughout the modern labor market that would make wages and salaries more competitive" (Berthelemey & Bourguignon 1996: 48). No description is provided of an empirical test for market wage rigidity, or how they propose to achieve a reduction in wages in the modern sector; but the assumption that labor markets in low-income countries are seriously distorted (i.e., by unions and governments) has a long and influential history in development economics from Lewis (1954), to Fei and Ranis (1964), and Harris and Todaro (1970).[5]

From the perspective of university administrators and personnel, the benefits of having more graduates of higher education in low-income countries extend well beyond the productive earning capacity of those who receive the higher education. The World Bank's Task Force on Higher Education and Society argues:

> Rate-of-return studies treat educated people as valuable only through their higher earnings and the greater tax revenues extracted by society. But educated people clearly have many other effects on society: educated people are well-positioned to be economic and social entrepreneurs, having far reaching impact on the economic and social well-being of their communities. They are also vital to creating an environment in which economic development is possible. Good governance, strong institutions, and a developed infrastructure are all needed if business is to thrive—and none of these is possible without highly educated people. Finally, rate-of-return analysis entirely misses the impact of university-based research on the economy—a far-reaching social benefit that is at the heart of any argument for developing strong higher educational systems. (World Bank 2000: 39)

Quantitative evidence and analysis are not marshaled in the World Bank's report in support of these views.

These two examples span a field of skeptics who implicitly reject the value of systematically consulting empirical evidence on wage structures to infer relative scarcity of skills in developing countries. The first point of view discounts the measurement of large differences in wages between educational groups as due to unspecified distortions in the labor market, and the second

denies the relevance of presumably small wage differentials associated with higher educational attainments in low-income countries as due to the neglect of unquantifiable, but clearly important, social externalities. In the 1980s, it could be conjectured that "the proliferation of models and the lack of attention to testability stems from the lack of good data" (Binswanger & Rosenzweig 1984: 40). But even in 1984, the authors forecast that the improvements in survey data for Asia should bring to an end the era of development economics which neglected to integrate theory and data regarding the performance of workers in low-income labor markets. The gains in household and labor force survey data in Africa in the last decade have been almost as dramatic, but there are still few African countries which use these surveys to evaluate programs and policies or inform priorities in education. Meanwhile, an econometric literature has begun testing hypotheses advanced for why estimated wage functions might be biased or misleading (Card 1999). Although this field of research in labor economics is dominantly directed to the study of wage structures in high-income countries—and notably the United States—the issues of statistical bias and measurement error do not seem fundamentally different in low- and high-income countries.

Wage differences between workers with various amounts and types of schooling provides initial information on private returns to schooling which may then need to be adjusted to take social costs and benefits into account. The most common concern with these direct measures of wage returns to schooling is that other determinants of the wage have not been adequately taken into account and that these "omitted factors" may themselves be plausibly correlated with schooling. Consequently, some of the influence of the omitted factor on wages will be spuriously attributed to schooling. These omitted factors could be related to the productive capacity of the individual worker (i.e., as ability, health, mobility, preferences) or to the process of sorting individuals into better-paying jobs (i.e., family connections, ethnicity, and other market imperfections such as the political allocation of government jobs or employment in public enterprises).

There is no entirely satisfactory way to deal with the bias potentially introduced by all such omitted variables, but two empirical strategies warrant discussion. Either the social statistician attempts to measure the omitted factor and to include it while estimating the wage function (and thereby focuses on the partial association conditional on the control variables), or else the statistician specifies an "instrumental variable" that is associated with schooling but which is assumed to not be correlated with the omitted variable.[6] The original motivation of this literature was to correct for the omitted "ability" and "family socioeconomic status" of the worker which were expected to overstate the

wage function returns to schooling. But these expectations have not been confirmed with any consistency by the extensive empirical literature. The first generation of evidence concluded that the magnitude of this total bias in estimated returns was small, probably because the omitted variable upward bias was offset by errors in the measurement of education, which would bias downward the ordinary least squares (OLS) estimate of the effect of education on wages (Card 1999).

Card (1999, 2001) interprets instrumental variable estimates as also suggesting that there exists heterogeneity in "response to schooling treatment" of individuals. Different instrumental variables often measure the impacts of the supply of educational opportunities in an individual's residential area, which might advance the schooling of a different subpopulation for whom the returns to education need not be the same. Thus, the policy implications of estimated returns to schooling depend on the choice of instrumental variables that simulate the effect of a specific policy operating at the margin of a specific sample. In exploring the robustness of wage returns across a variety of such interventions (that is, instrumental variables), a policy researcher could be encouraged to discover those interventions that achieved both a high return and a favorable socioeconomic distribution of benefits.[7] My effort to assess the robustness of instrumental variable estimates of overall educational returns in Côte d'Ivoire and Ghana did not find that they changed significantly from those estimated directly by ordinary least squares (Schultz 1999). I do not know of any instrumental variable estimates of wage returns to higher education in Africa.

Instrumental variables in the form of distance and access to school from the respondent's childhood household were used to estimate the private wage returns to schooling attainment for a sample from the Bicol Province of Philippines in the 1990s. The instrumental variable estimates of schooling returns are about 60% larger than those obtained by ordinary least squares, with or without correcting for possible sample selection bias (Maluccio 1997, Tables II.2, 3, 5). In Indonesia, when district school construction programs are used as an instrument for school attainment of respondents who were then of school age, the instrumental variable estimates of return to schooling in the 1990s is only slightly larger than those estimated by ordinary least squares (Duflo 2001). I see no clear basis for concluding from existing evidence that OLS estimates are overstatements (or understatements) of the returns to higher education in low-income countries generally or specifically in Africa.

The size of household surveys is a limiting factor in the analysis of higher educational returns. First, the fraction of the adult population which works for a wage and thus provides information for estimating a wage function may be small in a low-income African country, particularly for women.[8] The fraction

of the population with any higher education will also be very small. The only solutions to this problem are to expand the size of the survey or to oversample the better educated, perhaps by geographic stratification of the sample. This is implicitly already occurring when surveys are stratified and when the relatively small fraction of the population residing in urban areas—those who also happen to be among the better educated—are oversampled.

Contemporary labor force surveys document not only that wages differ by schooling but also that wages differ between workers with different years of postschooling experience. Presumably this is the case because they acquired training on the job and this work experience or maturation raises their productivity. When the wage is expressed in relative terms, or in logarithms, wages increase with years of postschooling experience, but at a diminishing rate in the cross section. This is approximated by a quadratic form in experience, in which the coefficient on experience squared invariably receives a negative sign when workers of all ages are pooled (Mincer 1974; Rosenzweig & Wolpin 2000).

Analyses of wage structures confirm that an increase in the relative supply of older or younger workers of a specific education level, who have more and less experience, reduces their own group's wages and thereby exerts a smaller "supply effect" on neighboring groups in the labor force with dissimilar amounts of experience or schooling. In other words, these groups are imperfect substitutes for each other in production. To make today's educational training opportunities more efficient, the wage differentials by education which are most relevant to policy are those among young recently graduated workers.

Consequently, if the wage returns to higher education are much lower among the young compared to the old, one possible conclusion is that the supply of educated workers relative to the derived demand for educated workers in the economy is larger than it was in the previous generation. The wages of young educated workers decline relative to those of young less-educated workers in order for the economy to employ the increased supply of educated youth. This was the conclusion drawn from a study of Kenya during the 1980s (Knight & Sabot 1981, 1990). By estimating wage returns within narrower age groups, any trend across age groups is offered as suggestive evidence of an evolving "imbalance" between supply and demand of educated workers. Wage returns may also rise with experience for a birth cohort as it ages if schooling and postschooling experience are complementary in production, but this possibility can be adequately assessed only when a repeated series of cross sectional surveys are analyzed (e.g., Card & Lemieux 2001).

Estimates are reported in the next section for two age groups, the young (age 25–34), who should have completed their education and entered the labor force, and an older group (age 35–54). The older group excludes those age 55

and older among whom health limitations and retirement begin to impact productivity and possibly change the composition of the working sample, which could potentially distort measured returns. The cost of disaggregating the sample by age is that, with smaller sample sizes, the return estimates are less precise.

A few country examples may suggest patterns prevalent in Africa and indicate how far the data can help to set priorities regarding the levels of education that are currently needed. Given the reluctance of leaders of higher education to consider these wage patterns for policy purposes, it is ironic that in those countries for which I could obtain data the returns to higher education appear to be substantial and possibly rising. Within the limited scope of this paper it is not possible to incorporate the public costs of these levels of schooling to approximate even rough estimates of the social returns to higher education.

Country Estimates from Household Surveys
of Wage Differentials

Repeated comparable household surveys on which to base an assessment about the market returns of education over time are available from four African countries. I focus on Ghana because it has experienced long swings in its educational investments and economic growth and because some of its features can be compared with those prevailing in Kenya[9] and neighboring Côte d'Ivoire. Finally, estimates from South Africa are available by four race groups which provides a simple test of how political restrictions in the supply of higher education to Africans affect their wage returns, signaling an inefficient and inequitable economic outcome caused by the past underinvestment in African higher education.

Ghana experienced a difficult economic period following its independence in 1957.[10] Economic growth kept up with population growth only during the first decade, and from 1965 to 1985 real GDP declined. By contrast in the same period, Kenya sustained a growth in per capita GDP of 2% per year, while Côte d'Ivoire grew initially at the same rate as its population, and then accelerated until the 1980s (World Bank, 1986). By the end of the 1980s, Ghana began to revive, while Côte d'Ivoire stagnated, and Kenya expanded rapidly. But in the 1990s the order reversed; Kenya had slowed to an annual growth rate of 2.2%, Côte d'Ivoire had grown at 3.7%, and Ghana at 4.3% (World Bank 2000–2001). Ghana started with much more widespread provision of primary education already in the 1950s, while Côte d'Ivoire and Kenya grew thereafter more rapidly and invested more heavily in their public educational systems, catching up to Ghana, as shown by five-year moving averages of educational attainment in Figures 1, 2, and 3, by gender and age. Against the backdrop of eco-

nomic growth and decline in these countries, household surveys can suggest how current wage structures reward those who have acquired more schooling. These implicit "private returns" to schooling are expected to be depressed by a relatively large supply of workers with these schooling skills, and they are expected to be raised by skill-biased technological change (typically unobserved) or by national growth which may boost the relative demands for higher skilled labor.

A nationally representative household survey, the Ghana Living Standard Survey (GLSS) was collected in 1987–1988, 1988–1989, 1991–1992, and 1998–1999.[11] Table 1 reports the regression coefficients from an estimated log wage function on different educational attainment categories for persons age 25 to 54, who report a wage and time worked. The omitted educational category is "none," which included 31% of the males in 1987 and 20% in 1998 in 1987; 55% of females had not received any schooling, and this unschooled share had declined to 40% in 1998. Individuals with only a secondary school certificate were 4.4% of the males and 1.2% of the females in 1987. These figures had increased slowly to 5.2% and 1.9%, respectively, by 1998. University degrees are rare; but including teacher/nurse/technical certificates from postsecondary institutions, the fraction with any higher educational degree was 6.8% for males in 1987 and 8.8% in 1998. Among females the share has remained roughly constant at 2.8%.

The private wage returns per year of schooling between different educational categories, are estimated at the bottom of Table 1. Enrollment in primary to middle school yields modest returns averaging about 4% per year in this period, whereas return between middle and secondary school are larger, averaging about 10%. University four-year degrees earn a return that averages about 16%; but because of the small sample, these estimates are highly variable from year to year and across sexes. The nurse/teacher certificates appear to be well rewarded for a two- or three-year course of study; however, the inability to assign a particular number of years to these courses or those called vocational and commercial precludes drawing any firm conclusions regarding the estimates of the returns to these heterogeneous educational programs, some of which require only primary school preparation for admission.

Table 2 reports the same specification for the wage function for the first and last year of the Ghana surveys but disaggregates by age. The estimates for returns to university training and postsecondary training tend to be larger for the younger birth cohort than the older birth cohort, suggesting that the balance of the supply versus the demand for higher educated workers is becoming more

Figure 1: Years of Schooling Completed in Ghana by Age in 1987: Males and Females
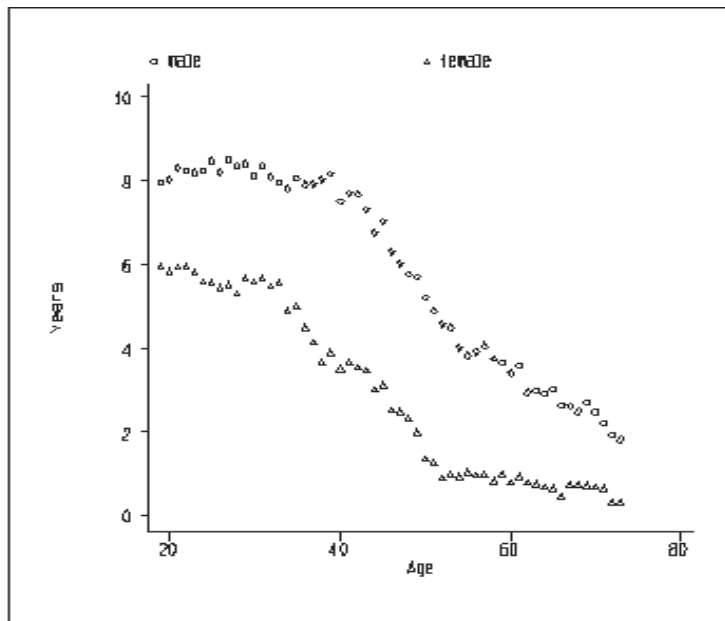
favorable for these best-educated workers in Ghana. It has been common to assume that returns to schooling fall as a student extends his or her education into more advanced levels of schooling (Becker 1964; Psacharopoulos & Woodhall 1985), but this does not appear to be the case in Ghana or in many other low-income countries where the education bottleneck to supply is often at the secondary or university levels (Schultz 1988).

In Côte d'Ivoire the more recent expansion of primary and secondary schooling has occurred during a period of overall growth. (See Figure 2). As shown in Table 3, private wage returns for primary and middle school are larger than in Ghana in 1987-1989 by about 10-12%, either because of the smaller supply of primary graduates in Côte d'Ivoire or the more rapid aggregate growth of the economy which stimulated derived demands for better educated workers. Secondary school is associated with very high 12% to 28% returns. At the university level, returns are variable within these age stratified samples but average 13%. There is no clear indication in Côte d'Ivoire that the returns to the younger sample (age 25–34) are falling relative to the older sample.

Kenya became independent in 1963 and has grown relatively rapidly for Africa, at least until the last decade. Its rapid expansion of education has consumed more than 6.5% of its GNP since about 1980, while private and locally funded secondary schools are also an important feature (Knight & Sabot, 1990; World Bank, 2000-2001, p. 284). In Ghana, the share of GNP spent on public education was 3.1% by 1980 and increased to 4.7% by 1997. Côte d'Ivoire initially spent the largest share of its income on public education (7.2% of GNP in 1980), but this share had fallen to 5.0% by 1997 with the recent retrenchment of the public sector (World Bank, 2000-2001).

Estimates of wage functions for Kenya presented in Table 4 are based on the 1994 Welfare Monitoring Survey II. Wage returns are on the order of 9% at the middle school level, and they tend to increase for women at the secondary level, and probably also in the heterogeneous vocational and technical training programs. At the university level, the returns are high and appear to be larger for women than men, which was not generally the case in Ghana or Côte d'Ivoire. If there is a difference between the younger and older cohorts, it is that the young tend to receive a larger wage return on their higher education than the older cohort, suggesting that the supply of university graduates has not yet caught up to the demand as of 1994, or possibly that the quality of higher education has improved over time.

Perhaps in response to the higher returns to women than to men at the secondary and higher educational levels, by 1994 women in Kenya were receiving almost as many years of schooling on average as men among the youngest generation.[12] Among Kenyans of an earlier generation (age 50-54), women had only a third as many years of schooling as had men, 1.4 compared to 4.2. (See Figure 3.) This apparently rapid advance in female education relative to male is probably contributing to the increased rate of migration of women from rural to urban areas and to the sharp decline in Kenyan fertility documented in the last decade. These factors placed Kenya among the first sub-Saharan countries to progress rapidly into its demographic transition, along with Botswana, Zimbabwe, and perhaps Senegal (National Research Council, 1993).

In 1993, the Project for Statistics on Living Standards and Development collected a representative household survey for South Africa from which Figure 4 is derived. More than three quarters of the population age 16-65 is Black African, 8% of mixed race or "colored," 3% of Indian descent, and 14% White. Table 5 reports the log wage function coefficients on the highest categories of education completed by workers, stratified for the two largest groups, Africans and Whites, whereas the smaller groups of mixed race and Indian exhibited intermediate levels of schooling and wage returns to schooling.

Table 1: Log Wage Function Estimates for Ghana in 1987, 1988, 1991, and 1998

	Years of	1987		1988		1991		1998	
	Schooling	Male	Female	Male	Female	Male	Female	Male	Female
Regression Coefficients *(Omitted category is no schooling)									
Some primary	4	.289	.203	.219	.389	.241	.303	.337	.098
Middle certificate	10	.574	.160	.477	.640	.563	.437	.615	.390
Secondary certificate	15	1.135	.334	1.054	1.224	1.063	.834	1.107	1.148
Commercial/vocational	5-12	.520	.256	.380	.733	.960	.316	.875	.774
Teacher/nurse/ Technical certificate	17	1.297	1.087	1.304	1.464	1.555	1.448.	1391	1.400
University	19	1.701	1.409	1.779	1.398	1.778	1.721	2.098	1.143
Rural resident	B	-.521	-.557	-.348	-.596	-.357	-.484	-.469	-.461
R^2	B	.138	.080	.117	.111	.180	.152	.181	.133
Mean of dependent variable									
(log hourly wage)		3.40	3.19	3.46	3.16	4.44	4.26	6.06	5.81
(Standard deviation)		(1.19)	(1.36)	(1.21)	(1.42)	(.991)	(1.09)	(1.15)	(1.15)
Sample size		1555	1444	1715	1617	1989	1878	2669	2788
Implied Private Rate of Return in Percent per Annum									
(Primary-none)	4	7.2	5.1	5.5	9.7	6.0	7.6	8.4	2.5
(Middle-primary)	6	4.8	-.7	4.3	4.2	5.4	2.2	4.6	4.9
(Secondary-middle)	5	11.	2.6	12.	12.	10.	8.0	9.8	15.
(UniversityBsecondary)	4	14.	27.	18.	4.4	18.	22.	25.	0

*Also includes postschooling experience and experience squared

Table 2: Log Wage Function Estimates for Ghana, 1987 and 1998

| Years of Schooling | | 1987 | | | | 1998 | | | |
| | | Age 25-34 | | Age 35-54 | | Age 25-34 | | Age 35-54 | |
		Male	Female	Male	Female	Male	Female	Male	Female
Regression Coefficients *(Omitted category is no schooling)									
Some Primary	4	.359	.249	.261	.250	.425	.301	.311	-.114
Middle certificate	10	.585	.412	.615	.132	.660	.502	.625	.175
Secondary certificate	15	1.321	.815	1.160	1.041	1.243	1.178	1.073	.991
Commercial/vocational	5-12	.832	.615	.357	.247	.849	.758	.905	.584
Teacher/Nurse/ Technical certificate	17	1.567	1.487	1.173	1.147	1.392	1.534	1.413	1.125
University	19	2.268	2.973	1.449	1.289	3.022	2.191	1.861	.203
Rural Resident	B	-.533	-.364	-.513	-.740	-.537	-.476	-.435	-.448
R^2	B	.125	.057	.151	.104	.164	.123	.190	.150
Mean of Dependent Variable									
(log hourly wage)		3.31	3.30	3.48	3.09	5.99	5.76	6.10	5.84
(Standard Deviation)		(1.20)	(1.35)	(1.18)	(1.36)	(1.12)	(1.11)	(1.17)	(1.37)
Sample Size		672	676	883	768	938	1132	1731	1656
Implied Private Rate of Return in Percent per Annum									
(Primary B None)	4	9.0	6.2	6.5	6.3	11.	7.5	7.8	-2.9
(Middle B Primary)	6	3.8	2.7	5.9	-2.0	3.9	3.4	5.2	4.8
(Secondary B middle)	5	15.	8.1	9.9	18.	12.	14.	9.0	16.
(University B Secondary)	4	24.	54.	5.8	6.2	44.	25.	20.	-20.

*Also includes postschooling experience and experience squared

Figure 2. Years of Schooling Completed in Côte d'Ivoire by Age in 1985: Males and Females.
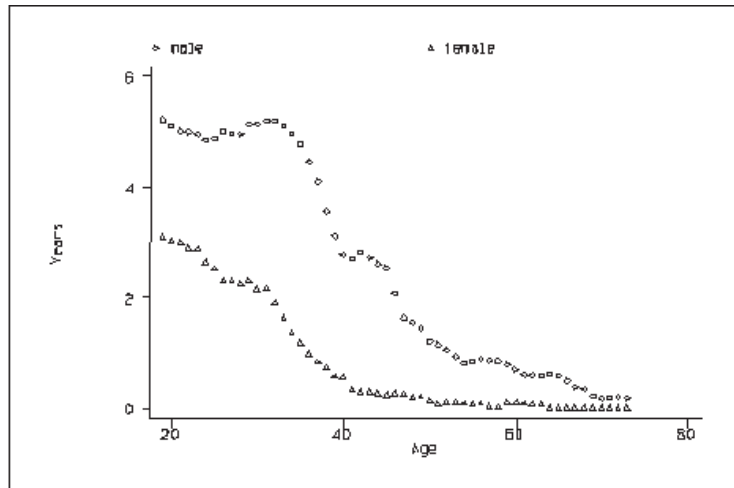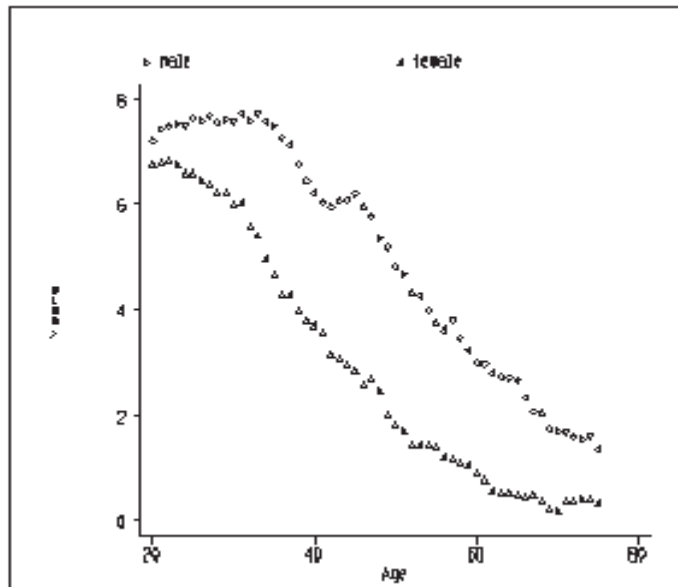

Figure 3. Years of Schooling Completed in Kenya by Age in 1994: Males and Females.

Table 3: Log Wage Function Estimates for Côte d'Ivoire in 1985–1987

	Years of Schooling	Age 25-34 Male	Female	Age 35-54 Male	Female
Regression Coefficients *(omitted category is "no schooling")					
Some Primary	4	.342	.353	.483	.674
Primary certificate	6	.920	.270	1.043	.624
Middle certificate	10	1.474	.653	1.502	.775
Secondary certificate	12	1.903	.887	2.013	1.333
Tech & professional	6-11	.338	.201	.185	.590
University	17	2.703	1.069	2.191	2.754
Rural resident	B	-.479	-1.21	-.718	-1.35
R^2	B	.389	.332	.353	.270
Mean of dependent Variable					
(log hourly wage)		5.71	5.10	5.63	4.73
(Standard deviation)		(2.14)	(2.79)	(2.11)	(2.96)
Sample size		867	666	1355	928
Implied Private Rate of Return in Percent per Annum					
(Primary-none)	6	15	4.5	17.0	10.0
(Middle-primary)	4	14	9.6	12.0	3.8
(Secondary-middle)	2	22	12.0	26.0	28.0
(University-secondary)	5	16	3.6	3.6	28.0

*Also includes postschooling experience and experience squared

The implied private wage returns to higher education are nearly twice as high for Africans as they are for Whites, and returns are highest for those with higher education within each distinguished race and age group, and for both sexes (Mwabu & Schultz 2000). One simple explanation for the high returns to secondary and post-secondary education for Africans is that the number of Africans who have been able to attain these levels of education has been restricted or politically rationed by the previous government. For example, only 2% of African men and 5% of African women ages 45-65 had any higher education. Even among the youngest age group (16-29), the fractions of African men and women with any higher education was only 5% and 12%, respectively. In contrast, 34% of White men and 25% of White women ages 45-65 had some higher education, with the fraction rising among younger Whites. The roughly 10 times larger proportion of Whites than Africans with higher education is one factor

**Table 4:** Log Wage Function Estimates for Kenya in 1994, by Age and Gender

	Years of Schooling	Age 25–34		Age 35–54	
		Male	Female	Male	Female
Regression Coefficients *(omitted category is "no schooling")					
Some primary	6	.574	.561	.584	.138
Middle certificate	8	.857	.651	.814	.462
Secondary certificate	12	1.151	1.397	1.279	1.206
Vocational/tech	10-14	1.531	1.772	1.507	1.580
University	16	1.983	2.452	1.784	1.858
Rural resident	B	-.603	-.943	-.681	-.901
R^2	B	.151	.193	.208	.167
Mean of dependent variable					
(log hourly wage)		2.27	1.51	2.22	1.45
(Standard deviation)		(1.17)	(1.32)	(1.26)	(1.29)
Sample size		2625	2290	3401	2210
Implied Private Wage Returns in Percent per Annum					
(Middle-none)	8	11.	8.1	10.	5.8
(Secondary-middle)	4	7.4	20.	12.	19.
(University-secondary)	4	21.	26.	13	16

*Also includes postschooling experience and experience squared.

lowering the return to higher education among the Whites compared with Africans. African wage returns are also higher for the younger groups, suggesting that the imbalance between supply and demand increased in the last years of the apartheid regime, with the wages of Africans ages 25-34 being nearly a third higher (32%) for men who had an additional year of higher education and higher by almost half (46%) for women. The political rationing of advancement of Africans into the higher education system generated both an inequitable distribution of schooling (see Figure 4) and an inefficient allocation of resources from a perspective of private returns. This pattern of returns underscores the urgent need in South Africa to expand access to higher education for non-Whites who were previously rationed out of the system, as well as to merge and equalize the quality or public resources spent per student, regardless of race.

Figure 4: Years of Schooling Completed in South Africa by Age in 1993:
Africans and Whites by Gender
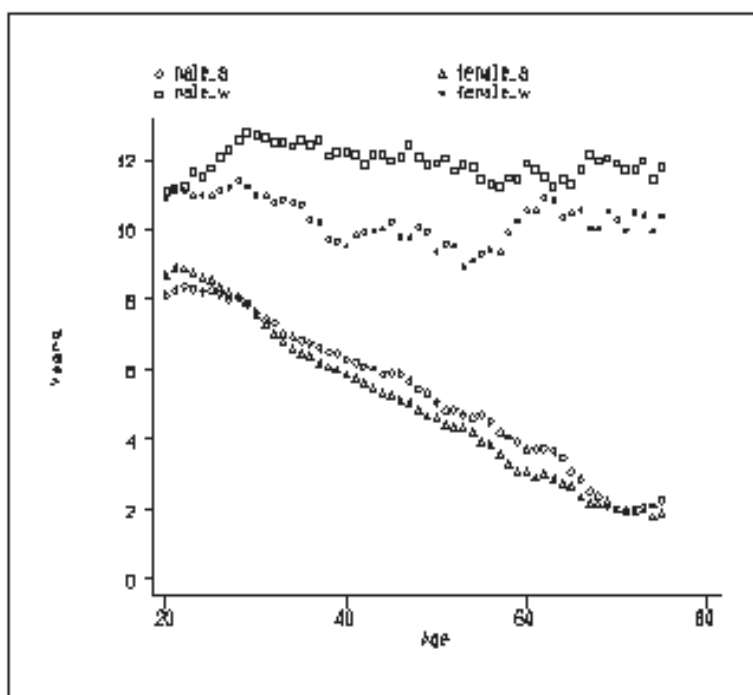
Who Benefits from Subsidized Higher Education?

Some aspects of the personal distribution of educational opportunity in Africa
are suggested by a cross tabulation of information available only from the 1985-
1989 Living Standard Surveys from Ghana and Côte d'Ivoire, which asked
about the education of the mother and father of all household members. The
measure of higher educational opportunity examined here is the likelihood that
a person received some higher education. It is calculated for all persons enu-
merated in the surveys collected in the late 1980s and is thus restricted to those
in a birth cohort who survived to this period and did not emigrate to another
country.

Table 6 reports that 1.8% of the males age 55 or over in Ghana had some
higher education, whereas that fraction increased more than fourfold, to 8.8%,

among those ages 35 to 44, and then fell back to 6.7% in the subsequent youngest group (25 to 34). Females have also experienced a large increase in their receipt of higher education in Ghana, but their likelihood of attending higher education was only about a quarter that of males. This schooling difference between men and women is widely evident in most parts of sub-Saharan Africa, with the prominent exception of South Africa, and was diminishing in Kenya by the late 1990s. (See Figures 1-4; Mwabu & Schultz, 2000; Schultz 1995). Among males in Ghana age 55 and over, those whose father had some secondary schooling had a 40% chance of higher education, 22 times the national average, and 33 times that of a male whose father had no schooling. (See Table 6.) Those older males with a mother who had some secondary school achieved higher education 67 times more frequently than those with a mother who had no schooling. These indications of extreme intergenerational inequality of educational attainment diminished for the younger males, as education became more widespread, but still remains unequal. Among those aged 25 to 34, the likelihood of continuing to higher education was about four times greater for those with a father with some secondary school than for those with a father with no schooling, and seven time greater if one's mother had this advantage in schooling. The intergenerational educational mobility for female respondents is even more unequal than for males, just as the overall levels of education are lower for females than for males.

Until the 1970s, the educational system reached a smaller fraction of the population in Côte d'Ivoire than in Ghana, but thereafter higher education was obtained by nearly twice the share of males in Côte d'Ivoire as in Ghana, or 11% of those age 25–34, while 2.8% of females of this age had reached higher education.[13]

Women in Côte d'Ivoire attained higher education only one-fourth as often as men, but even this gender share was an improvement for younger women compared with older women. The relatively rapid economic growth of Côte d'Ivoire until the 1980s was mirrored in its rapid expansion of the educational system at all levels, which contrasts with the decline in Ghana. However, the educational intergenerational mobility of the two countries appears to be of roughly the same order of magnitude. Among males or females aged 45–54, the likelihood of attaining higher education in Côte d'Ivoire is 25 times larger if one's father had some secondary schooling than if he had none, and 50 times larger if one's mother had this same educational advantage. These ratios of the likelihood of receiving higher education conditioned upon the education of one's father declined in Côte d'Ivoire to 3.5 for males aged 25–34; based on one's mother's education, they declined to 7.4. There are too few older women

with any higher education in the survey to assess longer-term trends for women in Côte d'Ivoire, but for those aged 25–44, the ratio of the probability that women will receive some higher education if their fathers had some secondary schooling to that of women whose fathers had no schooling is about 40 to 1— even more unequal than for males of the same age.

These indicators of intergenerational mobility confirm what observers have widely suspected and criticized (Colclough 1997; Kimalu et al. 2001; King, 1997; Psacharapoulos & Woodhall 1985). Higher education, which is predominantly public in Africa, has absorbed relatively large public subsidies per student year, often without charging any student fees; and in some cases, such as in Côte d'Ivoire, academically qualifying students are provided with living stipends. The resulting large public transfers made to students enrolled in higher education benefit predominantly those families who were relatively well educated in the past. According to the wage functions reported earlier, these well-educated parents receive, on average, relatively high wage rates and are disproportionately at the top of the income distribution. As shown earlier, the private wage returns to higher education are large, rewarding generously the families who can obtain this level of schooling for their children. Without systematic efforts to help the poor prepare to qualify for, and to enroll in, higher education, the maintenance of the institutions underlying the status quo will contribute to sustaining the substantial economic inequality present today in Africa, if not continuing to make it progressively more unequal in the future.

What policy alternatives might reduce these undesirable distributional consequences of the African system of higher education? The challenge is to find a self-sustaining source of revenues on which to anchor an expansion of higher education, while at the same time reducing the concentration of "rents" generated by the current system of higher education in the hands of the wealthiest elites.

Policies to Improve Distributional Consequences
of Educational Subsidies

Changing the personal distribution of benefits of higher education can be facilitated by a variety of pricing, transfer, and regulatory policies, and perhaps by changing the mix and location of educational institutions in Africa. Some of these changes might also improve the efficiency with which the public educational sector currently operates. Student loans, quotas, and targeted subsidies are all conventional methods to deal with the distributional problem described here, and they have been tried in different contexts with mixed success (Albrecht & Ziderman 1991; Colclough 1997; Johnstone 1992; Tilak 1997). Which of these approaches holds the greatest promise for Africa?

Table 5: Log Wage Function Estimates of Returns to Years of Schooling by Level in South Africa in 1993, by Race, and Gender

	Years of Schooling	Africans				Whites			
		25-34		35-54		25-34		35-54	
		Male	Female	Male	Female	Male	Female	Male	Female
Regression Coefficients (omitted category is "no schooling")									
Some	6-8	.293	.348	.465	.636	.083	.309	.734	-.246
Junior secondary	10	.728	.986	.872	1.291	.142	-.345	.195	-.315
Secondary	12	1.184	1.614	1.245	1.869	.546	.215	.668	-.069
Teacher/nurse/technical certificate	12-14	1.819	2.510	1.752	2.553	.870	.337	.793	.281
University	16	2.448	3.438	2.389	2.908	1.365	.713	1.137	.488
Rural	B	-.476	-.339	-.555	-.394	-.227	-.461	-.040	-.031
R^2	B	.360	.450	.346	.469	.247	.204	.151	.249
Mean of dependent variable (log hourly wage)		1.46	1.12	1.53	1.08	3.19	2.75	3.41	2.79
(Standard deviation)		(.890)	(1.09)	(.979)	(1.07)	(.598)	(.612)	(.746)	(.526)
Sample size		850	541	1115	767	214	192	317	541
Implied Private Rate of Return in Percent per Annum									
Junior secondary-none	10	7.3	9.6	8.8	13	1.4	-3.4	1.9	-3.1
Secondary-junior secondary	2	22.0	32.0	18.0	28.0	20.0	28.0	24.0	12.0
University-secondary	4	32.0	46.0	29.0	26.0	20.0	12.0	12.0	14.0

Note: The wage analyzed here is based on the sample for which the cash wage is positive and expressed as an hourly cash wage. A few additional individuals also report income in kind (food, housing, transportation, etc.). Summing these cash and in-kind income per hour leads to a wage with more outlying values that are less plausible, perhaps because the units of time, such as per day, leads to some large and some very small in-kind wage rates per hour.

Table 6: Proportion of Children with any Higher Education in Ghana and Côte d'Ivoire, by Child's Age, Sex, and Parents' Education

	Sons by Age				Daughters by Age			
	25 - 34	35 - 44	45 - 54	55+	25 - 34	35 - 44	45 - 54	55+
Ghana (1985-87)								
All persons	.067	.088	.048	.018	.018	.023	.010	.004
(sample size)	(1722)	(1188)	(876)	(1140)	(2205)	(1299)	(1077)	(1353)
Father's Highest Education								
None	.053	.061	.035	.012	.007	.010	.005	.002
Primary[a]	.091	.245	.095	.076	.041	.076	.028	.028
Secondary[a] or more	.238	.176	.462	.400[α]	.083	.171	.143	.000[α]
Mother's Highest Education								
None	.059	.077	.045	.015	.015	.014	.006	.002
Primary	.148	.295	.091	.091	.051	.154	.143	.103
Secondary or more	.417	1.00[α]	1.00[α]	1.00[α]	.120	.455	.333[α]	.000[α]
Côte d'Ivoire (years)								
All persons	.111	.066	.022	.004	.028	.007	.002	.001
(sample size)	(2000)	(1301)	(1161)	(1535)	(2605)	(1835)	(1395)	(1405)
Father's Highest Education								
None	.085	.054	.017	.003	.009	.004	.001	.000
Primary[b]	.272	.170	.083	.000[α]	.140	.077	.080	.143[α]
Secondary[b] or more	.301	.304	.429[α]	.667[α]	.404	.150	.000[α]	.000[α]
Mother's Highest Education								
None	.105	.064	.020	.004	.020	.007	.002	.001
Primary	.257	.222[α]	.000[α]	.000[α]	.289	.000[α]	.000[α]	.000[α]
Secondary or more	.778[α]	1.00[α]	1.00[α]	~	.733	.333[α]	~	~

The mean is based on a cell of less than 10 persons. Cell is empty[a]Primary and middle combined for first 10 years of primary, followed by five years of secondary. [b]Primary is six years and secondary is six years.

Given the survey evidence that private wage returns to higher education are substantial, it is not obvious why poor families do not invest more in the schooling of their children. One hypothesis is that the poor family and student are credit constrained, at least, when they want to invest in human capital, because human capital does not offer lenders a recoverable form of collateral in case of default, such as land for the farmer who borrows or business assets for the entrepreneur (Jacoby & Skoufias 1997). One solution to this problem is to offer students loans, which they could repay from their enhanced future earnings. A central student loan facility could hope to monitor the earnings of most workers with a higher education who predominantly work in the modern sector. Pooling a large number of loans to students with different abilities, specialties, and working in different labor markets, such a facility should be able to reduce the risk on its overall portfolio and thereby reduce the interest rates it must charge to self-finance future loans. This approach was first adopted at some private universities in high-income countries and then extended nationally by governments on the basis of established need to finance a fraction of the actual costs of higher education. The U.S. government has also been able to require income tax forms to validate parent and student incomes, thereby minimizing the opportunities for fraudulent default (Nerlove 1975).

Yet evaluations of a variety of student loan programs in low-income countries conclude that they have had serious problems, with sufficiently high default rates to not become self-sustaining. The cost of administration represents a large fraction of total program costs (Woodhall 1992). Kenya and Venezuela are cited as examples where repayment rates have been so low that it would have been cheaper for the government to have provided the higher education without fees (Colclough 1997: 77). Moreover, if university graduates become highly indebted to a state loan program, this situation might encourage emigration as a means of escaping the burden of repayment, thus exacerbating the problem of brain drain. Pressure to institute restrictions on the emigration of citizens with higher education could then follow (Bhagwati & Partington, 1976). The Soviet Union, for example, allowed its citizens to emigrate to Israel, but only after they repaid the state for the cost of their professional training.

India has used quotas to achieve more representation in higher education from lower castes and tribes and to increase the fraction of women in political offices (Chattopadhay & Duflo 2001). Although admission quotas may achieve a redistribution of the benefits of higher education, they are likely to also create a lower quality of schooling for the groups assigned minimum quotas. If the quota is not based on a readily monitored characteristic such as sex, caste, or race, how would it be administered? Ethnic and language groups might be identified which had below-average educational attainment, according to a

population census, and individuals from these disadvantaged groups could then be assigned a compensating upward adjustment in their rankings for fellowships and for admission into institutions of higher education. Although such a policy might have appeal for its transparency, it could also have undesirable political consequences in a country where ethnic conflicts are already a serious source of social friction.

What would constitute a satisfactory index of economic need on which to target transfers in order to redistribute the benefits of higher education? What readily verified information could be used to direct educational subsidies to the educationally disadvantaged which would not encourage counterproductive forms of behavior? The survey data presented earlier for Ghana and Côte d'Ivoire suggest that parent education would be one such basis for identifying those differentially represented in higher education. This criterion for an educational subsidy would not have a marked disincentive effect on effort, labor supply, or market earnings. In addition, a government agency would presumably find it easier to monitor than current income or parental wealth.

Geographical targeting should also be easy to administer and relatively efficient. The income and education gaps between rural and urban populations are generally larger in low-income countries than in high-income countries where economies are more integrated and labor mobility is higher. Tables 1 through 5 illustrate from survey estimates of wage structures that wages are substantially lower in rural areas, even after controlling for the worker's schooling, age, and sex. Wage rates are between 30% and 43% lower in Ghana, 38% and 75% lower in Côte d'Ivoire, 45% to 61% lower in Kenya, and 30% to 33% lower for Africans in South Africa.[14] Per capita household expenditures could be estimated from a national household survey to further identify the relative poverty of different regions or provinces of a country and to adjust the subsidy amounts that might be provided to help families whose children could enroll in higher education.

Between a fourth and a third of the variation in educational attainments across individuals in Ghana and Côte d'Ivoire can be accounted for by a three-way geographic distinction (rural/capital city/other urban), parent schooling, and age, as illustrated by the regressions in Table 7. For example, in Côte d'Ivoire the average education of a male in Abidjan is four years greater than in the rural areas. The national average for males ages 25 to 54 is 3.8 years of schooling. Having a father with eight years of education versus a father with no schooling is associated in this simple multi-variate regression with an extra advantage in education of 4 years (i.e., .521 * 8 = 4.2). A targeted educational subsidy for children from rural poor areas with less educated parents, as guided by simple

relationships such as those reported in Table 7, could be financed by increasing regular tuitions and fees for students currently enrolled in public higher education. As discussed in the next section, increased student fees could not only help to finance the redistribution of benefits from higher education toward the poor, but it could also have a number of other consequences for the governance and probably the efficiency and equity of higher education in Africa.

Table 7: Schooling Attainment of Persons Aged 25–54 Fitted to Geographic Areas and Parents' Schooling

	Ghana 1987–88		Côte d'Ivoire 1987–89	
	Male	Female	Male	Female
Regression Coefficients[a]				
Rural (other urban omitted category)	-2.94 (16.0)	-1.86 (14.0)	-2.79 (18.0)	-9.07 (10.9)
Capital city	1.54 (6.09)	1.66 (8.57)	1.24 (6.98)	(13.) .333
Mother's schooling years	.130 (3.04)	.294 (10.4)	.233 (2.35)	.333 (6.67)
Father's schooling years	.300 (13.0)	.318 (20.0)	.521 (16.0)	.615 (29.0)
Age years	.400 (4.81)	.161 (4.14)	.300 (4.07)	-1.90 (4.90)
Age squared/100	-.746 (5.89)	-.373 (4.14)	-.541 (5.66)	.158 (3.14)
R^2	.234	.343	.311	.369
Sample size	3643	4419	4451	5838
Mean of schooling years	7.16	3.80	3.77	1.29
(Standard deviation)	(5.64)	(4.91)	(5.01)	(3.15)

[a]Also included dummies for year of survey and whether the education of the mother or father is missing, in which case the parent's education is set equal to the mean of parents reporting in the sample.

A variety of low-income countries have, in the last decade, implemented human capital incentive programs to encourage household demand for more education, and these programs could be productively adapted to African circumstances. Bangladesh introduced a secondary school scholarship program for girls, which placed the scholarship in a bank account for the girl, contingent on her not marrying before age 18. Other government programs, restricted to poor families, transferred food allotments (wheat) to each family if their children attended school 85% of the days in the session (Arends-Kuenning & Amin

2000). In South and Central Mexico, transfers to the rural poor began in the fall of 1998. By the end of 2000, 3 million families residing in small, very poor, villages were eligible to receive school and food subsidies through a program called "Progresa." The program seeks to increase the school enroll-ment of children from poor families by giving grants to mothers whose chil-dren are enrolled in grades three through nine and who attended 85% of the time. The size of the transfer payment increases with the child's grade level to approximate what a child could earn by working rather than going to school and raises consumption levels in eligible households by about one fifth (Schultz 2001). Three states in Brazil have experimented for several years with school enrollment bonuses for poor families, and the federal government enacted leg-islation in 2001 to extend these programs to the poor throughout the country (Sedlacek 2001).

These means-based educational subsidy programs require methodical plan-ning and careful monitoring to achieve their objectives of redistributing human capital, but they hold the promise of alleviating poverty and encouraging pro-ductive human capital investment among the poor. An evaluation of the effec-tiveness of the Progresa program to reduce family income-differentials in en-rollment rates suggests that these direct subsidies for child education (and nutrition/health) are reducing poverty and inequality in Mexico. These pro-grams may prove more effective in reaching disadvantaged children than tradi-tional public expenditure programs which add to the public *supply* of services, by building more schools (health clinics) or expending more on school (clinic) quality (Schultz 2001).

Africa should be encouraged to experiment in the design of higher educa-tion subsidy programs targeted to the children of the poor and to rigorously evaluate the consequences of such social welfare experiments. A program in higher education would also need to include support for secondary school stu-dents from disadvantaged backgrounds to augment the pool of secondary school graduates who could qualify for higher education. These household-demand subsidies for public education and health programs could help Africa avoid creating the extreme patterns of economic inequality that have a persistent grip on Latin America today. What constructive role could private education play in this process?

Private and Public Higher Education and Governance

Private institutions may help produce the trained workforce that the estimated wage functions suggest are demanded today in Africa. Governments should not unnecessarily restrict them from entry into higher education. Some courses of study may be more suitable than others for the private sector. From the U.S.

experience, vocational, apprenticeships, and some professional programs appear to be more successful in the private than in the public sector. This is perhaps because the vocational knowledge they transmit to their trainees varies over time, as the skills that are in short supply to private firms will change. Private groups appear to be more flexible and responsive to such evolving market scarcities than public agencies. In particular, the public sector may be restricted by civil service regulations and personnel policies that limit its capacity to hire, advance, and fire employees, traits that may be essential to flexibly provide the training programs that are privately demanded and to effectively use new technologies such as the Internet.

Private sector training organizations will need to charge students the full costs for training and thereby set a competitive market price which should help the public sector adjust its own structure of fees and tuition. Any excess demand for admissions in the subsidized public sector institutions of higher education can then spill over into the private sector; and those desiring it may acquire vocational training, even if they cannot qualify for admittance into the major public institutions. Although the development of private training organizations may create a lower-quality tier of private schools catering to the upper middle classes, as they have in some other low- and high-income countries, such a measure should help to prepare the way for more competitive public tuitions and fees. Examples might be found in terms of business, accounting and secretarial schools, and technical skills relevant to the installation and use of new information technologies, where the government might retain a role of administering proficiency examinations to set some standards on the quality of training individuals receive in the private and public sectors.

The reallocation of public sector resources to the traditional areas of academic and professional training might be an appropriate consequence of the expansion of private training. These forms of specialization between private and public institutions could lead to expanding programs in the physical and biological sciences and engineering, preserving core studies in mathematics and statistics, social sciences, and key fields of the humanities. Such a measure would be justified in part by the size of self-financing enrollments. With the increase in fees, students would also have stronger incentives to complete their studies more quickly. Independently administered exams for professional competency could further encourage competition between private and public training institutions.

Those professions which are employed mostly by the public sector, such as teachers, nurses, and agricultural extension workers, may be emphasized in the mix of programs in the public sector higher educational system. Increasing the number and quality of graduates from these programs should benefit the public

sector by its supply effect in reducing the wages which the public sector should pay in the future for its personnel. This argument for the public training of teachers, nurses, etc., may be valid if the labor market institutions surrounding public employment are competitive and if the public sector regularly evaluates its employees and does not renew contracts with those who are not doing an adequate job. Conversely, if these public sector teaching appointments are implicitly made for a lifetime and are not contingent on monitoring and work incentives, the public may not gain from increasing the supply of teachers. Rather the consequence may be smaller class sizes, which may be primarily an amenity for teachers and not an efficient use of public educational resources (e.g., Kimalu et al. 2001). There is surprisingly little evidence that reducing classroom size below 30–40 at secondary school level enhances the performance of students, nor have I seen evidence on this issue at the level of higher education.

Increasing immigration to other countries in the region or to high-income countries signals that individuals in a particular career or professional occupation are domestically in generous supply in the national economy. Before increasing the public training in such areas of brain drain, a careful review of the conditions of employment and training in the country may identify other constraints and regulations that might be modified to make domestic employment in the field more attractive and competitive to those abroad. Clearly some of the skills needed are those for which there are good jobs abroad; and retaining top scientists, doctors, and engineers will be perennial problems for low-income countries. Higher education has, as a major challenge, restructuring its hiring and advancement policies to reward performance, thus enabling it to compete for a few of the best faculty in critical fields. As long as public institutions of higher education are regulated by civil servant pay scales and hiring regulations, these institutions will be disadvantaged in getting and keeping the most talented or the hardest working faculty.

This topic raises the complex issue of administration and governance of higher educational institutions. They must be responsible to the government and to the public through transparent financial and output records. Yet they also must establish distinctive methods of decentralized budgeting, personnel management practices, and incentives to motivate individuals to perform their individual roles and cooperate in the joint tasks which a complex educational system requires. Governing boards of higher educational institutions should be insulated from government interventions, but they must nonetheless be responsible to the public. This requires the development of special institutions adapted to the complexities of higher education as well as to local conditions.

Transparency of finances is essential, but to gain control of setting their own priorities, these institutions should decide how to allocate their own revenue fees, subject to periodic public audits and review. There has been cogent criticism for many years of the practice of setting fees for higher education too low, which leads to "excess demand" for university admissions which tends to favor the upper middle income classes. Korea, for example is reported to spend 3.5% of its GNP on primary and secondary education, striving to equalize its quality across regions, while parents spend almost as much on tutoring to purchase an advantage for their children in gaining admission to the prestigious public universities which are free (Kim & Lee 2001).

Yet the political pressures from the groups that are favored by the current system of "free" universities in Africa lobby effectively with the politicians to prevent the universities from raising their fees to recover a more substantial share of the public costs of higher education. As a consequence, university faculty are confronted with growing class sizes and decreasing support for training infrastructure such as laboratories, computers, and libraries, as well as decreasing real salaries in many settings. Faculty are forced to take on additional teaching jobs, limiting their capacity to perform research. This may be expected to lead them to teach their students outdated materials and diminish their effectiveness as instructors. Allowing for limited faculty self-governance without empowering professional societies or unions is no less important in low-income countries than it is in high-income countries.

But if higher education has a financial responsibility to use its fee revenues to create new programs, close unsuccessful ones, strengthen old ones, and introduce funds for incentive pay and performance standards for faculty, the marginal uses of funds could begin to remedy many of the common problems that have led to the weakening of some outstanding universities in Africa. The ability to allocate new user fees would give the higher educational governing boards a flexibility in responding to organizational problems that may be difficult to otherwise reform and to initiate new activities for which the social returns are arguably high. Decentralization in resource allocation and decision making should be encouraged, down to the department level or the research unit, with the governing board specifying and monitoring the desired outcomes (e.g., enrollments and quality of training). Selection of respected faculty by the permanent staff to serve on various levels of university management would also be desirable to maintain professional standards and reduce corruption.

Another of the long-standing organizational challenges facing higher education is to orient its research and training capacity to problems that have local social importance. One linkage that is often difficult to achieve is that between

private industry and university researchers. The industrial firm wants to control the knowledge and innovations it produces by patents and the like, whereas the university faculty wants to publish their research findings to add to the base of knowledge which is recognized by their world community of scientific peers. These tensions have their obvious counterpart in high-income countries. Low-income countries should strive to create an environment where private firms and university researchers can pool resources to their mutual benefit and where public interests are likely to be served in the exchange.

Creating an intermediate-level research center which could be allied to a university but remain financially independent might provide a mechanism for rewarding research-oriented faculty with a supplemental salary, research laboratories, and justified research expenses, while leaving intact the more homogeneous compensation scales for faculty who perform teaching functions. For example, some universities in the United States have separate coordinated institutions which help in the recruitment of outstanding scientists and scholars, offering a supplemental salary to research faculty on competitively renewable terms of appointment.

Tentative Conclusions

Empirical evidence has been assembled from household surveys collected from 1985 to 1998 in four African countries. In the cases of Ghana, Côte d'Ivoire, Kenya, and South Africa, workers are receiving higher wages to compensate them for having enrolled in higher education. The wage gains associated with each year of higher education completed range from 10–20%, if one excludes the extraordinary wage returns of Africans in South Africa which are probably due to the "unnatural experiment" of apartheid that restricted the supply of non-Whites in higher education. These private rates of return to higher education are relatively attractive by world standards, suggesting that private individuals in Africa currently have a strong financial incentive to acquire more higher education.

If there are external benefits to higher education accruing to others in society than the students and their families, these social external returns need to be documented. I realize that this task is daunting and controversial, but the analyses of the private wage returns to higher education reported here should in the future be extended to include public costs of providing the education, and then include the value of externalities. In my opinion, private wage returns to schooling in a low-income country should not be dismissed because they are incomplete or imperfect. An alternative scheme for evaluating higher education may be needed, because of its complexity, but it should involve standard cost-ef-

fectiveness arguments. Eventually an open political system will need to offer cogent criteria for setting program priorities within public higher education. There are many who are unsatisfied with the economic approach, but developing a superior methodology will require building on the scheme outlined here.

Although in some African countries, such as Kenya, women have made great advances in general education, the gender gap in schooling remains large in Côte d'Ivoire and Ghana, although not recently evident in South Africa. Since there are persuasive reasons to think that educating more women will improve the health and schooling of their children, as well as reducing their fertility, such impacts of female education can be interpreted as a social externality justifying an extra social subsidy for female education. But these arguments for governments investing more in women's education may be more convincing at the basic primary and secondary school levels than at the level of higher education.

The major disadvantage in expanding public outlays on higher education under its current financial arrangements in Africa is that it benefits children who are mostly from upper economic classes, living in urban areas, whose parents are relatively well educated within their generation. In other words, the large public subsidies for higher education financially benefit predominantly the upper classes, contributing to future economic inequalities. Low intergenerational educational mobility is illustrated in two countries in Table 6. An assessment might show that Africa was no more inequitable than other low-income regions, such as Latin America or South Asia, with regard to tax-subsidy arrangements or educational mobility. (Compare King's 1997 study of Indonesia.)

Comparisons over time for China have illustrated powerfully how cycles of reform, like those that occurred in the wake of the Communist Revolution and again during the Cultural Revolution, have broken down the traditional replication of educational and occupational opportunities among elite families but at the cost of disrupting secondary and higher education (Tang & Parish 2000). The mechanisms I propose to redistribute the gains from higher education in Africa are less radical, involving the use of user taxes and targeted transfers. The approach is not unprecedented, as noted in Mexico, Brazil, and Bangladesh; but its focus on higher education in Africa would be distinctive. Subsidies for higher education or fellowships would be targeted to children from more disadvantaged families and would be financed by increased fees and tuition for other students in public higher educational institutions who are now heavily subsidized by the state. Moving toward self-financing of higher education through increased user fees could also ameliorate some of the counterproductive involvement of politicians in the day-to-day governance of higher educa-

tion and allow more leeway for decentralized faculty self-governance. Encouraging private institutions to offer higher educational courses of a more vocational form could also free public institutions to concentrate on core university programs of higher education, as well as those training programs which directly supply personnel to the government, such as teachers, nurses, and agricultural extension agents. Where research is clearly a major part of university training programs, additional resources might be provided, possibly through parallel research institutions which could offer funding on a competitive basis, to release faculty time to engage in research. These research funds could be allocated by peer review committees, in the form of short-term competitive grants, as financed in the United States by the National Institutes of Health and the National Science Foundations, among others.

Unless a mechanism is found for improving the personal distribution of the benefits of higher education, international development agencies, private foundations, or other nongovernment organizations may find it difficult to expand their support for public higher education in Africa. Basic education at the primary and secondary levels, programs favoring women's education, programs in preventive health, and HIV/AIDS education programs, may all command more broad-based public support than public higher education as currently organized in most countries.

Notes

1 The differences in worker productivity by schooling, age, and sex were first used by Denison (1962), Schultz (1961), and Kuznets (1966) to attribute part of modern economic growth to the changing composition of the labor force in the United States. The systematic conceptual and empirical analysis of the 1940 federal census cross tabulations of earnings data provided Becker (1964) with a basis for his calculation of an internal rate of return which would, over an individual's lifetime, equate the opportunity cost of obtaining schooling to the discounted value of lifetime wage gains. Jorgenson (1995) has continued to extend this approach to treat the implied human capital investments as a form of capital accumulation in his national income accounts for the United States.

2   Foster and Rosenzweig (1995) assess the potential benefits of new technological options by estimating for Indian agriculture the effects of educating farmers so that they adopt new higher-yielding varieties. They also estimate a spillover effect which a farmer realizes from having better-educated neighbors. They find a social exernality of education, but the effect is observed at the primary school level.

3   Moretti (1998) estimates external returns to education in the United States by comparing wages for otherwise similar individuals who work in cities with higher and lower average levels of education from 1980 to 1990, based on his selection of instrumental variables which help him endogenize the city's supply of educated

workers. He estimates that workers receive a 15% higher wage in a city which has workers with one year more average education. Unobserved heterogeneity in labor demand and supply is difficult to distinguish and control for in this analysis, but the analytical strategy might be applied to account for the interregional variation in wages in low-income countries and across countries. Less germane to the objectives of this paper is work by Jaffe, Trajtenberg, and Henderson (1993). Geographic localization of knowledge spillovers as evidenced by patent citation has found that citations to patents are more concentrated in the same state and Standard Metropolitan Statistical Areas (SMSA), suggesting that the diffusion of inventions is localized in the United States from 1975 to 1989, which could be interpreted as evidence of spillover effects from research and development activity that produces patents on new knowledge at the city level which benefit neighboring producers by reducing their costs.

4   Unfortunately many empirical studies of the effect of parent schooling on child development are flawed from the perspective of this analysis, because they control for variables that are themselves likely to be affected by parent schooling. A deeper understanding of the marriage market might sharpen our insights into some of these connections and how gender differences in parent schooling contribute to child development.

5   Easterly (2001) provides a recent recapitulation of some of the evidence from cross-country regressions of growth on changes in educational attainment, which do not always find a positive partial correlation. His view challenges the idea that education at the aggregate level contributes to growth as it appears at the individual worker level. Anomalous estimates of cross-country growth rates over time conditioned on changes over time in education may be partly explained by measurement error. Topel (1999) examines the specifications of some of these aggregate growth regressions and interprets the meaning of the empirical evidence in light of wage function estimates.

6   Schooling is mapped onto the instrumental variable in a first-stage analysis, and then this prediction of schooling based on the instrument is used to explain wages in a second-stage analysis, which under specified conditions will be corrected for omitted variable bias and for classical sources of measurement error embodied in the survey variable measuring schooling (Card, 1999). An early study of East Africa attempted to hold constant for test achievement to evaluate the residual relationship between schooling and wages (Boissiere et al., 1985).

7   For example, building local community colleges may increase higher education among children from poor rural families who experience higher than average returns since they are most credit constrained. Alternatively, public expenditures to improve the quality of higher education which have the effect of reducing class size at the elite universities in the capital city may increase the educational attainment of children from high-income families whose wage returns to more and better quality higher education is lower than average.

8   The problem of sample selection of wage earners has been discussed extensively and has guided many econometric efforts to correct for this potential source of bias in this specific context of estimating the returns to education. The existing evidence does not indicate that the sample selection bias systematically understates or overstates the estimated returns to schooling in low-income countries or that it differentially affects the returns to schooling for men or women, though of course it could potentially be more serious for women who are less often observed to be working in a wage job (Schultz, 1995). But the problem deserves careful evaluation in low-income countries where the fraction of wage earners is markedly lower than in high-income countries. The bias is probably moderated for the higher educated, since they predominantly work in the wage sector.

9   Other studies of the wage structure in Kenya and the consequences of the divergent paths taken by the educational systems in Kenya and Tanzania relied on data from the 1970s and often generalized from surveys of manufacturing firms for whom wage workers may not be particularly representative (Knight & Sabot 1981, 1990). The living standard survey of Tanzania collected in 1993 did not include hourly wage data for individuals.

10   In 1957 Ghana and Korea were reckoned to have approximately the same income per capita, comparing local currency GNP by means of foreign exchange rates. Ghana had the highest income level in West Africa at that time but experienced an economic growth rate during the next 25 years which was only slightly more rapid than its population growth. In contrast, Korea grew much faster in the 1960s and thereafter until the financial crisis of 1997 when its income level per capita was about tenfold greater than Ghana.

11   The Ghana Living Standards Survey (GLSS) retained a similar questionnaire and comparable sampling methods in the four rounds, although the World Bank participated in the initial two years, and the educational attainment question changed in the last year to emphasize certificates and degrees received rather than the years of schooling completed by level. The most comparable measures are used to construct consistent categories from all of the surveys which are included in Table 1.

12   My tabulations of the 1994 Kenyan Welfare Monitoring Survey II are shown in Figure 3.

13   These differences between Ghana and Côte d'Ivoire may be affected by immigration and thus may not reflect accurately the levels of educational attainment achieved by a sequence of birth cohorts in the two countries. It is likely that a larger fraction of higher educated individuals from Ghana than from Côte d'Ivoire left the countries during the 1960s and 1970s when growth was much lower in Ghana than Côte d'Ivoire, particularly those in such professions as medicine and engineering.

14   The coefficient on rural residence in the wage functions reported in Tables 1-5 is converted to a wage differential by exponentiating the coefficient and subtracting it from 1.0. This represents how large a proportion the rural wage is of the urban wage. For example, for Kenyan males aged 25-34 the rural wage is 55% of the urban, i.e., .55 = exp (-.603) or 45 below urban levels.

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