# Assessing the Economic Returns to Investing in Youth in Developing Countries

James C. Knowles and Jere R. Behrman

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# Health, Nutrition and Population (HNP) Discussion Paper

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# ASSESSING THE ECONOMIC RETURNS TO INVESTING IN YOUTH IN DEVELOPING COUNTRIES

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**Abstract**: This paper explores the economic case for investments in youth in developing countries. The current cohort of youth is the largest cohort ever. The economic, social, and demographic context of their lives has undergone enormous change, thus requiring a rethinking and re-evaluation of the range of investments in youth. This reappraisal must incorporate a number of critical features including recognition of the wide range of youth investments, the considerable lag in effects, and the likelihood that youth investments in one area affect investments and behavior in other areas. The paper examines forty-one investments in the following broad categories: formal schooling; civilian and military training, work; reproductive health; school-based health; other health; and community and other. The paper develops a life-cycle approach using cost-benefit analysis to calculate the economic returns to investments in youth. However, the information necessary to apply the methodology is sufficient for only a few investments in a few countries. Moreover, even for these cases, the estimated economic returns vary widely depending on the assumptions used. Despite these limitations, the available evidence suggests that some types of investments in youth, e.g., investments in formal schooling, adult basic education and literacy, some types of school-based health investments (e.g., micronutrient supplements and, under certain circumstances, reproductive health programs), and measures designed to reduce the consumption of tobacco (e.g., increases in the tobacco tax), yield economic returns that are at least as high as are those for many investments in other sectors. The lack of reliable information on the effects of many investments in youth is the most important information gap and the area meriting the highest priority for future research.

**Keywords**: youth; adolescents; economics of youth; cost-benefit analysis; adolescent reproductive health; youth investment; adolescent health and development.

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ABEL | Adult basic education and literacy |
| AIDS | Acquired immune deficiency syndrome |
| CBA | Cost-benefit analysis |
| CEA | Cost-effectiveness analysis |
| DALY | Disability-adjusted life year |
| FFE | Food for Education Program, Bangladesh |
| GDP | Gross domestic product |
| GNP | Gross national product |
| HAART | Highly active antiretroviral therapy |
| HIV | Human immunodeficiency virus |
| NGO | Nongovernmental organization |
| PAN | Programa Nacional de Atención a Niños Menores de Seis Años, Bolivia |
| PIDI | Proyecto Integral de Desarrollo Infantil, Bolivia |
| PROGRESA | Programa de Educación, Salud y Alimentación, Mexico |
| STI | Sexually transmitted infection |
| TB | Tuberculosis |
| UN | United Nations |
| UNFPA | United Nations Population Fund |
| UNICEF | United Nations Children's Fund |
| WHO | World Health Organization |

# FOREWORD

The authors of this Discussion Paper make a valuable contribution to our understanding of the role of health, nutrition and population as determinants of economic growth and development. Beyond basic rights arguments, the investment in children and youths has important social returns such as future productivity of the workforce and poverty alleviation.

Although the topic has been hotly debated since Adam Smith's *Wealth of Nations*, the determinants of economic growth and prosperity are still not fully understood. Why have some regions experienced rapid economic growth and development during the past decade (Latin America and the East Asia and Pacific region), while others have stagnated or experienced negative growth, leaving a large part of their population in poverty (Sub-Sahara Africa, South Asia, and Central Asian Republics)? What role do globalization and international aid play in all of this?

Overall, the number of people throughout the world living in absolute poverty (defined as having an income of less than US$1 a day) has fallen by an estimated of 200 million since 1980. This situation may deteriorate during the next 12 to 18 months due to the sluggish global economic outlook. According to recent forecasts, global GDP is expected to rise by only 2.5 percent annually. High-income countries are expected to grow at about 2.1 percent in 2003, while developing ones will grow at a rate of 3.9 percent.

Factors contributing to economic growth and prosperity include policies and institutions that foster good governance, private sector investment, trade liberalization, natural resource conservation, basic education, and health. Good health, nutrition and population policies are now, also, recognized as important contributors to economic growth and development. And poor policies in these areas are often associated with poor economic performance.

Good health improves growth and development in the following ways:

- Nutrition positively affects labor productivity and growth
- Fertility and population dynamics affect growth
- Child health and youth health affect growth

Poor health and unhealthy habits on the other hand, reduces economic growth and development in the following ways (Hammoudi 1999):

- HIV/AIDS, malaria, tuberculosis (TB) lower labor productivity, growth, and household incomes
- Tobacco use adds an economic burden on households
- Disability in most cases, contribute to earnings loss and unemployment
- Treating diseases and the needed health care systems are expensive

  More than a quarter of the world's population—1.7 billion people—is between the ages of 10 to 24, and the numbers are growing. The vast majority of these young people—86 percent—live in developing countries where, in many places, they represent 30 percent of the population. To a large extent, the choices young people make—with regard to sex and reproduction as well as to other critical aspects of their lives—will determine the size, health and prosperity of the world's future population.

For many working to improve the quality of life in developing countries, investing in young people no longer requires justification. Youth constitute a large proportion of society and have many pressing needs. Nonetheless, a stronger and more coherent economic argument for youth investment is needed to spur appropriate action by governments and donors. This Discussion Paper was commissioned to investigate the economic case for investing in youth and to make some recommendations on areas for appropriate action.

The timing of this analysis is particularly opportune. Development institutions such as the World Bank and its government partners are increasingly focusing on investments in the 10 to 24 age group as a way to reduce poverty, break the cycle of poverty, build human capital and stimulate economic growth. At the same time, the work complements World Bank-sponsored analyses of investments in the youngest citizens—infants and children. It also feeds into the process to develop a comprehensive World Bank strategy on children and youth.

Furthermore, the topic has stirred considerable interest within the broader development community. Over seventy people from a range of institutions attended an expert group meeting held last October, co-sponsored by the Committee on Population of the National Research Council, to discuss the paper's findings and to sharpen the action recommendations. Based on the recommendations of the expert consultation, the World Bank is undertaking follow-up, country-level research in conjunction with our international partners and in-country experts.

It is in this spirit that we hope this Discussion Paper, with its innovative methods and provocative findings, will galvanize even greater attention to the problems and promise of youth in developing countries. With a greater understanding of appropriate policies, countries are more likely to give young people the best possible chance to stay healthy, learn, obtain a job or livelihood, and to participate fully in society.


*Alexander S. Preker*                    *Elizabeth Lule*

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# EXECUTIVE SUMMARY

*Youth constitute a large proportion of societies in developing countries and have many pressing health, education, economic, and social needs. Despite the critical value of youth to future well-being, it is possible that countries underinvest in the healthy development of adolescents and young adults. If there is a gap between current and desired social levels of investment in youth development, showing that the social rates of returns to investments in youth are higher than for the alternative use of these resources is likely to strengthen the case for using public resources to close this gap. The results of doing so are likely to include more efficient use of public resources, with possible benefits for many members of society.*

*Some evidence exists that youth-focused interventions are a cost-effective way to improve health, reduce poverty, and benefit society – yet there is no full economic analysis of the benefits and costs of youth investments in developing countries. This assessment aims to explore the economic case for investments in youth in developing countries by synthesizing the current knowledge of the economic costs and benefits of youth investments, analyzing key gaps in the evidence, and identifying priority research needs.*

## MAJOR THEMES UNDERLYING THIS ASSESSMENT:

*<u>The current cohort of youth in developing countries is the largest cohort ever, either in the past or predicted for the future, given the stage of the demographic transition in which the developing countries currently are on average, though of course there are variations across countries and regions</u>: This means that whatever investments in youth in developing countries are made have an important impact on a relatively large share of the population. It also means that there may be large resource implications and intergenerational transfers required to make substantial investments in youth.*

*<u>Major changes have been occurring in the context for youth in developing countries</u>:*

- *the world has become more integrated due to economic, technological, and cultural globalization;*

- *developing countries in which hundreds of millions of youth live – particularly in Asia but also elsewhere – have experienced historically unprecedented economic growth while smaller but still large numbers of youth have been in countries, particularly in Sub-Saharan Africa, Latin America, the Middle East/North Africa and Central Asia, with limited economic growth or stagnation, often with high rates of youth unemployment;*

- *human capital investments in the form of formal schooling and training have expanded rapidly and have facilitated the exploitation of new technologies and new markets by those in whom such investments have been made;*

- *at the same time, the severe fiscal constraints faced by most developing countries together with reappraisals of the role of governments has led to a situation in which a growing share of the investments in youth, particularly in health and schooling, is financed directly by households rather than through government;*

- *the health and nutritional environments have changed radically, with rapid transitions in each of these;*

- *cultural norms and legal changes, often related to globalization, have shifted to more emphasis on gender equalities, individualism and materialism.*

*Therefore it is necessary to rethink and to re-evaluate the range of investments in youth in developing countries – including, inter alia, schooling, training, reproductive health, and investments in other aspects of health including behavioral changes related to food consumption, physical activity and substance use. The large cohort size means that there are pressures on resources that are likely to be squeezed due to the large numbers – therefore strengthening the need for as good a case as possible to justify use of scarce resources for investments in youth in those cases in which such investments are warranted. The changed context means that the economic returns to different investments in youth probably have altered substantially.*

*This reappraisal of the economic returns to investing in youth in developing countries must incorporate certain critical features. Among these are:*

- *The inclusion of an appropriately wide range of such investments, including their costs and benefits, within a life-cycle context;*

- *The considerable lag in the effects and ultimate outcomes of many of these investments, implying that the choice of an appropriate discount rate may be of considerable importance to the results of the reappraisal;*

- *Consideration of these investments within the frameworks of standard policy concerns of efficiency and distribution and tradeoffs between efficiency and distribution;*

- *Sensitivity to problems in making inferences from behavioral data given endogenous choices (selectivity), important unobserved variables and other measurement and estimation problems;*

- *The likelihood that youth investments in one area impact on investments and behavior in other areas. For example, reducing youth unemployment might strengthen the demand for schooling. Improving nutrition might improve school performance and reduce the health risks of a youthful pregnancy. Curtailing drug use might reduce crime;*

- *Greater clarity regarding such matters as what are costs and what are transfers. Previous literature, for example, confused resource costs with transfers, such as welfare payments.*

### ANALYTICAL FRAMEWORK FOR EVALUATING INVESTMENTS IN YOUTH

*The review devotes considerable attention to a discussion of the available methodologies for estimating the effects of investments in youth. A broadly applicable analytical framework is developed to:*

- *point to the types of data needed;*

- *help in the specification of empirical models;*

- *facilitate the interpretation of empirical findings;*

- *identify possible estimation problems.*

*The review discusses the kinds of data available for the purpose of estimating the effects of investments in youth. The relative strengths and weaknesses of macro versus micro data, experimental versus behavioral data, and longitudinal versus cross-section data are examined. The review also highlights issues related*

*to the measurement of key variables, including benefits and costs, educational, health and nutrition outcomes (including problems arising from systematic biases in reporting), and important abstract concepts (e.g., social capital, self esteem, social exclusion).*

*The review devotes considerable attention to the advantages and disadvantages of randomized experiments.  The advantages of randomized experiments are numerous, including:*

- *the ability to control for omitted and unobserved variables;*

- *the possibility to zero in on key impacts that are difficult to observe in behavioral data (e.g., the separate effects of micronutrients);*

- *the possibility of using simple analytical methods to analyze the results;*

- *the opportunity afforded for ethnical rationing if resources are insufficient, at least initially, to cover the entire target population.*

*On the other hand, the review identifies a number of shortcomings of randomized experiments, including:*

- *frequent difficulties in implementation (including the risk of contamination) with attendant difficulties in interpretation of the results;*

- *possible "Hawthorne effects" (unless experiments are double blind);*

- *the possibility that future expectations may affect current behavior (particularly when investments are phased into areas randomly);*

- *the "black box" nature of experiments and their inability to address policy variants other than the specific one(s) evaluated by the experiment and possible change in the underlying structure of behavior over time;*

- *their high cost and the related problem that experiments are often too brief to permit the observation of important longer term effects.*

*Given the limitations of randomized experiments, the review also devotes considerable attention to the possibility of using behavioral data to estimate the effects of investments in youth.  The review focuses on a key challenge in using behavioral data, i.e., obtaining parameters of causal relationships, instead of only statistical associations, between variables.  The review discusses several possible solutions to this problem, including the use of natural experiments, instrumental variables, and fixed effects estimators. Econometric problems of measurement error, omitted variables, endogeneity, selectivity and identification are also discussed, together with possible solutions. The review concludes that much better data are needed, including more longitudinal data sets, data sets incorporating better measurement, and data sets including a wider range of instruments.*

## POLICY EVALUATION FRAMEWORK

*In addition to an analytical framework, the review also considers how information on the effects of investments in youth can be translated into effective policy.  A policy framework is developed that is based on the distinct economic concepts of efficiency and distribution.  This framework provides a justification for governmental intervention in investment decisions when either marginal social benefits differ from marginal private benefits or marginal social costs differ from marginal private costs. According to this policy framework, distributional objectives may provide a separate justification for*

*governmental intervention in investment decisions. For example, the review identifies the broadly supported objective of poverty reduction as an important distributional objective that may justify governmental intervention in some investment decisions. The analytical framework recognizes that in some cases the pursuit of distributional objectives may require a tradeoff in terms of reduced efficiency. However, the best distributional policy is generally one that achieves its objectives with the least possible sacrifice in efficiency. There are generally a large number of policy options available to the government to promote efficiency and distributional objectives. Since all policies involve costs (e.g., implementation and monitoring costs, distortionary costs), it is possible to develop a ranking of various policy options (including those designed to promote mainly distributional objectives) in terms of their costs. Policies ranked relatively high in such a policy hierarchy tend to be direct and relatively transparent interventions, such as taxes and subsidies, rather than quantitative restrictions or the direct provision of services by the government.*

## ALTERNATIVE METHODOLOGIES FOR EVALUATING THE ECONOMIC RETURNS TO INVESTMENTS IN YOUTH

*The review considers several alternative methodologies for evaluating the economic returns to investments in youth. It selects cost-benefit analysis (CBA) over cost-effectiveness analysis (CEA) because of the ability of CBA to:*

- *handle multiple outcomes;*

- *provide measures (benefit-cost ratios or internal rates of return) that can be compared directly with those estimated for investments in other sectors;*

- *address broader issues related to efficiency (including whether the objective used to measure "effectiveness" itself represents an efficient use of resources).*

*The review identifies the greatest challenge in using CBA, as compared to CEA, as the task of assigning monetary values to all possible effects of an investment. One way that this problem has been handled in the literature is to evaluate benefits in terms of their impact on economic growth (which, in effect, reduces cost-benefit analysis to a special form of CEA). The review rejects this approach because of its inability to address all issues related to efficiency (including efficiency issues related to economic growth) and its complete neglect of distributional issues (including across generations in the form of how much current consumption should be reduced in order to increase consumption by future generations). Instead, the review opts for a definition of benefits that is based on direct productivity effects, whenever possible, but that falls back, when necessary, on an alternative indirect method of valuing benefits that is based on the cost of the least-cost alternative investment that secures the same effect.*

# THE EFFECTIVENESS AND COST EFFECTIVENESS OF INVESTMENTS IN YOUTH

*The review examines a large number (41) of investments in youth in the following broad categories:*

- *formal schooling;*

- *civilian and military training, work;*

- *reproductive health;*

- *school-based health;*

- *other health;*

- *community and other.*

*The literature on these investments identifies a similarly large number of possible effects (39). However, the review finds that reliable estimates of effects are limited for the most part to investments in two categories: formal schooling and school-based health. Even in those categories reliable estimates are available for only a small subset of the hypothesized effects and for only a relatively small number of countries. For example, while there are reliable estimates for some countries of the effect of investments in formal schooling on earnings and labor productivity (and in a few cases, on child labor), there are no reliable estimates of the hypothesized effects of schooling on teenage pregnancies, HIV and STI incidence, youth unemployment, adult and child health and nutrition (including mental health), fertility, drug/alcohol abuse, domestic or civil violence, social exclusion and sexual abuse. For some of these hypothesized effects, estimates based on behavioral (as distinct from experimental) data are available and broadly accepted as valid in the literature. However, the evidence that most of these reported behavioral relationships are causal is either very weak or nonexistent.*

*Estimates of cost and cost effectiveness are even scarcer than reliable estimates of effects (although in nonformal education and in the training category there are more data on cost than on effectiveness). Evaluation studies in some categories (e.g., reproductive health) routinely omit information on costs. In other cases, the definition of costs, as well as the procedures used to collect cost data and estimate unit costs, are not well documented. Nevertheless, it is clear that many evaluation studies fail to include administrative/implementation costs, while almost all studies fail to include distortionary costs (e.g., the real costs involved in financing the investments). In many cases, costs are incorrectly defined to include transfers.[1]*

*The review finds evidence that the effects (and therefore the benefits) of many investments in youth differ significantly by income and gender. For example, school-based health investments benefit only those currently enrolled in school. In many developing countries, secondary students are disproportionately male and from upper-income groups. In the case of formal schooling, investments designed to improve the quality of schooling benefit only those enrolled in school, whereas targeted scholarship programs can be designed to benefit mainly poor and/or female out-of-school children and their families. Investments designed to reduce the consumption of tobacco products or to avert drug and/or alcohol abuse benefit mainly males in many countries, while adult literacy and basic education programs and some types of reproductive health investments benefit mainly females.*

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[1] At the same time, public savings in the form of an averted need for transfers is also incorrectly defined as a benefit in many studies.

*The review also finds that the effects (and benefits) of many investments in youth differ significantly according to the country or sub-country context. For instance, the economic returns to investments in schooling and training depend critically on conditions in labor markets. The effects of investments in health (including reproductive health) and nutrition depend critically on current health and nutrition conditions. For example, the effect of interventions such as micronutrient supplementation and de-worming depend on the extent of micronutrient deficiencies, the prevalence and intensity of helminthic infections, and on general levels of nutrition and health. Similarly, the effectiveness of many reproductive health investments depends on initial conditions, such as the incidence of HIV infection among adolescents or levels of teen pregnancies.*

*The review finds that the limited reliable information on all (or even most) of the hypothesized effects of alternative investments in youth makes it difficult to identify cases where the marginal social benefits or costs diverge significantly from marginal private benefits and costs. Without such information, it is difficult to build a case on efficiency grounds for government intervention in private investment decisions (i.e., for whole or partial government financing of investments as distinct from purely private financing).*

## THE BENEFITS OF INVESTMENTS IN YOUTH

*Two alternative methods are used to assign a monetary value to the estimated effects of alternative investments in youth, as previously mentioned. The first method, called the direct method, involves assigning a monetary value to each effect according to the estimate of the value of the additional production that it enables. For example, the benefits of enhanced labor productivity are estimated on the basis of the corresponding percentage increase in earnings. The review finds that a monetary value can be assigned directly to some, but not all, of the effects of investments in youth. However, the absence of reliable information on the monetary value of some broad effects (e.g., "increased education," improved health") suggests a two-step approach in which, first, such broad effects are broken down into a set of components and, second, the components are valued either directly (the preferred approach) or indirectly. This two-step procedure is necessary only when a broad effect, such as "increased education," is the primary proximate effect of an investment (e.g., a targeted scholarship program). Otherwise, such broad effects can be valued indirectly.*

## THE ECONOMIC RETURNS TO INVESTMENTS IN YOUTH

*The review develops a life-cycle approach to calculating the economic returns to investments in youth. However, it finds that the information necessary to apply the methodology is sufficient for only a few investments in a few countries. Moreover, even in these cases, the estimated economic returns are found to vary widely depending on the assumptions used. Despite these limitations, the available evidence suggests that some types of investments in youth, e.g., investments in formal schooling, adult basic education and literacy, some types of school-based health investments (e.g., micronutrient supplements administered to school children), and measures designed to reduce the consumption of tobacco (e.g., increases in the tobacco tax), yield economic returns that are at least as high as are those for many investments in other sectors.*

## MAIN CONCLUSIONS CONCERNING KEY INFORMATION GAPS AND FUTURE RESEARCH PRIORITIES

*The review highlights the lack of reliable information on the effects of many investments in youth as the most important information gap and the area meriting the highest priority for future research. In some cases, addressing this need will require the use of more and larger randomized experiments of longer duration and involving the collection of data on a broader range of outcomes than has been done in the*

*past. In some cases, however, obtaining reliable estimates of effects (particularly those involving considerable lags) will require the continued use of behavioral data. For this purpose, the review supports the collection of additional longitudinal data in developing countries, more attention to measurement issues, and more attention given to the collection of effective instruments. The review also calls for researchers to give more attention to the definition and measurement of costs than they have done in the past. In addition, the review calls for a concerted effort to pull together the information on the cost effectiveness (and particularly, the marginal cost effectiveness) of a wide range of investments that can be used to value indirectly the effects of investments in youth (assuming that the information on the effects themselves is forthcoming). Finally, the review calls for more efforts to collect information and to undertake analysis that permits the distinction between private and social rates of return and thus better assessment of efficiency arguments for public subsidies.*

# I. INTRODUCTION

Youth – by which we mean, say, people age 10 to 24 – constitute a large proportion of society and have many pressing health, education, economic, and social needs. Despite the critical value of youth to future well-being, countries may under invest in the healthy development of adolescents and young adults. If there is a gap between current and socially-desired levels of investment in youth development such that the social rates of returns to investments in youth are higher than for the alternative use of these resources, the case may be strong for using public resources to close this gap. The results of doing so are likely to include more efficient use of public resources, with possible benefits for many members of society.

Some evidence exists that youth-focused interventions are cost-effective ways to improve health, reduce poverty, and benefit society. For example, as compared to investments in child health and development, investments in youth offer a shorter time lag in some cases between costs and benefits, thereby improving benefit-cost ratios when even a relatively modest discount rate is used. Also, in countries in which there has been under investment in children, investments in youth may offer an opportunity to "catch up" in the area of human capital investments. Yet no one has undertaken a full economic analysis of the benefits and costs of youth investments. Such analysis has been undertaken to a limited extent in wealthier countries such as the United States, but has been very limited in the developing world, apart from investments in formal schooling.

This assessment aims to explore the economic case for investments in youth in developing countries by synthesizing the current knowledge of the economic costs and benefits of investments in youth, analyzing key gaps in the evidence, and identifying priority research needs.

## 1.1 MAJOR THEMES

A number of major themes that we summarize here underlie this assessment:

The current cohort of youth in developing countries is the largest cohort ever, either in the past or predicted for the future, given the stage of the demographic transition in which the developing countries currently are on average, though of course there are variations across countries and regions: This means that whatever investments in youth in developing countries are made have an important impact on a relatively large share of the population. It also means that there may be large resource implications and intergenerational transfers required to make substantial investments in youth.

Major changes have been occurring in recent decades in the context for youth in developing countries:

- the world has become more integrated due to economic, technological, and cultural globalization;

- developing countries in which hundreds of millions of youth live – particularly in Asia but also elsewhere such as in Botswana and Chile – have experienced historically unprecedented economic growth while smaller but still large numbers of youth have been in countries, particularly in Sub-Saharan Africa, Latin America, the Middle East/North Africa and Central Asia, with limited economic growth or stagnation, often with high rates of youth unemployment;

- human capital investments in the form of formal schooling and training have expanded rapidly and have facilitated the exploitation of new technologies and new markets by those in whom such investments have been made;

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- at the same time, the severe fiscal constraints faced by most developing countries and reappraisals of the role of governments have led to a growing share of the investments in youth, particularly in health and schooling, being financed directly by households rather than through governments;

- the health and nutritional environments have changed radically, with rapid transitions in each of these. The *nutritional transition* has involved shifts in dietary and physical activity/inactivity patterns that have resulted in increased prevalences of being overweight and obese and degenerative diseases. The *epidemiological transition* has involved a shift <u>from</u> high prevalence of infectious diseases <u>to</u> high prevalence of chronic and degenerative diseases associated with urban and industrial life styles, such as cardiovascular diseases, cancer and stress (Omran, 1971, Olshansky and Ault 1986, Popkin 2002). Accompanying this transition are shifts in age-specific mortality patterns and increases in life expectancies, while the composition of the burden of diseases has changed substantially (Murray and Lopez 1996, Smith and Haddad 2001, UNDP 2001). There has also been the appearance and rapid spread of new diseases such as HIV/AIDS. There also have been other even more substantial changes with declines of traditional scourges related to communicable diseases and malnutrition and the expansion of non-communicable maladies related to the diseases of modernity such as cardiovascular, malignant neoplasm and neuro-psychiatric conditions so that though life expectancies have increased significantly and the composition of the burden of diseases has changed substantially (Murray and Lopez 1996, Smith and Haddad 2001, UNDP 2001);

- cultural norms and legal changes, often related to globalization, appear to have shifted to more emphasis on gender equalities, individualism and materialism.

<u>Therefore it is necessary to rethink and to re-evaluate the range of investments in youth in developing countries – including, *inter alia*, schooling, training, reproductive health, and other aspects of health including behavioral changes related to food consumption, physical activity and substance use</u>. The large cohort size means that resources are likely to be squeezed due to the large numbers – therefore strengthening the need for as good a case as possible to justify use of scarce resources for investments in youth in those cases in which such investments are warranted. The changed context means that the economic returns to different investments in youth probably have altered substantially.

<u>This reappraisal of the economic returns to investing in youth in developing countries must incorporate certain critical features</u>. Among these are:

- The inclusion of an appropriately wide range of such investments, including their costs and benefits, within a life-cycle context;

- The considerable lag in the effects and ultimate outcomes of many of these investments, implying that the choice of an appropriate discount rate may be of considerable importance to the results of the reappraisal;

- Consideration of these investments within the frameworks of standard policy concerns of efficiency and distribution and tradeoffs between efficiency and distribution;

- Sensitivity to problems in making inferences from behavioral data given endogenous choices (selectivity), important unobserved variables and other measurement and estimation problems;

- The likelihood that youth investments in one area impact on investments and behavior in other areas. For example, reducing youth unemployment might strengthen the demand for schooling. Improving nutrition might improve school performance and reduce the health risks of a youthful pregnancy. Curtailing drug use might reduce crime;

- Greater clarity regarding such matters as what are costs and what are transfers. Much previous literature, for example, has confused resource costs with transfers, such as welfare payments.

## 1.2 ORGANIZATION OF REPORT

To reassess the economic benefits of investing in youth in developing countries requires frameworks for analysis to organize the existing fragmented and imperfect information. Section 2 presents such frameworks, then turns to problems of empirical inferences, and a basic framework for policy evaluation. Building on this foundation, Sections 3-5 turn to estimates of the rates of return to different investments in youth in different groups of developing countries, with an effort to distinguish between private and social rates of return and to distinguish between females and males. The strategy is to identify the time pattern of costs and benefits (requiring the translation of impacts into economic terms if they are not presented in those terms) over the life cycle from a range of piecemeal estimates, and then to estimate the ratio of the discounted benefits to the discounted costs. The methodology used to measure costs and benefits is sufficiently flexible to incorporate, in a simple way, a wide range of effects of different investments. The robustness of these estimates is explored by relaxing different assumptions related to critical aspects of costs, benefits and the discount rate. Such estimates are presented for a number of alternative investments in youth, including formal and nonformal schooling, reproductive health, school-based health interventions, and investments to reduce the consumption of tobacco. Section 6 then presents a synthesis and conclusions, with emphasis on what are the highest return investments in youth, how these compare with other investments, and what are the highest priority research areas.

To implement this strategy, we combine the piecemeal information that we have been able to find on the effects and costs of investments in youth in developing countries (Section 3), together with information that permits translating the effects into benefits measured in monetary terms (Section 4), in order to estimate benefit/cost ratios and internal rates of return (Section 5). We start with a life-cycle perspective and consider the estimated *costs* at the time the investments are made and the subsequent *effects* over the life cycle, based on the best estimates that we have been able to find. For the *benefits* what are needed are the effects of an investment in youth in such areas as schooling, unemployment, mortality and morbidity, teen pregnancies, HIV/AIDS infection and a way of associating a monetary value to each effect, as discussed in Section 4. We then calculate the present discounted values of the benefits and the costs, conditional on assumptions about the discount rate, and the internal rates of return to these investments in Section 5. Because of the great uncertainties that underlie many of the estimates that we use, we present some alternative estimates based on alternative assumptions for key variables, such as the discount rate. In light of the considerations discussed in Section 2.5, we ideally would like to be able to make separate estimates of total benefits and costs and private benefits and costs in order to be able to identify the extent to which there are efficiency reasons for using public resources to increase certain investments. Unfortunately, in most cases this distinction is very difficult to make. However, we try to identify cases where the private and social benefits are likely to diverge.

## 1.3 MAJOR CONCLUSIONS

There are three major conclusions of this paper:

1) There currently are large gaps in what we know with confidence about many aspects of the rates of return to investments in youth in developing countries. Too many studies are not sensitive to the major estimation problems in assessing the determinants or the impacts of such investments. Most studies focus only on the impacts and do not consider the costs (including possible distortionary costs), which also must be understood in order to assess the economic returns to

such investments.  In a number of cases they further confuse resource costs with transfers.  Often the impacts are in terms of some objective such as improved health and nutrition but not translated into economic benefits by assessing the productivity effects or by using the resource cost of alternative means to attain the same effects.  The majority of studies, moreover, do not consider whether the policies that are examined are likely to be the preferred policies for obtaining the policy objective.  For such reasons there is scope for a considerable research agenda in order to inform policy makers and other interested parties regarding the economic returns to various investments in youth in different contexts in developing countries.

2) Nevertheless, the available evidence suggests that there are some high-return investments in youth in developing countries and that there are efficiency reasons for using public resources in addition to private resources for such investments due to inadequacies in markets such as for capital, insurance and information.  Examples of such high-return investments include both supply-side and demand-side investments in formal schooling, investment in adult basic education and literacy targeted to adolescents, some types of school health services (e.g., micronutrient supplementation), investments designed to reduce the consumption of tobacco, and possibly some types of reproductive health investments.

3) What are relatively high rates of return for different investments in youth depends importantly on the context of such investments.  Rates of return to schooling, for example, are likely to be much higher in dynamic contexts in which there are rapid changes in technologies and markets through greater integration into world markets. Many health and nutrition investments tend to yield higher returns in settings in which health and nutrition conditions are poor. The economic returns to reproductive health investments designed to reduce rates of HIV infection increase proportionately with HIV incidence in the targeted age groups.

# II. FRAMEWORKS FOR ANALYSIS

This section begins with a discussion of why frameworks for analysis are necessary, then summarizes a standard analytical framework for the determinants of investments in youth and the impact of such investments, next notes the problems in estimating the impact of investments in youth, then considers the basic motives for policy interventions, and finally discusses alternative methodologies for economic evaluation of investments in youth.  The general framework that we summarize can be used for all investments in youth – investments that range from improving their human capital narrowly defined, for example, by improving their schooling, training, health and nutrition to improving their social capital and social participation to reducing their exposure to risks at home, in school and in the workplace and through substance abuse or other risky activities.  The wide range of possible investments in youth reflects that there are a wide range of possibilities in which the use of current resources affect future outcomes for youth – and, of course, the standard definition of investment is the use of current resources to improve expected future outcomes.  Policy changes may improve such investments in youth in terms of the basic policy motives of efficiency and distribution that are discussed in Section 2.5 through providing additional resources.  But policy choices also may increase such investments by introducing regulations that promote such investments by, say, improving conditions to reduce health hazards and sexual harassment in the work place or by eliminating or lessening regulations that limit such investments such as hiring/firing regulations and migration restrictions that limit employment and on-the-job learning of youth.

## 2.1 WHY FRAMEWORKS FOR ANALYSIS ARE NECESSARY

Good analysis of the impact of investments in youth has tripartite foundations: data, modeling and estimation. These three dimensions are critically interrelated. Data, of course, are essential for empirical analysis, limit the extent to which analyses can be undertaken, and shape most of the estimation problems. If there were available data from well-designed and well-implemented experiments,[2] associations between observed investments in youth and observed outcomes would reveal the underlying causality directly. But for numerous reasons, including costs and ethical concerns, such experimental data are rarely available.[3]

Therefore, while there may be high returns for some aspects of policy analysis to increase experimental data, most analysis has been and will continue to be based on behavioral data. Such behavioral data can "speak for themselves" regarding <u>associations</u> between investments in youth and various outcomes. But they generally can<u>not</u> "speak for themselves" with regard to what observed determinants – policies or otherwise – <u>cause</u> differences in investments in youth or to what extent observed investments in youth <u>cause</u> different outcomes. The problem is that most data are the result of a number of behavioral decisions taken by households, individuals, bureaucrats, policy-makers and others in light of a number of factors unobserved by analysts.[4] Good analysis of what causes household and individual investments in youth or of what effects such investments have is difficult, and requires a much more systematic approach than simply looking at associations among observed variables.

Analytical frameworks permit exploring systematically investments in youth, point to what data are needed for such explorations, facilitate the interpretation of empirical findings, and help to identify some of the probable estimation issues that should be addressed given the data used. The analytical frameworks provided by models are essential if the empirical estimates are based on behavioral data generated in the presence of unobservables such as innate ability and family connections. The problem, for example, is that youth with greater ability and motivation and better innate health may be more productive directly <u>and</u> may also benefit from higher levels of investments. Therefore it may be difficult to sort out the effect of investments in youth per se as opposed to the fact that such investments are correlated with unobserved abilities, motivation and innate health.

For such reasons, the empirical effects of investments in youth can be analyzed satisfactorily with nonexperimental data only within frameworks that incorporate well the essence of behaviors related to the phenomena of interest. To be interpretable, estimates based on behavioral data require some model of the underlying behaviors, though far too often in the literature the models used are not explicit. Those who are not clear about their framework of analysis may think they are revealing underlying truths

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[2]  With random assignment between treatment and control groups, no attrition problems and in which neither the subjects nor those who provided the experimental treatments knew which subjects received treatments and which received placebos (see Section 2.4.1).

[3]  Data may be available from so-called "natural experiments" in which, due to some fortuitous happenstance, all unobserved (by analysts) variables are the same in two groups so that, for instance, differences in observed productivities reflect only differences in observed human resource variables. But though such natural experiments are a conceptual possibility, it is difficult indeed to find two situations in which all unobserved variables are likely to be identical.

[4]  Throughout this paper "unobserved" means unobserved by analysts and policymakers. What is unobserved in this sense, of course, depends on the data set, though there are some widely unobserved factors such as innate ability, innate health, family connections, and preferences. Such factors, while not observed by analysts, are observed (perhaps imperfectly and with learning) by the individuals whose behaviors are being studied, and these individuals make decisions in part based on these factors. There are many examples of recent studies that emphasize these unobserved factors and their importance in analysis of behavioral data.

unconstrained by such frameworks, but they are instead usually making implicit assumptions that may upon examination not be plausible.

## 2.2. ANALYTICAL FRAMEWORKS FOR THE DETERMINANTS OF INVESTMENTS IN YOUTH

Households and the individuals in them are the proximate sources of demands for many investments in youth (e.g., schooling, health, social capital, behaviors that lead to productive lives), given their predetermined assets (i.e., physical, financial, and human, including endowments[5]), production functions related to human resources, public and private services related to investments in youth (i.e., schools, health clinics), and current and expected prices for inputs used in investments in youth and for outcomes of the investments. Policies, of course, may enter directly or indirectly into this process through a number of channels ranging from the accessibility and quality of public and private services to the functioning of capital markets for financing investments in youth to the functioning of markets in which these investments are expected to have returns. Becker's (1967) Woytinsky Lecture provides a simple framework for investments in human resources that captures many of the critical aspects of investments more broadly in youth and which has been widely appealed to in rationalizing empirical studies of the determinants of investments in youth.

In Becker's framework, human resource investment demands, under risk neutrality, reflect the equating of expected marginal private benefits and expected marginal private costs (both in present discounted terms) for investments in a given individual. The marginal private benefit curve depends importantly, *inter alia*, on expected private gains in productivity in all of the ways in which the human resource investment may have impacts. The marginal private benefit curve is downward-sloping because of diminishing returns to investments in youth (given genetic and other endowments) and because, to the extent that investments in youth take time (such as schooling, training and most other forms of education and social capital, as well as search in labor and other markets), greater investments imply greater lags in obtaining the returns and a shorter post-investment period in which to reap those returns. The marginal private cost may increase with investments in youth because of higher opportunity costs of more time devoted to such investments (especially for schooling and training) and because of increasing marginal private costs of borrowing on financial markets. The equilibrium human resource investment for an individual is where the marginal private benefits and the marginal private costs are equalized. This equilibrium human resource investment is associated with an equilibrium rate of return that equates the present discounted value of expected marginal private benefits with the present discounted value of expected marginal private costs. This simple stylized representation of human resource determinants is based on a dynamic perspective, with both benefits and costs not only in the present but also those that are expected in the future and with current period options conditional on past decisions. Thus it is consistent with placing investments in youth in a lifespan perspective, as has been emphasized from a number of different perspectives.

If the marginal private benefit curve is higher, all else equal, the equilibrium human resource investment and the equilibrium marginal private benefit both are greater. The marginal private benefit curve may be higher for one of two otherwise identical individuals except for the difference noted below that in many cases may be due directly or indirectly to policies because one individual (or whomever is investing in that individual, such as children's parents):[6] (1) has greater endowments that are rewarded in schooling (or other human resource) and in post-schooling labor markets; (2) has lower discount rates so that the

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[5] "Endowments" means characteristics that are given independent of behavioral decisions. Genetically determined innate ability and innate health robustness are examples.

[6] For the last three of these comparisons the otherwise identical individuals would have to live in different economies.

future benefits of investments in youth have greater value at the time of the investment decision; (3) has investments in youth options of higher quality (e.g., access to higher quality public schools or public health services) so that the marginal private benefits for a given level of private investments are higher, and the equilibrium investments greater;[7] (4) has better health and a longer expected life due to complementary investments, so that the post-investment period in which that individual reaps the returns to the investment is greater and therefore the expected returns greater; (5) has greater marginal private benefits to a given level of such investments because of labor market discrimination that favors that individual due to gender, race, language, family, village, or ethnic group; (6) has returns to human resources investments that are obtained more by the investor or the relevant decision maker (e.g., if traditional gender roles dictate that children of one sex, but not the other, provide old-age support for their parents, parental incentives may be greater to invest in youth who are likely to provide such support[8]); (7) has greater marginal private benefits to a given level of investment because of being in a more dynamic economy in which the returns to such investments are greater; (8) has greater marginal private benefits to a given level of such investments because of greater externalities from the human resource investments of others in the same labor market; or (9) lives in a more stable economy so that the discount rate for future returns is lower and thus the marginal private benefit of future returns greater.

If the marginal private cost is lower, ceteris paribus, the equilibrium human resource investment is greater, with the marginal private benefit lower at the higher investment level.  The marginal private cost might be lower for numerous reasons, again, most or all of which may be affected directly or indirectly by policies.  Compare two otherwise identical individuals except that one individual: (1) has lower private cost access to education and health services related to such investments because of closer proximity to such services or lesser user charges; (2) has less opportunity costs for time used for such investments (e.g., due to gender specialization in household and farm tasks performed by youth); (3) faces lower utility costs of such investments because of cultural norms that favor some activities associated with such investments more for some individuals than for others (e.g., in some societies, it is not thought desirable that girls past puberty mingle with males outside of the family in transit to school or in school so that the preference costs of schooling are lower for boys than for girls);[9]  or (4) is from a household with greater access to credit because of greater wealth or status or better connections.

The maximization through equating expected private marginal benefits and costs leads to dynamic decision rules or demand relations for human resource investments in individual i that depend on all relevant prices P, on all relevant resources R and on all the parameters of the relevant production functions, on preferences and on stochastic factors that, say, may enter into production processes (e.g., weather fluctuations) or reflect preference differences:

(1)      $H_i = H(P, R \mid$ production parameters, preference parameters, stochastic factors).

The prices include all prices that enter into the investing household's decision-making process, including the prices paid by the household for goods and services related to investments in youth, other uses of household resources and for transferring resources over time (i.e., the interest rate) and for insuring against uncertainty. At the time that any human resource investment decision is made, these prices

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[7]   If the investor must pay for greater human resource service related quality, investment does not necessarily increase with a higher quality option. What happens to the equilibrium investment depends upon where the marginal private cost curve for the higher quality option is in relation to the location of the marginal private benefit curve.

[8]   Though this tendency may be offset if, for example, human capital substitutes sufficiently for financial transfers in marriage markets (e.g., Rao 1993  and Behrman, et al. 1999 explore this possibility for India).

[9]   For this case the marginal utilities of marginal private benefits and costs are equated.

include all past and current prices (perhaps embodied in current stocks of human capital), as well as expected future prices (including expected future returns to investments). The resources include all resources of the individual, household (identified by ownership if there is intrahousehold bargaining), educational and health/nutrition institutions, and community that affect any household decisions. These resources include human resources that reflect past investments, financial resources, physical resources, genetic endowments, school characteristics, and general learning environments. Policies may have impacts directly and indirectly through a number of the prices and resources.

This simple framework systematizes six critical, common sense, points for investigating dimensions of the determinants and the effects of investments in youth – and how these relate to policy choices.

First, the impacts of changes in policies may be hard to predict by policymakers and analysts. If households or other entities face a policy or a market change, they can adjust all of their behaviors in response, with cross-effects on other outcomes, not only on the outcome to which the policy is directed.

Second, aggregation to obtain macro outcomes will average out random stochastic terms across individuals or households. But such aggregation does not average out systematic behavioral responses at the micro level. Therefore associations among macro variables can reveal, conditional on the overall context, what are those associations – but not causal effects of processes occurring at the micro level.

Third, the marginal benefits and marginal costs of investments in a particular individual differ depending upon the point of view from which they are evaluated: (i) There may be externalities or capital/insurance market imperfections so that the social returns differ from the private returns (Section 2.5) and (ii) there may be a difference between who makes the investment decision (e.g. parents) and in whom the investment is made (e.g. youth). The effectiveness of policies are likely to depend crucially on what are perceived to be the private effects from the point of view of private decision-makers, and these may differ from the social effects of interest to policymakers.

Fourth, investments in youth are *determined* by a number of individual, family, community, (actual or potential) employer, market and policy characteristics, only a subset of which are observed in available data sets. To identify the impact of the observed characteristics on investments in youth, it is important to control for the correlated unobserved characteristics.[10]

Fifth, to identify the *impact* of investments in youth, it also is important to control for individual, family, community, market and policy characteristics that determine the investments in youth and also have direct effects on outcomes of interest.

Sixth, empirically estimated determinants of, and effects of, investments in youth are for a given macro economic, market, policy, schooling and regulatory environment in which there may be feedback both at the local and at a broader level.

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[10] For example, if schools with higher quality tend to be in areas in which expected rates of returns from investments in youth tend to be greater but only indicators of school quality and not expected rates of return are observed in the data and if there is not control for the unobserved expected rates of return in the analysis, the impact of school quality on such investments is likely to be overestimated because in the estimates school quality proxies in part for unobserved expected rates of return to these investments. If expected rates of return differ across communities or clusters in the sample, they could be controlled in the estimates with community dummy variables (or fixed effects) (e.g., Alderman et al. 1996a for an example for Pakistan).

## 2.3 EMPIRICAL ISSUES – MEASUREMENT

To assess the rates of return to investments in youth, we need to (a) measure what we mean by investments in youth and by various outcomes that might be affected by investments, (b) estimate the impact of investments in youth on the latter measures, and (c) measure the costs of these investments. These are not trivial tasks. This section considers some of the measurement difficulties. Section 2.4 then turns to estimation problems.

Investments in youth: Key variables for this paper are indicators of investments in youth. In the case of schooling, for an important example, most empirical studies represent human resource investments empirically by years of schooling or highest grade of schooling (or level of schooling) completed. Though "years" and "grades" of schooling are often used as synonyms, they need not be the same if they are used literally and if there is grade repetition, as is widespread in many parts of the developing countries (e.g., in much of Latin America). And since repetition rates often differ by gender, not accounting appropriately for grade repetition may lead to misleading inferences about gender differences in the rate of return to schooling as well as the total rate of return to schooling. The point simply is that one of the major costs of schooling is the opportunity cost of time in school, which is greater if there is more grade repetition for a given schooling grade attainment. Putting aside the question of the time spent in school, there are other limitations of grades (years) of schooling as a measure of human resource investments. Probably most important is the implicit assumption that school quality is constant. But empirical measures indicate that school quality varies substantially, so it would be desirable in assessment of the impact of human resource investments in youth to represent not only the time (grades, years) that they spend in school, but also the quality of that schooling. If both the quantity and the quality of schooling should be included, but only the quantity is included as is usually the case, the likely result is to overstate the impact of time in school and to miss that there is likely to be an important quality-quantity tradeoff.

Besides schooling (or education more broadly defined), there are many other investments in the human resources of youth. Such investments may be directed, for example, at improving health, nutrition, information, social capital, and habitual behaviors that lead to desirable outcomes. Similar problems exist in empirical measurement of these variables as for education. For example, health is often measured by anthropometric indicators, respondent reports or clinical reports on disease histories, respondent reports on capabilities for undertaking certain activities or tests for doing so, or respondents' self-assessment of health. Some of these indicators may be good measures of particular disease conditions, but that does not make them (or their inverse) necessarily good measures of what people mean by good health. For another example, social capital is often measured by participation in group activities, but this is at best an imperfect and endogenous indicator of whether one has social capital in the sense of being able to obtain information or resources at times of need.

Outcome Variables: Unfortunately there are many problems in measuring these outcomes.[11] For some outcomes that may be affected importantly by investments in youth, data usually used in the social science literature do not include direct measures – self esteem and learning capacities are two examples. This may mean that important outcomes are missed when assessing the impact of investments in youth.

For some other outcomes there may be at best imperfect indicators – for instance, representing health by health-related inputs (e.g., nutrients), reported disease conditions, curative health care, and preventative health measures (e.g., vaccinations). Some of these measurement problems may be systematic, moreover, resulting in biases in the estimated impact of investments in youth. If, for example, those who have less

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[11] We limit our discussion here to micro data because the problems with the aggregate data are so severe (see Knowles and Behrman 2003).

schooling report less sickness for the same health conditions as those who have more schooling (perhaps because the degree of sickness viewed as normal varies inversely with schooling), the impact of schooling on actual sickness is likely to be underestimated.

For some other measures of outcomes conventions are used in the literature that may not be sensible. For example, economic gains from reducing mortality are represented at times by the present discounted value of foregone earnings of an individual (e.g., CGCED 2002). For young individuals, such gains can be considerable. For measuring the purely economic benefits of survivors, however, this seems an overstatement of the economic costs of mortality since such individuals also would have consumed – perhaps most or all of their earnings – over their lifetime.[12] For another example, the economic gains from improving the earnings capacities of individuals are at times measured by the reduction of their demands on governmental social welfare systems for transfers (e.g., CGCED 2002). But governmental transfers, though perhaps appropriately viewed as costs from a budgetary perspective, are not resource costs in the sense desirable to evaluate policies. There are likely to be some resource savings if social welfare programs are reduced because some resources are consumed in running and financing such programs. But such possible resource savings should not be confused with the amount of transfers involved (and the latter probably greatly exaggerate the true resource costs). For one last example, the gains from reducing crime are at times equated with the amount of losses that crime victims suffer due to crime. But, again, a significant component of the costs so calculated are transfers from the victims to the criminals, particularly in thefts. The amount of such transfers, once again, is not likely to reflect well the true resource costs of crime. All three of these examples point to substantial difficulties in evaluating benefits and to questionable practices that have been used in some previous studies.

We intend to deal with these difficult questions by evaluating the benefits in terms of the least cost alternative way of obtaining the same objective, along lines implemented by Summers (1992, 1994) in a well-known study of the economic benefits of female schooling (see Section 2.6 below). This procedure gives, for hard-to-evaluate-outcomes, what society is willing to pay for alternative ways of attaining the same gain – and thus, if the prices that are used in the evaluation reflect the true social marginal costs of resources, the true resource costs of such gains. Note that this method in principle includes both the direct resource cost gains and the indirect resource cost gains. To illustrate the latter, investments in youth that reduce crime may not only have gains from directly improving the safety of citizens but from indirectly encouraging international tourism and international investments. This procedure accounts for what resources society would be willing to pay for alternative ways of reducing crime in light of all these gains.

Even for the economic outcomes on which there long has been focus in evaluating the impact – particularly of schooling but also of training, health and nutrition – there often are serious measurement problems. People with less schooling, for example, may remember income less well, may have more problems in assessing the value of their income because more is in kind or self-produced, and may be subject to greater variations in income because of sporadic employment with seasonal fluctuations. If such factors lead to a tendency to underreport their incomes, then *ceteris paribus* the returns to schooling will be overestimated due to these systematic errors.

Costs: There often are problems in measuring the costs of investments in youth. The direct budgetary expenditures for particular investments, for example, may be intermingled with many other expenditures in budgets, and therefore be difficult to identify. They also may be spread among various budgets at various levels of aggregation – for example, if health clinic staff salaries are paid by the Ministry of Health but other recurrent expenditures are paid by local governments as in the Philippines. There further frequently is a problem that the budgetary expenditures do not reflect the true costs because of distortions

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[12]  This measure of the economic value of life also implies that there is no value to the life of an individual who is not productive because, for example, of age or disability.

in market prices, perhaps created by policies.  For example, governments may mandate wage rates for some workers such as teachers that may differ from the true scarcity value of such individuals, and then introduce other distortions such as in benefits or job securities in order to attempt to attract enough qualified individuals to these positions.  A major problem with evaluating costs, finally, pertains to the nongovernmental costs.  Policy-makers often ignore these because they are focused on governmental budgets.  But the costs of a program to the private sector may be considerable.  For example, many programs require considerable amounts of time of private individuals – time that has opportunity costs in the form of other uses.  For another example, as noted above, raising funds for governmental programs in itself may have large distortionary costs.

Measurement of Policies:  It might seem strange to include policies among the key variables for which there are measurement problems.  But there are serious measurement issues related to representing policies in empirical studies. For example, there is considerable emphasis on the potential for improved outcomes through policies that improve women's education.  But the empirical foundation for these claims in substantial part relates associations between years of schooling and outcomes that are viewed as desirable.  Years of schooling is not a policy variable, but the behavioral outcome that reflects the schooling market interaction between household/individual demands for time in schooling and various aspects of schooling supply that generally are indeed conditioned by policies.


## 2.4 EMPIRICAL ISSUES – ESTIMATION OF EFFECTS OF INVESTMENTS IN YOUTH

This paper is concerned with assessing what we know about the rates of returns to investments in youth in developing countries. But obtaining good empirical estimates of the effects of investments in youth is not easy, in part because of the measurement problems discussed above and in part for other reasons to which we now turn.  We first consider the possibility of empirical estimation through experiments and then through econometric methods using nonexperimental (behavioral) data.

### 2.4.1 Experimental Evaluation

To assess the impact of a particular change, such as increasing use of health clinics, the ideal would be a double-blind experiment with random assignment to treatment and control groups for the policies of interest.  Experiments have been conducted to evaluate a relatively small number of policies related to youth in developing countries.  One example is the Mexican Programa de Educación, Salud y Alimentación, PROGRESA (the Education, Health, and Nutrition Program),  which was introduced as part of an effort to break the intergenerational transmission of poverty and which included an evaluation sample in which communities were randomly assigned to immediate versus delayed treatment.  This design permitted evaluation of the impact of this program on a number of outcomes by comparing changes in treatment households with changes in control households (see Appendix A).[13]

But the possibilities for using such experiments for policy evaluation are limited.  First, most such experiments cannot be double-blind, with neither the subjects nor the evaluator knowing who received treatment (though some medical experiments can be if, for example, the placebo appears to human senses to be identical with the treatment).  That those who are treated know that they are treated may create better performance (i.e. the "Hawthorne effect").  That those who are not treated know that they are not treated may create incentives to obtain treatment through migration, political pressure, market purchases or other means.  Second, the argument often is made that new programs can not easily be introduced at

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[13]   Angrist, et al. (2003) analyze another example in which students were selected randomly from poor applicants to receive scholarships to attend private schools in urban Colombia.  Miguel and Kremer (2001, 2002) analyze the impact of random assignment of deworming programs among schools in Kenya.

the same time throughout a country, so it may be effective in terms of evaluation, as was attempted with PROGRESA, to introduce them in a random set of treatment communities and only later in a random set of control communities. But if members of the control group know that they will eventually be affected by the program and if they can transfer resources over time, they should immediately adjust their behavior to reflect their changed command over resources due to the expected eventual future direct program impact. If so, the comparison between the program and the treatment groups probably underestimates the program impact.[14]  Third, many experiments cannot be conducted because they are unethical or too costly. Imposing randomly some human resources, particularly related to health and nutrition but also to education, for example, is likely to be viewed as unethical. Even if some such possibilities are not viewed as unethical, they may be very costly in terms of resources or in terms of political costs. Consider the difficulties, for example, with the possibility of randomly assigning schooling among individuals in order to obtain better estimates of the effects of human resource investments in youth as would be desirable for the present study.  Fourth, even for the policies for which good experiments can be conducted at a reasonable (resource, ethical and political) cost, they reveal only the gross changes induced by the experimental treatment conditional on a particular situation, not what would happen in somewhat different circumstances. That is, experiments basically are "black boxes" that reveal the total impact of some change, but do not reveal anything about the underlying structural relations that could be used to infer what would be the effects of other changes. Fifth, there may be insufficient time to observe effects of interest to policy makers. This is a particular problem for youth investments, since many of the desired outcomes are expected to occur much later in life.

For such reasons, though it would be desirable to increase experimental evaluation of policies and to assure that the experiments that are undertaken are of high quality (e.g., with good baseline data and random assignment of treatment versus control groups), there are severe limits on what policies can be evaluated by experimental means. Nevertheless, the experimental design is an important benchmark against which other means of evaluation should be compared and judged to aid in understanding what are the probable biases that may arise from non-experimental evaluation.

### 2.4.2 Econometric Estimates of Impacts of Investments in Youth

Econometric or statistical methods are used to attempt to circumvent some of the limitations of the data, including that most data that are available for evaluation of the impact of investments in youth are behavioral data and not experimental data. Appendix B provides some discussion of these issues. The basic point is that there are a number of reasons – including measurement errors in variables, right-side variables that reflect current or past choices, important variables that are not observed in data sets (e.g., innate ability, preferences), and selected samples (e.g., clinic health test results only from those who go to health clinics and have the tests) – why the stochastic term in relations being estimated often are not likely to be independent of the right-side variables. As a result, estimates are likely to be biased and therefore misleading unless special data and estimation procedures, grounded firmly in the analytical framework used for the analysis, are used to control for these problems.

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[14]  Of course this is not a problem if members of the control group do not know that they eventually will be affected by the program, but such ignorance may be difficult to maintain because of interactions between members of the treatment and control groups and general information about the new program. In fact in some cases the administrators of the program may tell the control group directly that they will be included eventually in hopes of obtaining their agreement to serve in the control group and to enhance a sense of fair treatment.

### 2.4.3 Implications for Analysis of Endogenous Policies

Policies of all sorts – including those related to investments in youth – are not predetermined, but are made by individuals or groups of individuals with various objectives in mind, including accommodating to pressures from and needs of constituents.  This means that it may not be possible to evaluate the impact of governmental policies on various outcomes without controlling for the fact that governmental policies themselves are determined, implemented and monitored as part of a larger set of behavioral decisions.[15] The failure to control for the determinants of governmental policies may cause substantial mis-estimates of their effectiveness.  These mis-estimates, moreover, may either overestimate policy effectiveness or underestimate policy effectiveness, depending on what is the nature of the governmental decision. Therefore the usual estimates of policy effectiveness that do not control for the determinants of policies generally can not be assumed to give either lower or upper bounds on the true effects.

Rosenzweig and Wolpin (1986) formally develop these points. But the basic intuition is clear from considering the simple example of evaluating the impact on youth health of special health programs from cross-sectional data from a number of communities.  If the resources devoted to such special programs tend to be concentrated in communities that have greater political power, wealth and more-healthy youth net of the effects of the special health programs and of characteristics that are observed in the data, the association between youth health and resources devoted to special health programs without control for resource allocation among these special health programs in different communities overstates the effectiveness of the programs.  Those communities that receive more special health program resources would have had better youth health for other reasons that are correlated positively with the allocation of special health program resources (and *vice versa*).  On the other hand, if the resources devoted to such special health programs tend to be concentrated in communities that have poorer health environments, greater poverty and less-healthy youth net of the effects of the special health programs and of characteristics that are observed in the data, the association between youth health and resources devoted to special health programs without control for resource allocation among special health programs in different communities understates the effectiveness of the programs on youth health.  As a result, even if the special health programs are effective in improving youth health, the simple cross-sectional association between special health program resources in various communities and youth health may be negative (and, if positive, is an underestimate of the effectiveness of special health program resources).

A number of studies suggest that (a) governments do allocate resources differentially among various types of communities and (b) the failure to control for such allocations of resources across communities may lead to substantial misunderstanding of program effects (e.g., Behrman and Birdsall 1988, Gershberg and Schuermann 1999, Pitt *et al.* 1993).  Therefore it is essential to control for the determinants of program placement and intensity across recipients in order to evaluate with confidence the impact of programs.

### 2.5 PRIVATE VERSUS SOCIAL RETURNS, EFFICIENCY AND DISTRIBUTION

Often analyses of the impact of investments in youth are undertaken without consideration of the general rationale for policies.  It is just presumed that policies that, say, through increased investments in youth increase some outcome such as subsequent health must be good.  But such analyses are of little help in convincing skeptics that scarce resources should be allocated for these purposes, given many competing alternative uses.  Moreover they may not provide much in the way of guidelines for choosing among policy alternatives.  Therefore it is useful to ask why policy interventions with respect to investments in youth might be desirable.

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[15]  If programs are allocated randomly, as is discussed in Section 2.4.1, this problem is avoided.

At a general enough level of abstraction, policy should be chosen in order to maximize social welfare. That begs, of course, the critical political economy question of how the social welfare function is determined. Even if that difficult question is put aside, the practical guidance offered by the injunction to maximize social welfare may seem quite limited. For that reason it often is useful to think separately of the two standard economic justifications for governmental policy interventions: 1) to increase efficiency/productivity and 2) to redistribute resources.[16]

Policy justifications based on efficiency and on distribution are both firmly rooted in micro dimensions of behaviors as outlined in Section 2.1. *Both of these standard economic motivations for policy are concerned ultimately with the welfare of individuals as judged by those individuals.* This last statement is emphasized by placing it in italics because economic efficiency is viewed by some as a concern about allocation of things and technical and financial concerns, but *not* as a concern about people. However this reflects a fundamental misunderstanding. Economic efficiency ultimately is a concern with the welfare of people as judged not by policymakers or international experts, but by the individual decision-makers involved. There, in addition, is a separate important concern about the distribution of decision-making powers, including the distribution between females and males and across generations. But it is important to recognize that the efficiency motive for policy, far from being purely a mechanical or technical concern of "dismal scientists" devoid of concerns about people, is based fundamentally in people's perceptions of their own welfare.

### 2.5.1 Efficiency/Productivity

Resources are used efficiently in the economic sense of the term if they are used to obtain the maximum product possible given the quantities of the resources and the available production technologies at a point of time, and over time, and if the composition of that product increases the welfare of members of society as much as is possible given the resource and technological constraints, preferences and the distribution of resource ownership. It is important to note that efficiency is not just a concern about the static use of resources at a point in time, but also is a concern about the use of resources over time and thus productivity and productivity growth over time. An investment (or expenditure) is efficient if the marginal social benefit of the last unit of that investment just equals its marginal social cost.[17] If the marginal social benefit of a particular investment is greater (less) than the marginal social cost, society is not investing enough (is investing too much) and would benefit from increasing (decreasing) the level of investment until the marginal social benefits and costs are equalized.

Although applying the above rule maximizes social gains, private maximizing behavior leads to investments (including those related to youth) at the level at which the marginal private benefit of the investment equals its marginal private cost under the assumption that, given the information available to

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[16]    These two justifications include some other common concerns about policies, such as questions of access and quality of services and sustainability of overall economic development and of particular programs as is discussed in Behrman and Knowles (1998a). The distributional justification includes as a special case poverty reduction, which is characterized by some as the overarching objective in contemporary development policy (e.g., van der Gaag and Tan, 1997).

[17]    Three points should be noted. First, economic efficiency is not the same as engineering efficiency because of the incorporation of marginal benefits and marginal costs rather than focusing exclusively on technological efficiency. Second, these marginal conditions for efficiency may not hold if there are, for example, large discontinuities in production processes. In such cases choices may have to be made among a number of different alternatives, using an explicit welfare function to compare among the alternatives. Third, because of uncertainty in the real world this discussion could be recast in terms of expected values, with concern about possible risk aversion (or something other than risk neutrality). But, for simplicity, we do not do so.

them and the constraints that they face, individuals act in what they perceive to be their best interests (Section 2.2).  Consider the possibility that private incentives for investments differ from social incentives for such investments, first with respect to the marginal benefits and then with respect to the marginal costs.

Why might marginal social benefits exceed marginal private benefits for investments in youth?  The most frequent answers to this question include: (1) There are externalities in the form of effects on others that are transferred "external to markets."  Investments in education are thought to have not only private benefits to the person being educated, but, by adding to society's stock of knowledge, social benefits beyond the private benefits (positive "externalities" in the form of effects that are transferred external to markets). Other relevant examples of externalities include second-hand smoking, controlling contagious diseases such as HIV/AIDS, creating social capital, and developing incentives for legal rather than criminal behaviors. (2) Information on which schooling, health, and employment decisions are made may misrepresent the private rates of return to these investments because it is incomplete or incorrect  For example, youth may not know about contraceptives or about risks associated with STDs.  The "public good" nature of information (i.e., that the marginal cost of providing information to another consumer is virtually zero) leads to under-production of information from a social point of view by private markets because private providers cannot cover their costs if they price information at the social marginal cost as required for efficiency. (3) The combination of uncertainty, risk aversion and imperfect insurance markets may result in private incentives to underinvest in human, financial and physical assets because from a social point of view the risks are pooled. (4) The social discount rate may be lower than private discount rates because individuals value future outcomes more collectively than they do individually. (5) Prices for outcomes affected by such investments may understate social gains, in part because of distortions due to policies (e.g., policy restrictions on salaries in the health and education sectors).

Why might marginal social costs be less than marginal private costs for investments in youth? (1)  There may be capital market imperfections for some types of investments (e.g., social capital investments and human resource investments in part because these forms of capital are not accepted as collateral) such that the marginal private costs for such investments exceed their true marginal social costs, which probably is more relevant for individuals from poorer families who cannot relatively easily self-finance such investments. (2)  The sectors that provide some types of services (e.g., information, health care, schooling) may produce inefficiently because institutional arrangements do not induce efficient production of an efficient basket of commodities. School teachers and staff, for example, might be oriented towards rewards established by the Ministry of Education or union negotiations, not towards satisfying the demands of clients.  Governmental health workers may be more interested in their private practices than in their public work. (3) The sectors that provide services related to investments in youth may produce inefficiently because regulations preclude efficient production of an efficient basket of commodities.  For example, regulations that limit hours during which schools are open, or limit textbook choices, or that impose quality standards based on different conditions in other economies or that limit provision of services to public providers, all may result in much greater costs of attaining specific investments than would be possible with less regulations.[18]

What are the implications of differences in the marginal private and social benefits or cost?  Simply, if there are such differences, private incentives for investments in youth differ from social incentives.  In such circumstances, policies may increase efficiency by reducing the differences between the private and

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[18]  This is not to say that all regulations are bad. In some contexts regulations may be the most efficient means of attaining a goal, particularly if there are certain types of information problems (e.g., those related to the quality of goods and services that can not be easily discerned by consumers). But often regulations, no matter how good might be their intent, are not very effective policy tools (see Section 2.5.3 for further consideration of policy choices).

the social incentives or through other means that cause outcomes to be closer to the socially-desirable outcomes.

## 2.5.2 Distribution

Distribution is a major policy motive distinct from efficiency. Distributional concerns, at least officially in pronouncements of governments and of international agencies, often focus on the command over resources of the poorer members of society.[19] Society might well want to assure, for example, that everyone has basic schooling even at some efficiency cost (van der Gaag and Tan 1997). Though distributional concerns are often characterized by focus on the distribution of income or other resources among households, there may also be important distributional considerations within households. Household decision-makers are not likely to consider equally the preferences of all household members in allocating household resources. For example, if women have preferences for using more resources to invest in children than do their husbands, these preferences may not be weighed equally as those of their husbands in decisions made by their husbands. Moreover, even if some households as aggregates have sufficient resources to cover what society considers basic needs, certain types of individuals in households may not be allocated what society considers to be sufficient resources for their individual satisfaction of basic needs. A particularly germane example may be child labor. Such labor may contribute importantly to the resources and the welfare of the household decision makers, but may detract from improving the human resources of the child by, for example, exposing the child to health and other risks and limiting the education of the child. Therefore there may be an important intergenerational distributional tradeoff.

## 2.5.3 Policy Choices to Increase Efficiency and to Improve Distribution

If all other markets in the economy are operating efficiently and there are differences between marginal private and social incentives in a given market related to investments in youth, policies that induce investments at the socially efficient levels increase efficiency.[20] That still does not indicate what policies would be best to induce investments in youth at the socially desirable levels. There is a large set of possibilities, including governmental fiats, governmental provision of services at subsidized prices, price incentives in markets related to investments in youth, price incentives in other markets, and changing institutional arrangements in various markets. To choose among alternatives based on efficiency alone, there are two important considerations.

First, policies have costs. These costs include the direct costs of implementing and monitoring policies and the distortionary costs introduced by policies that may encourage socially inefficient behavior (including rent-seeking by both public and private entities). Often policymakers focus only on the direct costs and ignore the distortionary costs because only the direct costs have obvious and visible direct

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[19] Many policies, whatever their official justification, however, distribute resources to middle and upper class households. For some examples for human resource-related policies in Viet Nam, see Behrman and Knowles (1998b, 1999) and World Bank (1995).

[20] If all other markets in the economy are not operating efficiently, then policies that narrow the differences between private and social incentives in a particular market related to investments in youth do not necessarily increase efficiency and productivity. But, in the absence of specific information to the contrary, such as the existence of two counterbalancing distortions, a reasonable operating presumption is that lessening any one distortion between social and private incentives is likely to increase efficiency.

ramifications for governmental budgets. In fact the costs may be sufficiently high that it is not desirable to try to offset some market failures by policies.[21] But, if it is desirable to do so, there is a case generally for making policy changes that are directed as specifically as possible to the distortion of concern because that tends to lessen the distortionary costs. An *efficiency policy hierarchy* can be defined in which alternative policies to attain the same improvement in efficiency are ranked according to their social marginal costs, including direct and distortionary costs. This hierarchy indicates the preferential ordering of policies to deal with particular divergences between private and social incentives.[22]

Second, there are tremendous information problems regarding exactly what effects policies have, particularly in a rapidly changing world. This is an argument in favor of policies that are as transparent as possible, which generally means higher in the efficiency policy hierarchy with regard at least to distortionary costs because more direct policies are likely to be more transparent.[23] Information problems also provide an argument for price policies (taxes or subsidies) because if there are shifts in the underlying demand and supply relations they are likely to be more visible in a more timely fashion to policymakers if they have impact on the governmental budget than if they only change the distortions faced by private entities as tends to happen with quantitative policies.[24] Finally, information problems in the presence of heterogeneities across communities point to the possible desirability of decentralization and empowerment of users of social services in order to increase the efficacy of the provision of those services, though such considerations must be balanced off against possible economies of scale, higher quality of staff and possibly lower levels of corruption at more centralized levels, as well as intercommunity distributional concerns.

Thus, for efficiency/productivity reasons, particularly given that in the real world information is imperfect and changes are frequent, there is an argument generally for choosing policies as high as possible in the efficiency policy hierarchy defined by the extent of marginal direct and distortionary costs – and thereby using interventions that are focused as directly on the problem as possible. Note that this means that, for example, if there is a good efficiency reason for public support for investments in youth, that does *not* mean that the best way to provide that support is through governmental provision of the relevant services. Higher in the efficiency policy hierarchy than direct governmental provision of such services, for example, may be subsidies or taxes that create incentives for the efficient provision of these services whether the actual providers are public, private or some mixture. On the other hand, policies that

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[21] If the policies involve public expenditures as do most policies, it is important to consider the cost of raising the necessary tax revenue to finance the policy. For example, it has been estimated that the distortionary cost (often called the "deadweight loss") of raising a dollar of tax revenue in the United States ranges from $0.17 to $0.56, depending on the type of tax used (e.g., Ballard, Shoven and Whalley 1985, Feldstein 1995). Estimates for some other countries range from $0.18 to $0.85, depending on the tax (van der Gaag and Tan 1997). Harberger (1997) suggests using a shadow price of $1.20-1.25 for all fiscal flows on a project.

[22] For example, it sometimes is argued that female schooling should be subsidized because more-schooled women have fewer children, which relieves budgetary pressures on subsidized schooling and health services. But in this case increasing female schooling through such subsidizes would not seem obviously to be high in the efficiency policy hierarchy. Higher in the efficiency policy hierarchy might be the elimination of any public subsidies for education and health that are not warranted by the marginal social benefits exceeding the marginal private benefits.

[23] This also is an argument for considering an experimental approach to evaluating policy alternatives when possible – e.g., rather than introducing a reform country-wide, introduce variants of reforms for schools (and other social services) in randomly selected sites with careful monitoring of the results for both the experimental groups and the control groups (Section 2.4.1).

[24] Nevertheless there are likely to be some cases, such as providing information regarding the quality of goods and services related to investments in youth, for which quantitative regulations may be higher in the efficiency policy hierarchy than price policies because of the nature of the information requirements.

discriminate against one type of provider – for example, by making the availability of such subsidies dependent on whether the provider is public – are generally likely to be lower in the efficiency policy hierarchy than policies that do not have such conditions.

Now consider distribution. Generally speaking the subsidization of specific goods and services (and even less, the direct provision by governments of goods and services at subsidized prices) is not a very efficient way of lessening distributional problems.  Because subsidies are designed to lower prices to consumers, they induce inefficient consumption behavior.  Instead, it generally is more efficient (and thus less costly in terms of alternative resource uses) to redistribute income to consumers, allowing them to allocate the income in ways that lead to efficient patterns of consumption.[25] Nevertheless, there are some cases in which subsidization of selected goods and services may be defensible to attain distributional objectives. For example, in cases where it is difficult (and therefore costly) to target the poor households or poor types of individuals within households, subsidizing certain goods and services that are mainly consumed by the poor may be the most efficient policy alternative.

Rather than being concerned with the general command over resources of its poorer members, as noted above, society may deem it desirable that everyone enjoy basic human resource related (and other) services, including basic schooling, nutrition and health care.  Such an objective might be obtained through many means.  But presumably it is desirable to assure that everyone have these basic options at as little cost in terms of productivity as possible so, rather than ignoring efficiency considerations, it is desirable to choose policies as high as possible in the efficiency policy hierarchy and still assure that the basic service objectives are met.  Thus, to obtain a given distributional objective it is possible to define a *distributional policy hierarchy* in which policy alternatives that obtain that objective are ordered from lowest to highest marginal costs, including both direct and indirect costs.  Efficiency goals thus should play an important role in interaction with the pursuit of distributional goals, not as independent considerations.

### 2.5.4 Implications of Efficiency and Distributional Motives for Evaluating Benefits and Costs of Different Policies

There are important implications of the two policy goals – efficiency and distribution – for how the costs and benefits of policies should be valued:

1.  Whether particular policies are warranted or not depends on the social tradeoff between efficiency and distribution.

2.  Transfers may be an important tool for attaining distributional ends, but they are not costs in the sense that in themselves they use resources.  Related to transfers (as well as to other programs), however, generally are real resource costs related to program administration and distortions caused by the program.

3.  Just because there are large productivity gains relative to costs does NOT mean that a program warrants subsidies from the point of view of efficiency.  From the point of view of efficiency there is a reason for public policy support only if the social rate of return to a particular use of resources is greater than the private rate of return.

4.  With imperfect capital and insurance markets for the poor, there are likely to be some productivity and efficiency gains if the poor are beneficiaries of transfers.

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[25] However, even redistributing income may lead to inefficiency because it can affect the work effort of those on both the tax-paying and tax-receiving sides.

5. Measurement problems are great. These are particularly severe, for example, for the social welfare weights for marginal incomes for different members of society and for differences between social and private rates of returns due to market imperfections for the productivity and efficiency measures. But, despite such difficulties, it is important to attempt to undertake benefit cost analysis with such considerations in mind – though, all too often, they are ignored.

## 2.6 METHODOLOGY FOR ECONOMIC EVALUATION OF INVESTMENTS IN YOUTH

If one has reliable estimates of the effectiveness of a set of alternative investments in youth, how can one best evaluate them against the criteria of efficiency and distribution? There are several methodologies available in the literature.

Perhaps the simplest is cost effectiveness analysis (CEA). This consists of ranking a set of related investments according to their cost per unit of effectiveness, where the measure of "effectiveness" should be clearly defined and as narrow as practical, given the range of investments to be analyzed. CEA has been used widely to evaluate alternative investments *within* a given sector. For example, cost per life saved or cost per disability-adjusted life year (DALY) are criteria that have been widely used in CEA evaluations of alternative investments in the health sector. However, CEA has several shortcomings in the context of evaluating alternative investments in youth. First, it requires a single effectiveness measure. This is impractical in the case of many youth investments because they involve such a wide range of possible outcomes. Second, CEA does not provide any basis for comparing investments in youth to alternative investments, such as investments in economic infrastructure or investments to improve governance. Third, while CEA addresses aspects of the efficiency motive for policies, it does not do so comprehensively (i.e., it does not address whether the objective used to measure "effectiveness" itself represents an efficient use of resources).[26]

Cost-benefit analysis (CBA) is an alternative methodology for evaluating investments that is designed to handle alternative investments that may have several different outcomes. Because CBA values benefits in monetary terms, it obtains results (i.e., benefit-cost ratios or internal rates of return) that readily permit comparisons with alternative investments. If one has reliable estimates of effects, the problem is valuing them in monetary terms. This is often technically challenging and can be politically sensitive as well (e.g., assigning a monetary value to a human life). Although there are several approaches that are used to do this in the literature, we focus on two that would appear to be most promising for use in the present context.

The first approach is to define benefits in terms of an investment's impact on economic growth, typically measured in terms of growth in GNP per capita. This approach was used in the pioneering study by Coale and Hoover (1958) of the economic benefits of fertility reduction. More recently, this methodology was used (in combination with other methods) to estimate the economic benefits of a broad strategy to improve health in developing countries (Commission on Macroeconomics and Health 2001). Econometric estimates of the relationship between cross-country economic growth rates and a list of explanatory variables (e.g., initial income levels, economic policy variables, structural characteristics of the economy) and indicators of population health indicate that each 10 per cent improvement in average life expectancy at birth is associated with an increase in the rate of economic growth of 0.3 to 0.4 percentage points per year, holding other factors constant. Similar econometric analyses have been undertaken with respect to the association of other types of investments in youth (e.g., schooling) with economic growth (Barro and Sala-I-Martin 1995). In the context of the present review, there are three

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[26] On the other hand CEA can be, and often is, explicitly used to assess alternative means of attaining specific distributional goals, such as improving reproductive health outcomes for poor populations.

main problems with this approach. First, the associations that are found in cross-national analysis may not represent unbiased estimates of the causal effects of investments (due to omitted variable and endogeneity bias). Second, the available cross-national data (possibly apart from schooling) are not sufficiently disaggregated to disentangle the effects of investments in youth from similar investments in the broader population. Third, this approach does not deal well with either the distributional nor the efficiency motives for policies. Because it is on an aggregate level, it is not surprising that it does not deal much if at all with distribution. But it also needs to be made clear that maximizing growth is not the same as the efficiency motive for policy. Too high growth may be inefficient just as may be too low growth.

An alternative approach is to build on micro estimates of direct productivity effects that can be measured in monetary terms on the one hand and, for the effects that cannot be easily translated into monetary terms, use the resource cost of the most cost-effective alternative to achieve the same effects on the other hand. This strategy is used by Summers (1992, 1994) to analyze the benefits and cost of investing in female education. Using Pakistani data, Summers begins with estimates of the effect of an additional year of women's schooling on her lifetime earnings. Next he develops estimates of the effect of an additional year of women's schooling on child mortality, fertility and maternal mortality. He places a monetary value on these latter effects by using estimates of the cost of producing similar effects using alternative cost-effective interventions (e.g., the cost per child life saved through measles immunization).[27] He compares these estimates (with some discounting to reflect the lagged nature of the effects) of "social benefits" to the cost of providing an extra year of schooling to women and concludes that investing in girls' education yields relatively high returns. The main problems with this approach are that (1) it is partial equilibrium and therefore market feedbacks, particularly within relatively closed economies, may be missed and (2) information with which to assess private versus social rates of return, and therefore, the efficiency motive, is relatively rare. Nevertheless, this seems the best available methodology, so we adopt it in this paper. In our estimates of benefits we try to give appropriate attention to the lag between the investment and the expected effects, since with even a modest discount rate (e.g., 5 percent) the delay between investments and the resulting effects can have an important effect on benefit-cost ratios or internal rates of return. We also try to examine critically the case for public intervention with respect to each type of investment since most benefit-cost ratios by themselves do not shed any light on this issue.[28] Finally, we also try to examine the likely impact of investments on the poor as compared to the non-poor and on women as compared to men, since distributional concerns are not usually incorporated directly into benefit-cost estimates.[29]

Both the benefits and the costs are likely to vary from country to country, for a variety of reasons (e.g, the sixth point in Section 2.2). One of the main determinants of both benefits and costs is the average level of income in a given country (as perhaps measured by GDP per capita in PPP). This affects benefits in terms of increased earnings, which are often (but not always) an important component of the benefits of investments in youth. The average level of income in a given country also affects labor costs, which are

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[27] Summers' methodology involves using estimates of cost effectiveness ratios as a basis for valuing benefits. The implicit assumption is that discounted social benefits are at least equal to discounted social costs in the case of investments in which the cost-effectiveness ratio is at a minimum (e.g., measles immunization). If this is not the case, the cost-effectiveness ratio does not provide an accurate estimate of social benefits and would have to be adjusted downwards.

[28] To shed light on this issue benefit-cost ratios or internal rates of return are needed from both private and social perspectives, but both rarely are presented in existing studies. For examples of attempts to reshape CBA to address the issue of the benefits and costs of public intervention, see Devarajan, Squire and Suthiwart-Narueput (1997) and Behrman and Knowles (1998a).

[29] Of course, it is conceptually possible to weight benefits differently for different groups. However, this is rarely done in practice.

often (but not always) an important component of the cost of investments in youth. Often (but not always) the two will virtually offset one another, so that the benefit-cost ratio or internal rate of return is unaffected. However, in the case of investments where this is not the case, it will be necessary to adjust benefits and costs for differences in average levels of income. We shall do so if the necessary information is available.

The benefits and costs of many investments in youth also are alleged to vary significantly by gender. In such cases if the necessary information is available, we prepare separate estimates by gender.

# III. THE EFFECTS AND COSTS OF A RANGE OF BASIC INVESTMENTS IN YOUTH

Table 3-1 lists the alternative investments in youth that were examined in this study. The available evidence on the effects, costs and cost effectiveness of these investments is discussed in Knowles and Behrman (2003). An important general point is that many of the estimates of the effects of investments in youth are not persuasive because they are based on behavioral, not experimental, data and do not control for the behavioral choices that led to the investments in youth the effects of which are being evaluated nor for the many measurement problems (Sections 2.3 and 2.4).

**Table 3-1. Alternative Investments in Youth**

INVESTMENTS

Schooling
    School quality-improving investments (e.g., strengthening inputs, administration decentralization, school autonomy)
    Scholarship programs
    Enforcement of compulsory attendance laws

Training
    Vocational and technical training
    Adult basic education and literacy (ABEL) training
    Military training

Work
    Enforcement of child labor regulations
    Enforcement of other employment regulations (e.g., safety regulations, hours of work, minimum wage, restrictions on layoffs)

Reproductive health
    School-based reproductive health education
    Social marketing of reproductive health services targeted to youth
    Youth-friendly reproductive health services
    Linked services
    Peer counseling programs
    Mass media programs
    Workplace/community outreach services targeted to youth
    Investments designed to delay age at marriage
    Reproductive health policy development
    Treatment of HIV-infected youth

INVESTMENTS

School health investments

     School health policies

     School-based health education (apart from RH education)

     School lunch/feeding

     Micro-nutrient supplements administered to school children

     Mass de-worming of school children

     Water and sanitation facilities in schools

     Presumptive malaria treatment of school children

     Periodic physical examinations of school children

     School health insurance

Other health investments

     Increasing the tax on tobacco products

     Ban on tobacco advertising and promotion

     Anti-alcohol abuse investments

     Anti-drug abuse investments

     Mass media investments (apart from reproductive health)

     Food supplements for pregnant and lactating women

     Food fortification

     Road accident prevention

     Investments to improve the mental health of youth

Community and other investments

     Youth centers

     Youth development programs

     Micro-credit programs targeted to youth

     Youth rehabilitation programs

     Sports and recreation programs

Source: Knowles and Behrman (2003).

In surveying the literature on youth investments we have found that there are a number of very serious gaps in the information base that would support the kind of estimates we would like to present. In developing countries, there is very little evaluation of the effectiveness of existing youth programs. Where reliable estimates of effectiveness exist, the measurement is often over too short a period of time to be useful. In other cases, there is reliable information only on one or two effects of an investment (e.g., the productivity effects of investments in formal schooling). Information on other effects, including many of those needed to obtain estimates of social benefits, is often lacking. This is clearly a major gap in the information base on investments in youth. Without reliable information about the effectiveness of interventions, it is impossible to obtain reliable estimates of the benefits and thus of the benefit-cost ratios or the internal rates of return of various investments. The absence of reliable estimates of the full range of the hypothesized effects of investments frustrates efforts to obtain separate estimates of private and social benefits. Accordingly, the rationale for government intervention is absent or weak in the case of many of the possible investments in youth.

We summarize below the main findings of our review of the literature regarding the effects, costs and cost effectiveness of various categories of investments in youth.

Formal schooling.  There are reliable estimates for some countries of the cognitive achievement effects of both demand-side investments (scholarships) and supply-side investments (quality improvements) based on randomized experiments.  However, there is no developing country evidence of the effects or cost effectiveness of investments to enforce compulsory school attendance laws.  The effects of school quality investments and scholarships can differ significantly by income and gender.  For example, investments that improve the quality of schooling mainly provide benefits to children already enrolled in school.  Accordingly, such investments tend to benefit the better off more than the poor and boys more than girls, particularly if the investments are made at the secondary level.  In contrast, scholarships are often targeted to poor children or to girls in an effort to encourage them to enroll or remain in school.  Cost estimates are provided in several studies.  However, the cost estimates usually do not include estimates of distortionary and administrative costs, and in some cases they include transfers (e.g., scholarships).  Most of the countries for which reliable estimates of cognitive achievement effects are available are middle-income countries in Latin America (e.g., Mexico, Colombia, Brazil).  However, a randomized experiment on evaluating alternative quality improvement investments is currently ongoing in Kenya.

Civilian and Military Training.  Estimates are available of the cost of providing vocational/technical and adult basic education and literacy (ABEL) training in many countries.  However, the cost estimates do not include distortionary costs, or even administrative costs in some cases.  Reliable estimates of effects, in terms of cognitive achievement, are not available in any of the studies.  Most of the existing estimates do not address the problem of selectivity bias.  In countries where female illiteracy rates are considerably higher than those of males, ABEL investments are likely to benefit more females than males.  ABEL investments also tend to be effectively targeted to the poor.  There are no studies on the effects or cost of military training.

Work.  There are no reliable estimates of the effectiveness of child labor regulations/laws and other employment regulations/laws in developing countries, nor is there any information on the cost of enforcing them.  Some types of child labor (but clearly not all types) may enhance labor productivity, either through the acquisition of skills or through additional work experience.  However, there are no reliable estimates of these possible negative productivity effects of child labor regulations/laws.

Reproductive health.  There are reliable estimates of effects of some investments (e.g., reproductive health education provided in schools). In some cases, these are obtained from randomized experiments.  However, randomized experiments are rarely used to evaluate reproductive health investments in youth and are often too small to yield reliable results (e.g., an intervention is implemented in three schools with three others serving as controls).  Small quasi-experimental studies, which yield less reliable results, are much more common in the evaluation of reproductive health investments in youth.  Other problems include the short time span over which effects are estimated in most studies and the reliance on intermediate outcome indicators (e.g., delayed sexual activity) rather than measures of health impact (e.g., HIV infections prevented).  This is a significant problem because many reproductive health investments in youth are directed to low-risk populations (e.g., in-school adolescents) in which health impacts may be relatively small. Social benefits exceed private benefits for many investments in reproductive health since they involve the prevention or treatment of communicable diseases (e.g., HIV/AIDS prevention, STI diagnosis and treatment).  The biggest information gap in the reproductive health area is the lack of information on investment costs.  There are almost no studies of reproductive health investments in youth that present cost estimates.  The Honduras HIV prevention study (the results of which are used below) is an exception inasmuch as it provides estimates of both effects and costs.  However, many of the "estimates" are based on the consensus views of Honduran and international experts, rather than on the results of carefully designed research.  Another problem with the existing studies on reproductive health investments in youth is that they tend to focus on only one effect, e.g., HIV prevention, but not, for example, on teen pregnancy prevention.  There is almost no information on either the cost or effectiveness of reproductive health policy development investments or on investments designed to delay age at

marriage. In the case of highly active antiretroviral therapy (HAART) treatment of youth infected with HIV, the literature does not yet provide estimates of the potential health benefits or of the likely impact of HAART treatment on the secondary transmission of HIV.

School-based health investments. There are reliable estimates of the cost and effects of some school-based investments, e.g., de-worming and micronutrient supplements. The available evidence suggests that both school-based de-worming and micronutrient supplementation yield high returns in some settings (although there is apparent inconsistency in some of the findings of what appear to be carefully designed studies). There is somewhat less reliable information available on the costs and effects of school-based health education programs (other than those focused on reproductive health), school lunch and other feeding programs, and school water and sanitation investments. There is almost no information on the cost and effectiveness of investments in school health policy development, presumptive malaria treatment, periodical physical examinations, and school health insurance. An important distributional issue with respect to school-based health investments is that their benefits are mostly limited to children currently enrolled in school (who are predominantly from better off families and males in many countries).

Other health investments. There is reliable information on the effectiveness of tobacco taxes and bans on advertising, but there is little information on the cost of the investments required to implement these policies effectively. There is limited cost and effectiveness information for most of the remaining investments in this category (i.e., anti-drug and anti-alcohol abuse programs, mass media interventions, food supplements for pregnant and lactating women, food fortification programs, road accident control programs). However, there is no information on either the cost or effectiveness of investments to improve the mental health of youth.

Community and other investments. There is very limited information on the cost and effectiveness of youth centers, but there is no information on the remaining investments in this category (i.e., youth development programs, micro-credit programs targeted to youth, youth rehabilitation programs, sports and recreation programs targeted to youth).


# IV. BENEFITS

The literature review in Knowles and Behrman (2003) indicates that there is a wide range of possible effects from investments in youth. n order to carry out cost-benefit analysis of these investments, it is necessary to assign monetary values to their various possible effects. In some cases, it is possible to develop estimates of benefits directly in monetary terms that permit comparisons with costs and with other impacts that also are measured directly in monetary terms, such as the monetary value of enhanced labor productivity. We refer to benefits estimated in this way as "directly estimated" benefits, which is the preferred approach. However, in cases where it is conceptually or practically difficult to value benefits directly in economic terms, we develop estimates based on the least amount of money society currently spends to secure the same effects, as discussed above. We refer to benefits estimated in this way as "indirectly estimated" benefits.[30]

The preference is to assign monetary values directly to the effects of investments, where feasible. Consequently, Knowles and Behrman (2003) attempt to do so whenever possible. However, in the case

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[30] When indirect estimates of benefits are used, care must be taken to find an alternative intervention with the same effects. Otherwise, the estimates have to be adjusted.

of very broad effects such as "increased education" or "improved health," the direct valuation of benefits can be a daunting task. In cases where such effects are identified as one of several possible effects of an investment (and not likely to be the primary effect, in terms of the overall estimate of benefits), the indirect method can be very useful and is certainly preferable either to ignoring the effect completely or simply calling attention to its existence and then ignoring it (which is the tendency in most cases found in the literature).

In using the indirect approach, the following caveats are noted.

1.  The effect(s) of the cost-effective alternative investment have to be the same as the effect(s) for which a monetary value is sought. For example, if the cost per birth averted in a family planning program is used to value the effect of reduced fertility, it is important to adjust that cost for the other benefits that family planning programs provide, e.g., reduced maternal mortality and morbidity, reduced child mortality, ability to space births, and information.[31]

2.  It is important not to double count the value of effects that are directly and indirectly valued (van der Gaag and Tan 1997). For example, if the value of enhanced labor productivity is used to value the benefits of increased education among all children, even those who may voluntarily not participate in the labor force (e.g., persons engaged full-time in housework), it is incorrect to include the value of improved health of children as an additional benefit (since this benefit should be reflected already in the enhanced productivity of more educated persons in housework).

3.  What is really needed for indirect estimation is the amount of money society spends on the margin to secure a given effect, i.e., the marginal cost-effectiveness ratio rather than the average cost-effectiveness ratio. Unfortunately, there is little information currently available currently on marginal cost-effectiveness ratios (e.g., the marginal cost per DALY gained in immunization or family planning programs). However, in many mature programs, marginal cost-effectiveness ratios are likely to differ substantially from average cost-effectiveness ratios.

4.  The use of indirect methods to value broad effects of investments in youth will make it impossible in some cases to obtain separate estimates of private and social benefits (e.g., when broad effects include components that have both private and social benefits). Separate estimates of the private and social benefits associated with a given broad effect of an investment in youth are only possible if the benefits of the components are estimated individually.

In cases where a broad effect such as "increased education" is expected to be the primary effect of an investment (e.g., a targeted scholarship program), it is impractical to value the effect indirectly. In such cases, it is necessary to value the effect directly. Such broad effects are associated with a package of component effects. The literature often provides less guidance for valuing the package than it does in valuing its components (or at least some of them). Accordingly, when such broad effects need to be valued directly, it may be useful first to identify their various components and then to value each of these either directly (the preferred approach) or indirectly (the second-best approach). For example, in the case of "increased education," one of its components is enhanced labor productivity. Since there is a substantial literature on the relationship between increased education and enhanced labor productivity, on the one hand, and on how to assign a monetary value to enhanced productivity, on the other hand, it is usually possible to value this component directly. However, other components of increased education (e.g., reduced teen pregnancy, reduced crime, reduced fertility) are more difficult to value directly, and an

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[31] Such adjustments have not been made in previous applications of this methodology (e.g., Summers 1994, van der Gaag and Tan 1997).

indirect valuation may be more practical.[32] Knowles and Behrman (2003) identify the components of such broad effects in order to facilitate such a two-step valuation process. This information is summarized in Annex C.

Knowles and Behrman (2003) review the extensive literature relevant to valuing the benefits of the various hypothesized effects of investments in youth. It is convenient to group the various effects of investments in youth into the following three categories: (1) directly monetizable effects, (2) broad effects that are difficult to monetize directly, and (3) effects that are particularly difficult to monetize. In the case of directly monetizable effects, such as "enhanced labor productivity," the review discusses only direct methods of valuation. In the case of broad effects that are more difficult to value directly, such as "increased education" or "improved health," the review discusses both direct approaches to valuing the effects (using the two-step procedure discussed above) and indirect methods based on the cost of cost-effective alternative investments currently used to obtain the same effects (the Summers method discussed above). In the case of effects that are inherently difficult to value in monetary terms, such as "enhanced social capital" or "enhanced self esteem," the review provides only conjectures about how they might be valued.

The main findings of Knowles and Behrman (2003) regarding the valuation of the effects of investments in youth are summarized below.

**Directly monetizable effects of investments in youth**

Enhanced labor productivity. An estimated percentage increase in labor productivity can be valued directly by multiplying it by the average wage.

Reduced under-utilization of labor. There is often very little information on the activities of unemployed youth (i.e., the extent to which they may be engaged in housework or studying). This complicates efforts to place a monetary value on the increased labor utilization benefits obtained from reducing youth unemployment (a broad effect).[33] However, where such information is available, the percentage increase in labor productivity that results from reduced unemployment can be multiplied by the average wage to obtain a direct estimate of this benefit.

Increased/decreased work effort. There is often little information on the effect of investments in demand-side schooling (e.g., scholarships and other transfers) or the enforcement of child labor laws on adult and child work effort. However, when such information is available, this benefit (or cost) can be estimated directly by multiplying the reported change in work effort by the average wage.

Expanded access to risk pooling services. Estimates of this benefit can usually be made from knowledge of the characteristics of the risk insured against (e.g., the risk of health care expenditure among youth), usually in combination with some rather strong assumptions.

Reduced age at which children achieve a given level of schooling. In evaluating the benefits of a given schooling investment, it can be assumed that earlier completion of a given grade level results in a longer active period in which to recoup the benefits of enhanced productivity. Because this benefit occurs at the beginning of a person's active period, it is not as heavily discounted as some other education-related benefits.

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[32] However, in the case of some of the hypothesized effects of increased education (e.g., increased self esteem), even indirect valuation may be difficult.

[33] The most commonly used approach in the literature on youth investments is to assume that unemployed youth are not engaged in any productive activity. However, this is unlikely to be generally true.

Reduced cost of medical care.  There is some information on the cost of treating persons infected with HIV and other STIs. However, there is very little information on the cost of medical care associated with unsafe abortions, or from female genital cutting.  There is no problem in assigning a monetary value to the monetary component of this effect, since effects on the cost of medical care are usually expressed in terms of a percentage of an average level of spending on medical care.  However, it is more difficult to assign a value to the opportunity cost of time and other indirect costs (e.g., transportation costs) involved in obtaining medical care.

Increased tax revenue.  This is equivalent to a transfer. Hence, there is generally no benefit associated with the collection of increased tax revenue.  However, in some cases (e.g., a tobacco tax), the tax revenue collected may have lower than usual distortionary costs because the tax may be offsetting in part or in whole some distortion, and in such cases this benefit should be valued, if possible.

**Broad effects of investments in youth**

In directly valuing broad effects of investments in youth, such as "increased education" or "improved health," the problem is that there is often poor information on the relationship between a given broad effect and its components.  For example, one of the components of increased education may be reduced crime.  However, even if it is possible to estimate the unit benefits of reduced crime, estimates of the effect of increased education on the incidence of crime may not be available.  In such cases, it still may be possible to value such broad effects indirectly on the basis of the cost of cost-effective alternative investments that produce the same (or similar) package of effects.  For example, in the case of increased education, it may be much simpler to value it indirectly, e.g., according to the cost of cost-effective alternative investments that increase education (e.g., the cost of improving school quality, the cost of scholarship programs), particularly when increased education is only one among several effects of a given investment in youth (i.e., not the primary effect of the investment).  Table 4-1 lists some possible approaches to valuing indirectly the benefits associated with broad effects of investments in youth that are suggested in Knowles and Behrman (2003).

**Table 4-1. Possible approaches for indirectly valuing broad effects of investments in youth**

| Broad Effect | Indirect Valuation Method |
| --- | --- |
| Increased education | Cost of scholarship programs or quality improvement investments in schools per unit of increased cognitive achievement (e.g., percentage improvement in standardized test scores) |
| Reduced youth unemployment | Cost of public works programs targeted to youth per job created |
| Reduced child labor | Cost of scholarship programs per hour of reduced child labor |
| Averted teen pregnancy | Cost of family planning services targeted to youth per averted teen birth |
| Averted HIV infection | Cost of HIV/AIDS preventive programs targeted to high-risk populations. Alternatively, the estimated number of DALYs gained per averted HIV infection, multiplied by an estimate of the monetary benefits per DALY gained. |
| Averted STIs (other than HIV/AIDS) | Cost per STI averted through cost-effective investments to prevent HIV/AIDS (e.g., cost of preventive interventions directed to high-risk populations) |
| Averted TB infections | Cost per DALY gained of cost-effective investments in health (e.g., immunization) |
| Improved health | Cost per DALY gained of cost-effective investments in health (e.g., immunization) |
| Improved nutritional status | Cost per unit of improved nutritional outcome (e.g., height-for-age, goiter |

| Broad Effect | Indirect Valuation Method |
|---|---|
| | rate, hemoglobin level, birthweight) of cost-effective nutrition investments (e.g., micronutrient supplements, food fortification) |
| Improved mental health | No information available on the cost effectiveness of alternative interventions designed to improve mental health. A less satisfactory interim solution might be to obtain an estimate of the average number of DALYs lost per case of mental illness and to value each DALY gained on the basis of cost-effective alternative investments in health (e.g., immunization). |
| Delayed marriage (females only) | Cost of scholarship programs for girls per year of delayed marriage |
| Averted drug/alcohol abuse | No information available on the cost effectiveness of alternative interventions designed to avert drug/alcohol abuse. A less satisfactory interim solution might be to obtain an estimate of the average number of DALYs lost per case of drug/alcohol abuse and to value each DALY gained on the basis of alternative cost-effective investments in health (e.g., immunization). |
| Averted physical and/or sexual abuse | No information available on the cost effectiveness of alternative interventions designed to avert physical and/or sexual abuse. A less satisfactory interim solution might be to obtain an estimate of the average number of DALYs lost per case of physical and/or sexual abuse and to value each DALY gained on the basis of alternative cost-effective investments in health (e.g., immunization). |
| Averted crime | No information available on the cost effectiveness of alternative interventions designed to avert crime in developing countries. In this case, direct estimates may need to be prepared. See Knowles and Behrman (2003). |
| Averted female genital cutting | If an estimate of the average number of DALYs lost per case of female genital cutting can be obtained, it would be possible to value each DALY gained on the basis of alternative cost-effective investments in health (e.g., immunization). |
| Reduced fertility | Cost of family planning services per birth averted (with some adjustments for the fact that family planning services have other effects, e.g., birth spacing, improved health). |
| Averted abortion | Cost of family planning services per abortion averted (estimated crudely as the cost per pregnancy averted by family planning services divided by the proportion of pregnancies terminated by abortion). |
| Reduced tobacco use | Cost of enforcing an increase in the tobacco tax per one percentage reduction in tobacco use (can be used for any investment except investments designed to enforce an increase in the tobacco tax). Alternatively, an estimate of the number of DALYs gained, valuing each DALY gained on the basis of alternative cost-effective investments in health (e.g., immunization). |
| Reduced violence and civil conflict | No reliable information available on the cost effectiveness of alternative interventions designed to reduce violence and civil conflict. No solution proposed. |
| Averted orphans | Cost of cost-effective interventions (e.g., professionally assisted deliveries) designed to avert maternal deaths (which produce orphans). |

Source: Knowles and Behrman (2003).

**Effects that are particularly difficult to monetize**

Knowles and Behrman (2003) identify some of the effects of investments in youth as being particularly difficult to monetize whether directly or indirectly. These effects include:

- Increased social capital
- Averted infertility
- Averted social exclusion
- Improved self esteem
- Enhanced national security (an effect of military training)

In the case of some of the above effects (e.g., increased social capital, averted social exclusion), it is to difficult even to find a suitable measure of the effect. However, the difficulties involved in measuring and monetizing these effects does not necessarily imply that they are less important than other effects of investments in youth.

# V. THE BENEFITS AND COSTS OF INVESTMENTS IN YOUTH

## 5.1 EXISTING COST-BENEFIT ANALYSES OF INVESTMENTS IN YOUTH

There are only a few existing studies for developing countries in which the benefits and costs of investments in youth are calculated. Some of these studies are reviewed briefly in this section.

### 5.1.1 Bangladesh Food for Education (FFE) program

In Bangladesh, the government-funded Food for Education (FFE) program provides grants of food to households in designated poor localities on the condition that primary school-age children in the household are attending school. The annual FFE program expenditure needed to encourage an additional poor child to attend primary school was estimated to be $66.4, while the estimated annual expenditure for an additional very poor child to attend was estimated to be $95 (Ravallion and Wodon 2000). Benefits in the form of additional per capita consumption enjoyed both by the child attending school and his/her family when the child reaches adulthood were estimated to be $69.9 for the poor child and $52.6 for the very poor child. After netting out the value of the food grains received under the program, which are a transfer (but without including any estimate of social benefits), the internal rate of return was estimated to be 8.11 for the very poor and 11.50 for the poor. The report concludes that the FFE program is cost-effective as an education program. However, it suggests that a cash stipend program might be more cost-effective because of the likelihood that it would involve lower administrative costs.

### 5.1.2 Colombia PACES School Voucher Program

In Colombia, the PACES program provides vouchers to poor households that can be used to pay for children to attend private secondary schools. In municipalities in which the number of applicants exceeded the funds available, scholarship recipients were randomly selected through a lottery (Angrist et al. 2002). The total social cost of the program was estimated to be $43 annually per lottery winner, or $195 over a three-year period (after adjusting for different rates of voucher take-up in each year of the program). This cost, however, does not include any distortionary costs incurred, for example, in raising

revenues to finance this program or due to effects of the program on the behaviors of other household members (e.g., changing their labor supplies). The evaluation estimated that the additional 0.12-0.16 years of schooling completed by lottery winners would raise their annual incomes by about $36-48 per year (based on an estimated rate of return to schooling of 10 percent in Colombia and predicted average annual earnings of $3,000). Additionally, the estimated increase of 0.2 standard deviations in test scores among lottery winners was estimated to be the equivalent of about one full year of schooling (based on the mean test scores by grade of U.S. Hispanic students taking the same test), which if correct would translate into an additional gain of about $300 in annual earnings. Clearly the estimated gain in earnings (even if heavily discounted) would exceed the program's cost as calculated in the study (and probably even with the incorporation of the distortionary costs not included) in any cost-benefit analysis (even if social and other private benefits from improved cognitive achievement are ignored).

### 5.1.3 Mexico PROGRESA Scholarship Program

The PROGRESA scholarship program and its estimated effects are summarized in Section 3.2.2. The benefit-cost ratio of this program also has been estimated based on those effects and additional information (Behrman, Sengupta and Todd 2002). The financial cost of the program primarily is the cost of the scholarships that are awarded monthly for the ten months of the school year for eligible children who attend at least 85 percent of the time, plus the cost of a once-a-year book allowance and the per family member share of a general subsidy that PROGRESA provides to each eligible family based on a poverty level proxy means test. The effect of increasing schooling attainment by about 0.7 grades is translated into a benefit in this evaluation by using the present discounted values of income effects over the life cycle based on prior estimates of the impact of schooling on income in Mexico. This exercise leads to estimates of a benefit/cost ratio of 1.7 for a real interest rate of 5 percent (2.7 for a real interest rate of 3 percent, illustrating the sensitivity of these estimates to the choice of discount rate). There are no spillover effects in the sense that there is no impact on the schooling of children who are not participants in the program but who attend the same schools as children who are participants.

In certain respects, this is a high-quality evaluation because of the experimental data that were available due to the Mexican government's willingness to evaluate the program and the careful analysis of the effects that permitted multiple channels and the estimation of the effects had the program been in place for the whole career of children (even though it would be necessary to collect data for roughly a decade before it would be possible to have direct observations on the effects for the program over a child's school career). Nevertheless, the discussion above in Section 2.5, 2.6 and 3.2 point to several limitations of this evaluation, many of which are shared by other evaluations including many of those summarized above:

(1) The cost estimates do not include the administrative costs of the program (which have been estimated to be relatively low, on the order of magnitude of 10 percent) nor the distortionary costs of raising governmental revenues for the program (which, together with administrative costs of 10 percent, would reduce the benefit-cost estimate to one if they were 40 percent of the total program expenditures – not a huge number in comparison, for example, with estimates of Feldstein 1995).

(2) The costs do not include any additional resource costs due to additional school inputs that may have been used to accommodate the induced changes in schooling. Unless the schools previously had unutilized capacities, the fact that no spillover effects were found suggests that school inputs were either underutilized or increased (but, unfortunately, there is not direct evidence on changes in school inputs).

(3) The effects include only those on schooling attainment, not on education in some broader sense as represented, for example, by cognitive achievement (though based on partial data, Behrman, Sengupta and Todd 2000 do not find significant effects on such tests in the first year of the program).

(4) The benefits include only the labor productivity-related benefits and not the larger array of possible benefits that we argue above are likely to constitute the broad effect of increased education.

(5) The available information does not permit an assessment of possible efficiency gains from the program (except that the increased enrollment is consistent with a capital market constraint on investments for poor households prior to the program, and estimates indicate response that are inversely related to income, which is consistent with such a constraint). For instance, they provide no way to assess whether there are any positive spillovers on others because of one individual having more schooling.

(6) This evaluation seems to confuse transfers with resource costs in representing costs (see Section 2.5.4). The benefit-cost estimates, thus, are overstated because of the failure to include additional school input, administrative and distortion costs and understated due to the inclusion of transfers as a cost. These two errors work in opposite directions and may partially offset one another.

### 5.1.4 Increasing the Quality versus the Quantity of Basic Schooling in Rural Pakistan

Increasing the quantity of schooling an individual receives is likely to raise his or her cognitive skills. Improving school quality is likely to have the same effect. Increasing the quantity of schooling – by providing a primary education to children who otherwise would not go to school, or by providing a middle school education to children who otherwise would leave school upon the completion of primary school – entails substantial costs. Similarly, improving the quality of schools has costs. However, in the case of quality improvement, there is little or no change in the opportunity cost of student time – a large component of the total cost of schooling.

Behrman, Ross and Sabot (2002) developed a conceptual framework for evaluating the rates of return to increases in the quantity versus the quality of schooling. They collected most of the necessary data for rural Pakistan, and made estimates with methods that control for the key behavioral choices and for unobserved determinants of education. They found that increasing the quantity and improving the quality of schooling are alternative means of increasing the productivity and earnings of the labor force.[34] Their estimates are that the social rate of return to enabling the graduate of a low-quality primary school to complete middle school – 2.8 percent – is low compared to improving school quality – 13.0 percent – or providing access to a low-quality primary school – 18.2 percent. The relatively high rate of return to improving quality reflects the absence of any additional opportunity cost to the students and the absence of higher capital costs for students already enrolled in school. In this context, it appears that productivity and equity concerns both point towards expanding primary schools, even if they are of lower quality. And, because few boys now lack access to basic schooling, girls will benefit disproportionately.

This study again points to some of the difficulties in undertaking such evaluations. Even with the special data collected for the study, for example, it was not possible to identify with confidence the relative importance of the various components of teacher quality (i.e., the relative importance of factors such as teacher experience, teacher schooling, teacher training). This study also limits the measurement of the effects of changes in schooling to the value of labor market outcomes, and provides no information on possible efficiency reasons for interventions. Further, as in the other studies reviewed in this section, there is no attention to some possibly important distortionary costs, such as those incurred to raise governmental revenues.

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[34] Alderman, *et al.* (1996b) found that higher cognitive skills are rewarded with higher wages in rural Pakistan, presumably because more skilled workers are more productive. Because they are more skilled, graduates of even low-quality primary schools earn more than uneducated workers. In like manner, graduates of high-quality primary schools and graduates of middle schools who attended low-quality primary schools earn more than students who complete only low-quality primary schools.

**5.2 METHODOLOGY USED TO CALCULATE THE BENEFIT-COST RATIO AND THE INTERNAL RATE OF RETURN**

This paper calculates benefit-cost ratios and internal rates of return for various investments in youth using EXCEL spreadsheets in an extension of a procedure previously used, for example, by Summers (1992, 1994).  This procedure simplifies the process of doing the simulation experiments referred to above. Section 5.2.1 develops the methodology using matrix algebra notation so that interested readers can understand the details of the procedures.  Some readers may wish to skim this section and proceed directly to Section 5.2.2, which presents an illustration.

### 5.2.1 Methodology for Cost-Benefit Analysis

The objective is to estimate an s×1 vector of discounted benefits (**B**) corresponding to an s×1 vector of alternative investments[35] in youth (**H**), expressed in thousands of US$ (for concreteness).  Then this vector can be used together with an s×1 vector **C** of the discounted costs, again corresponding to the s×1 vector of alternative investments in youth (**H**), in order to calculate an s×1 vector of cost-benefit ratios or an s×1 vector of internal rates of return, once again with one element for each of the corresponding alternative investments in youth (**H**).

The procedure we use begins with a matrix (spreadsheet) of discounted effects (**E**) with m+n rows and s columns.[36] The first m rows refer to directly monetizable effects of a one thousand dollar investment in youth. The last n rows refer to the broad effects of the investment (i.e., effects that cannot be directly monetized). The s columns refer to s alternative investments, i.e., $H_1, H_2, H_3, \ldots, H_s$.  We partition the matrix of effects **E** into sub-matrices $E_1$, containing the first m rows of **E**, and $E_2$, containing the last n rows of **E**.[37]

We next define the broad effects translation matrix **T** with m+n rows and n columns, each (m+n)×1 column of which lists first the m directly monetizable components of one of the n broad effects and then the n remaining components of one of the n broad effects.  The elements in each column of matrix **T**, i.e., the components of each broad effect, are in fact discounted effects, while the last n rows of each column in matrix **T** are themselves discounted broad effects.  We next partition the matrix **T** conformably into sub-matrices $T_1$, containing the first m rows of **T** (corresponding to directly monetizable effects), and $T_2$ containing the last n rows of **T** (corresponding to broad effects).  The matrix **T** embodies an important simplifying assumption, i.e., that the components of each broad effect do not vary by intervention.  Otherwise, the matrix **T** would be much larger (i.e., (m+n)×n×s instead of only (m+n)×n).

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[35] Alternatively, the procedures described here might be used to estimate the benefit-cost ratios of a set of related investments that would extend the coverage of a program to successively larger percentages of the program's target population. In this case, the cost effectiveness of each successive investment might decline to reflect the increasing marginal cost of providing services to successively harder-to-reach sub-groups of the target population.

[36] Since the effects of a given investment in youth are assumed to occur over the person's lifetime, the effects are discounted to a single age (e.g., 18 years).

[37] **E** and **T** (see next paragraph) are assumed to be fixed matrices for the alternatives that we explore. This requires the assumption that, for the range of investments considered, the marginal effects are constant. In the interest of simplification, our procedure also assumes there are no interactions among the various investments (although there are clearly cases where this is not true, i.e., where synergies exist).

Lastly, we define an (m+n)×1 vector of benefits (**Z**) corresponding to one unit of each of the m+n directly monetizable and broad effects.[38] We partition **Z** into **Z₁**, containing the first m elements of **Z**, and **Z₂**, containing the last n elements of **Z**. The first m elements of vector **Z** (**Z₁**) – the benefits associated with directly monetizable effects – are estimated directly. The last n elements of vector **Z** (**Z₂**) – the benefits associated with the broad effects – are calculated by transposing the rows and columns of the two sub-matrices in matrix **T** to obtain the n×m sub-matrix **T₁´** and the n×n submatrix **T₂´**, and then post-multiplying **T₁´** by the m×1 vector **Z₁** and adding it to the expression obtained by post-multiplying **T₂´** by the n×1 vector **Z₂**:

$$\mathbf{Z}_2 = \mathbf{T_1}´\ \mathbf{Z_1} + \mathbf{T_2}´\ \mathbf{Z_2}$$

Which implies:

$$\mathbf{Z}_2 = (\mathbf{I} - \mathbf{T_2}´\ )^{-1}\ \mathbf{T_1}´\ \mathbf{Z_1}$$

Where **I** is the n×n identity matrix (i.e., matrix with 1's on the diagonal and zeroes elsewhere). In some cases, we may want to use indirect estimates of the benefits of broad effects rather than estimating them directly (i.e., use indirect estimates for some elements of **Z₂**, rather than basing them on estimates of the corresponding elements of $(\mathbf{I} - \mathbf{T_2}´\ )^{-1}\mathbf{T_1}´\ \mathbf{Z_1}$).

Under these assumptions, the s×1 vector of discounted benefits (**B**) corresponding to s alternative investments in youth (**H**) is given by:

$$\mathbf{B}\ =\ (\mathbf{E_1}´\ \mathbf{Z_1} + \mathbf{E_2}´\ \mathbf{Z_2}\ )\ \mathbf{H}$$

The vector of discounted benefits (**B**) is compared to the vector of discounted costs (**C**), both of which are discounted to the same age (e.g., age 18, or the age at which a given investment is assumed to occur). The benefit-cost ratio (BCR) for a given investment s is defined as:

$$BCR_s = b_s/c_s$$

Where $b_s$ refers to element s of **B** and $c_s$ refers to element s of **C**.

The internal rate of return (IRR) for a given investment s ($IRR_s$) is calculated as the discount rate that makes $b_s = c_s$.

A separate set of matrices (spreadsheets) in principle should be used for different categories of countries (e.g., grouped according to their per capita income), for different genders, and for other groups (e.g., ethnic minorities) for which disaggregated analysis is needed. The limited availability of the necessary disaggregated estimates, however, limits the extent to which such disaggregation currently is possible.

### 5.2.2 A Hypothetical Illustration of the Methodology

We illustrate the methodology with a (relatively) simple, purely hypothetical example. For our example, we take the case of an investment (e.g., a scholarship program for girls) designed to increase the amount of schooling a girl has by one year. We assume that the target group of girls would have quit school at age 13 after completing six grades, in the absence of the investment; and that with an investment of

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[38]  The benefits are discounted back to the actual average age at which the investment is assumed to occur, which we assume to be age 18 in the absence of any reason to make an alternative assumption..

$1,000 we are able to keep 10 girls age 13 in school until they complete seven years of schooling, at which point they will be age 14. The $1,000 investment consists of the following costs: $250 in distortionary costs to raise the revenues to finance this investment, $100 for the program's administrative costs, $300 in costs to accommodate the additional 10 girls in school (i.e., $30 per enrolled pupil), $250 of household investments, largely in the form of forgone earnings of the girls, and a discounted cost of $100 for the girls' children to continue their schooling beyond the grade at which they otherwise would have left school.

We assume that the effect of the hypothetical investment is to increase schooling among the 10 girls by a total of 10 school years (one completed school year per scholarship beneficiary) and that this increase in years of schooling completed results in a proportionate increase in education (as measured by cognitive achievement). However, increased education is a broad effect assumed to have the following components:

- Each girl's labor productivity increases by 10 percent from age 16 until her retirement (assumed to occur at age 60)

- Completed fertility is reduced by one child (i.e., the average woman decides not to have a 5th child at age 36)

- Each girl's health improves by 0.05 DALYs per year, beginning at age 14 and continuing throughout her lifetime (which is assumed to be 70 years).

- The health of each of the girls' four children is assumed to improve by 0.05 DALYs beginning at her age 36 and continuing for the 18 years that her children are assumed to spend with her.

- Each of the girls' four children completes 0.5 years more schooling than they otherwise would have completed by the time each girl (woman) reaches age 40.

- The probability that the girls will be infected by HIV decreases by 0.01 from age 15 to age 24.

Most of the above components of increased education are directly monetizable effects. However, the increased education that the girls' children are assumed to receive is a broad effect assumed to have the same components as the girls' own increased education (but with substantially longer lags). But, in the case of the girls' children, it is assumed that there is no effect of the investment on their own children's schooling or on their children's risk of contracting HIV. In addition, each HIV infection averted is assumed to be a broad effect with the following components (reflecting the additional assumptions that a girl, if infected with HIV, would be infected on average at age 20, that the infection would turn into AIDS at age 25, and that she would die as soon as she turns 27):

- The additional medical care necessary to treat a person with AIDS is averted at ages 25 and 26 (i.e., during the last two years of life)

- There is an improvement in health equivalent to 34.6 DALYs at age 27

Table 5-1 presents the assumed effects (including the components of broad effects) of this hypothetical investment over each girl's life cycle.

**Table 5-1. Assumed timing of life-cycle effects for one girl in hypothetical girls' scholarship example**

| | Increased education | Enhanced labor productivity | Reduced fertility | Improved health | Improved health of children | Increased education of children | Reduced risk of HIV infection | Improved health (HIV) | Decreased medical care (HIV) | Discount factor |
|---|---|---|---|---|---|---|---|---|---|---|
| Discounted (to age 18) cumulative sum of effect | 1.2155 | 2.0576 | 0.4155 | 1.1972 | 1.0200 | 0.6837 | 0.0939 | 22.3035 | 1.3875 | |
| Age | | | | | | | | | | |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2763 |
| 14 | 1 | 0 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | 1.2155 |
| 15 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 1.1576 |
| 16 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 1.1025 |
| 17 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 1.0500 |
| 18 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 1.0000 |
| 19 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.9524 |
| 20 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.9070 |
| 21 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.8638 |
| 22 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.8227 |
| 23 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.7835 |
| 24 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0.01 | 0 | 0 | 0.7462 |
| 25 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0 | 0 | 1.0 | 0.7107 |
| 26 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0 | 0 | 1.0 | 0.6768 |
| 27 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0 | 34.6 | 0 | 0.6446 |
| 28-35 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | — |
| 36 | 0 | 0.1 | 1 | 0.05 | 0.2 | 0 | 0 | 0 | 0 | 0.4155 |
| 37 | 0 | 0.1 | 0 | 0.05 | 0.2 | 0 | 0 | 0 | 0 | 0.3957 |
| 38 | 0 | 0.1 | 0 | 0.05 | 0.2 | 0 | 0 | 0 | 0 | 0.3769 |
| 39 | 0 | 0.1 | 0 | 0.05 | 0.2 | 0 | 0 | 0 | 0 | 0.3589 |
| 40 | 0 | 0.1 | 0 | 0.05 | 0.2 | 2 | 0 | 0 | 0 | 0.3418 |
| 41-53 | 0 | 0.1 | 0 | 0.05 | 0.2 | 0 | 0 | 0 | 0 | — |
| 54-60 | 0 | 0.1 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | — |
| 61-69 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | — |
| 70 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0.0791 |

According to the above assumptions, and assuming a discount rate of 5 percent, the effects matrix (**E**) for the $1,000 investment in this example looks as follows:

**Table 5-2. Effects matrix (E) for hypothetical scholarship program for 10 girls**

| Effects of hypothetical investment | Scholarship program |
|---|---|
| Enhanced productivity | 0.0000 |
| Reduced fertility | 0.0000 |
| Improved health | 0.0000 |
| Improved health of children | 0.0000 |
| Decreased medical care expenditure | 0.0000 |
| Increased education | 12.1551 |
| Increased education of children | 0.0000 |
| Averted HIV infections | 0.0000 |

Source: see text.

There is only one effect in the above table, the broad effect of 10 girls receiving one additional year of schooling at age 14. Because the benefits are discounted to age 18, the effect of the investment is shifted forward to age 18, using the discount rate. The last three effects (i.e., the last three rows of the table) are broad (i.e., not directly monetizable) effects.

Table 5-3 presents the broad effects translation matrix (**T**) for this hypothetical example. The numbers presented in this table are the cumulative sums of the annual effects presented in Table 5-1 discounted to age 18.

**Table 5-3. Broad effects translation matrix (T) of hypothetical scholarship program for girls.**

| Components of broad effects | Broad effects | | |
|---|---|---|---|
| | Increased schooling | Increased schooling of children | Averted HIV infections |
| Enhanced productivity | 2.0576 | 2.0576 | 0 |
| Reduced fertility | 0.4155 | 0.4155 | 0 |
| Improved health | 1.1972 | 1.1972 | 22.3035 |
| Improved health of children | 1.0200 | 1.0200 | 0 |
| Decreased medical care expenditure | 0 | 0 | 1.3875 |
| Increased schooling | 0 | 0 | 0 |
| Increased schooling of children | 0.6837 | 0 | 0 |
| Averted HIV infections | 0.0939 | 0 | 0 |

Source: see text.

The unit benefits associated with each of the assumed effects are assumed to be as follows:

Enhanced labor productivity. Each woman's full earnings are assumed to be $100 annually.

Reduced fertility. The value to society of averting each woman's fifth birth at age 36 is assumed to be $50 (based on the least-cost alternative means of reducing fertility by one birth).

Improved health. The value to society of each DALY gained is assumed to be $10 (based on the assumed cost per DALY gained from the least-cost alternative investment to improve health).

<u>Decreased medical care expenditure</u>. Medical care expenditure for HIV infected persons is assumed to be $270 annually during their last two years of life.

The full unit benefit vector (**Z**) for this hypothetical example is presented in Table 5-4.

**Table 5-4. Benefit vector (Z) for hypothetical example of scholarship program for girls**

| Benefits | Elements of vector Z |
|---|---|
| Enhanced productivity | 100 |
| Reduced fertility | 50 |
| Improved health | 10 |
| Improved health of children | 10 |
| Decreased medical care expenditure | 270 |
| Increased schooling* | 475 |
| Increased schooling of children* | 249 |
| Averted HIV infections* | 597 |

Source: see text.
*Elements obtained by solving the equation above for $\mathbf{Z}_2$, i.e., $\mathbf{Z}_2 = (\mathbf{I} - \mathbf{T_2}')^{-1} \mathbf{T_1}' \mathbf{Z_1}$

When the benefits vector **Z** is pre-multiplied by the transpose of the effects matrix **E**, the resulting scalar ($5,771) is the estimated benefits at age 18. Discounted to age 13, the age at which the investment is assumed to be made, the estimated benefits are $4,522. The benefit-cost ratio for this hypothetical investment is therefore 4.52. The internal rate of return (i.e., the discount rate that equates the present value of the stream of benefits to the present value of the stream of costs) is 19.3 percent.

## 5.3 ESTIMATES OF THE BENEFITS AND COSTS OF INVESTMENTS IN YOUTH

In this section, we estimate the benefits and costs of some investments for which a sufficient amount of information is available to permit the preparation of estimates of investment effects, costs and benefits. The investments analyzed include:

- Scholarship program (Colombia)
- Adult basic education and literacy program (Colombia)
- School-based reproductive health education program to prevent HIV/AIDS (Honduras)
- Iron supplements administered to secondary school students (low-income country)
- Tobacco tax (middle-income country)

Before proceeding, we would like to emphasize that the estimates presented are quite specific to a particular country or context. They do not represent generally applicable estimates of the returns to the above investments. Additionally, as will become apparent in the discussion that follows, the estimated benefit-cost ratios (and internal rates of return) are quite sensitive to the particular assumptions used.

<u>Scholarship program</u>. The effect of the investment on increased education is estimated on the basis of results obtained in the PACES voucher program (Colombia), which awarded scholarships to poor children (some of whom were selected randomly from among applicants via a lottery) to attend private secondary schools (Angrist et al. 2002, Section 5.1.2 above). The estimated effect of the scholarships was 0.12 additional grades of schooling completed by each lottery winner (as compared to lottery losers, all of whom had also applied to the program). In addition, each lottery winner performed 0.2 standard

deviations higher on standardized achievement tests, a difference that was estimated to be equivalent to having completed approximately one additional grade of schooling.[39]  There was almost certainly an effect of the investment on the average age at which secondary school was completed, since repetition rates were significantly lower among lottery winners and because 8th grade completion rates among lottery winners were about 10 percentage points higher (with age held constant).  But the average age at which a given grade was completed was not reported, possibly because most of the sample children were still in secondary school at the time of the evaluation.  There was also some evidence that lottery winners were less likely to be married at the time of the survey (although the effect was less than one percent).  No information was provided on the possible effect of the scholarships or of the means used to raise revenues for the program on adult work effort.  However, lottery winners (school children) worked significantly fewer hours per week (about 1.2 fewer hours per week).

In calculating the benefits and costs of a scholarship program, the following assumptions were used:

- The total cost of the investment (i.e., during the three years in which the program operated before its effects were measured) is equal to $227.65 per scholarship recipient (consisting of $9.07 in additional resources consumed to provide education, $185.93 in reduced work effort of children receiving scholarships, and $32.65 for administrative and distortionary costs)[40]

- Each scholarship recipient completes 0.12 additional grades of schooling (i.e., the effect of the scholarship on higher test scores is initially assumed to be zero)

- The cost of the investment is spread out equally during three years (i.e., ages 13, 14, 15)

- Each additional year of secondary schooling completed results in a 10 percent increase in annual earnings, as compared to expected future average annual earnings of $3000.

- Earnings are received continuously from age 16 until age 60

- The investment reduces the average age of completing secondary school by 0.2 years per scholarship recipient , which is assumed to provide an additional 0.2 years of earnings at age 15.

- There is no effect of the investment on age at marriage or on the number of hours worked by adults.

- The discount rate is 5 percent per annum

Since increased education is a broad effect, the following additional assumptions were made about the components of increased education:

- Each additional year of completed secondary schooling results in reduced fertility (i.e., 0.1 fewer births at age 35, averaged over males and females) and improved health (1.0 DALY spread out evenly between ages 15 and 70)

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[39]  In PROGRESA (see Section 5.1.3), by comparison, the estimated effect of scholarships on cognitive achievement was estimated to be the equivalent of 0.7 grade completed.

[40]  Education costs ($9.07) were estimated as the additional amount spent by households on schooling for lottery winners ($235.81) less the amount saved by the government in public school costs per lottery winner ($226.74). The cost of reduced work effort ($185.93) was estimated on the basis of the estimated 1.2 hours less per week worked by lottery winners, assuming 48 weeks worked per year and an average hourly wage of $0.71 (adjusted for the fact that voucher take-up rates declined over time). Distortionary and administrative costs (including the cost of raising the necessary fiscal revenue) were assumed to be 30 percent of the net change in public expenditure ($108.83, i.e., public outlays on scholarships of $335.58 less reduced public expenditure on secondary schooling of $226.74).

- Each additional year of completed secondary schooling results in 1.2 fewer hours worked per week by scholarship recipients while enrolled in school

- There is no effect of increased education on any of the following: crime, violence and civil conflict, social exclusion, youth unemployment, teen pregnancies, HIV infection or STIs, drug/alcohol abuse, physical/sexual abuse, or mental health. Clearly, this assumption (necessitated by the absence of estimates of increased education on these hypothesized effects) renders it impossible to obtain separate estimates of the social and private benefits of this investment.

The benefits from reduced fertility, improved health and reduced child work are assumed to be as follows:

- $50 per birth averted (indirectly estimated, based on the cost of 4 couple years of protection using contraceptives)

- $20 per DALY gained (indirectly estimated, based on the cost of cost-effective health investments targeted to youth)

- $0 (based on the assumption, for secondary students, that the benefits of any decrease in child labor is offset by the loss in benefits from reduced work experience)

Under these assumptions, the benefits discounted to age 13 are $3,152, while the costs (also discounted to age 13) are $953. The benefit-cost ratio is 3.31, while the internal rate of return is 25.6 percent. However, these estimates are quite sensitive to the discount rate used. For example, if a discount rate of 3 percent is used instead of 5 percent, the benefit-cost ratio increases from 3.31 to 4.41. The estimates are also very sensitive to the assumed productivity effect of an additional year of schooling. For example, if this effect is reduced from 0.10 to 0.08, the benefit-cost ratio decreases from 3.31 to 2.77.

The estimates are not sensitive to the inclusion of other components besides enhanced labor productivity in the broad effect of increased education. For example, if both the assumed fertility and health effects are reduced to zero, the benefit-cost ratio decreases only from 3.31 to 3.30. However, the estimates are sensitive to the assumed effect of the scholarship on the average age at which children complete school. If this effect is reduced to zero, the benefit-cost ratio declines from 3.31 to 2.68.

The preceding estimates assume that the effect of the scholarship on education is limited to the increase in the number of grades completed by scholarship recipients. If the effect is expanded to reflect the improved performance of scholarship recipients on standardized achievement tests (estimated to be the equivalent of an additional grade completed in the Colombia study), the benefit-cost ratio increases dramatically, from 3.31 to 25.63, while the internal rate of return increases from 25.6 percent to 93.9 percent.

Adult basic education and literacy program.

Information on the effectiveness of investments on adult basic education and literacy (ABEL) in creating lasting cognitive achievement is not readily available. It is also unclear how appropriately and accurately costs are measured in the available evaluation literature. Accordingly, cost-benefit estimates are prepared for this type of investment using a wide range of assumptions in terms of cost and effectiveness. Estimates of the cost per trainee successfully completing an ABEL course range from $20.40 to $97.78 for four projects in three countries, i.e., Ghana (2 projects), Bangladesh, and Senegal (World Bank 2002b). This implies that a $1,000 investment in ABEL could produce from 10.23 to 49.02 successful trainees. However these cost estimates apparently do not include the distortionary costs resulting from raising revenues to finance these programs, and thus probably are underestimates of the true costs. There

is no information on the level of lasting cognitive achievement successful trainees would acquire.  An upper limit is probably the equivalent of four years of primary schooling.  A lower limit is plausibly the equivalent of one year of primary schooling (although the possibility that in some mass campaign programs less is acquired cannot be ruled out).  The range of assumptions about cost and effectiveness create a wide range of estimates about the cost effectiveness of ABEL, i.e., from 10.2 years of primary school equivalency to 196.1 years of primary school equivalency per $1,000 investment (not including distortionary costs).

The cost-benefit estimates are made using the following assumptions:

- The training is provided to 18 year olds and is assumed to be the equivalent of only one year of primary schooling completed

- The effect of $1,200 invested in ABEL (including distortionary costs of 20 percent) is initially assumed to create only 10.23 years of primary school equivalency

- Each additional year of primary school equivalency results in a 10 percent increase in annual earnings, as compared to average annual earnings of $1,400 in Colombia[41]

- Earnings are received continuously from age 19 until age 60

- The discount rate is 5 percent per annum

Since the increased education that is assumed to result from ABEL investments is a broad effect, the following additional assumptions were made about the components of increased education:

- Each additional year of primary school equivalency results in reduced fertility (i.e., 0.1 fewer births at age 35, averaged over males and females) and improved health (1.0 DALYs spread out evenly between ages 19 and 70)

- There is no effect of increased education on any of the following: violence and civil conflict, crime, child labor, social exclusion, youth unemployment, teen pregnancies, HIV infection or STIs, drug/alcohol abuse, physical/sexual abuse, or mental health. Clearly, this assumption (necessitated by the absence of estimates of increased education on these hypothesized effects) renders it impossible to obtain separate estimates of the social and private benefits of this investment

The benefits from reduced fertility, improved health and reduced child work are assumed to be as follows:

- $50 per birth averted (indirectly estimated, based on the cost of 4 couple years of protection using contraceptives)

- $20 per DALY gained (indirectly estimated, based on the cost of cost-effective health investments targeted to youth)

Under these assumptions, the benefits discounted to age 18 are $23,880, while the costs (including distortionary costs) are $1,200.  The benefit-cost ratio is 19.9, while the internal rate of return is 70 percent. However, these estimates are quite sensitive to the discount rate used.  For example, if a discount rate of 3 percent is used instead of 5 percent, the benefit-cost ratio increases from 19.9 to 27.6. The

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[41]  The estimate of average annual earnings among those without any formal schooling completed is calculated assuming annual earnings of $3,000 for those having completed 8 years of schooling (from the preceding example for Colombia) and a 10 percent rate of return on an additional year of schooling.

estimates are also very sensitive to the assumed productivity effect of an additional year of primary school equivalency. For example, if this effect is reduced from 0.10 to 0.08, the benefit-cost ratio declines to 15.93. If, alternatively, the productivity effect of the ABEL training is assumed to be 0.10 initially but to diminish at 5 percent annually, the benefit-cost ratio declines to 11.55. If it is assumed to decline at 10 percent annually, the benefit-cost ratio falls to 8.14.

If instead of the lower limit of cost effectiveness that is used in preparing the above estimates (i.e., 10.2 successful trainees per $1,000 invested and one year of primary school equivalency per successful trainee), the upper limit is used (i.e., 196.1 trainees per $1,000 invested and four years of primary school equivalency per successful trainee), the benefit-cost ratio rises to an astoundingly high 1,764 (i.e., discounted benefits of $2,116,248 for each $1,200 invested), corresponding to an internal rate of return of 980 percent!

School-based reproductive health education program to prevent HIV/AIDS. Estimates of the effectiveness of this investment are based on estimates developed in the Honduras HIV/AIDS modeling work supported by the World Bank (2002c). It is important to underline at the outset that the benefits presented for this investment are *limited to the effects of the investment on HIV prevention*. No other effects were considered in the Honduras study. It was estimated that a school-based reproductive health education program targeted to adolescents (ages 10-19) would reach an estimated 60 percent of the targeted population and, among those reached, would reduce HIV incidence by 38 percent (the baseline annual HIV incidence among adolescents was estimated to be 0.001 in Honduras). Such a program was estimated to cost $10.44 per targeted adolescent (and $12.53, if an additional 20 percent in distortionary costs are included in the unit cost estimate to represent the cost of mobilizing the necessary tax revenue to finance the investment). Under these assumptions, the cost per averted HIV infection is $54,947, or 0.0182 new infections averted per $1,000 invested.

Both aggregate and disaggregated estimates of the benefits of this investment are prepared. The aggregate estimate is based on estimates of benefits prepared by the Commission on Macroeconomics and Health (2001), i.e., that averting an HIV infection in a developing country involves a gain of 34.6 DALYs 5-8 years after the infection is averted and that each DALY should be valued at 1-3 times the level of annual earnings. Assuming that annual earnings are $1000 and that the lower limit of the estimate of benefits is used (i.e., one times annual earnings), the aggregate estimate of benefits per averted HIV infection would be $34,600 (34.6×$1000=$34,600). Such an estimate would include the benefits not only from improved health but also from the other components of the broad effect of averting an HIV infection (e.g., reduced medical care costs). Under these assumptions, the benefit-cost ratio is 0.493, while the internal rate of return is undefined (since even undiscounted benefits are less than costs).[42] If a 3 percent discount rate is used, the benefit-cost ratio rises to 0.543. This relative insensitivity with respect to changes in the discount rate reflects the fact that the benefits of the investment are assumed to occur at a relatively young age (23).

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[42] If each DALY gained from an averted HIV infection is valued at twice the level of national earnings ($2000, instead of $1000, and still less than the upper range of three times the level of national earnings estimated by the Commission on Macroeconomics and Health [2001]), the benefit-cost ratio rises to 0.987 (with an IRR of 4.7 percent).

A disaggregated estimate of the benefits from averting one HIV infection, which is a broad effect, would be based on the following assumptions regarding the benefits of the components:

- It is assumed that any HIV infection is averted at age 18

- In the case of improved health, it is assumed that each HIV infection averted results in a gain of 34.6 DALYs (but valued differently, as explained below) at age 23

- Each DALY of improved health gained is valued according to the cost per DALY gained from alternative cost-effective health investments targeted to the same age group. An estimate of $20 per DALY gained is used for this purpose.

- In the case of secondary HIV infections, it is assumed (consistent with estimates in the Honduras HIV/AIDS modeling) that each infected adolescent infects 0.1 others between the age of infection (18) and the age of death (23)

- Each secondary infection averted is assumed to provide a benefit of $4,867 (based on the estimated discounted benefits of averting an HIV infection, using the disaggregated method)

- It is assumed that each averted HIV infection averts the annual medical care costs of caring for an AIDS patient, assumed equal to 2.7 times the level of annual earnings ($2,700, assuming annual earnings of $1,000) during the last two years of life (i.e., at age 21 and 22)

- There is no effect of an averted HIV infection on secondary TB infections, orphans social exclusion or education. Clearly, this assumption (necessitated by the absence of estimates of averted HIV infection on these hypothesized effects) renders it impossible to obtain separate estimates of the social and private benefits of this investment.

Using the disaggregated estimate of benefits, the estimated benefit-cost ratio is only 0.102, while the internal rate of return is again undefined (the estimated benefit-cost ratio increases to 0.109 with a discount rate of 3 percent). The estimated benefit-cost ratio is so low in this case because the estimated benefits of each averted HIV infection are only $4,867 in this case (compared to $34,600 when an averted HIV infection is valued using the aggregate method discussed above).[43]

The estimated benefit-cost ratios for this investment are directly proportional to the incidence of HIV infection in the targeted adolescent population. For example, if the incidence of HIV infection in the targeted adolescent population is 1 percent, instead of 0.1 percent, the benefit-cost ratio increases by a factor of 10, from 0.493 to 4.93 in the case of the benefits estimated using the aggregate method and from 0.102 to 1.02 in the case of benefits estimated using the disaggregated method.[44] The benefit-cost ratio would presumably be significantly higher in both cases if some of the other benefits of such an investment (e.g., STIs averted, teenage pregnancies averted) were considered.

In addition to the fact that the Honduras study neglects benefits other than the prevention of HIV infections, it is also very conservative in assuming that the benefits of health education do not continue beyond a single year. A more realistic assumption might be that the HIV prevention effectiveness of health education declines at a fixed annual rate over time. However, an offsetting factor is that the

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[43] Estimates of the benefit-cost ratio were prepared for two other reproductive health investments targeted to Honduran youth (i.e., social marketing of reproductive health services designed to prevent HIV/AIDS and workplace/community outreach services designed to prevent HIV/AIDS). The estimated benefit-cost ratios were 0.199 and 0.249 respectively, with plausible ranges of 0.041-0.399 and 0.051-0.548 respectively.

[44] The estimated benefit-cost ratios for the two other youth reproductive health investments referred to in the preceding footnote would also increase proportionately with increases in HIV incidence in the targeted youth population.

incidence of HIV infection is likely to rise with age. In the absence of better information, it is not unreasonable to assume for illustration that these two factors offset one another. In this case, health education received at age 15 would have the same impact, in terms of HIV infections averted per $1,000 investment, at ages 18-29. Under these revised assumptions, the estimated benefit-cost ratio would increase to 4.59, in the case of benefits estimated using the aggregate method, and to 1.115, in the case of benefits estimated using the disaggregated method.

Iron supplementation administered to secondary school children

It has been estimated that iron supplements provided to school children increase their cognitive achievement by 5-25 percent (McGuire 1996). The annual cost of iron supplements per school child has been estimated to be $0.10 (World Bank 2002a). A conservative estimate of delivery costs per child is $0.05 (i.e., 50 percent of the cost of the drugs).

A direct estimate of the benefits and costs of iron supplements administered to school children is based on the following relatively conservative assumptions:

- Iron supplements are administered to children ages 13-15 for three years

- The annual cost of the iron supplements is $0.15 per child ($0.18, including additional distortionary costs of 20 percent).

- The effect of iron supplementation at age 15 is to increase each child's cognitive achievement by 5 percent

- The cost of the investment is spread out equally during three years (i.e., ages 13, 14, 15)

- Each additional year of secondary schooling completed results in a 10 percent increase in annual earnings, as compared to average annual earnings of $200.

- Earnings are received continuously from age 16 until age 60.

- The discount rate is 5 percent per annum

Since increased education is a broad effect, the following additional assumptions were made about the components of increased education:

- Each additional year of completed secondary schooling results in reduced fertility (i.e., 0.1 fewer births at age 35, averaged over males and females) and improved health (1.0 DALYs spread out evenly between ages 15 and 70)

- There is no effect of increased education on any of the following: crime, violence and civil conflict, social exclusion, youth unemployment, teen pregnancies, HIV infection or STIs, drug/alcohol abuse, physical/sexual abuse, or mental health. Clearly, this assumption (necessitated by the absence of estimates of increased education on these hypothesized effects) renders it impossible to obtain separate estimates of the social and private benefits of this investment.

The benefits from reduced fertility and improved health are assumed to be as follows:

- $50 per birth averted (indirectly estimated, based on the cost of 4 couple years of protection using contraceptives)

- $20 per DALY gained (indirectly estimated, based on the cost of cost-effective health investments targeted to youth).

Under the above assumptions, the benefit-cost ratio is estimated to be 32.1, while the internal rate of return is 88 percent. Using a discount rate of 3 percent, the benefit-cost ratio increases from 32.1 to 45.2. If the productivity effect of an additional year of schooling is assumed to be 8 percent, rather than 10 percent, the benefit-cost ratio declines to 25.8.

Tobacco tax.

Estimates of the cost per DALY gained from a tax on tobacco products (i.e., $5-17) are obtained from World Bank (1999a). An aggregate estimate of benefits per DALY is based on the work of the Commission on Macroeconomics and Health (2001), i.e., that a DALY should be valued at 1-3 times the level of annual earnings.

An aggregate estimate of the benefits from a tobacco tax is based on the following conservative assumptions:

- An investment of $1,000 ($1,200, including additional distortionary costs of 20 percent) would produce a gain of 58.82 DALYs (i.e., the cost per DALY gained is assumed to be $17)

- There is a lag of 30 years between such an investment and the resulting gain in DALYs

- Annual earnings are $1,000

- Each DALY gained is valued at one times annual earnings

Under these assumptions, $1,200 invested in a tobacco tax today would yield discounted future benefits of $13,610. The benefit-cost ratio is therefore 11.34, and the internal rate of return is 13.9 percent. Given the long lag between costs and benefits, the benefit-cost ratio is quite sensitive to a change in the discount rate. For example, using a discount rate of 3 percent raises the benefit-cost ratio from 11.34 to 20.20. The estimated benefit-cost ratio is also quite sensitive to the length of the lag between costs and benefits. For example, increasing the lag from 30 to 40 years, reduces the benefit from 11.34 to 6.96. Valuing each DALY at twice annual earnings ($2,000) raises the benefit-cost ratio from 11.34 to 22.68. Reducing the cost per DALY gained from $17 to $5 (its lower limit) increases the benefit-cost ratio from 11.34 to 38.56.

# VI. SYNTHESIS AND CONCLUSIONS

## 6.1 WHAT ARE HIGHEST RETURN INVESTMENTS?

Based on the very limited information available on the effects of investments in youth, it would appear that the investments in youth with the highest economic returns include: investments in formal schooling (i.e., supply-side investments in the quality of schooling, demand-side investments in targeted scholarship

programs), investments in adult basic education and literacy targeted to adolescents, selected investments in school-based health services (e.g., micronutrient supplements), and investments designed to reduce the use of tobacco products (e.g., an increase in tobacco taxes). School-based reproductive health programs to prevent HIV/AIDS provide comparably high economic returns when annual HIV incidence among targeted youth rises to 1-2 percent or more or when their effects are assumed to last over a longer period than one year (although there is unfortunately no information in the literature that establishes that the effects of these investments continue for several years). The economic returns to school-based reproductive health programs designed to prevent HIV/AIDS would also be higher if they could be shown to yield other benefits, such as the prevention of adolescent pregnancies and other types of STIs.

Table 6-1 presents estimates of the benefit-cost ratios for selected investments in youth in particular countries or country settings for which there is sufficient information available to support the preparation of such estimates. The data and assumptions used to obtain the estimates reported in Table 6-1 were discussed above (Section 5.3). What is most interesting in this table is not the estimates obtained under a single set of assumptions (column 2) but rather the very wide range of estimates one obtains by using alternative, and perhaps equally plausible, sets of assumptions (column 3). In fact, for several of the investments, the plausible ranges in the estimates of benefit-cost ratios overlap, making it impossible to develop an unambiguous ranking of their economic returns. The appropriate conclusion to draw from Table 6-1 is that, even in cases where the information base is relatively strong, there remains a high level of uncertainty regarding the economic returns to alternative investments in youth.

**Table 6-1. Estimated benefit-cost ratios of some investments in youth in selected countries**

| Investment | Estimated benefit-cost ratio (assuming 5% annual discount rate) | Plausible range in estimated benefit-cost ratio |
|---|---|---|
| Scholarship program (Colombia) | 3.31 | 2.77 to 25.63 |
| Adult basic education and literacy program (Colombia) | 19.9 | 8.14 to 1,764 |
| School-based reproductive health program to prevent HIV/AIDS (Honduras) | 0.493 | 0.102 to 4.59 |
| Iron supplementation administered to secondary school children (low-income country) | 32.1 | 25.8 to 45.2 |
| Tobacco tax (middle-income country) | 11.34 | 6.96 to 38.56 |

Source: Estimates in Section 5.3.


## 6.2 HOW DO INVESTMENTS IN YOUTH COMPARE WITH OTHER INVESTMENTS?

Of course, one purpose of estimating benefit-cost ratios (and internal rates of return) for alternative investments in youth is to compare their economic returns to those of alternative investments. If the benefit-cost ratios are properly calculated and are greater than one, the investment is worth undertaking in an expected value sense. For investments for which they are less than one, then they are not worth undertaking. Therefore in an important sense, the estimates in Section 5.3 (and summarized in Table 6-1 above) provide a basis for comparing the economic returns of investments in youth with those of other investments.

Table 6-2 lists the benefit-cost ratios of some development bank-supported investments in other sectors for purposes of comparison. These investments were made in the so-called "hard" sectors. When one compares the estimates in Table 6-2 to those in Table 6-1, the immediate impression is that at least some types of investments in youth are likely to compare quite favorably to investments in other sectors. To place the findings above in a broader context, the following two sub sub-sections review estimates of

rates of return for investments in youth in the US and for investments in child health and childhood development in developing countries. Unfortunately, in both cases, the number of comparable studies is very few.

**Table 6-2. Benefit-cost ratios for selected development bank-supported investments**

| Project (year) | Benefit cost ratio |
| --- | --- |
| Hill Forest Development Project, Nepal (1983) | 1.18 |
| Irrigation Systems Improvement Project, Philippines (1977) | 1.48 |
| Livestock Development Project, Uruguay (1970) | 1.59 |
| Livestock and Agricultural Development Project, Paraguay (1979) | 1.62 |
| Cotton Processing and Marketing Project, Kenya (1979) | 1.80 |

Source: van der Gaag and Tan (1997)

### 6.2.1 Evaluation of U.S. investments in youth

Even in developed countries, where there has been a lot of research on youth problems, much of the available research is limited to establishing relationships between various risk factors, on the one hand, and various forms of risky behavior and negative outcomes on the other hand. For example, it is observed that youth who are "connected" to their schools are much less likely to engage in risky behavior. The possibility that the risk factors, the risky behavior and negative outcomes may all be driven by common unobserved factors is seldom considered in this literature.[45] Instead, the authors tend to interpret the associations as causal links that can be translated into effective policies. For example, the observation that multiple risk factors are often found in a given youth and appear to be associated with risky behavior that is greater than would be expected in an additive model leads the researchers to conclude that interventions should be comprehensive in scope.

Considerable attention has also been given in the youth literature to costing various negative outcomes. This information would be useful in estimating the potential benefits from various investments in youth. Unfortunately, most studies of this type do not compare the costs associated with negative outcomes to the cost of reducing such outcomes (i.e., there is no cost-benefit analysis). Much of this research also fails to consider the possibility that the same unobserved factors that may have caused the negative outcomes also may have affected their estimated costs. For example, in the discussion of teen pregnancy, it is observed that teen mothers complete fewer years of schooling than women who begin childbearing after age 20. However, this difference may reflect the effects of an unobserved factor that affects both the probability of becoming a teen mother and the number of years of schooling completed (e.g., low self esteem, low native intelligence, limited options). There is also a tendency to include transfer payments (e.g., welfare payments) as part of the economic cost of various negative outcomes.

There has been considerable research in the U.S. on the problems of adolescents and of their possible social costs. Unfortunately, there is not much information on the costs and effectiveness of interventions to address these problems (Burt, Zweig and Roman 2001). Nevertheless, dramatic estimates of the economic returns of some types of investments are occasionally obtained. For example, a school-based HIV, STD, and pregnancy prevention program in a U.S. setting estimated that for every dollar invested in the program, $2.65 in total social and medical costs was saved (Wang et al 2000). According to another estimate, a US$1 investment in education to prevent unprotected sexual behavior saves US$5.10 in resources that would otherwise have to be used to address the problems created by such behavior (Del

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[45] However, the extensive literature on the effects of teenage pregnancy in the U.S. includes some exceptions to this characterization. See, for example, Hofferth, Reid and Mott (2001).

Rosso and Marek 1996).  Or, each US$1 invested in education about the hazards of tobacco is estimated to save $18.80 in resources required to address smoking-related health problems.

There has been some research on the private and social costs of certain negative youth outcomes, such as dropping out of school, crime and drug abuse (Chaplin and Lernan 1996, Cohen 1998), and teenage pregnancy (Burt 1985, 1986, Burt and Levy 1987, Hofferth, Reid and Mott. 2001, Mensch 2002). Again, some of this research has produced dramatic estimates of potential economic returns.  For example, according to a study by the Carnegie Foundation, each year's class of high school dropouts imposes a cost of $260 billion of costs on the US economy (Burt 1998).  The average high school dropout will earn $230,000 less and contribute $70,000 less to taxes.[46] Each added year of secondary schooling reduces the probability of adult dependency on welfare by 35 percent. Each year the U.S. spends $20 billion in income maintenance, health care cost, and nutrition to support families begun by teenagers.

In the case of crime, Cohen (1998) has identified the following costs: victim costs (lost productivity, medical costs, pain, suffering and reduced quality of life), criminal justice costs (police, investigative costs, court costs, costs of incarceration), and the forgone earnings of the youth while incarcerated.  Using a 2 percent discount rate, he estimates that the typical career criminal causes $1.3-$1.5 million in "external costs" (i.e., costs imposed on others, including loss of property).[47]  Similarly, he estimates the lifetime cost of a heavy drug user to be $370,000 to $970,000.  Cohen also estimates the total cost of saving a high-risk youth, after adjusting for duplicative costs from the fact that many lifetime criminals are also drug abusers and high-school dropouts, to be $1.7 to $2.3 million dollars.

There is a growing perception in the U.S. that successful youth interventions should address more than one type of behavior (Catalano et al. 1999).  Unfortunately, it is acknowledged that the limited evaluation research on investments in youth tends to focus on narrow interventions targeted to a single problem (e.g., smoking, teenage pregnancy, crime).[48] Much of the U.S. research concerns the associations between various youth behaviors considered to be at risk (e.g., smoking, use of other addictive substances, unprotected sex), on the one hand, and socio-economic characteristics or psychological characteristics of youth, on other hand.  This research has found that socio-economic characteristics (e.g., income, race/ethnicity, family structure) are not very good predictors of risky behavior (Resnick et al. 1997, Blum et al. 2000).  At the same time, it has demonstrated that there are patterns of psychological traits and at-risk behavior among youth (profiles or syndromes), although it is not yet clear whether they are good predictors of negative outcomes, such as teenage pregnancy, dropping out of school, delinquency, violence or crime.  The research also indicates that there are important interactions, or negative synergies, between various types of youth problems (Burt 1998, Burt, Zweig and Roman 2001).  The conclusion drawn is that effective youth programs should start before a youth manifests negative behavior, include incentives for positive behavior, and address multiple problems.

The extensive research on teen pregnancy suggests the importance of dealing with selectivity bias in making inferences about causal effects (Mensch 2002).  However, there is little information on the cost of

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[46]  Other estimates of these costs have ranged between $90,000 and $600,000 and between $30,000 and $200,000 respectively (Burt 1998).

[47]  Cohen's concept of "external costs" differs from economic costs in several respects. For example, he includes the lost productivity of a criminal or heavy drug user in his estimate of costs, but he excludes the pain and suffering and lost quality of life experienced by criminals who die prematurely because these costs "are internalized by the offender." His inclusion of the value of stolen property as a cost (instead of a transfer) is another example of where his definition of "external costs" differs from that of standard economic costs.

[48]  However, there are exceptions (Burt 1998). Several programs have involved random assignment to treatment and control groups and multiple interventions (e.g., Children At Risk Program, Quantum Opportunities Program)

interventions to address these problems or of their impact, apart from a few model programs (Burt, Zweig and Roman 2001).

Despite the absence of cost data and some confusion over the definition of benefits, there are several careful studies of the effects of investments in youth in the U.S. For example, a randomized control trial, involving over 3,000 students in 56 public schools, implemented a drug abuse prevention program, teaching general life skills and skills for resisting social influences to use drugs. Follow-up data were collected six years after the initial baseline survey. Significant reductions were found for both drug and polydrug (tobacco, alcohol, and marijuana) use in the groups receiving the prevention program, compared to the control groups. The conclusion from this study was that drug abuse prevention programs conducted during junior high school can produce significant and durable reductions in tobacco, alcohol, and marijuana use if they (i) teach a combination of social resistance and general life skills, (ii) are properly implemented, and (iii) include at least two years of booster sessions (Botvin et al 1995). However, no benefit-cost analysis was done in connection with the study.

Another study of the effectiveness of an AIDS prevention program was implemented in four schools in New York City with ninth and eleventh grade students (867 students) in intervention and control classes. The program focused on correcting facts about AIDS, teaching cognitive skills to appraise the risk of transmission, increasing knowledge of AIDS-prevention resources, changing perceptions of risk-taking behavior, clarifying personal values, understanding external influences, and teaching skills to delay intercourse and/or consistently use condoms. An evaluation carried out three months after the end of the program found that the intervention group presented the following positive behavioral outcomes when compared with the control group: decrease in intercourse with high-risk partners, increase in monogamous relationships, and an increase in consistent condom use (Walter and Vaughan 1993). Again, however, no benefit-cost analysis was done in connection with the study.

Evaluation studies of 10 U.S. school-based prevention programs have shown sustained reductions in tobacco and alcohol use (World Bank 2002a). Evaluation of life-skills training targeting 4,466 seventh graders showed 50 to 70 percent reductions in tobacco and alcohol use with significant impact after three years. The Star program similarly reduced tobacco, alcohol, and marihuana use by 30 percent in 4,978 sixth and seventh graders. This study concluded that prevention in schools is most effective when school lessons are reinforced by a clear, consistent social message that teen alcohol, tobacco, and drug use is harmful, unacceptable, and illegal. However, another report indicates that school-based programs are not very effective in achieving sustained reductions in tobacco use (World Bank 1999).

One study of the costs and benefits of school health programs was based on a model that comprised representative aspects of what were considered to be the most effective programs (WHO 1996). The researchers used the model to estimate benefit-cost ratios for a smoking prevention program, and incrementally, substance and sexual behavior programs. The study found that for every dollar spent on changing smoking behavior the estimated benefit was nearly $19, while for every dollar spent on preventing other substance abuse and in preventing risky sexual behavior the estimated benefits were $5.50 and $5.00 respectively.

In summary, some of the studies on the U.S. provide useful information on which to build to make careful estimates of the economic returns to investing in youth. However most of these studies provide information only on some of the components necessary for such assessments. Generally they do not, for example, address the nature of distortionary costs such as those incurred in raising revenues for the programs or in inducing changes in behaviors of other family members. Nor do they permit distinctions between private and social rates of returns, as are necessary for understanding the efficiency motive for policy.

### 6.2.2 Child Health and Early Childhood Development in Developing Countries

There are very few systematic economic evaluations of early childhood health and development programs in developing countries (Belli and Appaix 2002).[49] However, there are a large number of macroeconomic studies that examine relationships between various measures of general health status and specific disease prevalence (e.g., HIV, malaria, TB) on economic growth (Belli and Appaix 2002). Most of these studies interpret relations between growth and various health measures as causal, although such an interpretation generally is difficult to justify. In addition, as previously mentioned, even the existence of causal relationships between health and disease, on the one hand, and economic growth, do not establish the existence of economic benefits that would be appropriate to include in a cost-benefit analysis. We summarize below some of the few examples of micro-economic analyses of which we are aware that do provide a basis for estimating the economic benefits of child health investments.

#### 6.2.2.1 Supplemental Feeding Program in Tamil Nadu, India

One of the earliest benefit-cost analyses of an early child development program was prepared for a supplemental feeding program targeted to malnourished children in Tamil Nadu state, India (Knudsen 1981).[50] This study utilized findings from an earlier study on the effects of supplemental feeding programs in Colombia and Chile (Selowsky 1981). Knudsen estimates that supplemental feeding increases earnings by 55 percent among severely malnourished children, with the effect being one-half as large (27.5 percent) among non-severely malnourished children. He estimates that the program's internal rate of return is 14.5 percent. However, the internal rate of return rises to 21.5 percent if the program's distributional impact is explicitly considered by assigning greater weight to the poor in computing program benefits. The study also includes estimates of the benefits of reduced child mortality and longer life expectancy on population growth, based on the annual consumption of an individual.

#### 6.2.2.2 Nutrition Investments in the Philippines

A benefit-cost analysis was prepared for three nutrition interventions that were tested in the Philippines and that were to designed to eliminate severe vitamin A deficiency (Popkin et al. 1980). The three different interventions were the distribution twice yearly of a mass dosage of vitamin A capsule, vitamin A fortification of monosodium glutamate (MSG), and a public health intervention that used paraprofessionals for an education, sanitation, immunization, and horticulture program. Each program was operated in four ecological areas over a two-year period. Program benefits included reduced mortality, blindness, morbidity and treatment costs. Benefits did not include transfers (i.e., reduced welfare payments and increased taxes). Costs included private household costs (including the opportunity cost of time) and excluded research costs. Although the study used relatively high discount rates (8 percent and 15 percent), the results of the study indicated that the fortification and mass dosage capsule interventions provided discounted benefits much greater than their discounted costs. The relatively poor showing of the public health intervention may have been due to the narrow range of benefits for which it was evaluated (a problem we have noted in the corresponding literature on investments in youth). The study's results also indicate that the interventions yielded higher returns among youth age 7-16 than

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[49]   This is in contrast to the US, where extensive economic evaluation of programs such as Women, Infants and Children (WIC) and Head Start has been conducted (van der Gaag and Tan 1997). For example, rigorous evaluations of the WIC program have shown that each dollar spent saves the government from $1.77 to $3.13 in government-funded medical care costs alone. Evaluation of the High/Scope Perry Pre-school program, a randomized intervention for the evaluation of which longitudinal data were collected over a period of 25 years, produced an estimated benefit-cost ratio of 7.16. These studies, however, suffer from limitations in their representation of distortionary costs and with confusing some transfers with costs.

[50]   The discussion of this study is based on Belli and Appaix (2002).

among children age 1-6. This difference is mostly attributed to the effect of discounting future benefits over a longer period in the case of younger children.

### 6.2.2.3 PROGRESA micronutrient supplements for infants and small children in rural Mexico:

Parts of the PROGRESA program was described above in Sections 2.4.1, 3.2 and 5.1.3. But those discussions focused on the value of the evaluation approach in general and its application to schooling scholarships in particular. In addition there are other components of PROGRESA, including nutritional supplements for children up to age five and pregnant and lactating women. PROGRESA was designed to be randomly assigned to localities; a randomization design that was confirmed in subsequent analysis and utilized in the evaluation of a number of components of the PROGRESA program (Section 2.4.1). However, a shortage in the availability of one component of this intervention – a nutritional supplement provided to preschool children – appears to have led local administrators to exercise discretion in the delivery of this intervention, systematically favoring those children with poorer nutritional status. Consequently, when comparing outcomes expressed in terms of differences in means between treatment and control groups, the estimates indicate that PROGRESA had no effect on preschool child nutritional status. But when Behrman and Hoddinott (2002) used child specific fixed effects instrument variable (using random assignment for program eligibility as the instrument) regressions to control for these selection effects, they found that PROGRESA had significant and substantial positive impacts in increasing growth in stature by about a sixth and in reducing the probability of a child being stunted for children in the age range of 12 to 36 months, with somewhat larger effects for children in poorer communities but also for children who have more educated mothers.

Under the assumptions that (1) there is strong persistence of changes in small children's anthropometric development so that the percentage changes for adults equal those (are half of those) that are estimated for children and (2) that adult anthropometric-earnings relations from elsewhere in Latin America apply to the labor markets in which these children will be working as adults, the impact from this effect alone would be a 2.9 percent (1.4 percent) increase in lifetime earnings. This evaluation does not calculate the benefit-cost ratio for this intervention due to lack of cost data. Thus this evaluation points to the possibility of fairly substantial benefits from the provision of nutritional benefits to infants and young children in such a population. It also points to some of the difficulties of evaluating programs beyond those discussed above, for example, in the summary in Section 5.1 of the PROGRESA scholarship program. In particular it illustrates how even programs that are well-designed from the point of view of evaluation may have some components of their implementation that violate the assumptions of the evaluation design and that, if not dealt with, may lead to substantial misunderstanding of the program effects and benefits. It further ignores distortionary costs and provides no information with which to judge whether this program is warranted on efficiency grounds due, for example, to positive spillovers or imperfect capital and insurance markets.

### 6.2.2.4 Early childhood development program in urban Bolivia

Bolivia has undertaken an early childhood development and nutrition program, PIDI (Proyecto Integral de Desarrollo Infantil, which now is part of PAN, Programa Nacional de Atencion a Niños y Niñas Menores de Seis Años), that provides day-care, nutrition and educational services to children between the ages of six months and six years who live in poor, predominantly urban areas for the period of time for which data currently are available for analysis. The goals of PIDI are to improve health and early cognitive/social development by providing children with better nutrition, adequate supervision and stimulating environments. It is hoped that the program will also ease the transition to elementary school, improve progression through elementary grades, and raise school performance, all of which are expected to increase post-school productivity.

An early economic evaluation of PIDI proposed and illustrated a framework within which to estimate the benefits and costs of the program (van der Taag and Tan 1997). This study analyzed the effect of PIDI interventions on a hypothetical cohort of 1,000 children. The study begins by estimating that the discounted net social benefits of schooling investments that existed prior to PIDI (a 7 percent discount rate was used), i.e., primary schooling provided to 20 percent of the approximately 80 percent of children who survived until age 5, amount to $264,517. The first effect of PIDI analyzed in the study is its (hypothetical) effect in reducing under 5 mortality in the hypothetical cohort from about 200 to 10 (a strong effect indeed!), thereby adding 190 children to the 800 who were assumed to survive in the absence of PIDI. The study estimates that this mortality reduction effect of PIDI increases net discounted social benefits from $264,517 to $327,340, i.e., the lives of children saved are valued on the basis of the gains in the productivity of the 20 percent who receive primary schooling.[51] The study proceeds to estimate the discounted net benefits of the other effects of the PIDI program (i.e., its effect on primary enrollment, improved primary school performance, and increased progression to postprimary education). It estimates the benefit-cost ratio for the PIDI program to be between 1.38 and 3.06, depending on the assumptions used.[52]

In addition to this early evaluation based on hypothetical zassumptions, PIDI collected two rounds of longitudinal household data for evaluation in 1995/6 and 1997/8 that are used by Behrman, Todd and Cheng (2001) to analyze the impacts of PIDI on child outcome measures related to nutrition, health, cognitive development and psychosocial skills and to provide some illustrative estimates of the benefit-cost ratios of the program.

Cost-benefit analysis, based on the preferred estimates and explicit assumptions about other aspects of the effects, considers four different channels through which PIDI might be expected to have an effect on lifetime earnings. They include a direct effect of the program on earnings operating through greater physical stature and cognitive skills and indirect effects operating through less time spent in school to achieve a given level of education and/or higher educational attainment levels. Benefit-cost ratios are simulated based on empirical estimates for some of the links from other developing countries and assumptions in other cases in which the available literature only suggests the statistical significance of the effects, but not the magnitudes. Subject to the caveat that a number of assumptions underlie these estimates, they at least suggest the possibility that the benefit-cost ratios are fairly considerable for PIDI, i.e., 1.7 or higher, which are broadly comparable to the estimates obtained in the earlier study by van der Gaag and Tan (1997). These estimates while suggestive, thus, have the same types of limitations as do the estimates of PROGRESA scholarships that are discussed in Section 5.1.3.

### 6.3 WHAT ARE HIGHEST PRIORITY RESEARCH AREAS?

At a general level, the highest priority research areas that emanate from this review are those that are necessary to obtain better empirical estimates of the benefit-cost ratios and internal rates of return to the plethora of possible policies that might improve the development of youth in developing countries. We refer to these as research gaps and discuss them below. In addition, the findings reported in this review raise a number of key questions that are also discussed in this concluding sub sub-section.

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[51] As previously noted, valuing lives saved on the basis of their labor productivity is a strong assumption. In this case, it might have been preferable to value the child mortality effects of PIDI on the basis of the cost of cost-effective alternative investments that saved the same number of children's lives (as in Summers 1992, 1994).

[52] In addition to varying assumptions about the effect of PIDI, the higher estimates include program benefits in the form of direct service delivery (e.g., child care) plus an estimate of the benefits from expected fertility reduction due to PIDI (van der Gaag and Tan 1997).

### 6.3.1 Research gaps

This review has found critical information gaps in the following areas:

1. The most important gap in the knowledge base is the absence of reliable estimates of many of the hypothesized effects in the literature on investments in youth. In future research, the highest priority should probably be given to obtaining reliable estimates of the effects of those investments for which little if any information currently exists (e.g., the effects of ABEL, vocational and technical training, military training, reproductive health policy development, investments designed to avert drug and alcohol abuse and to improve mental health, youth centers, youth rehabilitation programs, sports and recreation programs targeted to youth). There is clearly a need for more, and larger, randomized experiments of longer duration than have been conducted in the past. Such experiments also need to collect data on a wider range of outcomes than in previous studies. Indeed, one important contribution of this review and of the companion literature review (Knowles and Behrman 2003) may be to guide future researchers in terms of the data needed to make reliable and complete assessments of the effects of investments in youth. Due to the limitations of randomized experiments for some purposes (i.e., measuring effects that occur only after a considerable lapse of time), there is also a parallel need for more careful behavioral research on the effects of investments in youth than has been done in the past. Such research will require better data, i.e., more longitudinal data sets, more carefully measured variables and data on appropriate instruments.

2. Investments in youth are hypothesized to have a very wide range of effects. It is not the problem of attaching monetary values to these hypothesized effects that currently constrains efforts to obtain estimates of their economic returns. Rather it is the lack of reliable estimates of the effects of the investments. One solution to this problem that is explored in this review is the valuation of broad effects indirectly on the basis of the cost of least-cost alternative investments that obtain the same broad effects. Although this approach to valuing broad effects may enable one to obtain estimates of benefit-cost ratios for many investments in youth, treating broad effects as a package makes it more difficult to distinguish social from private benefits (since the social effects that give rise to a possible divergence between the two may be packaged together with private effects as components of a single broad effect).

3. Partly in the short to medium-term, due to the lack of reliable information on many of the hypothesized effects of investments in youth, there is a role for indirect valuation of the effects of investments in youth (particularly of broad effects, such as "increased education" or "improved health," that are difficult to monetize directly). We have suggested some possible approaches to developing indirect valuations of many of the hypothesized broad effects of investments in youth in this review and in the companion literature review (Knowles and Behrman 2003). However, there is a critical need for more research in this area. What is needed are estimates of *marginal* cost-effectiveness ratios for a number of alternative investments because these best reflect the value that society currently attaches to securing a given outcome.

4. This review has found that cost estimates are not available for many types of investments in youth (particularly in the reproductive health area). In addition, we have found that the definition of costs (and in some cases, even benefits) used in some studies is often incomplete and/or incorrect. Administrative costs and distortionary costs (most often related to the cost of financing investments) have been frequently neglected, while transfers have often been treated as a cost. More effort clearly needs to be devoted to the collection of accurate cost data and to the estimation of investment costs.

### 6.3.2 Some key remaining questions

The findings of this review raise a number of specific questions, including:

1. Could better information be obtained with which to make estimates for some of the areas that we touch upon in Section 3 for which information is very scanty?  For example, mental health recently has recently become more widely recognized as a potentially important area for future health intervention. Estimates suggest that mental health problems are likely to account for a rapidly expanding share of poor health in the developing world.  However, we have been able to find almost no information with which to compare investments in mental health with other investments.  For another example, the rapid nutritional transition means that being overweight and obese rapidly is becoming a widespread problem for many youth in developing countries, but there is almost no information available with which to evaluate possible investments designed to address the problem of obesity.  And these are only examples of a pervasive shortage of good estimates of program effects and of program resource costs.

2. Are there important policy areas that we have missed in Section 3 despite our effort at broad coverage?  Might there be, for example, important legal changes that we have missed concerning, for example, minimum ages of marriage or property rights of youth?

3. Where are the returns from better quality data likely to be greatest?  Across the board, given positive discount rates, the costs and returns early in any investment are particularly important.  Although there is already a scarcity of information on the public costs of investments in youth, private costs, such as the opportunity cost of time of private citizens necessary to participate in the benefits of various investments, is generally ignored.

4. How can information be collected to assess better investments in light of the efficiency motive for policy?  For such assessments, it is important to distinguish between private and social benefits and costs – but there is almost no information with which to assess these differences.  Obtaining reliable estimates of both private and social benefits depends critically on the availability of reliable estimates of a full range of the effects of a given investment, not only of the private benefits associated with increased productivity.

5. Can evaluations integrate better the efficiency and the distributional motives for policies and the tradeoffs between them?  While both are often recognized, the tradeoffs are infrequently explored. This is clearly a fertile area for future research.

6. How do such estimates need to be fine-turned for particular countries?  Many of the assumptions regarding costs and benefits are likely to vary substantially across countries because of differential prices and institutions.  How do they need to be fine-tuned for distinctions by gender, race and ethnicity?

7. In the absence of complete information on the economic returns to alternative investments in youth, are there guidelines that development practitioners can follow in designing youth programs that would prioritize youth investments in specific contexts in the short to medium term?  One such guideline might be to focus on interventions that address highly prevalent problems, e.g., micronutrient supplements in poorly nourished populations or reproductive health interventions targeted to populations at high risk.  Thus, examining the country context carefully may provide useful and immediate guidance as to which investments in youth are likely to yield the highest economic returns.  In addition, some investments may provide benefits much sooner than others.  For example, effective adult basic education and literacy (ABEL) training may raise labor productivity almost immediately.  Investments involving a long lag before benefits are experienced will be attractive only in cases where the expected benefits are very large (e.g., reducing tobacco consumption). Lastly, investments in youth differ importantly in their

distributional and gender effects. Often these differences are apparent from a careful consideration of the country context. In cases where investments in youth are targeted to specific groups, it may be relatively easy to identify those providing the highest returns.

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# APPENDIX A.  EXPERIMENTAL EVALUATION: THE EXAMPLE OF MEXICO'S PROGRESA

In 1997, the federal government of Mexico introduced the Programa de Educación, Salud y Alimentación (the Education, Health, and Nutrition Program), known by its Spanish acronym, PROGRESA, as part of an effort to break the intergenerational transmission of poverty.  PROGRESA has a multiplicity of objectives, primarily aimed at improving the educational, health and nutritional status of poor families, and particularly of children and their mothers. PROGRESA provides cash transfers linked to youth's enrollment and regular school attendance and to clinic attendance.  The program also includes in-kind health benefits and nutritional supplements for children up to age five, and pregnant and lactating women. By the end of 1999, PROGRESA covered approximately 2.6 million families or about 40 percent of all rural families and one-ninth of all families in Mexico.[53]  At that time the program operated in almost 50,000 localities in more than 2,000 municipalities and 31 states.  PROGRESA's budget of approximately $777 million in 1999 was equivalent to 0.2 percent of Mexico's GDP.  In early 1998, the International Food Policy Research Institute (IFPRI) was asked to assist the PROGRESA administration to "determine if PROGRESA is functioning in practice as it is intended to by design."  The evaluation is based on longitudinal data collected from 24,000 households from 506 localities in seven states who were interviewed periodically between November 1997 and November 1999.  Of the 506 localities, 320 localities were assigned to the treatment group and 186 localities were assigned as controls. Specifically, the 320 treatment localities were randomly selected using probabilities proportional to size from a universe of 4,546 localities that were covered by phase II of the program in seven states. Using the same method, the 186 control localities were selected from a universe of 1,850 localities in these seven states that were to be covered by PROGRESA in later phases.  Statistical tests confirm that indeed assignment to treatment versus control was random at the community level (Behrman and Todd 1999).[54] As originally planned the localities serving the role of a control group started receiving PROGRESA benefits by December 2000.  A number of evaluation studies have been carried out using these data, in most cases exploiting some dimension of the experimental design of the study (Skoufias 2001 provides a synthesis of many of these studies and of the overall program).

PROGRESA has several striking and unusual features from the perspective of social scientists and policy analysts.

(1) PROGRESA based some of its essential components on the outcomes of social science research in the literature.  Transfers were given to women, for example, because previous research on intrahousehold allocations suggested that income directed towards mothers had larger associations with investments in children than income directed towards fathers.

(2) PROGRESA used modern social science tools in order to guide its decisions.  For instance discriminant analysis was used on census data in the initial stages of identifying target communities and households within those communities and GIS systems were used to systematize information on location of schooling and health services relative to the communities.

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[53]  PROGRESA has evolved into OPORTUNIDADES under the Fox administration, and has expanded into semi-urban and urban areas (cities up to one million inhabitants) with some modifications such as covering higher grades of schooling and self-selection for applying for enrollments.  In 2002 the target is to enroll a million families.  If that target is achieved the program will cover over 20 million individuals.

[54]  The same study reports that there are somewhat more significant differences in some variables than would be expected by chance at the household and individual level.  But most of these differences, though significant due to the large sample size, are not very substantial.

(3) PROGRESA recognized that baseline data and longitudinal household and service-provider data with treatment and control groups were essential to serious evaluation of the program and implemented the collection of baseline data (prior to the introduction of the program, which always is the stated intent but often not the realization in various developing country contexts) with longitudinal follow-up and random assignment to treatment and control communities.

(4) PROGRESA, as noted, contracted an outside research agency, IFPRI (a member of the CIGAR group of international agricultural research institutions, with a strong history of data analysis and evaluation in developing countries), to undertake an extensive evaluation of the program.

These are considerable and important features of PROGRESA. Moreover PROGRESA and the key individuals behind PROGRESA not only incorporated such features into their program plans, but – which is much more difficult – gave them sufficient priority that they were carried out reasonably well during the very difficult time of program development, implementation and rapid expansion, all within an environment with not inconsiderable political pressures. PROGRESA already has been a model for development of related programs and evaluation strategies elsewhere, for example, in Brazil Colombia, Honduras, Nicaragua, . Hopefully these and other programs will build not only on the substantive aspects of PROGRESA, but also learn from and improve upon the program evaluation that has been given considerable thought and high priority by PROGRESA.

Other programs, first of all, usefully could emulate the strengths of PROGRESA in terms of building on existing social science research, data collection and evaluation that are noted above. These are considerable strengths and require substantial commitments to give sufficient priority to these matters in the presence of all of the great pressures and unanticipated problems that a new program inevitably faces. But the result is the potential for much better evaluation of the program and how it or other programs can be modified to improve the attainment of the objectives.

But beyond emulating the strong points of the PROGRESA in the above regards, other programs could improve upon PROGRESA in some respects that would enhance more the evaluation possibilities. Of course some of these improvements from the point of view of evaluation may have political and other costs. We recognize that there are such costs, but have no special insight regarding them, so we do not discuss them here.

(1) The evaluation design could explore a number of aspects that are difficult to explore with the present PROGRESA data or that require imposing a lot of structure to do so. There could be randomly assigned variations (perhaps across communities to avoid invidious comparisons within communities), for example, in the payment schedule for attending different grades of school by gender; in whether the payments are made to mothers, fathers or the children themselves; in whether payments are made to the demand side (households, individuals) or to suppliers (e.g., schools) directly; in whether other components of the PROGRESA package were included; in whether these payments are conditional on attending schooling;

(2) The data collection/evaluation process could be made more independent of the implementing agency. The evaluating agency could be contracted by some other part of the government (not by the implementing agency) and have direct responsibility for collecting the data to be used (rather than having the implementing agency in charge of data collection). Data could be made available for public use earlier. These changes would increase credibility regarding the degree of independence of the evaluation.

Both of these changes are being considered for the evaluation of the expansion of PROGRESA in urban areas in the current OPORTUNIDADES program.

# APPENDIX B. ECONOMETRIC ESTIMATES OF IMPACTS OF INVESTMENTS IN YOUTH

Econometric or statistical methods are used to attempt to circumvent some of the limitations of the data, including that most data that are available for evaluation of the impact of investments in youth are behavioral data and not experimental data. This appendix briefly discusses some of these problems and possible resolutions.

## *B.1 Relations to be Estimated*

Econometric analyses of impacts should be based on relations such as those implied in the discussion in Section 2.2. Such relations can be used (i) to estimate directly the underlying structural relations that determine investments in youth or their impact (e.g., human resource production functions analogous to relation 2) in which investments in youth may be one input in the production, for example, of subsequent adult health and (ii) to estimate dynamic decision rules or demand relations for investments in youth or for inputs conditional on past investments in investments in youth (as in relation 1).

Structural Relations – Production Functions: Structural relations are the basic underlying relations in the models of behaviors such as in Section 2.2. Structural relations are not estimated nearly as often as are the reduced-form dynamic decision rules or demand relations that are discussed below. But one type of structural relations – production functions – are estimated with some frequency. A linear or log-linear approximation to a general production function of the type discussed in relation (2) above with cognitive achievement ($CA_i$) produced by two categories (vectors) of variables relating to the $i^{th}$ individual and his/her household (XI) and to the $s^{th}$ school (XS) and by an explicit stochastic disturbance term (Ui) is:[55]

(2A)    $CA_i = a_{XI}XI + a_{XS}XS + U_i.$

The household vector of variables may include, for example, parent's schooling and the home learning environment, as well as the schooling to date of the ith individual/youth. The school vector of variables includes aspects of school management and curricula that may be affected directly by policies related to the supply side of schooling. The stochastic term captures random effects that are not correlated with any of the other predetermined right-side variables. It is useful for the discussion below of estimation issues to distinguish among four different subgroups of variables: the superscripts "o" and "u" refer to "observed in the data used" and "unobserved in the data used", the superscript "b" refers to variables that are behaviorally determined within the model used, and the superscript "p" refers to variables that are predetermined within the model used so that the variable list in the general production function relation is $XI^{ob}$, $XI^{ub}$, $XI^{op}$, $XI^{up}$, $XS^{ob}$, $XS^{ub}$, $XS^{op}$, $XS^{up}$, $U_i$. If these were substituted into (2A) each would have its own coefficient "a" with an appropriate superscript to indicate its impact on $CA_i$. The distinctions among these different variable groups are important because some of the most substantial and most pervasive estimation problems arise from unobserved variables or behaviorally determined variables (see below).

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[55] Linear approximations are used here because they are the simplest forms but they still permit characterization of various estimation issues. Log-linear forms in which all of the variables are replaced by the logarithms of their values (which implies interactions among all the right-side variables) are identical in representation once the variables are redefined. In empirical studies linear and log-linear specifications are very common, but other functional forms also are used at times. For other functional forms the essence of the estimation issues is the same. If the functional form that is used is not a good approximation to the true functional form, there is misspecification error that is akin to omitted variable bias discussed below (with the unobserved variable being the variable that would have to be added to transform the assumed specification to the true functional form).

The parameters (a's) in the production function give the direct impact of the right-side variables, including investments in youth. With good estimates of the appropriate production functions the direct determinants of many outcomes determined by behaviors could be evaluated with considerable confidence to answer many of the questions of interest about direct policy impacts. If good estimates of production functions are embodied in overall models of optimizing behavior, moreover, simulations can be made of the impact of policies given all the relevant behavioral adjustments and of counterfactual policies changes, all conditional on the model. Note that the possibilities of simulating the impact of counterfactual policies exist with the use of structural models even though they are not possible with experiments and may be very difficult to undertake with reduced-form dynamic decision rules. Good production function estimates may be difficult to obtain, however, because of estimation problems discussed below.

Reduced-Form Dynamic Decision Rule or "Demand" Relations: A second set of relations that can be estimated to explore the determinants of Investments in youth and the impact of investments in youth are dynamic decision rules or "demand" relations that are conditional on past investments in youth. These relations give some behavioral outcome in the current period as dependent on all predetermined (from the point of view of the entity making the decisions) prices and resources and on the parameters in the underlying production functions and preferences. As noted above, these are the relations that are most commonly estimated. These demand functions in principle are derived explicitly from the constrained maximization behavior of families that is discussed in Section 2.2. As such they incorporate all of the underlying structural parameters that are involved in that process. But all of the choice variables during the period of interest are substituted out, so the demand functions are so-called reduced-form relations because the maximizing behavior that determines such variables has been combined and "reduced" to the relations that give the behavioral outcomes as a function of purely predetermined and expected prices, resources, policies and of the underlying preferences and technologies. In some empirical studies, the underlying structural parameters can be identified from estimation of the demand relations. In most cases, however, demand functions are just posited to result from constrained maximization and the underlying structural parameters are not identified in the estimates, though the demand parameters still are some combinations of these parameters. In such cases, demand functions permit the estimation of the total effects of predetermined variables on the behavioral variables of concern, but not estimation of the exact mechanisms through which determinants act.

On a general level, demand functions can be written with a vector of behavioral outcomes (Z) dependent on a vector of prices broadly-defined (P) and a vector of resources (R). Both the prices and the resources may reflect policies. If there are uncertainties regarding relevant future prices, policies and shocks, then the characteristics known at the time of the decision of interest regarding the distributions of those outcomes should be included. A linear approximation for a family or individual facing prices PF and with resources $RF_f$ and a vector of stochastic terms ($V_f$) is:

(1A) $\qquad\qquad Z_f = b_{PF}PF + b_{RF}RF_f + V_f.$

The resources include predetermined schooling and other human resources. The stochastic term in each relation includes all the effects of all the stochastic terms in all of the production activities in which the family/individual is engaged (i.e., all of the elements of the vector $U_i$), plus perhaps other chance events. Both prices and resources may be observed or unobserved in the data, so it is useful to indicate that distinction here as above in the discussion of production function inputs (again, using superscripts "o" and "u"). There is one such demand relation (or one element in the vector $Z_f$) for every behavioral outcome of the individual/family (and similarly for firms or other entities). Each of these demand relations conceptually includes the same identical right-side predetermined variables so that any predetermined variable that affects any one behavioral outcome may affect all other behavioral outcomes. Good estimates of these relationships, with predetermined investments in youth among the right-side

variables, would inform us about the impacts of these investments – an essential component for evaluating the rates of return to these investments.

## B.2 Estimation Problems

There are a number of possible problems in obtaining good estimates of the impact of investments in youth on different outcomes such as those considered in Section 3 below. Therefore what are presented as estimates of relations such as those that are discussed in Section 2.4.2.1often may be biased. These estimation problems share a common characteristic: the disturbance term in the relation actually estimated is <u>not</u> simply an element in $U_i$ or $V_f$ that is distributed independently of all the right-side variables in the relation being estimated, but instead is correlated with right-side variables (e.g., because it is a compound disturbance term that includes unobserved variables as well as $U_i$ or $V_f$ or because of the way that $U_i$ or $V_f$ is defined for the sample used in the estimates).

<u>Measurement error</u>: Measurement error may contaminate any of the observed variables used for estimates of the relations (1A) and (2A). Random measurement error occurs if what is observed is not the true variable, but the true variable plus a random error.[56] As is well known, random measurement error in a right-side variable tends to cause bias in the coefficient estimate of that variable towards zero. Intuitively, if the observed investments in youth are a noisy measure of the true value of investments in youth, the true dependence of outcomes such as cognitive achievement on investments in youth such as their schooling is masked, and the result is an underestimate of the effect of the investment on the outcome. The bias is greater the larger is the variance in the measurement error relative to the variance in the true value. Random measurement error can be reduced with better measurements of the desired concept. Random measurement error can be controlled with instrumental variable estimates if the error in the instrument used is independent of the error in the observed variables of interest, as may occur, for example, with different measures of the same concept.[57]

<u>Omitted variables</u>: In both production function estimates and demand function estimates there may be variables that should be included among the right-side variables but that are not observed and therefore not included. For the production function estimates, for example, there may be unobserved inputs such as inherent ability, motivation, and school management capabilities. In terms of relation (2A) with the subcategories of variables, the basic estimation problem is that the observed right-side variables ($XI^{ob}$, $XI^{op}$, $XF^{ob}$, $XF^{op}$) may be correlated with the unobserved variables ($XI^{ub}$, $XI^{up}$, $XF^{ub}$, $XF^{up}$) that are included in the compound disturbance term with $U_I$.[58] Therefore the estimates of the impact of the observed variables include not only their true effects but also part of the effects of any correlated unobserved variables. For the demand relations (1A), the compound disturbance term includes, in addition to $V_f$, the other unobserved variables ($PF^u$, $RF^u$). If any of the observed variables on the right-side of relation (1A) is correlated with any of the unobserved variables, its coefficient estimate is biased because, in addition to its own effects, it is representing in part the effect(s) of the correlated unobserved variable(s). If, say, ability affects the outcome of interest and investments in youth are correlated with ability because individuals with greater ability tend to obtain more schooling, then the usual estimate of

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[56]  Random measurement error is what usually is emphasized, and is what we discuss here. Measurement error also may be systematically related to the true variable, with implications that depend on the exact nature of the systematic relation.

[57]  For example, schooling reports from adult siblings or from adult children could be used for this purpose if schooling is a right-side variable as in some recent estimates of the impact of schooling on wages (Ashenfelter and Krueger 1994, Behrman, Rosenzweig and Taubman 1994).

[58]  The compound disturbance term includes all the unobserved variables unless their effects are controlled in some way.

the impact of investments in youth on the outcome is likely to be biased (and likely to make investments in youth appear to have a larger effect than they really do) because in the usual estimates investments in youth in part are representing the effects of unobserved ability, not only of investments in youth per se.[59]

As is well known, the sign and magnitude of omitted variable bias depends on the effect of the omitted variable(s) and on its correlation with included variables and their true coefficients. Five means of dealing with omitted variable bias are (i) to measure variables that often are unmeasured (e.g., "ability" could be measured using Raven's tests, as in Knight and Sabot 1990), (ii) to use fixed effects to control for unobserved variables (which requires multiple observations at the level of aggregation at which the fixed effects are used) as in Behrman and Rosenzweig (1999, 2002a,b), Behrman, Rosenzweig and Taubman (1994, 1996), Behrman, Foster and Rosenzweig (1997a,b), Behrman, et al. (1999), Foster and Rosenzweig (1994, 1995, 1996), Miller, Mulvey and Martin (1995), Pitt, Rosenzweig and Hassan (1990), Rose (2000), Rosenzweig and Schultz (1983, 1985, 1987), Rosenzweig and Wolpin (1986, 1993). (iii) to replace right-side variables with their instrumented values by using identifying instruments that do not appear in the relation being estimated and are not correlated with the disturbance term in the relation being estimated as attempted by Alderman, et al. (1996b, 2001), Angrist (1990), Angrist and Lavy (1999), Card (1995, 1999), (iv) to compare the behaviors or the "before and after" changes in behaviors of beneficiaries of policies with those of individuals who would be eligible but are in the control group (perhaps with matching on observed characteristics as in Heckman, Ichimura and Todd 1997), and (v) to use experimental data as in Angrist, et al. (2003), Behrman and Hoddinott (2001), Behrman, Sengupta and Todd (2002), Skoufias (2001) and Schultz (2000). All of these approaches have their limitations. Some variables are very hard to measure at reasonable costs. Fixed effects do not permit the estimation of the linear effects of observed variables at the same level of aggregation as the fixed effects (though the effects of interactions among observed variables, such as family background and program characteristics, can be estimated), exacerbate the impact of measurement errors, do not control for unobserved variables, and control for the unobserved fixed variables perfectly only if the true relationship being estimated can be manipulated so that the unobserved fixed effect appears only as an additive linear term . It often is difficult to find identifying instruments that (a) do not appear in the relation being estimated, (b) are independent of the compound disturbance term in the relation being estimated (which includes all of the unobserved variables), and (c) are sufficiently correlated with the observed right-side behavioral variables (though lagged price and other shocks are candidates for panel data). The control group comparisons depend on good assignments of households to the actual and potential beneficiary groups versus those who are not eligible; if there are incorrect assignments, misleading comparisons may be made (though matching may reduce this problem considerably). Matching controls only for observed variables but not unobserved ones. Experiments often are costly, hard to maintain (i.e., keeping control and treatment groups separate), and in some cases not politically possible or ethical (see Section 2.4.1 above).

Endogeneity: Endogeneity bias occurs when a variable that is determined within the model appears as a right-side variable in some other relation. Among the relations discussed above, production functions are the ones for which endogeneity most obviously might be a problem because the right-side variables include some behavioral inputs (e.g., health and nutritional status in relation 2A). Included on the right side of that relation is a stochastic term ($V_f$) that, as noted above in Section 2.4.2.1, includes the stochastic terms from all of the production function relations in the model — including those for health and nutritional status. This results in a correlation between health and nutritional status and the stochastic term in the cognitive achievement production function that causes biases in the estimated impact of health and nutritional status on cognitive achievement production. The sign and the magnitude of the bias

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[59] While we indicate the likely direction of biases in the text, the actual biases depend on the exact difference between the correct specification and the specification used and the covariances among all the variables in both specifications, so the actual biases may not be in the directions that we posit are likely on the basis of first-order effects.

depend upon the exact structure of the model.  If there are no unobserved behavioral inputs in the production function, prices and any other variables that enter into the reduced- form demand relations in (1A), but not directly in the production function, can serve as identifying instruments for controlling for endogeneity.

Selectivity:  Selectivity bias may result if observations are available only for a selected subset of the sample.  A relevant example is for estimating the impact of school characteristics on cognitive achievement tests given at the secondary school level.  Such test scores are not observed for everyone in most samples from most developing countries because not everyone attends secondary school.  These test scores are only observed for individuals whose expected gains from attending secondary school exceed the cost of attending secondary school, which is likely to differ by socioeconomic class because those who are better off are more likely to be able to self-finance such investments in the presence of imperfect or absent capital markets for investments in youth.  The problem is that this subsample is not randomly selected.  The subsample selection procedure, with its systematic relation between the disturbance term in the true relation and test scores, creates a correlation between the disturbance term and test scores for the subsample for which estimates of the relation can be made.  As a result, if the relation is estimated using only this subsample, a biased estimate of the true relation between test scores and school characteristics is obtained.  The standard means of controlling for selectivity is to incorporate the behaviors that cause selectivity explicitly into the model, though in some cases finding observed variables that determine the selectivity but that do not enter into the relation of interest (which is necessary to identify the coefficients of interest) may be difficult.

# ANNEX C. THE COMPONENTS OF BROAD EFFECTS OF INVESTMENTS IN YOUTH

Table C-1 lists the various components of broad effects of investments in youth.  Each column of Table C-1 refers to a given broad effect.  A "**+**" in a particular column indicates that the broad effect corresponding to that column includes the component corresponding to that row of the table.  For example, column (1) of Table C-1 refers to the broad effect of "increased education." The table indicates that the components of this broad effect include "enhanced labor productivity," "averted youth unemployment," "averted child labor," among others. Note that some of the components themselves are broad effects (e.g., "averted youth unemployment," "averted child labor").

**Table C-1. The Components of Broad Effects of Investments in Youth**

| Components | Unit | Increased education | Averted youth unemployment | Reduced child labor | Averted teen pregnancy | Averted HIV infection | Averted STIs | Improved health | Improved nutritional status (height) | Improved nutritional status (body mass) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Enhanced labor productivity | % | + | + | | | | | + | + | + |
| Reduced under-utilization of labor | % | | + | | | | | | | |
| Increased adult work effort | % | | | | | | | | | |
| Increased social capital | Crime rate | | | | | | | | | |
| Expanded access to risk pooling services | 1 insured person | | | | | | | | | |
| Reduced age at which children achieve a given level of schooling | 1 year | | | | | | | | | |
| Reduced cost of medical care | % | | | | | + | | + | + | |
| Averted infertility | 1 woman | | | | | | + | | | |
| Increased tax revenue | $ | | | | | | | | | |
| Increased education | 1 year of schooling completed | | | + | + | + | | | | |
| Averted youth unemployment | 1 youth | + | | | | | | | | |
| Reduced child labor | 1 hour | + | | | | | | | | |
| Averted teen pregnancy | 1 pregnancy | + | + | | | | | | | |
| Averted HIV infection | 1 infection | + | | + | | | + | | | |
| Averted STIs | 1 infection | + | | + | | | | | | |
| Averted TB infections | 1 infection | | | | | + | | | | |
| Improved health | 1 DALY | + | | + | + | + | + | | + | |

| Components | Unit | Broad Effects | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Increased education | Averted youth unemployment | Reduced child labor | Averted teen pregnancy | Averted HIV infection | Averted STIs | Improved health | Improved nutritional status (height) | Improved nutritional status (body mass) |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Improved nutritional status (height) | 1 cm | | | | | | | | | |
| Improved nutritional status (body mass) | % change in body mass index | | | | | | | | | |
| Improved nutritional status (anemia) | 1 anemic person | | | | | | | | | |
| Improved nutritional status (iodine deficiency) | 1 iodine deficient person | | | | | | | | | |
| Improved nutritional status (Vitamin A deficiency) | 1 Vitamin A deficient person | | | | | | | | | |
| Improved nutritional status (birthweight) | 1 kilo | | | | | | | | + | + |
| Reduced obesity | 1 obese person | | | | | | | | | |
| Improved mental health | 1 depressed person | + | | | | | | | + | |
| Delayed marriage | 1 year | | | | | | | | | |
| Averted drug/alcohol abuse | 1 person | + | + | | | | | | | |
| Averted physical and/or sexual abuse | 1 victim | + | | + | | | | | | |
| Averted crime | 1 criminal | | + | | | | | | | |
| Improved self esteem | 1 youth | | | | | | | | + | |
| Averted female genital cutting | 1 victim | | | | | | | | | |
| Reduced fertility | 1 birth | + | | | + | | | + | + | |
| Averted abortion | 1 abortion | | | | + | | | | | |
| Reduced tobacco use | 1 tobacco user | | | | | | | | | |
| Reduced violence and civil conflict | 1 death | + | | | | | | | | |
| Averted social exclusion | 1 excluded person | + | | | + | + | | | | |
| Averted orphans | 1 orphan | | | | | + | | | | |

# Table C-1 (continued)

| Components | Units | Improved nutritional status (anemia) (10) | Improved nutritional status (iodine deficiency) (11) | Improved nutritional status (Vitamin A deficiency) (12) | Improved nutritional status (birthweight) (13) | Reduced obesity (14) | Improved mental health (15) | Delayed marriage (16) | Averted drug/alcohol abuse (17) | Averted physical and/or sexual abuse (18) | Averted crime (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Enhanced labor productivity | % | + | + | + | | | + | | + | | + |
| Reduced under-utilization of labor | % | | | | | | | | | | |
| Increased adult work effort | % | | | | | | | | | | |
| Increased social capital | Crime rate? | | | | | | | | | | |
| Expanded access to risk pooling services | 1 insured person | | | | | | | | | | |
| Reduced age at which children achieve a given level of schooling | 1 year | | | | | | | | | | |
| Reduced cost of medical care | % | + | + | + | + | + | + | | | | |
| Averted infertility | 1 woman | | | | | | | | | | |
| Increased tax revenue | $ | | | | | | | | | | |
| Increased education | 1 year of schooling completed | + | + | | | | | + | | | |
| Averted youth unemployment | 1 youth | | | | | | | | | | |
| Reduced child labor | 1 hour | | | | | | | | | | |
| Averted teen pregnancy | 1 pregnancy | | | | | | | + | | + | |
| Averted HIV infection | 1 infection | | | | | | | + | + | + | |
| Averted STIs | 1 infection | | | | | | | + | + | + | |
| Averted TB infections | 1 infection | | | | | | | | | | |
| Improved health | 1 DALY | + | + | + | + | + | + | | + | | + |
| Improved nutritional status (height) | 1 cm | | | | + | | | | | | |
| Improved nutritional status (body mass) | % change in body mass index | | | | | | | | | | |
| Improved nutritional status (anemia) | 1 anemic person | | | | | | | | | | |
| Improved nutritional status (iodine deficiency) | 1 iodine deficient person | | | | | | | | | | |
| Improved nutritional status (Vitamin A deficiency) | 1 Vitamin A deficient person | | | | | | | | | | |
| Improved nutritional status (birthweight) | 1 kilo | + | | | | | | | | | |
| Reduced obesity | 1 obese person | | | | | | | | | | |
| Improved mental health | 1 depressed person | | + | | | + | | | + | + | |
| Delayed marriage | 1 year | | | | | | | | | | |

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|  |  | Broad Effects | | | | | | | | | |
| Components | Units | Improved nutritional status (anemia) | Improved nutritional status (iodine deficiency) | Improved nutritional status (Vitamin A deficiency) | Improved nutritional status (birthweight) | Reduced obesity | Improved mental health | Delayed marriage | Averted drug/alcohol abuse | Averted physical and/or sexual abuse | Averted crime |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| Averted drug/alcohol abuse | 1 person |  |  |  |  |  |  |  |  |  |  |
| Averted physical and/or sexual abuse | 1 victim |  |  |  |  |  |  | + | + |  |  |
| Averted crime | 1 criminal |  |  |  |  |  | + |  | + | + |  |
| Improved self esteem | 1 youth |  |  |  |  | + |  |  |  |  |  |
| Averted female genital cutting | 1 victim |  |  |  |  |  |  |  |  |  |  |
| Reduced fertility | 1 birth | + | + | + | + |  |  | + |  |  |  |
| Averted abortion | 1 abortion |  |  |  |  |  |  |  |  |  |  |
| Reduced tobacco use | 1 tobacco user |  |  |  |  |  |  |  |  |  |  |
| Reduced violence and civil conflict | 1 death |  |  |  |  |  |  |  |  |  |  |
| Averted social exclusion | 1 excluded person |  |  |  |  |  |  |  |  |  |  |
| Averted orphans | 1 orphan |  |  |  |  |  |  |  |  |  |  |

Table C-1 (continued)

| Components | Units | Improved self esteem | Averted female genital cutting | Reduced fertility | Averted abortion | Reduced tobacco use | Reduced violence and civil conflict | Averted social exclusion | Averted orphans |
|---|---|---|---|---|---|---|---|---|---|
| | | (20) | (21) | (22) | (23) | (24) | (25) | (26) | (27) |
| Enhanced labor productivity | % | | | + | | | | + | |
| Reduced under-utilization of labor | % | | | | | | | | |
| Increased adult work effort | % | | | | | | | | |
| Increased social capital | Crime rate | | | | | | + | | |
| Expanded access to risk pooling services | 1 insured person | | | | | | | | |
| Reduced age at which children achieve a given level of schooling | 1 year | | | | | | | | |
| Reduced cost of medical care | % | | | | + | + | + | | |
| Averted infertility | 1 woman | | | | + | | | | |
| Increased tax revenue | $ | | | | | | | | |
| Increased education | 1 year of schooling completed | | | | + | | + | + | + |
| Averted youth unemployment | 1 youth | | | | | | | | |
| Reduced child labor | 1 hour | | | | | | | | |
| Averted teen pregnancy | 1 pregnancy | + | | | | | | | |
| Averted HIV infection | 1 infection | | | | | | | | |
| Averted STIs | 1 infection | | | | | | | | |
| Averted TB infections | 1 infection | | | | | | | | |
| Improved health | 1 DALY | + | + | + | + | + | + | + | + |
| Improved nutritional status (height) | 1 cm | | | | | | | | + |
| Improved nutritional status (body mass) | % change in body mass index | | | | | | | | + |
| Improved nutritional status (anemia) | 1 anemic person | | | | | | | | + |
| Improved nutritional status (iodine deficiency) | 1 iodine deficient person | | | | | | | | + |
| Improved nutritional status (Vitamin A deficiency) | 1 Vitamin A deficient person | | | | | | | | + |
| Improved nutritional status (birth weight) | 1 kilo | | | | | + | | | |
| Reduced obesity | 1 obese person | | | | | | | | |

| | | Broad Effects | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Components** | **Units** | Improved self esteem | Averted female genital cutting | Reduced fertility | Averted abortion | Reduced tobacco use | Reduced violence and civil conflict | Averted social exclusion | Averted orphans |
| | | (20) | (21) | (22) | (23) | (24) | (25) | (26) | (27) |
| Improved mental health | 1 depressed person | | + | | | | + | | + |
| Delayed marriage | 1 year | | | | | | | | |
| Averted drug/alcohol abuse | 1 person | + | | | | | | | |
| Averted physical and/or sexual abuse | 1 victim | | | | | | + | | |
| Averted crime | 1 criminal | + | | | | | + | | |
| Improved self esteem | 1 youth | | | | | | | | |
| Averted female genital cutting | 1 victim | | | | | | | | |
| Reduced fertility | 1 birth | | | | | | | | |
| Averted abortion | 1 abortion | | | | | | | | |
| Reduced tobacco use | 1 tobacco user | + | | | | | | | |
| Reduced violence and civil conflict | 1 death | | | | | | | | |
| Averted social exclusion | 1 excluded person | | | | | | | | + |
| Averted orphans | 1 orphan | | | | | | | | |

Source: Knowles and Behrman (2003).

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