Human Capital Accumulation and Social Benefits Among Asian and Near Eastern Countries

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Overview

In developing countries, girls routinely receive less education than boys of a comparable age. Consider primary school enrollment rates for low- and middle-income countries as of 1993. In South Asia, the enrollment rate for girls was 23 percentage points below that for boys; in Sub-Saharan Africa, as well as in the Middle East and North Africa, it was 13 points lower. These patterns hold up when secondary school enrollment rates are compared. For low-income countries in all regions in 1993, the secondary enrollment rates for females lags that for males by 13 percentage points.[2]

Just as this disparity will arise from many different causes, it results in a variety of development problems. From the perspective of "human capital" analysis, relatively less education for females results in the exclusion of one-half of the population from fully participating in a modern economy which demands skilled workers. From the perspective of public health, it harms the health and nutrition of children. From the perspective of families, it results in a total fertility rate which is higher than socially optimal.

Clearly, there are other factors which reap social benefits as measured by a lower fertility rate, lower infant mortality rate, and a longer life expectancy rate. Successfully implemented family planning programs have been shown to reduce the fertility rate. Rising per capita incomes are linked to lower infant mortality rates and longer life expectancies. Increased access to primary health care, particularly for the poor, will lower the infant mortality rate.

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[1] This research began while the author was in the Asia and Near East Bureau, at the urging of Dirk Dijkerman, Chief of the Strategy and Economic Analysis Office, and Gregg Baker, and was continued and completed while in the Global Bureau, Economic Growth Center. I would like to express my thanks to Elaine Grigsby of the Office of Economic and Institutional Reform in the Global Bureau's Economic Growth Center for supporting this research. Special thanks go to Alan Batchelder, Juan Buttari, Jim Elliott, Gretchen Bloom, and Jerre Manarolla who provided valuable comments and insights on an earlier draft, and to Michael Shea, who provided assistance in putting the study in the context of current thinking on human capital and social benefits. Ellen Peterson of CDIE's Research and Reference Service has been most helpful in searching source materials as well as reading earlier drafts and suggesting editorial changes. I would also like to thank Casey Delhotal and Lee Goldberg of CDIE's Economic and Social Data Service for their computer assistance and stimulating subject discussions. I am grateful for the helpful comments from Donald Snodgrass of the Harvard Institute for International Development. All remaining errors, however, are mine and suggested comments and revisions should be directed to me.

[2] All data from the *World Development Report* 1996, pages 200-201. (The World Bank: Washington, DC)

For more than a decade, a growing body of research has underscored the social benefits to be gained by increasing the education of girls in developing societies. For example:

- In 1985 a study by D. Wheeler compared the rate of return on "social investments" in education and family planning with the return on physical investments in infrastructure. Outlays for education and family planning scored higher.

- The 1990 *World Development Report* drew attention to the relationship between an additional year of education for mothers and their children's health. Every year of education is associated with a nine percent decline in the under-five mortality rate.

- *Letting Girls Learn*, a 1991 World Bank study, estimated that if female secondary school enrollment in 1965 had been 30 percent -- rather than the actual 6 percent -- then 300,000 infant deaths per year would have been avoided.

- In the World Bank's 1993 report, *The East Asian Miracle*, the fact that the eight high-performing Asian economies were among the first to eliminate gender gaps in school enrollment is credited with contributing to superior productivity growth.

- Analysis by Subbarao and Raney in 1993 used data for seventy-two developing countries and showed that increasing female secondary education, particularly in countries with currently low enrollment levels, is highly effective in reducing fertility and infant mortality rates. These results are discussed more fully in later sections of this paper.

D. Wheeler, "Female Education, Family Planning, Income and Population: A Long-run Econometric Simulation Model," in Nancy Birdsall, editor, *The Effects of Family Planning Programs on Fertility in the Developing World*, World Bank Staff Working Paper no. 677, 1985, pages 116-206 (Washington, DC: World Bank).

The World Bank, *World Development Report 1990*, page 81.

Barbara Herz, K. Subbarao, Masooma Habib, and Laura Raney, *Letting Girls Learn: Promising Approaches in Primary and Secondary Education*, Discussion Paper Number 133 (The World Bank: Washington, DC). This result was cited in The World Bank, *Advancing Gender Equality*, 1995, page 17.

The World Bank, *The East Asian Miracle: Economic Growth and Public Policy*, page 47 (Oxford University Press: 1993).

K. Subbarao and Laura Raney, "Social Gains from Female Education: A Cross-National Study," *World Bank Discussion Papers*, Number 194, 1993. (The World Bank: Washington, DC)

George Psacharopoulos, "Returns to Investment in Education: A Global Update," *World Development*, September 1994 (22:9), pages 1325-1343. The rate of return is calculated based on estimates of additional lifetime earnings. The bibliography to this article is unusually extensive.

- Psacharopoulos, in 1994, reported that the rate of return on an investment in education for females was higher than for males in developing countries.

The results of these research activities, as well as the analysis in this paper, do not provide any "surprises" from the point of view of standard economic theory. To say that increasing education has social and economic benefits is not going very far out on an intellectual limb. Like many other development activities, promoting education is done in the confidence that it will yield positive returns. What is innovative and most interesting about this research, however, is that the econometric analysis generates estimates of *relative* rates of return to different development activities and policy choices. For national governments in low-income countries, as well as for international aid organizations, a keen interest in these results is warranted. Some of the policy implications for development are sketched out in the final section of this paper.

It should be made clear that the econometric analysis in this paper, as well as in the bulk of other research on this topic, has identified ***structural*** relationships, rather than ***causal*** relationships. Development, like life, is a complex activity. There are interactions between nearly every force or institution in society. For example, more education leads to greater productivity and higher incomes, which in turn can finance an additional investment in education. Or consider a decline in the fertility rate which -- by more healthful birth spacing -- lowers the infant and child mortality rates. This, in turn, would lower the desired family size for households and lead to an additional decline in the fertility rate.

To some, not identifying causal relationships might be a serious flaw. On the other hand, if structural relationships between indicators display significance at high levels of confidence, and those relationships persist through time, then valuable insights can be obtained.

The approach of this paper is to examine many of these issues for a select group of thirty-three developing countries in the Asia and Near East regions. Regression analysis is used to estimate parameters. Differences between the results for this group and for broader groups of all regions are discussed.

George Psacharopoulos, "Returns to Investment in Education: A Global Update," *World Development*, September 1994 (22:9), pages 1325-1343. The rate of return is calculated based on estimates of additional lifetime earnings. The bibliography to this article is unusually extensive.

I. Introduction

An educated woman provides benefits to her family and community in several ways: she has better opportunities to obtain higher paying jobs, thus increasing family income and purchasing power. She promotes better health care and hygiene and provides a more nutritional diet for her family. Because an educated woman has better knowledge of the symptoms and effects of diseases, she tends to get medical help earlier and to use medicine more effectively than an uneducated counterpart. In addition, she tends to marry later, have fewer children, and occupy more influential positions in the family and community. These are the conclusions of various studies which showed a high correlation between the level of female education and lower fertility, lower infant mortality, and longer life expectancy.

Except for the wage and income benefit, all the other benefits accruing to the family and the community/society are in non-monetary forms:

- How much is it worth to avoid one infant death? Or prevent one unwanted pregnancy?
- Obtain one more early medical examination or intervention?
- Delay a marriage by one year?

Clearly the total value of female education should not be measured solely by how much more an educated woman earns in the market place but should be based on how much she contributes to the overall benefit of the family, community, and nation.

Elizabeth King and Anne Hill of the World Bank, using cross country data for 152 developing countries for the period 1960 through 1985, show that primary school enrollment for girls is positively correlated with life expectancy and inversely correlated with fertility and infant mortality. They also find that per capita GNP is positively correlated with female primary school enrollment, i.e., countries with high primary school enrollment for females have higher per capita GNP, and countries with low primary enrollment for females tend to have lower per capita GNP. In addition, they find that countries with large gaps between male and female education have lower per capita GNP than countries with smaller education gaps. They conclude that large gender disparities in educational attainment appear to reduce per capita GNP.

K. Subbarao and Laura Raney in a recent econometric study examined the role of female secondary education relative to and in combination with health and family planning (FP) programs that are aimed at reducing fertility and infant mortality. They

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See, for example, King, E. M. & Anne Hill, *Women's Education in Developing Countries*, The World Bank, 1993.

King & Hill, page 19.

Subbarao and Raney, "Social Gains from Female Education: A Cross-National Study," *op. cit.*

found that higher secondary school enrollments for females have a generally stronger impact on reducing fertility than family planning programs. They state, based on regression analyses, that:

> Family planning services undoubtedly reduce the fertility rate, but the magnitudes of the elasticities of the Total Fertility Rate (TFR) with respect to family planning (FP) services are small ... Simulations show that a doubling of female secondary enrollments (from the mean of 19% to 38%) in 1975, holding all other variables constant at their mean values, would have reduced the TFR in 1985 from 5.3 to 3.9, whereas a doubling of the family planning service score (from the mean of 25% to 50%), again holding other variables constant, would have reduced the TFR in 1985 from 5.5 to 5.0. These illustrative scenarios are suggestive of the powerful influence of female education in fertility reduction and the potential from combinations of female education and effective family planning programs.

Although a rigorous cost benefit analysis is ruled out due to lack of data, an implication of their findings is that, for a given amount of resources, educating females at the secondary school level would be more effective in reducing the total fertility than simply promoting FP programs. They conclude that both programs in tandem would be most effective. One potential weakness of Subbarao's and Raney's study is that they seek the determinants of 1985 total fertility in 1970 and 1975 female secondary school enrollments, a ten to fifteen year lag between the cause and effect; their rationale is that those female students who were enrolled in secondary schools in 1970 and 1975 would have reached their prime reproductive age by 1985.

This view, while plausible, begs several unanswered questions:

- What about the impact of secondary school enrollments in other years, for example 1971, 1972...?
- What about the impact of other forms of education, such as informal education, on the job training, family learning?

In fact, all present and past education, regardless of primary or secondary, formal or informal, should have some influence on today's fertility rate.

- What if the level of female secondary school enrollments did not change or even declined during 1970-1975?
- Would the total fertility rate in 1985 stay constant or even increase?

Clearly, Subbarao's and Raney's study needs to be modified and expanded to provide answers to questions like these.

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ibid., pages 13-16.

In this paper, we investigate the determinants of fertility, infant mortality, and life expectancy among Asian and Near Eastern countries (ANE) using cross country data. In the process, we attempt to provide answers to questions such as:

- Are the family planning activities effective in reducing fertility among ANE countries?
- Should we invest more in educating females than males?
- Does reducing the gender gap in human capital contribute to socio-economic development?
- What is the impact of economic growth on social benefits?

II. "Big Picture" Trends and Individual Country Experience

In the last several decades, there has been an across-the-board improvement in infant mortality rates and life expectancy in virtually every developing country. For the thirty-three countries analyzed in this study, for example, the median infant mortality rate went from 130 deaths per thousand live births in 1967 to only 47 in 1993. The median life expectancy rate for the same group of countries went from 51 years in 1967 to 67 in 1993. A related measure, the total fertility rate, went from 6.2 births to 3.6 during the same time period. These broad-ranging trends have narrowed the gap with indicators commonly associated with high-income economies.

Trends in the median rates are indications of the "demographic transition" nearing completion. Nearly all of the high-income economies have completed this transition. A handful of low-income economies, such as Sri Lanka, have mostly undergone the transition, as well.

However, individual country experiences have differed widely. For example, while the median infant mortality rate for the thirty-three countries dropped by nearly two-thirds, the ratio of the highest mortality rate to the lowest actually got worse. Although the median life expectancy rate increased by sixteen years, the disparity between the best and worst countries of these thirty-three remained about the same. The disparity between the lowest and highest total fertility rates increased.

It is precisely the divergence in country experience that makes this paper's analysis -- and work in a similar vein -- so valuable. In the search for insight into why some have progressed toward lower infant mortality and longer life expectancy, at least three factors are worth considering:

- female education
- family planning services
- per capita income

The regression analysis in this paper serves to both establish the significant structural relationships between these factors and the social benefits of lower fertility rates, and to estimate the order of importance for each factor.

The indicators under examination in this paper bear close resemblance to the

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The "demographic transition" refers to the latter half of a common demographic change undergone by developing countries. Throughout much of history, the population growth rate has been low, with both fertility and mortality rates high and in a rough equilibrium. In this century, mortality rates have fallen in most countries. When fertility rates remain high, population growth explodes. When a country develops enough to lower its fertility rate, population growth is slowed. The new equilibrium of fertility and mortality rates that are both low is evidence of the "demographic transition."

The United Nations Development Program (UNDP) publishes the HDI each year in its *Human Development Report*.

components of the UNDP's "Human Development Index," (HDI) a summary measure of economic and social indicators. There are four parts to the HDI, with different weights and adjustments:

- GDP per capita
- life expectancy rate
- adult literacy rate
- average years of schooling

For the first two components of the HDI, this paper uses them as independent variables. The third component, the literacy rate, is used as a dependent variable. The fourth component is not part of the regression analysis in this paper. To a large extent, this paper can be used to understand more deeply how improvements in the HDI can be achieved.

The United Nations Development Program (UNDP) publishes the HDI each year in its *Human Development Report*.

III. Human Capital Formation and Data

During the past thirty years, there has been tremendous progress in human capital formation among all Asian and Near Eastern countries, particularly among the East Asian countries. King and Hill show that by late 1975, almost all East Asian countries achieved close to 100% primary school enrollments and more than 40% in secondary school enrollments for male school age children. Similar progress has been observed in South Asian, Near Eastern and North African countries. In spite of the progress, King and Hill show that the gap in primary school enrollment rates for boys and girls remained pronounced in 1975 among most South Asian, Near Eastern and North African countries. For various reasons -- social, religious, financial, and traditional -- the governments and family decision makers in these countries seem to have relegated female education to the level of secondary importance. This gap between male and female primary school enrollment rates, according to King and Hill, is a major cause for the lag in socio-economic development in these countries.

In the present study, the idea that the aggregate human capital stock, availability of family planning devices and encouragement of their uses, and the level of economic well being ultimately determine the level of fertility, infant mortality, and life expectancy is being tested. The basic hypothesis is that the total fertility rate (TFR), infant mortality rate (IMR), and life expectancy (LE) are dependent on the stock of human capital, availability of family planning services, and the standard of living, all measured at the same time period. Since human capital formation is a result of accumulated knowledge through formal and informal education, on the job training, family learning and so on, education in general clearly is a key factor for long term social and economic progress. It is not surprising then that Subbarao and Raney found a close statistical correlation between fertility and past secondary school enrollments.

Ideally, human capital formation data need to be collected from all past sources of formal and informal education, family learning, and on the job training. However, such data for human capital formation are not available. In the absence of systemic data that are designed to capture all human capital accumulation, we look for proxies that would approximate the stock of a country's human capital. The UNDP publishes a series of socio-economic data including "Adult Literacy Rate" of most countries. The adult literacy rate is defined by the UNDP as "the percentage of persons aged 15 and

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Elizabeth King of the World Bank provided the author a copy of a set of time series education stock data based on school enrollment figures. Since this data series excludes informal human capital accumulation, the data set represents and measures a portion, albeit a large portion, of human capital data needed for our study. Nevertheless, we plan to incorporate the new data series in the future analysis.

See UNDP, *Human Development Report 1994*, "Selected Definitions". The quality and reliability of literacy data are somewhat suspect because the interpretation of this standard definition *at the national level* can be different from country to country. Nonetheless, the benefits outweigh the costs in using literacy data as a proxy for human capital.

over who can, with understanding, both read and write a short simple statement on their everyday life". Literacy data provide a good proxy for the human capital stock, because literacy reflects a sum total of all forms of education, such as formal school education, non-formal education, family learning and on the job training. Informal education is considered important and provides significant social benefits in many developing countries.

What we want to measure is the level of human capacity and capability, not the number of school enrollments or years of schooling. Primary and secondary school enrollments, on the other hand, are a good indicator of the stock of future human capital. That is, the impact of improvements in primary school enrollments will appear after several years; and any correlation study using enrollment data must lag the response by several years, as was done by Subbarao and Raney. This time lag introduces an element of uncertainty which could be avoided if human capital stock data were used. Since the adult literacy rate indicates human capacity at the time of measurement, it does not require a lagged relationship.

All data used in this study come from the UNDP publication, ***Human Development Report 1994***, except for the family planning program scores which are based on a study conducted in 1989 by John Ross, Parker Mauldin, Steven Green, and Romana Cooke. The family planning program scores consist of four program components:

- policy and stage setting (maximum score of 32 points),
- service and service related (maximum of 52 points),
- record keeping and evaluation (maximum of 12 points), and
- availability and accessibility (maximum of 24 points).

The total maximum score any country can obtain is 120 points, which is converted to 100 points maximum by scaling down proportionately. Subbarao and Raney have generously provided the data to this USAID Office for use in this study.

The plan of the rest of this paper is as follows: Section IV provides a hypothesis for the determinant of Fertility, Infant Mortality, and Life Expectancy and makes empirical estimations of the determinants using data for 33 ANE countries. The statistical significance of the estimated results are provided. In Section V, an attempt is made to evaluate the differential impact of female and male literacy rates on total fertility, infant mortality, and life expectancy. The analysis concludes that cross country

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See UNDP, *Human Development Report 1994*, "Selected Definitions". The quality and reliability of literacy data are somewhat suspect because the interpretation of this standard definition *at the national level* can be different from country to country. Nonetheless, the benefits outweigh the costs in using literacy data as a proxy for human capital.

John A. Ross, W. Parker Mauldin, Steven R. Green and E. Romana Cooke, *Family Planning and Child Survival Programs, as Assessed in 1991*, The Population Council, New York, 1992.

data analysis is ill suited for drawing conclusions regarding the differential impact of female and male literacy. The study confirms the findings of other authors that gender disparity in human capital is an important factor in determining fertility, infant mortality, and life expectancy. Conclusions drawn directly from the data analysis are provided in Section VI. In Section VII, policy implications for development assistance activities are sketched out.

IV. Determinants of TFR, IMR, and LE

The hypothesis is that Total Fertility Rate, Infant Mortality Rate and Life Expectancy are primarily determined by the stock of human capital, availability of family planning programs, and the level of GDP per capita converted to dollars using a purchasing-power-parity adjusted conversion, all measured in a single time period. It is assumed that on the average the desired number of children is less than the actual, the infant mortality rate is too high, and life expectancy should be extended. This hypothesis can be expressed as,

-- $TFR_t = a_0 + a_1 HC_t + a_2 FP_t + a_3 GDP_t/cap$,
-- $IMR_t = b_0 + b_1 HC_t + b_2 FP_t + b_3 GDP_t/cap$,
-- $LE_t = c_0 + c_1 HC_t + c_2 FP_t + c_3 GDP_t/cap$.

Where HC_t = Stock of Human Capital in period t,
FP_t = Family Planning Scores in period t, and
GDP_t/cap = PPP adjusted GDP per capita in period t.

A priori, the theory predicts that the estimated coefficients, (a_1,a_2,a_3) and (b_1,b_2,b_3) should be negative and coefficients, (c_1,c_2,c_3) are expected to be positive, because as the stock of human capital, family planning, and the standard of living increase, we expect the total fertility and infant mortality would decline and life expectancy would increase. In addition, we assume a linear relationship to hold in a range in which data have been observed. The selection of countries in the sample is largely dictated by data availability. For instance, Kuwait, Saudi Arabia, South Korea, Malaysia, Singapore, etc. are included although they are not USAID assistance recipient countries. North African countries are also included following the USAID's definition of Asia & Near East (ANE) countries. (See Annex A for a list of the thirty-three sample countries and for the data used.) In estimating and testing the hypothesis, although the theory calls for contemporaneous relationship, we are unable to obtain all data for the same year. Thus, whereas TFR, IMR, LE, and HC (Literacy Rate) data are for 1992, family planning and GDP per capita data are for 1989 and 1991, respectively. This should not invalidate the basic relationship, because these variables do not vary greatly in a short period of time. The following regression estimations have been obtained:

(1) $TFR_{92} = 8.63 - 0.037\ TL_{92} - 0.029\ FP_{89} - 0.00007\ GDP/cap_{91}$
(15.9) (-4.1) (-4.8) (-1.3)
[-0.53] [-0.29] [-0.06]
Adj R^2 =0.68

A word of caution is in order on the interpretation of the estimated relationships. Since the hypothesis is for structural relationships, we should not interpret them as causal relationships although other considerations suggest that they might be causal (see King and Hill, 1993, for example).

(1) $IMR_{92} = 161.6 - 1.12\ TL_{92} - 0.21\ FP_{89} - 0.0043\ GDP/cap_{91}$
(14.8) (-6.1) (-1.7) (-4.2)
[-1.19] [-0.16] [-0.27]
Adj $R^2 = 0.78$

(1) $LE_{92} = 41.5 + 0.20\ TL_{92} + 0.058\ FP_{89} + 0.0011\ GDP/cap_{91}$
(16.9) (4.9) (2.1) (4.9)
[0.21] [0.04] [0.07]
Adj $R^2 = 0.76$

Where TL = total literacy scores; FP = family planning scores; and GDP/cap = Real GDP per capita in PPP terms.
The numbers in () are t-values of the estimated coefficients; and the numbers in [] are elasticities calculated at the mean values of variables. Subscripts refer to years in which variables are measured.

We draw the following conclusions:

1. All explanatory variables -- total literacy rate, family planning scores, and per capita GDP -- are statistically highly significant in explaining the variation of TFR, IMR, and LE except the GDP per capita in the fertility equation, which is significant only at the 80% confidence level at 29 degrees of freedom. Similarly, the family planning scores are significant in explaining the IMR variations at the 90% confidence level. All estimated coefficients have expected signs and the hypothesis explains between 68% to 78% of variations in dependent variables. The most powerful explanatory variable is the total literacy variable -- a human capital proxy -- which exhibits consistently high elasticities. The estimated coefficients for total literacy are sharp as indicated by the high t-values, i.e., the estimated coefficients are definitely different from zero. Notice that the elasticity of total literacy with respect to IMR is highly elastic at -1.19, implying that 1 percent increase in human capital will reduce IMR by 1.19 percent, a highly effective means of reducing IMR.

2. Of the three explanatory variables, total literacy is by far the most powerful and influential variable in affecting fertility, infant mortality, and life expectancy. We conclude that the level of human capital as represented by the total literacy scores is the most powerful factor and effective means to reduce fertility and infant mortality, and to improve life expectancy at birth. The following table summarizes the order of importance of explanatory variables based on the elasticities and t-values.

Order of Importance of Explanatory Variables

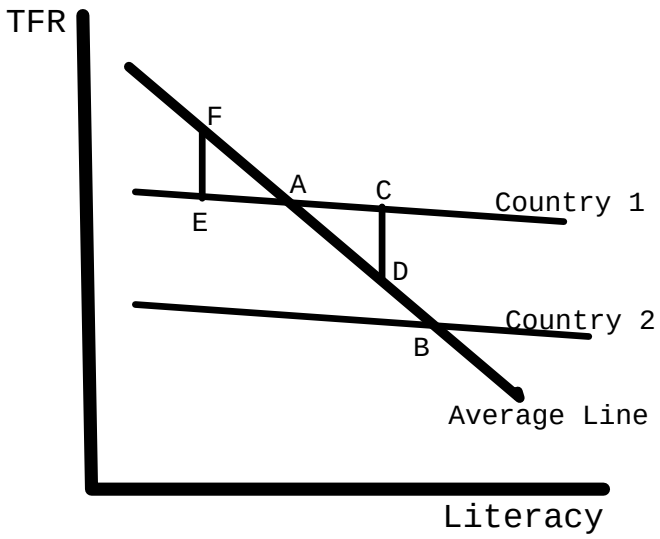
Degree of Effectiveness	Total Fertility Rate	Infant Mortality Rate	Life Expectancy
High	Human Capital	Human Capital	Human Capital
Medium	Family Plan	GDP per Capita	GDP per Capita
Low	GDP per Capita	Family Plan	Family Plan

Notice that the Family Planning activity is effective in reducing the total fertility rate while its impact on reducing IMR and improving LE is weaker. This finding is significantly different from the World Bank study by Subbarao and Raney. Their study indicated that family planning had only a marginal impact in reducing TFR. It is unclear why this difference occurs. It could be that they have used worldwide data while this study covers ANE countries only. Obviously, further analysis is needed.

The standard of living variable, GDP per capita, is strongly correlated in reducing IMR and improving life expectancy at birth, but marginally effective in reducing TFR. In sum, the combined effect of 1% improvement in total human capital, 1% improvement in family planning scores, and 1% increase in GDP per capita would reduce total fertility by 0.88% (0.53+0.29+0.06), reduce infant mortality by 1.62% (1.19+0.16+0.27), and increase life expectancy by 0.32% (0.21+0.04+0.07). These social gains resulting from increasing human capital, family planning activities, and economic growth are great indeed.

3. A purpose of cross country regression analysis is to obtain the long term average trend line of TFR, IMR, and LE for the countries in the sample. That is, as country 1 improves its set of literacy, family planning and GDP per capita, its TFR for example would decline along ***the average trend line over time***. Figure 1 depicts the situation. We have one observation for each

Figure 1.



country. Let A and B be the observed average points of fertility and literacy of country 1 and country 2, respectively. Over time, fertility declines along the long term trend. The relationship between the cross country analysis and within country cross-sectional analysis is also shown in Figure 1 as country 1 and country 2. The within country cross-sectional relationship between literacy and fertility is drawn flatter than the trend line, because social infrastructure -- such as religion, cultural pattern, customs, and social institutional settings -- does not change in the within country cross-sectional analysis and therefore constrains peoples' behavior around the social norms. A net result is that those people who have higher literacy (point C in Figure 1) than the average tend to have higher fertility than the average trend line would predict at D. Similarly, the opposite would be the case for those people who have lower literacy (point E) than the average. Their fertility would be lower than that predicted by the long term trend line at F, because of the influence of existing social infrastructure. Traditional social norms and infrastructure tend to make people behave conservatively.

Some economists suggest that in some cases the slope of within country cross-sectional regression could be steeper than the cross country analysis. While this is possible, in the next Section, we will show this is not the case for the thirty three Asian and Near Eastern countries in our sample.

V. Differential Impact of Female and Male Literacy Rates

Many experts have strong interests in distinguishing the differential effect of educating female and male. It is commonly accepted that many developing countries favored, and a number of countries still do favor, educating male over female. As a consequence fertility and infant mortality did not decrease and life expectancy did not improve as much. Female education is considered to yield the highest return in terms of social benefits. We note that many such studies are based on cross country analyses, mainly because of lack of country time series data which the researchers prefer.

In this paper, we attempt to estimate the differential impact of female and male literacy and to measure the impact of gender gap on TFR, IMR, and LE. In many respects, the best way to evaluate the differential impact of female and male human capital is to run a regression with both variables, female and male literacy rates, in the same equation. However, this was not possible for the sample countries at hand because of high correlation between female and male literacy rates. The estimated coefficients are insignificant and often with wrong signs.

In the following we regress female and male literacy rates separately. The UNDP report provides female and male literacy rates for the year 1990. There are 9 relationships, 3 each for TFR, IMR, and LE. Equations (1a), (1b), and (1c) are for TFR as a function of female literacy, male literacy, and gender gap, defined as the difference between male and female literacy rates in addition to FP and GDP per capita variables. We expect *a priori* that for TFR and IMR the estimated coefficients should have negative signs except the gender gap term which should have a positive sign. That is, increasing gender gaps will increase both TFR and IMR. For LE, however, we expect positive signs for all terms except the gender gap term which should have a negative sign. For as the gender gap increases, we would expect adverse social benefits, thus shorter life expectancy.

(1a) $TFR_{92} = 7.95 - 0.028\ FL_{90} - 0.032\ FP_{89} - 0.0001\ GDP/cap_{91}$
(17.3) (-3.6) (-5.1) (-1.9)
[-0.34] [-0.32] [-0.09]
Adj R^2 =0.66

(1b) $TFR_{92} = 9.21 - 0.035\ ML_{90} - 0.033\ FP_{89} - 0.0001\ GDP/cap_{91}$
(11.7) (-3.3) (-5.3) (-2.0)
[-0.42] [-0.33] [-0.09]
Adj R^2 = 0.63

(1c) $TFR_{92} = 5.15 + 0.065\ (ML-FL)_{90} - 0.032\ FP_{89} - 0.0001\ GDP/cap_{91}$
(7.1) (3.0) (-4.8) (-2.3)
[0.29] [-0.32] [-0.09]
Adj R^2 = 0.62.

Where:

FL = female literacy rates,
ML = male literacy rates,
FP = family planning scores, and
GDP/cap = Real GDP per capita.

The numbers in () are t-values of the estimated coefficients; and the numbers in [] are elasticities calculated at the mean values of variables. Subscripts refer to years in which variables are measured.

Similar regression estimations have been carried out for the Infant Mortality Rate and Life Expectancy as follows:

(2a) $IMR_{92} = 141.5 - 0.85\ FL_{90} - 0.27\ FP_{89} - 0.005\ GDP/cap_{91}$
(14.9) (-5.4) (-2.1) (-4.8)
[-0.77] [-0.20] [-0.32]
Adj $R^2 = 0.75$

(2b) $IMR_{92} = 188.3 - 1.21\ ML_{90} - 0.31\ FP_{89} - 0.005\ GDP/cap_{91}$
(12.4) (-5.8) (-2.5) (-5.0)
[-1.5] [-0.23] [-0.32]
Adj $R^2 = 0.76$

(2c) $IMR_{92} = 68.8 + 1.54\ (ML-FL)_{90} - 0.32\ FP_{89} - 0.006\ GDP/cap_{89}$
(3.9) (2.9) (-2.0) (-4.8)
[0.51] [-0.24] [-0.32]
Adj $R^2 = 0.61$

(3a) $LE_{92} = 45.31 + 0.15\ FL_{90} + 0.071\ FP_{89} + 0.0013\ GDP/cap_{91}$
(21.1) (4.1) (2.4) (5.5)
[0.14] [0.05] [0.08]
Adj $R^2 = 0.72$

(3b) $LE_{92} = 37.51 + 0.21\ ML_{90} + 0.078\ FP_{89} + 0.0013\ GDP/cap_{91}$
(10.6) (4.2) (2.7) (5.6)
[0.26] [0.06] [0.08]
Adj $R^2 = 0.73$

(3c) $LE_{92} = 58.26 - 0.28\ (ML-FL)_{90} + 0.078\ FP_{89} + 0.0015\ GDP/cap_{91}$
(15.9) (-2.6) (2.3) (5.6)
[-0.09] [0.06] [0.10]
Adj $R^2 = 0.64$.

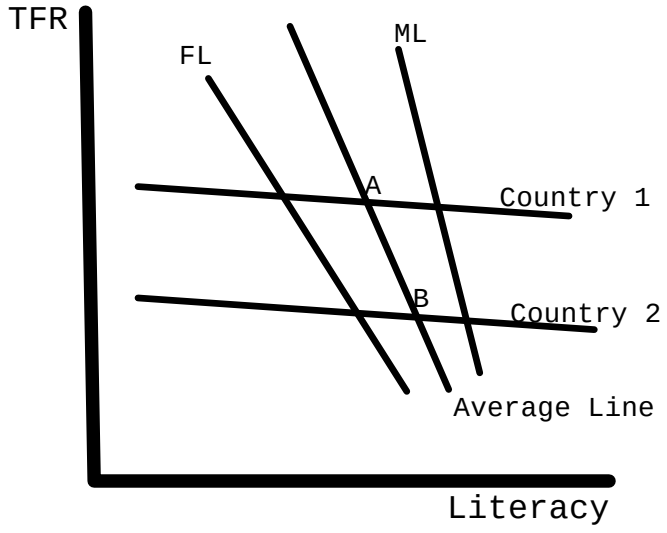
1. All explanatory variables -- both female and male human capital, family planning, and per capita GDP -- are statistically significant in explaining the variation in TFR, IMR, and LE. All estimated coefficients have anticipated signs and explain about 61%-76% of variations. For instance, an increase in female literacy, male literacy, family planning scores, and GDP/cap will decrease fertility rates and infant mortality rates, but increase life expectancy. However, if the gender gap becomes worse, i.e., the difference between male and female literacy widens, fertility and infant mortality rates will rise while life expectancy will decrease (see equations 1c, 2c, and 3c). These results are in accord with generally accepted views.

2. Equations 1a, 1b, 2a, and 2b imply that improvements in adult male literacy (ML) would reduce TFR and IMR much faster than improving adult female literacy (FL).

Similarly, improvements in adult male literacy would improve LE more effectively than improving adult female literacy (equations 3a and 3b). This result seems to contradict the commonly accepted view that educating females would be more effective in increasing social benefits than educating males. A closer examination of the data, however, reveals that this seemingly odd result is a consequence of three facts:

i. TL (the average line in Figure 2), ML, and FL are not independent variables. In fact, TL is a weighted average of ML and FL with the equal weight of 0.5 which means ML and FL are equal distance away on both sides of TL;

Figure 2.



ii. ML is always higher than FL among all sample countries which means the ML and FL regression lines are to the right and to the left hand side of the average line, respectively; and

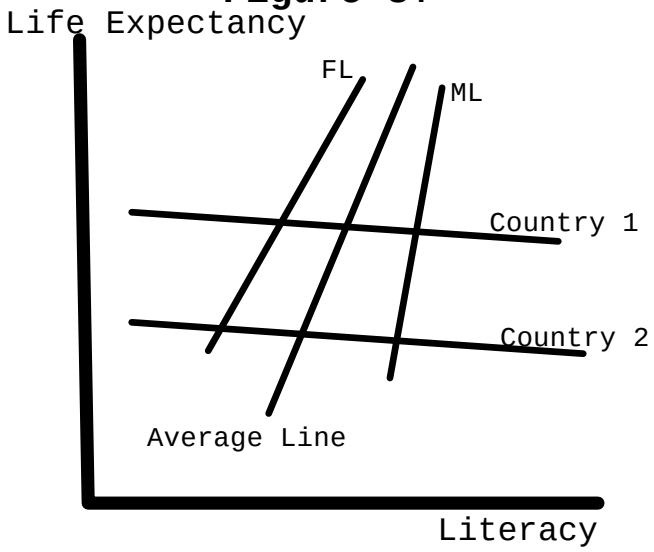
iii. Countries with higher literacy rates have smaller gender gaps which means the distance between ML and FL becomes less as literacy increases.

Figure 2 illustrates the situation. Countries 1 and 2 now have two literacy points: male literacy (ML) is to the right of the average line and female literacy (FL) is to the left of the average. They are at an equal distance from the TL average line. As literacy increases across countries, the distance between ML and FL becomes smaller. Thus, the ML regression line has a slope that is invariably steeper than the FL regression line as indicated in equations 1a and 1b. This statistical result is just a consequence of a coincidental data structure and one should not interpret it as a structural relationship. A similar conclusion can be reached for the infant mortality rate. Equations, 2a and 2b, show that IMR would be reduced much more rapidly and effectively by increasing ML (elasticity of -1.5%) than FL (elasticity of -0.77%). Again, this result is a statistical quirk, not evidence of any meaningful social relationship.

3. With regard to Life Expectancy at birth, we encounter a situation similar to those of TFR and IMR. Figure 3 (next page) shows why the increase in male literacy rate appears to be more effective in improving life expectancy than the female literacy rate. This is of course a fictitious result due to the data characteristics as described above. The analysis also points out that the slopes of within country regression, country 1 and 2, should be flatter than that of the trend line, because if they were steeper, the analysis implies that the coefficient of FL must be larger than the coefficient of ML, which is not the case.

The above illustration points out the fact that cross country data are ill suited for analyzing the differential impact of male and female human capital on TFR, IMR, and LE. We need female and male human capital time series data of one country to differentiate the impact of female and male human capital. Unfortunately, such time series data are not yet available.

Figure 3.



4. While we are unable to estimate the differential impact of male and female human capital on social benefits, the male-female gap in Human Capital, as measured by the difference between the male and female adult literacy rates, is a highly important factor in determining TFR, IMR, and LE. A one percent reduction in the difference between male and female adult literacy would reduce the fertility rate by 0.29 percent, infant mortality by 0.51 percent, and life expectancy by 0.09 percent. While it is not possible at this time due to lack of data to estimate the value of benefits in terms of dollars and cents, the reduction of the gender disparity in human capital clearly promotes social benefits, i.e., social benefits from improving female human capital

would clearly exceed the social benefits from improving male human capital, because educating girls would improve literacy as well as reduce gender disparity whereas educating boys, while improving literacy, would likely increase gender disparity. The table on the following page compares the estimated values of differential social benefits in response to 1 percent improvement in FL and ML.

Differential Social Benefits in Response to 1 Percent Increase in FL and ML* (In Percent)

Social Benefits	1% Percent Increase in FL holding ML Constant	1 Percent Increase in ML holding FL Constant
TFR	-0.63	-0.13
IMR	-1.28	-0.99
LE	+0.23	+0.17

* Calculated from equations (1a,1b,1c), (2a,2b,2c), and (3a,3b,3c).

Clearly, social gains are far greater from educating girls than boys. The differential gain is greatest for total fertility.

In addition, the cost of improving the female human capital would likely be less than the cost of improving male human capital, because the average adult literacy rate for male is 76.3 percent for the sample ANE countries while the same for female is only 55.8 percent. Assuming an increasing marginal cost function as the literacy rate approaches 100 percent, it would be more cost effective to improve the female literacy rate by 1 percent from 55.8 percent to 56.4 percent than to raise the male literacy rate by 1 percent from 76.3 percent to 77.1 percent.

In sum, human capital accumulation provides dual benefits: as total human capital increases, fertility and infant mortality decline and life expectancy increases; and, in addition, if the human capital gender disparity decreases, i.e., female human capital accumulates faster than male human capital, there is additional social benefits from the improvement in gender disparity.

VI. Conclusions Drawn Directly from the Regression Analysis

We have demonstrated that the total fertility rate, infant mortality rate, and life expectancy in ANE countries are highly correlated with the stock of human capital, family planning activities, and GDP per capita, all measured contemporaneously. The analysis concludes that human capital stock as measured by the total literacy rate is most powerful in reducing TFR and IMR and improving LE. It has been shown that improving female human capital is a double edged sword in increasing social benefits: by increasing total human capital stock and by decreasing gender disparity. Family planning activities also have contributed significantly in reducing TFR, but have a marginal impact on IMR and LE. The measure of economic growth, GDP per capita, is shown to have significant effect on reducing IMR and improving LE, but has a marginal effect on reducing TFR. We have also shown that the cross country analysis is ill-suited to evaluate the differential impact of female and male literacy on social benefits.

VII. Policy Implications for Development Assistance Activities

During the past several decades, nearly all developing countries have recorded significant progress in providing education for females, as well as providing education generally. However, during the 1980s the rate of increase in access slowed. In many developing countries, the net enrollment rate declined over the decade.

One priority for developing countries, as well as for aid donor organizations, is two-fisted: *reverse* declines where they have occurred, and *accelerate* progress where it has slowed.

The analysis of this paper -- which underscores the key role played by increased female literacy rates in reducing fertility and infant mortality rates, and raising the life expectancy rate -- strongly supports this priority. In particular, investment in primary schooling is the most direct method of raising literacy rates for both females and males.

Part of the problem with stalled efforts to raise the level of female human capital is that resources for primary education have been cut in many developing countries. For example, among the approximately three dozen developing countries for which UNESCO data are available, about half reported declines in resource allocation during the 1980s.

In addition, better use must be made of resources which are allocated to education. Among "good" policy choices are:

- In many countries, subsidies to tertiary education should be re-allocated to primary education.
- One of the most intimidating barriers to raising education levels for girls is culturally-based opposition. Therefore, projects to provide schooling are most likely to succeed when a setting acceptable to the culture is created.
- Outcome-based programs should also be favored in spending decisions.
- Special programs to promote the education of girls are also optimizing so long as the rate of return for female education exceeds that of male education.

The analysis of this paper joins a large body of evidence which advocates investments in female education as a means of attaining lower fertility rates, lower

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George Psacharopoulos, *Building Human Capital for Better Lives*, 1995 (The World Bank: Washington, DC), page 11.

Psacharopoulos, *ibid.*, chapters 2 and 3.

In the 1995 book, Psacharopoulos outlines a similar agenda. The emphasis on primary education has been reflected in World Bank priorities during recent years. Of Bank lending for education, primary school accounted for nearly one-third during fiscal years 1990 to 1994. This share represents a doubling from the percentage during fiscal years 1975 to 1979.

infant mortality rates, and higher life expectancy rates -- as well as the social benefits associated with those three achievements.

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Subbarao, K. and Laura Raney, "Social Gains from Female Education, A Cross-National Study," *World Bank Discussion Paper*, Number 194, 1993. (The World Bank: Washington, DC)

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ANNEX A

SAMPLE DATA USED IN THE STUDY

ANNEX A

SAMPLE DATA

HDI Rank	Country	TFR	GDP	FemLit	MaleLit	InfMort	LifeExp	FamPlan
32	Republic of Korea	1.7	8320	95	99	21	70.4	81
43	Singapore	1.7	14734	74	92	8	74.2	63
51	Kuwait	3.8	13126	68	78	15	74.6	0
54	Thailand	2.3	5270	92	96	26	68.7	80
57	Malaysia	3.7	7400	72	89	14	70.4	66
67	Saudi Arabia	6.5	10850	50	76	31	68.7	0
68	Turkey	3.6	4840	72	91	57	66.7	46
73	Syrian Arab Republic	6.3	5220	53	82	40	66.4	44
79	Libyan Arab Jamahir	6.5	7000	52	78	70	62.4	0
81	Tunisia	3.6	4690	59	77	44	67.1	69
86	Iran	6.1	4670	45	67	41	66.6	57
90	Sri Lanka	2.5	2650	85	94	24	71.2	80
94	China	2.3	2946	68	92	27	70.5	87
98	Jordan	5.8	2895	72	91	37	67.3	31
99	Philippines	4.0	2440	90	90	40	64.6	49
100	Iraq	5.8	3500	51	73	59	65.7	1
103	Lebanon	3.2	2500	74	89	35	68.1	49
105	Indonesia	3.2	2730	77	91	66	62.0	80
109	Algeria	5.0	2870	49	74	62	65.6	46
110	Egypt	4.2	3600	35	66	58	60.9	66
111	Morocco	4.5	3340	40	64	70	62.5	57
116	Vietnam	4.0	1250	84	93	37	63.4	68
129	Papua New Guinea	5.0	1550	48	82	54	55.3	26
130	Myanmar	4.3	650	72	90	83	56.9	12
132	Pakistan	6.3	1970	22	49	99	58.3	48
133	Lao PDR	6.7	1760	76	92	98	50.3	8
135	India	4.0	1150	35	64	89	59.7	72
142	Yemen	7.3	1374	28	56	107	51.9	26
146	Bangladesh	4.8	1160	23	49	109	52.2	72
147	Cambodia	4.5	1250	24	52	117	50.4	9
149	Nepal	5.6	1130	14	39	100	52.7	59
162	Bhutan	5.9	620	26	55	131	47.8	22
171	Afghanistan	6.9	700	15	48	164	42.9	36

HDI Rank refers to the country's standing in the league table for the Human Development Index, calculated by the UNDP.