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Gender Gaps in Human Capital and Economic Growth in Developing Countries

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Abstract: This paper examines the impact of gender gaps in human capital on economic growth in developing countries. Based on data from the World Bank for the 1990-2010 period and a sample of seventy-eight developing economies, we find that the growth rate of GDP per capita is dependent on gross capital formation, the changes in both male and female life expectancy, the change in the gap between male and female life expectancy, the change in the proportion of the population having access to improved sanitation services, population growth, and the GDP per capita in 2000. It is observed that the estimated coefficient of one explanatory variable, namely, the change in female life expectancy, does not have the expected positive sign, possibly due to the collinearity between this variable and the change in male life expectancy as well as gross capital formation. Statistical results of such empirical examination will assist governments in developing countries identify areas that need to be improved upon reduce gender gaps in human capital—specifically those that address female life expectancy—in order to foster economic growth.

JEL Classifications: O12, O15, O40

Keywords: Gender gaps, Human capital, Female life expectancy, Economic growth, Developing country, Sanitation access

1. Introduction

This study examines the relationship from gender equality to growth. According to the *2012 World Development Report: Gender Equality and Development*, this relationship is important for policy implications for two reasons. First, since development is defined as a process of extending freedoms equally for everyone, gender equality is *per se* a core objective; in very much the same way as lower income poverty or greater access to justice is part of the development process. Second, there is some evidence that greater gender equality can enhance growth in three ways: i) substantial (and growing) productivity gains may be achieved with a reduction in barriers to more efficient allocations of women's skills and talents; ii) better outcomes for the next generation may be molded by the improvement of women's endowments, opportunities, and agency; and iii) more positive outcomes, institutions, and policy options may be produced by raising women's individual and collective agency.

One priority area for policy going forward pointed out by the *2012 World Development Report* is the reduction in gender gaps in human capital, namely those concerning female life expectancy.

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This paper attempts to estimate the impact of gender gaps in this priority area on economic growth. Based on data from the World Bank for the 1990-2010 period and a sample of seventy-eight[1] developing economies we find that the growth rate of GDP per capita is dependent on gross capital formation, the changes in both male and female life expectancy, the change in the gap between male and female life expectancy, the change in the proportion of the population having access to improved sanitation services, population growth, and the 2000 GDP per capita. We observe that the coefficient estimate of one explanatory variable, namely, the change in female life expectancy, does not have the expected positive sign, possibly to the collinearity between this variable and the change in male life expectancy as well as gross capital formation. Statistical results of such empirical examination will assist governments in developing countries identify areas that need to be improved upon reduce gender gaps in human capital—specifically those that improve female life expectancy—in order to foster economic growth. We argue that public actions play an important role in addressing this issue, such as, for instance, the improvement of service delivery for clean sanitation as well as better prenatal and maternal care.

This paper is organized as follows. In the next section, a selected review of the economic literature on the effect of gender gaps on economic growth is discussed. This is followed by the development of a theoretical model and the formulation of a statistical model to be estimated. Theoretical underpinnings for the inclusion of explanatory variables are presented in this section. Statistical results are reported in the subsequent section. A final section gives concluding remarks as well as policy recommendations.

2. Selected Review of the Selected Literature

According to a World Bank (2001) report, "research from around the world has shownthat gender inequality tends to slow economic growth and make the rise frompoverty more difficult". Clearly, a country's economy will be in jeoparty if the female half of its population does not gain equal access to the economic contribution process. The economic costs of gender gaps thus are high, given that not only do they decrease the women's welfare but also tend to reduce that of males and children and in the process hinder economic development.

In the same vein, Blackden et al. (2006) develop a model in which gender inequality has an adverse effect on asset accumulation and factor productivity and thus impacts economic growth. This is because excluding highly qualified girls from the educational process results in a reduction in the overall average amount of human capital. In addition, restricting female education causes a reduction in the human capital of the next generation as women's educational attainment tends to substantially lower child mortality and fertility.

Most of the empirical studies on the causal effect of gender gaps on economic growth or per capita income have found a significant negative impact of gender gap inequality on economic growth. The findings of these macroeconomic studies are also consistent with those of the microeconomic literature (see, for example, Hill and King (1995); World Bank (2001); and King, Klasen, and Porter (2008)).

On the other hand, Barro and Lee (1994), Barro and Lee (1996), and Barro and Sala-i-Martin (2003) find that the inclusion of male and female primary and secondary schooling results in the coefficient associated with female schooling being negative. They attribute this negative sign to a reflection of a large gap in schooling between genders, which in turn may be viewed as a proxy for backwardness. They also identify problems such as the high collinearity between male and female education as well as the endogeneity of the last two variables, among others.

Using different measures of the gender gap, Dollar and Gatti (1999) find that female secondary education does positively and nonlinearly affect growth while the impact of male education is both insignificant and negative. In countries at low levels of development, i.e., predominantly agricultural, the effect of raising female education is neglible while in more developed ones, it is significant. Klasen (2002) and Klasen and Lamanna (2009), on the other hand, are able to estimate both the lower and upper bounds of the impact of gender inequality on growth. The upper bound is estimated when male education is used as a proxy for average level of education as the implicitly assumed specification is that the gap may be narrowed when girls are more intensively educated while keeping boys' educational level the same. On the other hand, the lower bound is estimated under the assumption that increases in female education may only be obtained at the expense of less male education.

An indirect way in which gender inequality may affect economic growth is through its impact on fertility, and hence population growth. Many studies have shown that women in developing countries with less education tend to have high fertility which leads to high population growth. This is turn acts as an impediment to economic growth (see, for instance, Hill and King (1995), Klasen (1999), Murthi, Guio, and Drèze (1995), Schultz (1994), and World Bank (2001)).

A joint publication by the Food and Agriculture Organization of the United Nations (FAO) (2010), the International Fund for Agricultural Development (IFAD), and the International Labour Office (ILO) estimates that agricultural output in developing countries could be increased by as much as 2.5 to 4 percent as a result of an equalization of access to productive resources for female and male farmers, while output per worker may rise by 13 to 25 percent after elimination of barriers preventing women from entering certain sectors or professions (see Cuberes and Teignier Baqué (2011) and Hurst et al. (2011)). Given today's integrated and competitive world, these are significant gains considering that even small improvements in the efficient use of resources can have large effects on economic growth. Do, Levchenko, and Raddatz (2011) argue that in a world of open economies the economic cost of gender inequality has become larger since it reduces a country's ability to compete on the international scene—especially when such country has a comparative advantage in the production of goods and services that male and female workers are equally suited to produce. They also find that those industries that are more dependent on female labor thrive more in countries with more gender equality.

As populations in developing countries such as China or in regions such as Eastern Europe age rapidly, fewer workers will be supporting increasing numbers of elderly in the medium run. As a result, having more women in the work force can lessen the effect of declining working-age populations.

Building upon the first priority area for policy going forward of the reduction in gender gaps in human capital, namely those addressing female life expectancy, in this paper we wish to empirically analyze the effect of these gaps on the growth rate of GDP per capita using a sample of seventy-eight developing countries. We first formulate a model relating the change in gender gap in human capital to the growth of income. We rely on the traditional process of introducing gender gap as an input in the production function with the stipulation that the greater the gap the smaller the output as the gap may be viewed as a less than efficient use of resources. We then specify the statistical model to be estimated while giving the theoretical underpinnings for the inclusion of explanatory variables. Empirical results are presented in a subsequent section. The final section gives concluding remarks as well as policy implications.

3. The Theoretical Framework

In deriving the GDP growth model, we shall make use of the rather traditional approach of introducing gender gap as an "input" in the aggregate production function:

$$Y = F(K, N, H, G, INF) \qquad (1)$$

where Y is income, K is physical capital, N is labor, H is human capital, G denotes gender gap while INF represents infrastructure.

Assuming the aggregate production function exhibits constant returns to scale we can rewrite (1) as:

$$Y/N = F(K/N, 1, H/N, G/N, INF/N) \qquad (2)$$

Differentiating (2) above, one obtains:

$$y_{pc} = F_K(I/Y) - b_K n + b_H h_{pc} + b_G g_{pc} + b_{INF} inf_{pc} \qquad (3)$$

where $y_{pc} = y - n$ is the growth rate of GDP per worker, h_{pc} is the growth rate of human capital per worker, g_{pc} is the growth rate of the gender gap per worker, inf_{pc} is the growth rate of infrastructure per worker, F_i is the marginal product of input i in the economy, I is investment defined as the change in the total capital stock over time, b_j is the elasticity of aggregate output with respect to input j, and lower-case letters denote rates of change.

4. The Statistical Model

Based on equation (3), we proceed to test it by specifying the following statistical model:

$$y_{pc} = \underset{}{\beta_0} + \underset{(+)}{\beta_1 I/Y} + \underset{(+)}{\beta_2 malelife} + \underset{(+)}{\beta_3 femlife} + \underset{(-)}{\beta_4 lifegap} + \underset{(-)}{\beta_5 2000PGDP} + \underset{(+)}{\beta_6 sanit} + \underset{(-)}{\beta_7 pop} + \epsilon \qquad (4)$$

where y_{pc} = Average annual growth rate of GDP per capita, 2000-10.

I/Y = Share of gross capital formation in the GDP, in 2009.
malelife = Average annual growth rate of male life expectancy, 1990-2009.
femlife = Average annual growth rate of female life expectancy, 1990-2009.
lifegap = Average annual growth rate of the ratio of male to female life expectancy, 1990-2009.
2000PGDP = GDP per capita, in 2000.
sanit = Average annual growth rate of the fraction of the total population having access to improved sanitation services, 2008-10.
pop = Average annual growth rate of the total population, 2000-10.

Since GDP per worker is not readily available, we use the 2000-2010 GDP per capita growth rate at market prices based on constant local currency for y_{pc}. For I/Y, we use the share of gross capital formation (formerly known as gross domestic investment) in the GDP lagged one period, i.e. for 2009. As far as human capital is concerned, we use the growth rates of both male and female life expectancy[2]. We expect the coefficient estimates for both these variables to have a positive sign. In order to capture the effect of gender gaps on growth, we include the annual percentage change in the ratio of male to female life expectancy and expect the coefficient estimate for this variable to be negative, i.e., as the gap in this health proxy variable narrows over time we expect an increase in the growth rate of GDP per capita.

In addition, addressing pockets of gender disadvantage in health requires having infrastructure in place such the delivery of basic services such as improved sanitation[3]. Policies designed to

ameliorate the delivery of services such as clean water, sanitation, and maternal care are critical in reducing the incidence of maternal mortality. Turkey, for example, was successful in decreasing maternal mortality through an improvement in health care delivery and a focus on expectant mothers. For the growth rate of the labor force, we use the 2000-2010 average annual growth rate of population, since data on the former is not readily available.

Finally, to capture the tendency for poor countries to grow faster than rich countries, termed β-convergence, as shown by Barro and Sala i Martin (1990) we include the initial (2000) level of real GDP per capita. The primary reason for this convergence result in neoclassical growth models is diminishing returns to physical capital. We thus expect that the coefficient estimate on this variable to have a negative sign.

Data for all variables are from the *2012 World Development Report* and the *2012 World Bank Indicators.*

5. Empirical Results

Table 1 gives least-squares estimates of regression coefficients in equation (4) for a sample of seventy-eight developing countries. We observe that all explanatory variables are statistically significant at the 5 percent or lower level and all but one coefficient estimates do have their anticipated sign. The goodness of fit of the model is quite good as indicated by the value of 0.449 of the adjusted coefficient of determination.

Table 1. Dependent variable: Growth Rate of GDP per capita

	Coefficient Estimates	***t-Statistics***
Intercept	3.591	3.384
2000PGDP	-0.0002	-2.342**
I/Y	0.097	2.786***
malelife	52.829	4.237***
femlife	-54.138	-4.144***
lifegap	-54.863	-4.047***
sanit	0.113	4.190***
pop	-0.624	-2.358**

Notes:
(1) Observations n = 78;
(2) Adjusted $R^2 = 0.449$;
(3) ** and *** indicate statistical significance at the level of 5% and 1%, respectively.

As the share of gross capital formation in the GDP of a developing country increases by 1 percentage point, we would expect an increase of 0.10 percentage point in growth rate of GDP per capita, other things being equal. All else equal, a one-percentage point increase in the annual growth rate of male life expectancy is expected to lead to an increase of 53 percentage points in growth rate of GDP per capita, while this rate is expected to decrease by about 0.02 percentage point for every one-hundred dollar increase in the 2000 GDP per capita level. This latte result is consistent with β-convergence, even though its effect is rather weak.

On the other hand, a one-percentage point decrease in the percentage change in the ratio of male to female life expectancy, i.e., a narrowing of gender gap in health as proxied by this variable, is expected to result in a 55 percentage point increase in growth rate of GDP per capita. Ceteris paribus, as the growth rate of the share of the total population having access to improved sanitation services increases by one percentage point, we would expect growth rate of GDP per capita to increase by 0.11 percentage point.

Finally, regression results show a negative effect of the percentage change in female life expectancy on economic growth. This result is similar to Barro and Lee (1994), Barro and Lee

(1996), and Barro and Sala-i-Martin (2003) who find that including male and female primary and secondary schooling results in the coefficient associated with female schooling being negative. While they attribute this negative sign to a reflection of a large gap in schooling between genders, which in turn may be viewed as a proxy for backwardness, we suspect that in our case this is due the high collinearity between the percentage change in male and female life expectancy as well as between this latter variable and the percentage change in the gap between male and female life expectancy, as attested to by the sample correlation coefficient which is reported in Table 2.

Table 2. *Sample Correlation Coefficient Matrix*

2000PGDP	1						
I/Y	-0.181	1					
	-1.605						
malelife	-0.104	0.141	1				
	-0.912	1.239					
femlife	-0.083	0.218	0.961	1			
	-0.723	**1.950**	**30.189**				
lifegap	-0.078	-0.315	-0.039	-0.312	1		
	-0.682	**-2.892**	-0.340	**-2.865**			
sanit	-0.036	0.018	0.148	0.157	-0.050	1	
	-0.317	0.153	1.301	1.390	-0.439		
pop	-0.284	-0.132	0.350	0.286	0.198	-0.032	1
	-2.582	-1.164	**3.257**	**2.604**	**1.759**	-0.276	

Note: Bold t-statistics imply statistical significance at the 5% or lower level.

The effect of population growth on growth of GDP per capita, as expected, is negative and statistically significant. For every one percentage point increase in the average annual growth rate of the total population, we expect growth rate of GDP per capita to decline by 0.62 percentage point.

From the statistical results we are able to make the following policy recommendations:

First, governments in developing countries need to devise programs aimed at reducing gender gaps in this priority area in order to promote greater economic growth;

Second, governments in these countries need to continue policies designed to improve life expectancy of both men and women to encourage further growth;

Third, their efforts to allow their population greater access to improved sanitation services while reducing discrimination against women will go a long way toward promoting further economic growth; and

Fourth, governments in developing countries need to implement measures to curb population growth in order to achieve higher growth in GDP per capita.

6. Conclusion

In this paper we formulate a simple growth model that incorporates the effect of gender gaps in human capital, namely in health, and specify a statistical model to empirically test this effect using

data from a sample of seventy-eight developing economies. From the statistical results we are able to draw the following conclusions:

1. Within the set of seventy-eight developing economies used in this study, gender equality in health as proxied by life expectancy has a positive impact on growth of GDP per capita. Governments in these countries need to devise programs aimed at reducing gender gaps in this priority area in order to promote greater economic growth.
2. Governments in developing countries need to continue policies designed to improve life expectancy of both men and women to encourage further growth.
3. Government efforts to allow their population greater access to improved sanitation services while reducing discrimination against women will go a long way toward promoting further economic growth.
4. Results of this study also indicate weak β-convergence. This suggests that while physical capital may be subject to diminishing returns, human capital may mitigate such diminishing returns.
5. Governments in developing countries need to implement measures to curb population growth in order to achieve higher growth rate in GDP per capita.

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Notes

[1] The sample consists of the following 78 countries: Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Chile, China, Democratic Republic of Congo, Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Czech Republic, Ecuador, Egypt, Ethiopia, Georgia, Ghana, Greece, Guinea, Hungary, India, Indonesia, Iran, Israel, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lao PDR, Lithuania, Malawi, Malaysia, Mali, Mexico, Moldova, Morocco, Nepal, Nicaragua, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Senegal, Sierra Leone, Slovak Republic, South Africa, Sri Lanka, Sudan, Syrian Arab Republic, Tajikistan, Tanzania,Thailand, Tunisia, Turkey, Uganda, Ukraine, Uruguay, Uzbekistan, Vietnam, Zambia, and Zimbabwe.

[2] We included the ratio of girls to boys' enrollments in primary and secondary school, as well as both male and female primary education completion rates, but these variables were found to be statistically insignificant and thus were dropped from the statistical model.

[3] We did include in the statistical model both the fractions of the rural and urban population having access to an improved water source, but found them to be insignificant and therefore removed them.