Hindawi Publishing Corporation
Economics Research International
Volume 2012, Article ID 715419, 8 pages
doi:10.1155/2012/715419

Research Article

Gender Gaps in Human Capital in Developing Countries: An Empirical Assessment

Minh Quang Dao

Department of Economics, Eastern Illinois University, 600 East Lincoln Avenue, Charleston, IL 61920, USA

Correspondence should be addressed to Minh Quang Dao, mqdao@eiu.edu

Received 21 March 2012; Accepted 30 April 2012

Academic Editor: Colin C. Williams

This paper examines the impact of various determinants on gender gaps in human capital in developing countries. We find that female primary completion is dependent on per capita GDP growth, female employment in agriculture, in industry, and in services, and the interactions between per capita GDP growth and female employment in industry and in services. We are also able to show that the ratio of girls to boys' enrollments in primary and secondary schools is a function of the poverty rate, the fraction of the population with access to an improved water source, and maternal mortality. In addition, we observe that girls' mortality is dependent upon the fraction of the population having access to improved sanitation and water services, and ethnic fractionalization. Finally, we find that maternal mortality is a function of the fraction of the population with access to improved water services, the fraction of births attended by skilled staff, the fraction of women receiving prenatal care, and ethnic fractionalization. These statistical results can assist developing countries identify areas that need to be improved upon in order to reduce gender gaps in human capital—specifically those concerning female mortality and education.

1. Introduction

Over the last twenty-five years, the lives of girls and women have undergone a dramatic change. There are now more literate girls and women than before and more girls than boys are in school in a third of developing economies. However, there are still around 3.9 million girls and women estimated to be dying each year in many low- and middle-income developing countries. Girls and women who live in poor countries or in those with a high degree of ethnic fractionalization continue to lag behind the progress toward gender equality.

One priority area for policy going forward pointed out by the *2012 World Development Report: Gender Equality and Development* is the reduction in gender gaps in human capital, namely, those concerning female mortality and education. This paper attempts to estimate the impact of the underlying determinants of gender gaps in this priority area. Based on data from the World Bank for the 2004–2009 period and a sample of fifty (The sample consists of the following countries: Argentina, Armenia, Azerbaijan, Belarus, Bolivia, Bulgaria, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt Arab Republic, El Salvador, Ethiopia, Georgia, Greece, Guatemala, Honduras, Hungary, Indonesia, Iraq, Israel, Jordan, Kazakhstan, Kyrgyz Republic, Lithuania, Mali, Mexico, Moldova, Morocco, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Senegal, Serbia, Slovak Republic, Sri Lanka, Syrian Arab Republic, Tanzania, Togo, Turkey, Uruguay, and Venezuela.) developing economies, we find that the female primary completion rate is dependent on the growth rate of per capita GDP and the shares of female employment in agriculture, in industry, and in services as well as the interaction between per capita GDP growth and the share of female employment in industry and that between per capita GDP growth and the share of female employment in services. On the other hand, using a sample of forty-five countries (The sample consists of the following countries: Argentina, Armenia, Bangladesh, Bolivia, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, China, Colombia, Dominican Republic, Ecuador, El Salvador, Ethiopia, Georgia, Ghana, Guatemala, Guinea, India, Indonesia, Kenya, Kyrgyz Republic, Lao PDR, Madagascar, Malawi, Mali, Mauritania, Moldova, Morocco, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Philippines, Rwanda, Senegal, Tajikistan, Tanzania, Uganda, Uzbekistan, and Zambia.), we are able to show that the ratio of girls to boys enrollments in primary and secondary schools is a linear function of the fraction of the population below the international poverty line of $2.00 a day, of both the fraction of the rural and urban population with access to an improved water source and of the maternal mortality ratio. From another sample of fifty-nine (The sample consists of the following countries: Albania, Armenia, Azerbaijan, Bangladesh, Benin, Bolivia, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Colombia, Democratic Republic of Congo, Republic of Congo, Croatia, Dominican Republic, Ecuador, Egypt Arab Republic, Ethiopia, Georgia, Ghana, Guinea, Haiti, Honduras, India, Indonesia, Iraq, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Madagascar, Malawi, Mali, Mauritania, Moldova, Morocco, Nepal, Niger, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Serbia, Sierra Leone, Somalia, Sudan, Syrian Arab Republic, Tajikistan, Tanzania, Togo, Turkey, Uganda, Ukraine, Uzbekistan, Zambia, and Zimbabwe.) developing economies, we observe that the girls mortality rate is dependent upon the fraction of the population having access to improved sanitation facilities, the fraction of the rural population having access to an improved water source, and the degree of ethnic fractionalization. Finally, using a sample of fifty-six (The sample consists of the following countries: Albania, Azerbaijan, Bangladesh, Benin, Bolivia, Bosnia and Herzegovina, Brazil, Burkina Faso, Cambodia, Cameroon, Central African Republic, China, Democratic Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Dominican Republic, Egypt Arab Republic, El Salvador, Ghana, Guinea, Haiti, India, Indonesia, Iraq, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lao PDR, Madagascar, Malawi, Mali, Mauritania, Mexico, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Rwanda, Sierra Leone, Somalia, Sudan, Tajikistan, Thailand, Turkey, Uganda, Ukraine, Uzbekistan, Zambia, and Zimbabwe.) developing countries, we find that the maternal mortality ratio is a function of both the fraction of the rural and urban population with access to an improved water source, the fraction of births attended by skilled health staff, the fraction of pregnant women receiving prenatal care, and the degree of ethnic fractionalization. Statistical results of such empirical examination will assist governments in developing countries identify areas that need to be improved upon in order to increase female educational attainment and reduce gender gaps in human capital—specifically those that address female mortality and education. We argue that public actions play an important role in addressing these determinants, such as, for instance, the improvement of service delivery for clean water, sanitation, and prenatal and maternal care.

This paper is organized as follows. In the next section, a selected review of the economic literature on gender gaps is presented. Then the formulation of a statistical model to be estimated is discussed. 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 Literature

Ethnicity is an important factor contributing to the understanding and addressing of gender gaps. Lewis and Lockheed [1] estimate that two-thirds of girls who are out of school globally are part of ethnic minorities in their own countries. And this is true even for countries that have experienced rapid economic growth. As a result, wide gender gaps in education persist. Chioda et al. [2] find indigenous women in Guatemala suffer a 60 percent illiteracy rate, putting them 20 percentage points above their male counterparts and twice the rate of their nonindigenous counterparts. Similarly, according to Hannum and Wang [3], rural ethnic minorities in China have less access to education and health than the Han, Hui, and Manchu who are more urban.

Poverty is another important element in the persistence of gender inequality. According to the UNESCO [4], a wealthy urban child attains on average around 10 years of education whereas a poor rural girl has less than 6 months. In 2008, for every 100 male tertiary students in sub-Saharan Africa and every 76 in South Asia, there were only 66 female students. According to Yuki et al. [5], one of the greatest gender gaps in net enrollment rates in the world can be found in the Republic of Yemen and that it has been difficult to sustain any kind of progress in reducing these gaps. For some parts of society, not all men and women have shared equally the benefits of economic growth. In fact, according to the *2012 World Development Report*, greater gender equality on all fronts is not guaranteed by income growth per se. Gender gaps only close quickly when *growth* in conjunction with the functioning and the evolution of *markets* and *institutions*—both *formal* and *informal*—has played out and when they all interact to influence *household* decisions in favor of educating girls and young women across a broad range of countries.

The same kind of remark can be made with respect to gender gaps in health. In Vietnam, for example, more than 60% of female ethnic minorities have childbirth without prenatal care, a rate which is twice as many as that for the majority of the Kinh women [6]. Poverty seems to be the culprit here as well, as rich people have lower fertility rates which imply lower risk of childbirth deaths. As far as mortality of girls in infancy and early childhood is concerned, this is primarily due to the failure of institutions to provide clean water and sanitation. Female mortality in infancy is high in countries where there is a high burden of infectious diseases. On the other hand, developing countries like Bangladesh, China, and Vietnam that have improved access to clean water and sanitation have also experienced significant reductions in excess girl morality during the last twenty years [6]. As Waddington et al. [7] argue, part of the solution is the provision of clean water at the point of use through piped delivery since water treatment at the source may be less effective in the reduction of diarrhea deaths due to the potential for recontamination. Björkman and Svensson [8] also document that child mortality in Uganda is reduced when public primary healthcare providers are monitored by their communities.

Insofar as high maternal mortality is concerned; the main reason for it is a failure of institutions to provide medical care and services to expectant mothers. Prata et al. [9] show that in most developing countries the implementation of interventions designed to reduce maternal mortality faces serious challenges such as the availability of unreliable data as well as the shortage in both human and financial resources and limited political involvement. They argue that to achieve a decline in maternal mortality requires increased commitments on the part of local, national, and international political bodies, delegating some clinical tasks from higher-level healthcare providers to mid- and lower-level ones, and improvement of health-management information systems.

Building upon the first priority area for policy going forward of the reduction in gender gaps in human capital, namely, those addressing female education and mortality, in this paper we wish to empirically analyze the effect of the various determinants of these gaps using four samples of developing countries. We first hypothesize that female educational attainment as measured by the female primary completion rate in a developing country is a function of the following factors: per capita GDP growth rate and the fractions of females employed in agriculture, industry, and services. We then revise the statistical model to account for the interaction between per capita GDP growth and those fractions. Next, we hypothesize that gender gaps in education as measured by the ratio of girls to boys enrollments in primary and secondary schools depends on the following determinants: the poverty rate as measured by the fraction of the population below the international poverty line of \$1.25 a day, of \$2 a day, and the poverty gap at \$1.25 a day, the fraction of the population having access to improved sanitation facilities, those of both the rural and urban population having access to an improved water source, and the maternal mortality ratio. We then hypothesize that the girls mortality rate is a function of the following factors: the fraction of the population having access to improved sanitation facilities, those of both the rural and urban population having access to an improved water source, and the degree of ethnic fractionalization. Finally, the maternal mortality ratio is hypothesized to depend on the following determinants: the fraction of the population having access to improved sanitation facilities, those of both the rural and urban population having access to an improved water source, the fraction of births attended by skilled health staff, the fraction of pregnant women receiving prenatal care, and the degree of ethnic fractionalization.

3. The Statistical Models

If we assume that various exogenous factors affect the female primary completion rate in a developing country, we can state the following statistical model:

$$\begin{aligned}\text{FemPrim} = \; & \underset{}{\beta_0} + \underset{(+)}{\beta_1 \text{gpc}} + \underset{(+)}{\beta_2 \text{FemAgEmp}} + \underset{(+)}{\beta_3 \text{FemIndEmp}} \\ & + \underset{(+)}{\beta_4 \text{FemSerEmp}} + \epsilon,\end{aligned} \tag{1}$$

where FemPrim = female completion rate, 2006–2010. gpc = gross domestic product per capita growth rate, 2009–2010. FemAgEmp = share of female employment in agriculture, 2006–2009. FemIndEmp = share of female employment in industry, 2006–2009. FemServEmp = share of female employment in services, 2006–2009.

According to the *2012 World Development Report*, economic growth which results in higher incomes makes it possible for households that previously could only send their sons to school to be able to now send their daughters as well. In addition, as countries develop, they are better able to build schools and hire teachers and thus make education systems more accessible. To capture this effect, we include the growth rate of per capita GDP for the 2009–2010 period and expect the coefficient estimate of this variable to have a positive sign.

Economic growth also changes the economic structures of a country such that there are more prominent activities in which males no longer have a comparative advantage. This change provides new opportunities for female employment. As a large proportion of the female labor force is engaged in all sectors of the economy, families respond to these opportunities by investing more in their daughters education. We thus include the shares of female employment in agriculture, industry, and services and expect the coefficient estimate for these variables to be positive.

To estimate the impact of poverty and institutions on the gender gap in primary and secondary education, we specify the following statistical model:

$$\begin{aligned}\text{GirlBoyEd} = \; & \beta_0 + \underset{(-)}{\beta_1 \text{Pov\$1.25}} + \underset{(-)}{\beta_2 \text{PovGap\$1.25}} + \underset{(-)}{\beta_3 \text{Pov\$2}} \\ & + \underset{(+)}{\beta_4 \text{Sanit}} + \underset{(+)}{\beta_5 \text{H}_2\text{ORural}} + \underset{(+)}{\beta_6 \text{H}_2\text{OUrban}} \\ & + \underset{(-)}{\beta_7 \text{MatMort}} + \epsilon,\end{aligned} \tag{2}$$

where GirlBoyEd = ratio of girls to boys enrollments in primary and secondary schools, 2009. Pov\$1.25 = fraction of the population below the international poverty line at \$1.25 a day, various years. PovGap\$1.25 = poverty gap at \$1.25 a day, various years. Pov\$2 = fraction of the population below the international poverty line at \$2 a day, various years. Sanit = fraction of the population having access to improved sanitation services, in 2008. H_2O Rural = fraction of the rural population having access to an improved water source, in 2008.H_2O Urban = fraction of the urban population having access to an improved water source, in 2008. MatMort = maternal mortality ratio, per 100,000 live births, 2004–2009.

Poverty excludes girls and young women from having access to education. In spite of the overall progress, in many sub-Saharan countries and some parts of South Asia, primary and secondary school enrollments for girls continue to be much lower than those for boys. In Mali, for example, school enrollments for girls are the equivalent of those in the United States in the early 1800s, while Pakistan and

Ethiopia do not fare any much better. We choose three measures of poverty to assess its impact on gender gaps in education, namely, the fraction of the population below the international poverty line of \$1.25 a day, of \$2 a day, and the poverty gap at \$1.25 a day. We expect the coefficient estimate for these variables to have a negative sign.

In addition, addressing pockets of gender disadvantage in education requires the delivery of basic services such as clean water and improved sanitation. As a result, we choose to include in the statistical model both the fractions of the rural and urban population having access to an improved water source as well as that of the total population having access to improved sanitation services and expect the coefficient estimates for these variables to have a positive sign.

In developing countries with high fertility rates, there is a higher incidence of deaths associated with maternal mortality. Higher maternal mortality results in fewer women who can invest their time in acquiring human capital such as education since the returns on this investment are incurred over a much shorter time horizon. This in turn leads to forward-looking parents' responses to invest less in the education of their daughters and feeds the vicious cycle of underinvestment in girls schooling [6]. We include maternal mortality ratio to capture this adverse effect and expect its coefficient estimate to have a negative sign.

We next examine the effects of institutions and ethnicity on girls mortality rate by specifying the following statistical model:

$$\begin{aligned}\text{GirlMort} = \beta_0 &+ \underset{(-)}{\beta_1 \text{Sanit}} + \underset{(-)}{\beta_2 \text{H}_2\text{ORural}} + \underset{(-)}{\beta_3 \text{H}_2\text{OUrban}} \\ &+ \underset{(+)}{\beta_4 \text{Ethnic}} + \epsilon,\end{aligned} \tag{3}$$

where GirlMort = the probability of a 1-year-old girl dying before reaching the age of 5, 2004–2009. Sanit = fraction of the population having access to improved sanitation services, in 2008. H_2O Rural = fraction of the rural population having access to an improved water source, in 2008. H_2O Urban = fraction of the urban population having access to an improved water source, in 2008. Ethnic = index of ethnic diversity with 1 for a country that is completely ethnically diverse and 0 for a country that is ethnically homogeneous.

According to the *2012 World Bank Report*, the improvement in the delivery of services, especially of clean water and sanitation, is of primary importance in reducing the excess deaths of girls in infancy and early childhood in developing countries. Vietnam, for example, has been able to decrease excess mortality among young girls by an expansion of access to clean water and improved sanitation. To capture this effect we thus include both the fractions of the rural and urban population having access to an improved water source as well as that of the total population having access to improved sanitation services and expect the coefficient estimates for these variables to have a negative sign.

Ethnicity is another important factor in understanding and addressing gender inequality. In Vietnam, for example, more than three-fifths of childbirths occur without prenatal care, twice the rate for the majority Kinh, while in China rural ethnic minorities have less access to health than the more urban Han, Hui, and Manchu. We thus include an index of ethnic diversity as an explanatory variable and expect its coefficient estimate to have a positive sign.

Finally, we investigate the impact of institutions and ethnicity on the maternal mortality ratio by specifying the following statistical model:

$$\begin{aligned}\text{MatMort} = \beta_0 &+ \underset{(-)}{\beta_1 \text{Sanit}} + \underset{(-)}{\beta_2 \text{H}_2\text{ORural}} + \underset{(-)}{\beta_3 \text{H}_2\text{OUrban}} \\ &+ \underset{(-)}{\beta_4 \text{SkilBirths}} + \underset{(-)}{\beta_5 \text{Prenatal}} + \underset{(+)}{\beta_6 \text{Ethnic}} + \epsilon,\end{aligned} \tag{4}$$

where MatMort = maternal mortality ratio, per 100,000 live births, 2004–2009. Sanit = fraction of the population having access to improved sanitation services, in 2008. H_2O Rural = fraction of the rural population having access to an improved water source, in 2008. H_2O Urban = fraction of the urban population having access to an improved water source, in 2008. SkilBirths = percentage of total births attended by skilled health staff, 2006–2010. Prenatal = percentage of pregnant women receiving prenatal care, 2006–2010. Ethnic = index of ethnic diversity with 1 for a country that is completely ethnically diverse and 0 for a country that is ethnically homogeneous.

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 healthcare delivery and a focus on expectant mothers. We thus choose to include both the fractions of the rural and urban population having access to an improved water source as well as that of the total population having access to improved sanitation services as well as the percentage of total births that are attended by skilled health staff and the percentage of pregnant women receiving prenatal care. We expect the coefficient estimates for these variables to have a negative sign. We again include an index of ethnic diversity in the statistical model and expect its coefficient estimate to have a positive sign. Data for all variables are from the *2012 World Development Report,* the *2011 World Bank Indicators*, and Alesina et al. [10].

4. Empirical Results

Table 1 gives least-squares estimates of regression coefficients in (1) for a sample of fifty developing countries. We observe that three explanatory variables are statistically significant, and their coefficient estimates do have the anticipated positive sign. As per capita GDP in a developing country increases by 1 percent, we would expect an increase of 0.75 percentage point in its female completion rate, other things being equal. All else equal, a one-percentage point increase in female employment in agriculture is expected to lead to

Table 1: Dependent variable: female completion rate.

	Coefficient estimate	t-statistic
Intercept	−42.777	−0.768
gpc	0.757	1.409
FemAgEmp	1.137	1.997**
FemIndEmp	1.449	2.157**
FemServEmp	1.404	2.551*

Adjusted $R^2 = 0.244$.
*Significant at the 1 percent level.
**Significant at the 5 percent level.

Table 2: Dependent variable: female completion rate (with interaction terms).

	Coefficient estimate	t-statistic
Intercept	−58.648	−0.709
gpc	11.779	0.414
FemAgEmp	1.026	1.221
FemIndEmp	1.593	1.730*
FemServEmp	1.646	1.980*
FemAgEmgpc	−0.006	−0.022
FemIndEmgpc	−0.203	−0.546
FemSerEmgpc	−0.121	−0.442

Adjusted $R^2 = 0.395$.
*Statistically significant at the 10 percent level.

an increase of 1.14 percentage point in female completion rate, while this rate is expected to increase by about 1.45 percentage point for every one percentage point increase in the female employment rate in industry. On the other hand, a one-percentage point increase in female employment rate in the service sector is expected to result in a 1.40 percentage point increase in female completion rate.

However, as pointed out in the *2012 World Development Report*, gender gaps have been quickly reduced in countries due not only to growth and the functioning of markets themselves but also to their interactions. Income growth, for example (by loosening budget constraints and markets (by opening new employment opportunities for women)) have all joined forces to impact household decisions in favor of educating girls and young women across a broad spectrum of developing countries.

Table 2 reports regression results when interaction terms are included in the statistical model. We observe that explanatory power of the model has increased significantly, as attested to by the higher value of 0.395 of the adjusted coefficient of determination. However, the female employment in agriculture variable is no longer statistically significant.

A backward elimination stepwise method was applied to arrive at a revised model, the regression results of which are reported in Table 3. The goodness of fit of the model is slightly improved as indicated by the higher value of 0.409 of the adjusted coefficient of determination. All independent variables are now statistically significant, including per capita GDP growth. All else equal, as per capita GDP grows by 1 percent we expect female completion rate to increase by

Table 3: Dependent variable: female completion rate (with interaction terms) revised model.

	Coefficient estimate	t-statistic
Intercept	−57.274	−1.095
gpc	11.166	4.022*
FemAgEmp	1.012	1.898***
FemIndEmp	1.578	2.634*
FemServEmp	1.633	3.042*
FemIndEmgpc	−0.195	−2.011**
FemSerEmgpc	−0.115	−3.565*

Adjusted $R^2 = 0.409$.
*Statistically significant at the 1 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 10 percent level.

Table 4: Dependent variable: ratio of girls to boys' enrollments in primary and secondary schools.

	Coefficient estimate	t-statistic
Intercept	112.782	7.748
Pov$1.25	−0.009	−0.698
PovGap$1.25	−0.026	−0.194
Pov$2	−0.044	−0.599
Sanit08	0.041	0.621
H_2O rural	0.130	1.358
H_2O urban	−0.259	−1.742*
MatMort	−0.007	−0.803

Adjusted $R^2 = 0.279$.
*Significant at the 10 percent level.

11 percentage points. Female employment in all sectors is statistically significant, and their coefficient estimates do have the anticipated positive sign. All else equal, a one-percentage point increase in female employment in agriculture is expected to lead to an increase of 1.01 percentage point in female completion rate, while this rate is expected to increase by about 1.58 percentage point for every one percentage point increase in the female employment rate in industry. On the other hand, a one-percentage point increase in female employment rate in the service sector is expected to result in a 1.63 percentage point increase in female completion rate.

We also note that countries with high per capita GDP growth concomitant with high female employment rate in industry and/or service have slightly lower female completion rates. A possible explanation for this finding is the higher opportunity cost of female schooling associated with expanding female employment opportunities resulting in parents' decisions unfavorable to educating girls and young women.

Table 4 gives least-squares estimates of regression coefficients in (2) for a sample of forty-five developing countries. We observe that only one explanatory variable is statistically significant and its coefficient estimate does not have the anticipated positive sign.

A backward elimination stepwise method was applied to arrive at a revised model, the regression results of which

Table 5: Dependent variable: ratio of girls to boys' enrollments in primary and secondary schools (revised model).

	Coefficient estimate	t-statistic
Intercept	117.286	8.766
Pov$2	−0.064	−1.175
H_2O rural	0.168	1.978*
H_2O urban	−0.297	−2.165**
MatMort	−0.010	−1.402

Adjusted $R^2 = 0.315$.
*Significant at the 10 percent level.
**Significant at the 5 percent level.

Table 6: Sample correlation coefficient matrix.

	Pov$2	H_2O rural	H_2O urban	MatMort
Pov$2	1			
H_2O rural	−0.551 **−4.332**	1		
H_2O urban	−0.406 **−2.913**	0.556 **4.386**	1	
MatMort	0.722 **6.833**	−0.663 **−5.808**	−0.560 **−4.430**	1

Note: bold t-statistics imply statistical significance at the 1 percent or lower level.

are reported in Table 5. The goodness of fit of the model is significantly improved as indicated by the higher value of 0.315 of the adjusted coefficient of determination. One more independent variable is now statistically significant, namely, the fraction of the rural population having access to an improved water source, and its coefficient estimate does have the expected positive sign. While t-tests imply statistical insignificance of the other two explanatory variables, this is due to the severe degree of multicollinearity among all four explanatory variables, as shown by the correlation coefficient matrix reported in Table 6. When we exclude these two variables from the model, the value of the adjusted coefficient of determination decreases noticeably.

All else equal, a one-percent increase in the fraction of the population below the $2 international poverty line is expected to lead to a reduction of 0.06 percentage point in the ratio of girls to boys enrollments in primary and secondary education. On the otherhand, a one-percent increase in the fraction of the rural population having access to an improved water source, is expected to result in an increase of 0.17 percentage point in the ratio of girls to boys enrollments in primary and secondary education whereas a one maternal death per 100,000 live births is expected to lead to a decrease of 0.01 percentage point in the ratio of girls to boys enrollments in primary and secondary education, ceteris paribus.

Table 7 gives least-squares estimates of regression coefficients in (3) for a sample of fifty-nine developing countries. We observe that only one explanatory variable is statistically significant and its coefficient estimate does have the anticipated negative sign. The goodness of fit of the model is very good as indicated by the high value of 0.513 of the adjusted coefficient of determination. All else equal, as the fraction of the population having access to improved sanitation services increases by one percent, one would expect the girls mortality rate to decrease by 0.45 percentage point.

Table 7: Dependent variable: girls' mortality rate.

	Coefficient estimate	t-statistic
Intercept	65.608	2.226
Sanit	−0.447	−2.887*
H_2O rural	−0.356	−1.523
H_2O urban	0.006	0.017
Ethnic	23.886	1.556

Adjusted $R^2 = 0.513$.
*Significant at the 1 percent level.

Table 8: Dependent variable: girls' mortality rate (revised model).

	Coefficient estimate	t-statistic
Intercept	66.013	3.901
Sanit	−0.447	−3.013*
H_2O rural	−0.355	−1.639**
Ethnic	23.938	1.606**

Adjusted $R^2 = 0.521$.
*Significant at the 1 percent level.
**Significant at the 10 percent level.

Table 9: Dependent variable: maternal mortality rate.

	Coefficient estimate	t-statistic
Intercept	1220.092	5.500
Sanit	−1.135	−0.841
H_2O rural	−4.528	−2.587**
H_2O urban	−5.515	−1.867***
SkilBirths	−5.382	−3.131*
Prenatal	3.393	1.811***
Ethnic	127.620	1.224

Adjusted $R^2 = 0.706$.
*Significant at the 1 percent level.
**Significant at the 5 percent level.
***Significant at the 10 percent level.

A backward elimination stepwise method was applied to arrive at a revised model, the model, the regression results of which are reported in Table 8. The goodness of fit of the model is slightly improved as indicated by the higher value of 0.521 of the adjusted coefficient of determination. All independent variables are now statistically significant and their coefficient estimates do have their expected sign. Ceteris paribus, a one-percent increase in the fraction of the rural population having access to an improved water source is expected to lead to a decrease of 0.36 percentage point in girls mortality rate, while a one-unit change in the ethnic diversity index results in a 24 percentage point increase in the probability of a 1-year-old girl dying before reaching the age of 5.

Table 9 gives least-squares estimates of regression coefficients in (4) for a sample of fifty-six developing countries. We observe that all but two explanatory variables are statistically significant and only the coefficient estimate of the percentage

Table 10: Dependent variable: maternal mortality rate (revised model).

	Coefficient estimate	t-statistic
Intercept	1213.048	5.488
H_2O rural	−5.120	−3.204*
H_2O urban	−5.454	−1.852***
SkilBirths	−6.236	−4.513*
Prenatal	3.730	2.044**
Ethnic	144.392	1.415

Adjusted R^2 = 0.707.
*Significant at the 1 percent level.
**Significant at the 5 percent level.
***Significant at the 10 percent level.

Table 11: Sample correlation coefficient matrix.

	H_2O rural	Ethnic	H_2O Urban	SkilBirths	Prenatal
H_2O rural	1				
Ethnic	−0.408	1			
	−3.280				
H_2O urban	0.683	−0.209	1		
	6.878	−1.571			
SkilBirths	0.587	−0.309	0.545	1	
	5.330	**−2.388**	**4.776**		
Prenatal	0.456	−0.134	0.452	0.694	1
	3.764	−0.991	**3.726**	**7.078**	

Note: bold t-statistics imply statistical significance at the 5 percent or lower level.

of pregnant women receiving prenatal care variable does not have the anticipated negative sign. The goodness of fit of the model is very good as indicated by the high value of 0.706 of the adjusted coefficient of determination. All else equal, as the fraction of the rural population having access to an improved water source increases by one percent, one would expect the number of maternal deaths to decrease by 5 for every 100,000 live births. On the other hand, a one-percent increase in the fraction of the urban population having access to an improved water source is expected to lead to an increase of 6 maternal deaths per 100,000 live births, ceteris paribus. A one-percent increase in the number of births attended by skilled health staff is expected to result in a decrease of 5 maternal deaths per 100,000 live births, holding all other variables constant.

A backward elimination stepwise method was applied to arrive at a revised model, the regression results of which are reported in Table 10. The goodness of fit the model of does not change much as attested to by the value of 0.707 of the adjusted coefficient of determination. The results are qualitatively the same, with the exception that the effect of ethnic diversity on the maternal mortality rate is higher at 144 maternal deaths for every 100,000 live births, all else being equal.

While t-tests imply statistical insignificance of the ethnic diversity variable, this is due to the severe degree of multicollinearity among all five explanatory variables, as shown by the correlation coefficient matrix reported in Table 11. When we exclude this variable from the model, the value of the adjusted coefficient of determination decreases noticeably.

5. Conclusion

In this paper we use four statistical models and data from four samples of developing economies to empirically analyze the impact of several explanatory variables on the female primary completion rate, the ratio of girls to boys enrollments in primary and secondary schools, the girls mortality rate, and the maternal mortality ratio. From the statistical results we are able to draw the following conclusions.

(1) Within the set of fifty developing economies used in this study, per capita GDP growth has a positive impact on female primary completion rate, along with the shares of female employment in agriculture, industry, and services. Governments in these countries need to devise programs aimed at fostering economic growth and providing employment opportunities for women in all sectors of the economy in order to promote greater gender equality in education. On the other hand, the interaction between growth and employment opportunities may result in slowing down the move toward more gender parity in education as the rising opportunity cost of female schooling may lead to parents' decisions that are unfavorable to educating girls and young women.

(2) Governments in developing countries need to pursue antipoverty policies while instituting programs to give their population more access to an improved water source as well as reducing maternal mortality to bring about greater gender equality in primary and secondary school enrollments.

(3) Government efforts to allow their population greater access to improved water source and sanitation services while reducing discrimination against ethnic minorities will go a long way toward reducing excess girls deaths in developing countries.

(4) To reduce maternal deaths, governments in developing countries should again provide their citizens with better access to an improved water source, a higher percentage of deliveries attended by personnel trained to give the necessary supervision, care, and advice to women during pregnancy, labor, and the postpartum period, as well as a higher percentage of pregnant women receiving prenatal care. They should also ensure that ethnic minority women receive adequate maternal care.

Acknowledgment

The author would like to thank Thi Minh Chi Le for her support during the completion of this paper.

References

[1] M. A. Lewis and M. E. Lockheed, *Inexcusable Absence: Why 60 Million Girls Aren't in School and What to Do about It*, Center for Global Development, Washington, DC, USA, 2006.

[2] L. Chioda, R. Gracia-Verdú, and A. M. Muñoz Boudet, *Work and Family: Latin American Women in Search of a New Balance*, World Bank, Washington, DC, USA, 2011, Office of the Chief Economist and Poverty Gender Group, LAC.

[3] E. Hannum and M. Wang, "China: a case study in rapid poverty reduction," in *Indigenous Peoples, Poverty and Development*, G. Hall and H. Patrinos, Eds., World Bank, Washington, DC, USA, 2010.

[4] UNESCO Institute for Statistics, *Global Education Digest 2010: Comparing Education Statistics across the World. Special Focus on Gender*, UNESCO Institute for Statistics, Montreal, Canada, 2010.

[5] T. Yuki, K. Mizuno, K. Ogawa, and M. Sakai, *Promoting Gender Parity, Lessons from Yemen: A JICA Technical Cooperation Project in Basic Education*, Japan International Cooperation Agency Research Institute, 2011, Background paper for the WDR 2012.

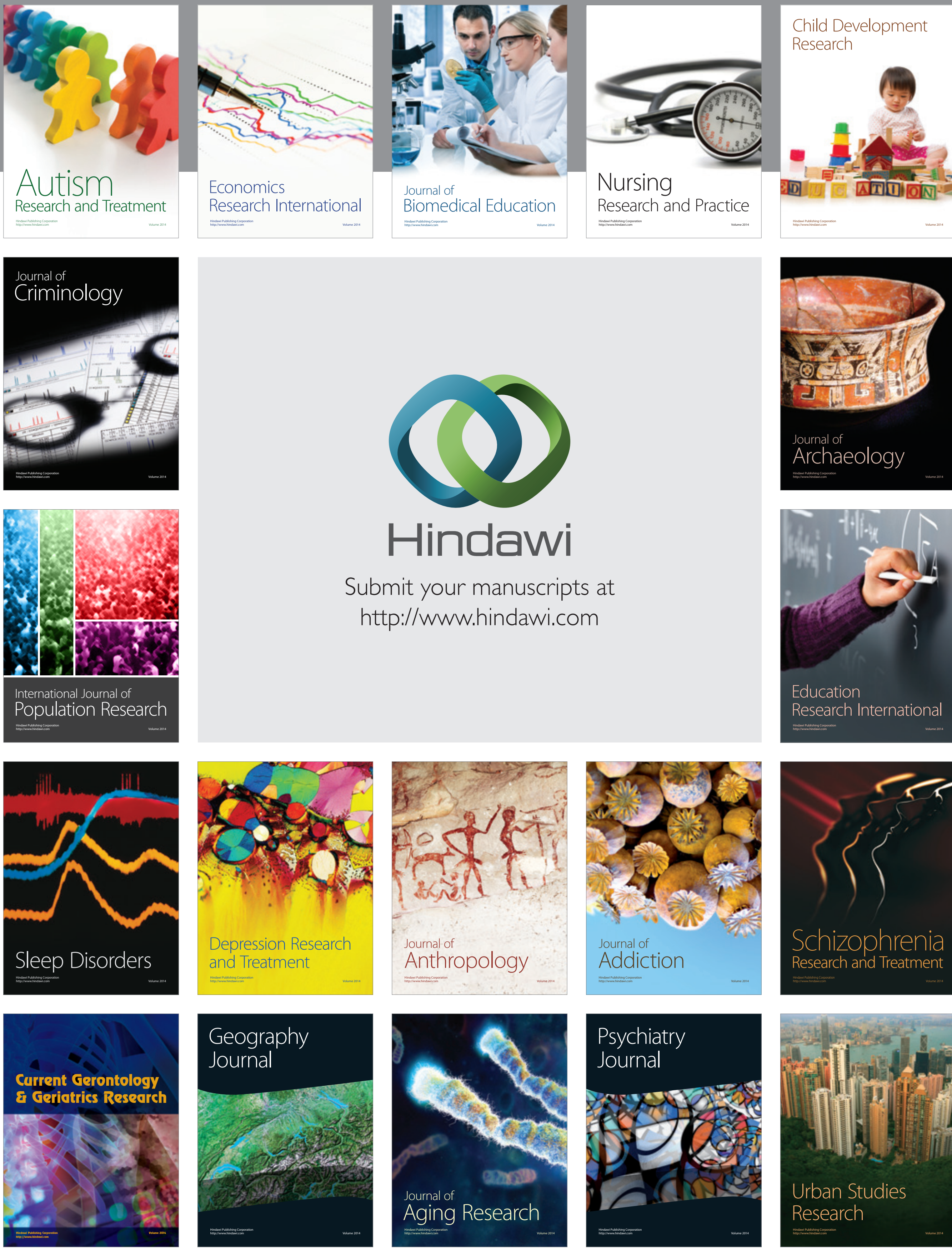
[6] *World Development Report 2012: Gender Equality and Development*, Oxford University Press, New York, NY, USA, 2012.

[7] H. Waddington, B. Snilstveit, H. White, and L. Fewtrell, *Water, Sanitation and Hygiene Interventions to Combat Childhood Diarrhoea in Developing Countries*, International Initiative for Impact Evaluation 31E, New Delhi, India, 2009, Synthetic Review.

[8] M. Björkman and J. Svensson, "Power to the people: evidence from a randomized field experiment on community-based monitoring in uganda," *Quarterly Journal of Economics*, vol. 124, no. 2, pp. 735–769, 2009.

[9] N. Prata, P. Passano, A. Sreenivas, and C. E. Gerdts, "Maternal mortality in developing countries: challenges in scaling-up priority interventions," *Women's Health*, vol. 6, no. 2, pp. 311–327, 2010.

[10] A. Alesina, A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg, "Fractionalization," *Journal of Economic Growth*, vol. 8, no. 2, pp. 155–194, 2003.


Autism
Research and Treatment
Economics
Research International
Journal of
Biomedical Education
Nursing
Research and Practice
Child Development
Research
Journal of
Criminology
Hindawi
Submit your manuscripts at
http://www.hindawi.com
Journal of
Archaeology
International Journal of
Population Research
Education
Research International
Sleep Disorders
Depression Research
and Treatment
Journal of
Anthropology
Journal of
Addiction
Schizophrenia
Research and Treatment
Current Gerontology
& Geriatrics Research
Geography
Journal
Journal of
Aging Research
Psychiatry
Journal
Urban Studies
Research