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DOES DEMOCRACY EXPLAIN GENDER DIFFERENTIALS IN EDUCATION?

Abstract: This study shows that despite a strong empirical association between gender differentials in enrolment ratios and democracy, that democracy alone does not explain gender differentials in education in Africa and Asia. The results indicate that income, employment in agriculture, religious heterogeneity and colonialism also help explain the under-representation of girls in education in these regions. Countries in which the duration of suffrage has been longer, tend to perform better on average in terms of gender equality in education.

JEL Codes: O11, O15, O43, O57.

Keywords: gender, education, democracy, suffrage.

1 Introduction

One of the United Nations Millineum Development Goals (MDG) was to eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education by 2015 (UN 2008). Gender disparity in education at the primary, secondary and tertiary levels continues to persist in certain regions. A number of studies have shown that gender inequality in education can negatively impact upon macroeconomic variables – economic growth (Shultz 1994, Knowles *et al*. 2002, Klassen 2002, Dollar and Gatti 1999), child mortality (Klassen and Wink 2002), fertility (Basu 2002). Educating girls has been shown to be an important foundation for creating the next generation of human capital as mothers are seen as crucial in determining the education and health of their children (Schultz 2002). "If girls remain uneducated, they are likely to become women who are illiterate, impoverished and less likely to raise healthy and educated families. Society cannot afford to allow another generation to forego its potential" (UNGEI 2008). Fanfuwa (1974) and Mann (1985) observe that the roots of gender discrimination arose during the colonial administration under which women were marginalised and their participation restricted in social and economic activity. This was inherited by post-colonial governments which continued to prioritise male education. A number of factors have given rise to increased attention on women's education in the recent past, including the collapse of authoritarian regimes in Eastern Europe and Latin America, the commitment to reducing fertility rates in Asia and Africa, globalisation and the increased participation of women in economic activity. Gender parity in education therefore can only be understood within the context of these changes in the political, social and economic spheres.

The relationship between economic growth and democracy has been examined in the work of Acemoglu *et al.* (2008), Londegran and Poole (1996); government sector size, efficiency, intervention and the quality of the government in La Porta *et al*. (1999; democracy, income, communism and Muslim culture in Borooah and Paldam (2007) and democratic transition in Huntingon (1991). Huntington cites the fall of authoritarian regimes and modernisation among factors for the transition to democracy by nations. Along the same line of reasoning, Borooah and Paldam show that poverty, communism and Muslim culture as constraints towards achieving higher levels of democracy. The hypothesis that education leads to increased democracy has been supported in the work of Barro (1999), Glaeser *et al.* (2004), and Papaioannou and Siourounis (2005). While many studies have been carried out on the effects of education on democracy, much less attention has been paid to the effects of democracy on education, see Brown (2000).

The present study contributes to the literature by examining specifically, the effects of democracy on gender inequality in education. The empirical results suggest that democracy alone does not fully explain gender differentials in education in Africa and Asia. This study also represents an initial effort at examining the effects of the *duration* of suffrage on gender in/equality in education. This may provide some explanation as to why some regions/countries perform better than others in terms of gender equality in education. The rest of this paper is structured as follows: Section 2 states the hypothesis, Section 3 explains the data, Section 4 discusses the empirical results and Section 5 summarizes the conclusions.

2 The Hypothesis

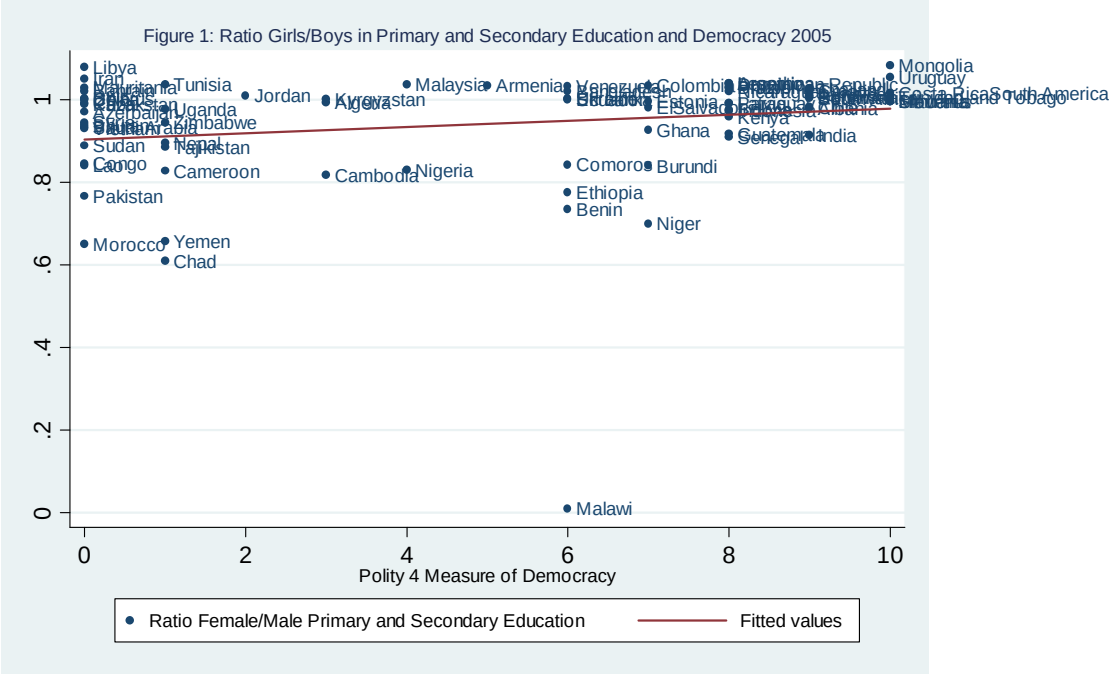
According to Hadenius and Teorell (2005) '…the existence of certain fundamental democratic rights involving universal suffrage, free and fair elections, the upholding of a number of political liberties' can be seen as the basic criteria of democracy. Women in many countries did not have the right to vote until the twentieth century. It can be argued that greater democracy improves the status of women through educational development and increased employment opportunities, empowering women and leading women to positions of leadership. Women in positions of responsibility and leadership can promote the development of women at grassroots levels.

Accordingly, with the objective of enhancing the understanding of gender inequality in education, this study investigates two hypotheses:

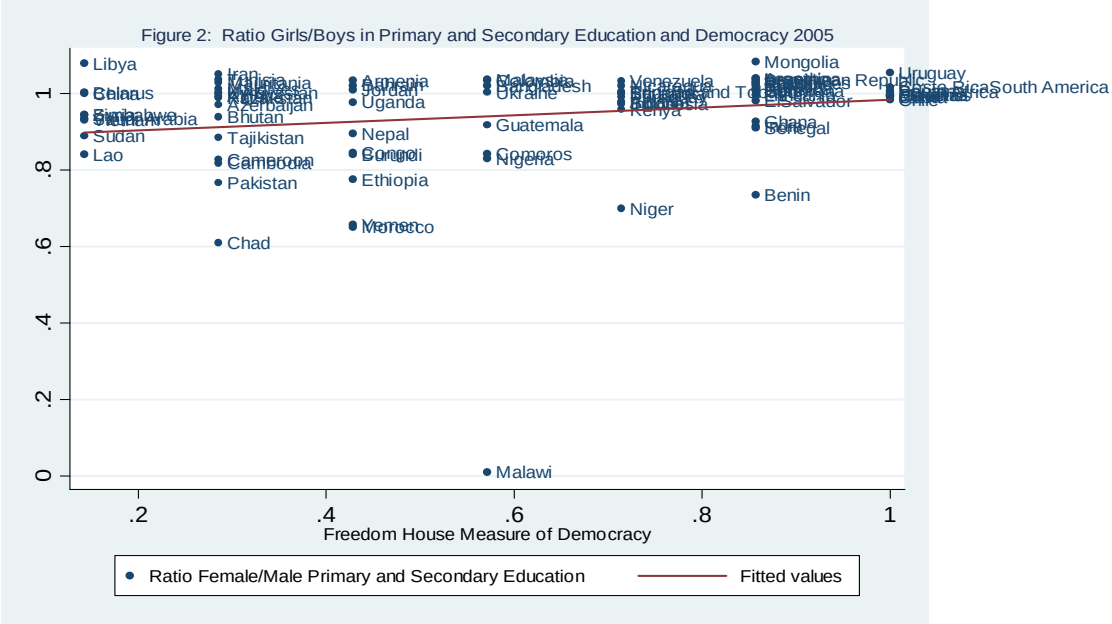
1) Does democracy lead to greater gender parity in education?
2) Does the duration of suffrage matter for gender parity in education?

Does Democracy Lead to Greater Gender Parity in Education?

Figures 1 and 2 plot the relation between the Polity 4 and Freedom House Democracy Indices respectively and the primary and secondary school gender ratio. The Figures demonstrate that there is a positive relation between democracy and gender parity in education. Despite the strong association between democracy and gender parity, it is worth noting that democracy fails to explain gender parity in education in Africa, particularly in Malawi notwithstanding the relatively high levels of democracy. This raises the important question of why there is an under-representation of girls in education in Africa.



Note: The regression represented by the fitted line reports a coefficient of 0.74 (Robust SE = 0.20), N = 79, R^2 = 0.13 from a regression of Ratio of Girls/Boys in Primary and Secondary Education on the Polity 4 Measure of Democracy.



Note: The regression represented by the fitted line reports a coefficient of 0.69 (Robust SE = 0.15), N = 79, R^2 = 0.11 from a regression of Ratio of Girls/Boys in Primary and Secondary Education on the Freedom House Measure of Democracy.

This can be attributed to several factors that include: ethno-lingual fractionalisation (Easterly and Levine 1997), colonial heritage (Brown 2000), culture (Dollar and Gatti

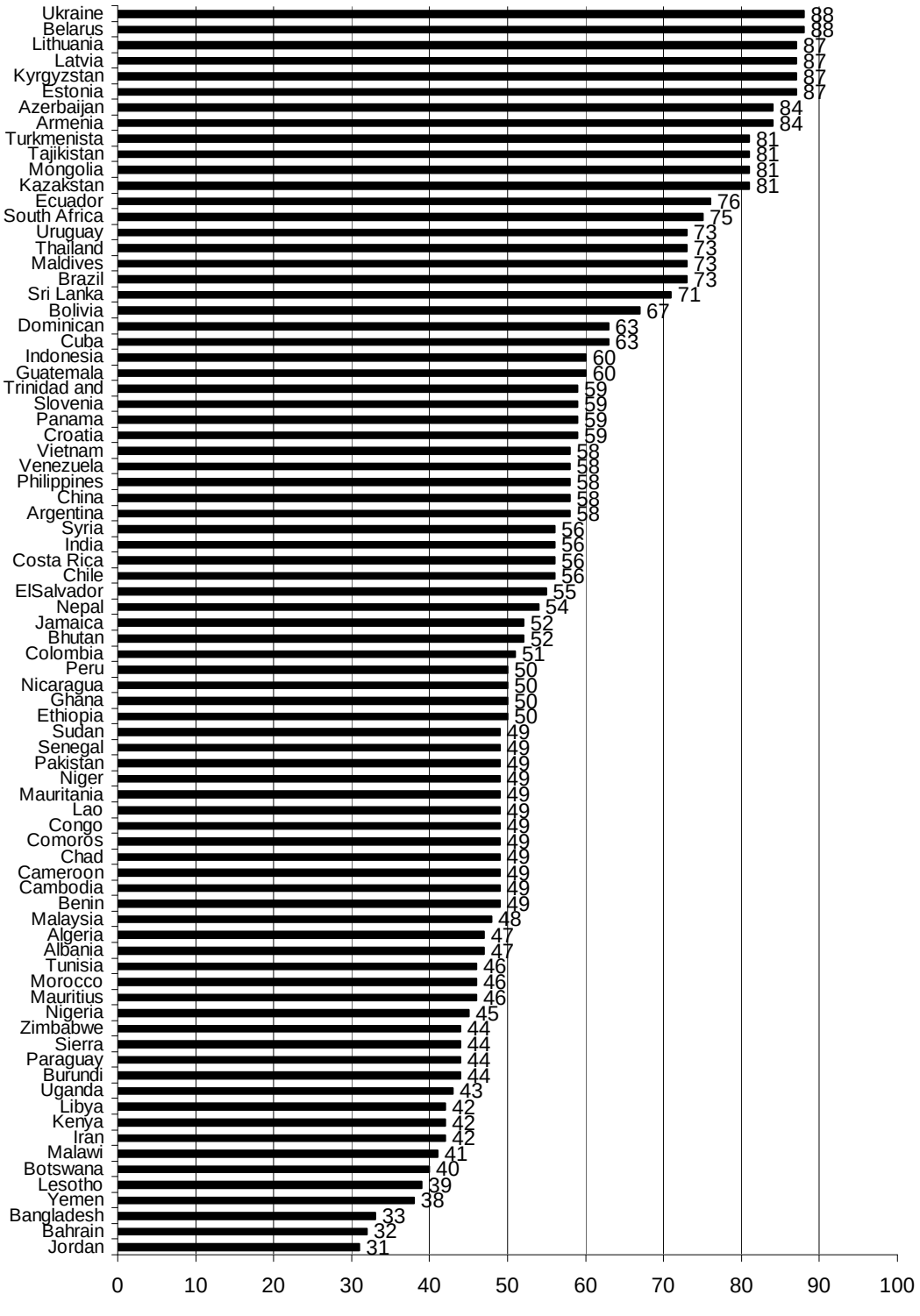
1999, Inglehart and Baker 2000), trade openness (Baliamoune-Lutz and McGillivray 2007). In an attempt to explain the case of Africa, Brown (2000) shows that political regime, whether authoritarian or democratic, cannot account for the variance in enrolment in Africa. According to him, colonial heritage has important implications for the impact of political institutions on education in Africa[1]. Easterly and Levine (1997) show that Africa's high ethnic fragmentation explains a large part of its poor growth performance and political instability. Baliamoune-Lutz and McGillivray in an investigation of Sub-Saharan African and Arab countries demonstrate that trade induced growth can generate greater inequalities in education.

Does the Duration of Suffrage Matter for Greater Gender Parity in Education?

Figure 3 illustrates the duration of suffrage up until 2005 (the current year in the present study) for the countries in the sample. The duration of suffrage is longest for females in the Eastern European and Central Asian countries. By 1930, only women in the high income OECD countries, the USSR, Mongolia and Ecuador had acquired suffrage (Ramirez *et al*. 1997).

[1] See Cooray (2009) for an examination of the negative impact of colonialism on adult literacy rates of the colonised.

Figure 3: Duration of Suffrage to 2005



Note: In South Africa white women acquired suffrage in 1930 but black women did not gain suffrage until 1993.

Source: Dates of suffrage acquisition from Ramirez F, Soysal Y and Shanahan S. (1997). Duration of suffrage calculated as the difference between 2005 and the year of suffrage.

Many African, Asian and Middle Eastern countries gained suffrage only after independence. Evidence shows that the political participation of women was undermined under the colonial regime due to the introduction of cash crop agriculture and the preference for recruiting women in agriculture (Adams 2006). This perhaps explains the reason for the gender disparity in education in favour of males in Africa and Asia despite relatively high levels of democracy. Although suffrage following independence permitted women to participate in the political process, progress has still to be made in the area of education in these regions.

3 Data

The dependent variable in this study is educational attainment between the genders which is measured by the enrolment ratio for girls divided by the enrolment ratio for boys at the primary and secondary, and tertiary levels. The primary and secondary enrolment ratios are combined as data are available for most countries combined. These outcome variables are used specifically because they are associated with the 3rd MDG. The sample comprises 80 countries (see Figure 3) which constitutes a representative cross section of all regions except the high income OECD countries. These countries are excluded from the sample given that gender parity in education is relatively high in these nations. The data sources are provided in the appendix. Estimation is carried out using both cross sectional and panel data methods. All data are collected for the years 1990, 1995, 2000 and 2005. The observations are taken every fifth year for the panel data estimation year rather than averaging the data to minimise problems associated with serial correlation (see Acemoglu *et al.* 2008).

A preliminary examination of the data show that there are regional differences in the ratio of girls to boys in primary and secondary, and tertiary education (see Figures 4-8). An enrolment ratio of 1 indicates parity between females and males and deviations below (above) 1 can be interpreted as a degree of male (female) advantage on the enrolment measure. South Asia and Africa represent the greatest persistence in underrepresentation of girls. Regional differences are particularly striking at the tertiary level where there are more female enrolments in all regions overall, except South East Asia, South Asia and Africa (see Figures 7 and 8).

Figure 4: The Ratio of Girls and Boys in Primary and Secondary and Tertiary Education: Middle East

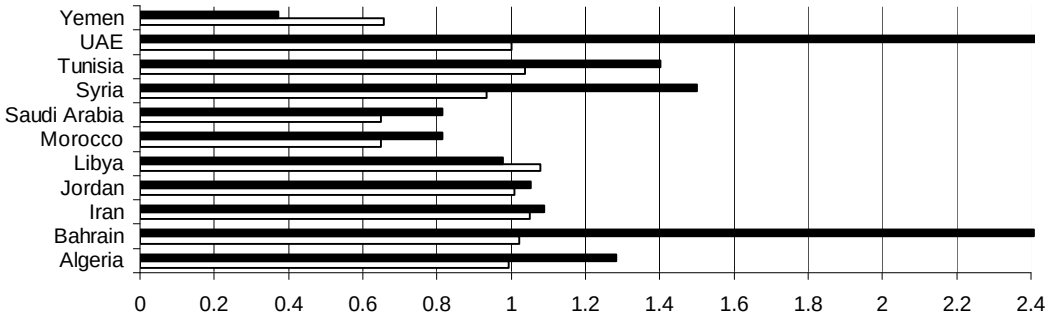


Figure 5: The Ratio of Girls to Boys in Primary, Secondary and Tertiary Education: Eastern Europe and Central Asia

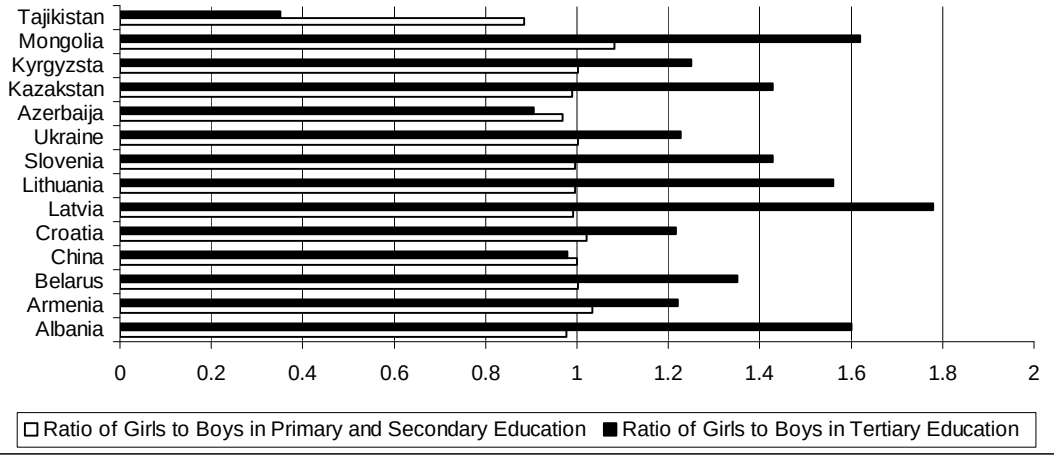


Figure 6: The Ratio of Girls to Boys in Primary and Secondary and Tertiary Education: South America

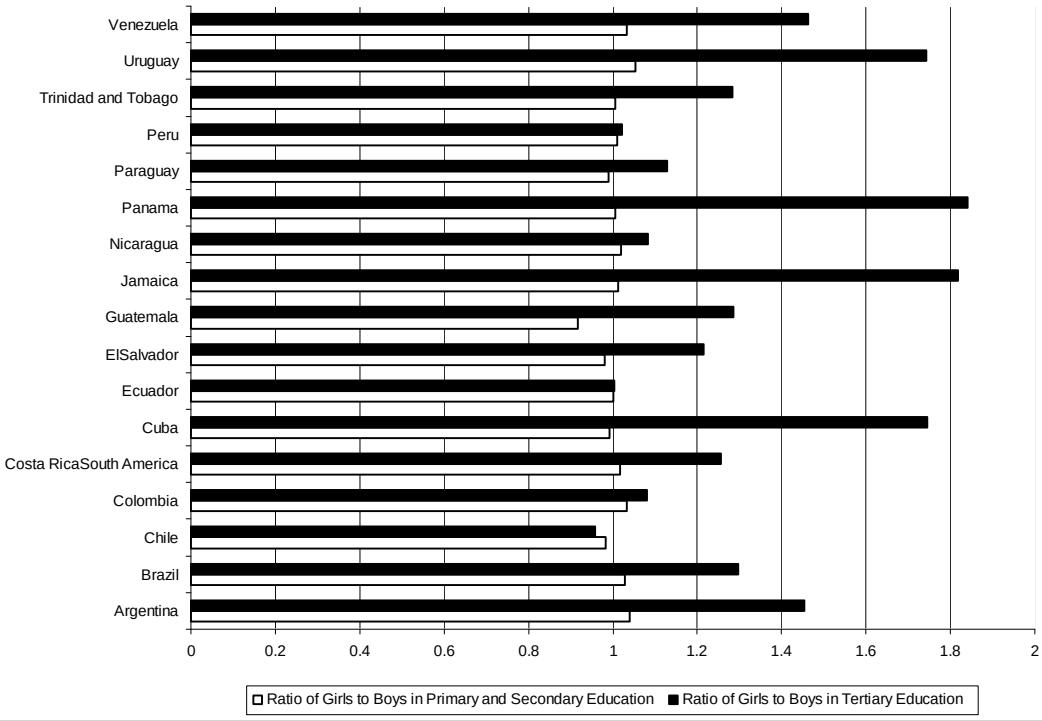


Figure 7: The Ratio of Girls to Boys in Primary and Secondary and Tertiary Education: South and South East Asia

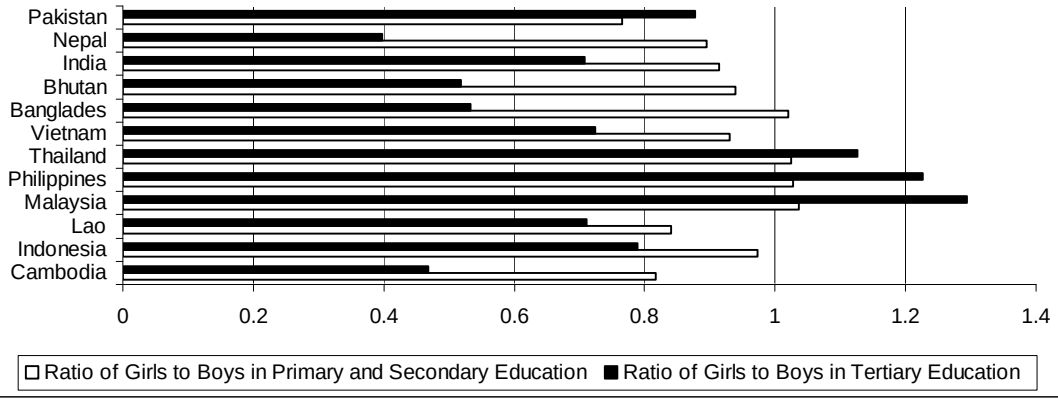
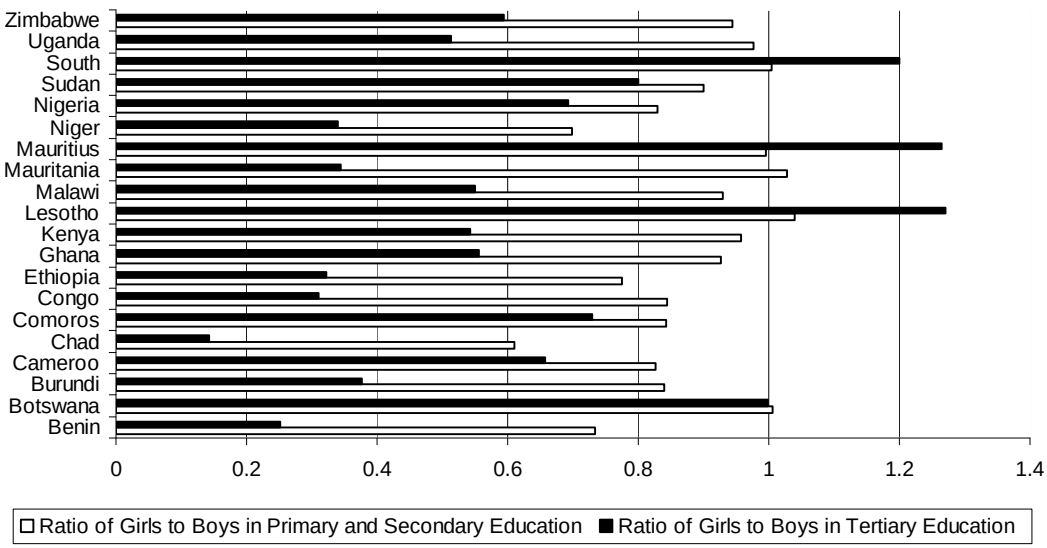


Figure 8: The Ratio of Girls and Boys in Primary and Secondary and Tertiary Education: Africa



The main independent variables in this study are the democracy index, and a variable 'Time', created to measures the duration of suffrage. Democracy in the present study is measured by two indices[2]. The Polity 4 Democracy Index which ranges from a scale of 0-10 with 0 representing no democracy (full autocracy) and 10 representing full democracy, and the Freedom House Political Rights Index which assigns countries a numerical rating from 1-7, with 1 indicating the highest degree of freedom and 7 the lowest degree of freedom. To maintain consistency with the Polity 4 Index, the Freedom House Political Rights Index is reversed so that 7 represents the highest level of democracy and 1 the lowest level (as in Brown 2004). Both democracy indices are normalised to one. Figures 1 and 2 in Section 2 depict the relation between democracy using both these indices and gender parity in education at the primary and secondary levels. Democracy appears to explain gender differentials in education in most countries except some African and Asian countries that fall below the regressions represented by the fitted lines.

[2] These two measures are commonly used in the literature. See Acemoglu *et al*. (2008), Brown (2004).

The next variable of interest is the duration of suffrage. It is possible to argue that the longer the time period since women acquired the right to vote, the greater the opportunity for women to avail themselves to educational expansion and increased employment opportunity. A variable 'Time' is created to capture the time length since the right was granted for women to vote. This is calculated by subtracting from the current year (2005 in the present study), the year in which women gained the right to vote in each country.

To control for the effect of other factors, the study includes a number of variables based upon the previous literature. As a high level of per capita income is associated with greater gender equality (Dollar and Gatti 1999, Klasen 2002), per capita income is used to measure a country's overall level of economic development. Government expenditure per student at the primary, secondary and tertiary levels is included to capture government investment in education. Reduced fertility is shown to improve not only gender parity in education but also lower the dependency burden, leading to increased savings rates and economic growth (Klasen 2002). Therefore the fertility ratio is used to estimate the effects of fertility on the gender ratio in education (see Klassen 2002, Dollar and Gatti 1999). The percentage of the population engaged in agriculture has been traditionally associated with greater gender disparity and income inequality in favour of males. The studies of Cagatay and Ozler (1995), Fontana and Wood (2000) and (Balliamoune-Lutz and McGillvray 2007) also show that with development, increased openness to trade can lead to increased gender inequality due to the fact that labour for these export industries are supplied primarily by unskilled females. To account for this, variables for employment in agriculture and trade openness are incorporated as independent variables. Employment in agriculture is

measured by those employed in the agricultural sector as a % of total employment and trade openness by the export of goods and services as a % of GDP.

Given the variation in education between the genders across regions, four dummy variables are created for Africa, the Middle East, South East and South Asia, and South America and the West Indies with Eastern Europe and Central Asia as the benchmark group. Dollar and Gatti (1999), and Inglehart and Baker (2000) among others show that cultural influences have a significant impact on education. The effects of cultural heritage on gender are therefore captured by four dummy variables for religion – Roman Catholicism, Islam, Buddhism and Hinduism with Christianity as the base group. Acemoglu *et al*. (2008), La Porta *et al*. (1999) and Barro (1999) highlight the importance of historical factors in influencing institutions, Brown (2008) the effect of colonialism on enrolment and Cooray (2009) the impact of colonialism on the adult literacy rate. Therefore, a dummy variable is created to control for the influence of colonialism on enrolment. As many of the countries that have a greater proportion of male enrolments are either former British or French colonies, the colonial dummy variable takes on a value of one if a country was a British or French colony and zero if not.

4 Empirical Results

The following model forms the basis of the empirical analysis.

$$E_{FMit} = \boldsymbol{x}_{it}\,\beta + \mu_t + \delta_t + \nu_t + \upsilon_t$$

where E_{FMit} is the enrolment ratio female/male for the primary and secondary and tertiary levels for country i in period t. All control variables mentioned in Section 3 are captured by the vector $\boldsymbol{x}_{it}$. μ_t represents a set of regional dummy variables, δ_t a

series of religion dummy variables and ν_t a colonialism dummy variable. υ_t is a random error term that captures all other variables. The initial estimation is carried out using OLS on cross sectional data. Robustness checks are carried out using both GMM estimation and panel data methods.

Cross Sectional Estimation: Full Sample

Table 1 presents cross section results for the full sample. Equations (1)-(4) in the Table are estimated with the enrolment ratio girls/boys at the primary and secondary level as the dependent variable and equations (5)-(8) are estimated with the enrolment ratio girls/boys at the tertiary level as the dependent variable in 2005. Both the Polity 4 and Freedom House Democracy indices are used to ensure the robustness of the results to the measure of democracy. Equations (1), (3), (5) and (7) are estimated with the Polity 4 Democracy Index and equations (2), (4), (6) and (8) with the Freedom House Democracy Index.

The results presented in Table 1 show that per capita income is only one of the contributing obstacles to gender parity in education. The variables of interest are the democracy index and Time. The democracy index is consistently statistically significant at the 1% and 5% levels in all equations. The Time variable is positive and significant in equations (1) –(4), (7) and (8) providing support for the argument that the longer the duration since suffrage the higher the level of gender parity. The coefficient on the colonialism dummy variable is significant in equations (1) – (6). The explanatory power of the models are high and in the range of 0.66-0.75.

Table 1: Gender Differentials in Education for the Full Sample: OLS Estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent Variables	Dependent Variable							
	Enrolment Ratio Girls/Boys Primary and Secondary 2005				Enrolment Ratio Girls/Boys Tertiary 2005			
Per Capita Income 1990	0.035 (0.021)*	0.032 (0.019)*	0.024 (0.015)*	0.015 (0.009)*	0.45 (0.12)***	0.45 (0.15)***	0.21 (0.10)**	0.22 (0.10)**
Exp. Per Student at Primary Level	0.03 (0.02)	0.01 (0.02)	0.048 (0.026)*	0.047 (0.027)*	-	-	-	-
Exp. Per Student at Secondary Level	0.01 (0.02)	0.01 (0.02)	0.008 (0.017)	0.013 (0.018)	-	-	-	-
Exp. Per Student at Tertiary Level	-	-	-	-	0.01 (0.14)	0.02 (0.03)	0.01 (0.10)	0.02 (0.15)
Africa Dummy	-0.08 (0.05)*	-0.09 (0.05)*	-	-	-0.09 (0.05)*	-0.07 (0.04)*	-	-
Asia Dummy	-0.05 (0.03)*	-0.07 (0.04)*	-	-	-0.05 (0.03)*	-0.08 (0.05)*	-	-
Middle East Dummy	-0.01 (0.08)	-0.01 (0.08)	-	-	-0.04 (0.03)	-0.05 (0.07)	-	-
South America Dummy	-0.05 (0.04)	-0.06 (0.04)	-	-	-0.01 (0.04)	-0.03 (0.05)	-	-
Buddhism Dummy	-	-	0.04 (0.05)	0.02 (0.06)	-	-	0.09 (0.09)	0.08 (0.08)
Hinduism Dummy	-	-	-0.042 (0.020)**	-0.05 (0.03)*	-	-	-0.043 (0.024)*	-0.010 (0.006)*
Islam Dummy	-	-	0.069 (0.033)*	0.057 (0.032)*	-	-	0.031 (0.19)*	0.021 (0.012)*
Roman Catholic Dummy	-	-	0.043 (0.024)*	0.042 (0.025)*	-	-	0.026 (0.016)*	0.025 (0.015)*
Democracy (Polity4)	0.09 (0.04)**	-	0.011 (0.002)***	-	0.020 (0.010)***	-	0.011 (0.004)***	-
Democracy (Freedom House)	-	0.022 (0.010)**	-	0.015 (0.006)**	-	0.011 (0.005)**	-	0.010 (0.004)***
Employment in Agriculture	-0.05 (0.01)***	-0.004 (0.02)**	-0.045 (0.017)**	-0.036 (0.017)**	-0.082 (0.047*)	-0.090 (0.050)*	-0.170 (0.100)*	-0.167 (0.100)*
Fertility Rate	-0.04 (0.05)	-0.04 (0.06)	-0.08 (0.04)*	-0.086 (0.046)*	0.11 (0.28)	0.04 (0.011)	-0.48 (0.30)*	-0.48 (0.36)
Exports	0.002 (0.002)	0.002 (0.002)	0.002 (0.001)	0.001 (0.001)	0.01 (0.01)	0.01 (0.01)	0.001 (0.001)	0.001 (0.002)
Time	0.002 (0.001)**	0.002 (0.001)**	0.0024 (0.0013)*	0.002 (0.001)**	0.001 (0.001)	0.001 (0.001)	0.0025 (0.0014)*	0.0024 (0.0013)*
Colony Dummy	-0.088 (0.051)**	-0.05 (0.025)**	-0.03 (0.02)*	-0.02 (0.01)**	-0.023 (0.014)*	-0.024 (0.015)*	-0.001 (0.001)	-0.002 (0.002)
Joint St. Significance Region Dummy: p Value	0.09	0.10	-	-	0.09	0.10		-
Joint St. Significance Religion Dummy: p Value	-	-	0.07	0.08	-	-	0.08	0.08
R^2	0.68	0.66	0.70	0.66	0.67	0.66	0.72	0.75

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively.

Equations (1) – (2) and (5) and (6) indicate that gender parity is lower in all regions compared to the benchmark group which is Eastern Europe and Central Asia. The coefficients on the Africa and Asia regional dummy variables are statistically significant at the 10% level. Hence, the regions in which per capita income is lowest, girls are least represented in primary and secondary, and tertiary education. An examination of the coefficients on the religion dummy variables show that the Hinduism, Islam and Roman Catholicism variables are statistically significant at the 10% level. A country's religious beliefs seem to have some effect on gender dis/parity. While the Islam and Catholicism appear to have a positive effect on gender parity compared to the benchmark group Christianity, Hinduism have a negative effect.

Inglehart and Baker (2000) show that that the populations of the historically Catholic countries, have similar political, religious and economic ideologies thereby forming a cluster. Similarly the Middle Eastern countries form a cluster due to having a common set of beliefs. The countries that belonged to the former Soviet Union also appear to form another cluster. It is possible that religious heterogeneity in Asia and Africa contribute towards slowing down attainment towards greater gender equality. Employment in agriculture is significant at the 5% and 10% levels in all equations and the fertility rate is significant at the 10% level in equations (3), (4) and (7).

The joint statistical significance of the region coefficients cannot be rejected at the 10% level, suggesting that region matters for gender disparity in education. Estimation is therefore carried out on the sample by region in the following section, to account for any regional disparity.

Cross Sectional Estimation: By Region

The openness variable is dropped in the regional estimation as this variable is statistically not significant in all of the above equations. The rest of the analysis is carried out using the Polity 4 democracy index as the measure of democracy given that both the Freedom House and Polity 4 indices yield similar estimates in Table 1. The SUR estimation method is used to take into account cross correlation between the error terms of the regions. Table 2 presents results for estimation with the primary and secondary enrolment ratio in 2005 as the dependent variable.

Table 2: Gender Differentials in Education at the Primary and Secondary Levels by Region: SUR Estimation

Dependent Variable: Enrolment Ratio Girls/Boys in Primary and Secondary Education 2005

	(1)	(2)	(3)	(4)	(5)
Independent Variables	Middle East	Eastern Europe and Central Asia	South East and South Asia	Africa	South America and the West Indies
Per Capita Income 1990	0.010 (0.006)*	0.020 (0.011)**	0.025 (0.012)**	0.026 (0.011)**	0.020 (0.011)**
Exp. Per Student at Primary Level	0.041 (0.022)*	0.042 (0.021)*	0.041 (0.022)*	0.042 (0.021)**	0.039 (0.023)*
Exp. Per Student at Secondary Level	0.012 (0.026)	0.012 (0.015)	0.013 (0.016)	0.012 (0.015)	0.005 (0.01)
Buddhism Dummy	-	0.005 (0.005)	-0.001 (0.007)	-	-
Hinduism Dummy	-	-	-0.005 (0.003)*	-	-
Islam Dummy	0.005 (0.008)	0.01 (0.01)	-0.009 (0.004)**	- 0.008 (0.011)*	-
Christianity Dummy		0.002 (0.01)	-	-0.001 (0.011)	-
Roman Catholic Dummy	-	0.001 (0.012)	-	0.002 (0.008)	0.001 (0.008)
Other Religion Dummy	-	-	-	-	-
Democracy	0.008 (0.002)***	0.008 (0.002)***	0.008 (0.002)***	0.008 (0.002)***	0.009 (0.001)***
Employment in Agriculture	-0.05 (0.025)**	-0.047 (0.024)**	-0.047 (0.014)***	-0.047 (0.014)***	-0.047 (0.024)**
Fertility Rate	-0.034 (0.022)	-0.036 (0.020)*	-0.035 (0.021)*	-0.036 (0.021)*	-0.032 (0.022)
Time	0.007 (0.005)	0.008 (0.004)**	0.002 (0.002)	0.008 (0.012)	0.002 (0.007)
Colony Dummy	-0.036 (0.021)**	-0.031 (0.025)	-0.040 (0.023)**	-0.042 (0.024)**	-0.025 (0.020)
R^2	0.61	0.62	0.61	0.62	0.60

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively.

The democracy index is significant at the 1% level in all regions. The variable Time is significant at the 5% level in Eastern Europe and Central Asia. This is the region in which women have had the right to vote for the longest period. In many of the Asian, African and Middle Eastern countries women gained the right to vote only after independence. Despite the fact that South America gained independence long before these regions, women in South America also gained the right to vote only around the same time as these regions. Therefore the duration of suffrage appears to matter for gender equality in education. The coefficient on the colonialism dummy variable is significant in the Africa, Asia and the Middle Eastern regions demonstrating the importance of historical factors in school enrolment. Per capita income and government expenditure per student at the primary level are significant for all regions. The proportion employed in the agricultural sector is significant at the 1% level in Africa and Asia and at the 5% level in the rest of the regions. The fertility rate is significant at the 10% level in Eastern Europe and Central Asia, East and South Asia and Africa. The coefficients on the Islam and Hinduism dummy variables are negative and statistically significant in the East and South Asia region and the Islam dummy variable is negative and statistically significant in the Africa region. Note that the Islam dummy variable is positive and not statistically significant in the Middle East suggesting that religion has a positive effect in the Middle East. This result confirms the result obtained in Table 1 above that religion appears to have a negative impact on gender equality in regions that are characterised by religious diversity.

Table 3 reports results by region with the gender ratio at the tertiary level as the dependent variable.

Table 3: Gender Differentials in Education at the Tertiary Level by Region: SUR Estimation

Dependent Variable: Enrolment Ratio Girls/Boys in Tertiary Education

	(1)	(2)	(3)	(4)	(5)
Independent Variables	Middle East	Eastern Europe and Central Asia	South East and South Asia	Africa	South America and the West Indies
Per Capita Income 1990	0.266 (0.122)**	0.264 (0.116)**	0.264 (0.120)**	0.267 (0.118)**	0.266 (0.118)**
Exp. Per Student at Secondary Level	0.041 (0.027)	0.033 (0.122)	0.039 (0.026)	0.035 (0.124)	0.034 (0.124)
Exp. Per Student at Tertiary Level	0.104 (0.086)	0.091 (0.084)	0.102 (0.085)	0.092 (0.085)	0.091 (0.085)
Buddhism Dummy	-	0.006 (0.039)	-0.002 (0.089)	-	-
Hinduism Dummy	-	-	-0.007 (0.004)*	-	-
Islam Dummy	-0.04 (0.02)*	0.004 (0.042)	-0.016 (0.009)*	-0.080 (0.050)*	-
Christianity Dummy	-	0.006 (0.041)	-	-0.001 (0.016)	-
Roman Catholic Dummy	-	0.031 (0.055)	-	0.023 (0.041)	0.025 (0.044)
Democracy	0.015 (0.007)**	0.016 (0.007)**	0.015 (0.007)**	0.010 (0.005)**	0.022 (0.01)**
Employment in Agriculture	-0.214 (0.100)**	-0.29 (0.15)*	-0.212 (0.100)**	-0.208 (0.098)**	-0.208 (0.098)**
Fertility Rate	-0.271 (0.218)	-0.291 (0.210)	-0.275 (0.216)	-0.286 (0.212)	-0.287 (0.213)
Time	0.004 (0.006)	0.004 (0.002)**	0.006 (0.005)	0.005 (0.006)	0.008 (0.063)
Colony Dummy	-0.261 (0.016)*	-0.022 (0.019)	-0.019 (0.011)**	-0.027 (0.014)**	-0.014 (0.010)
R^2	0.71	0.71	0.71	0.71	0.71

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively.

The results for the tertiary level are slightly different to that of the primary and secondary levels, with government expenditure per student and fertility losing significance. The coefficient on democracy continues to be significant at the 5% level. The coefficient on per capita income is significant at the 5% level in all regions. The variable Time is significant at the 5% level again in Eastern Europe and Central Asia. As before, the colonialism dummy variable is significant in the Middle East, Asia and Africa highlighting the negative effect exerted by colonialism in these regions. Note that at the tertiary level, religion has a significant and negative impact

on education in the Middle East as opposed to the primary and secondary level. Similarly, the coefficient on Islam is significantly negatively related to gender parity in education in Africa, and Hinduism and Islam negatively related to education in Asia. There is a significant negative relationship between the school gender ratio and agricultural employment. The explanatory power of the models are high with the independent variables explaining 71% of the variation in the dependent variable.

Panel Data Estimation

Given that the cross country results suggest region specific effects, the model is estimated using panel data in this section to capture any country specific effects. A question that arises in this regard is whether a fixed or random effects model is more appropriate. A fixed effects model involves estimating the individual country effects as parameters. This leads to a substantial loss in degrees of freedom. In particular, when the number of countries exceed the number of time periods as in the case of this study, a random effects model will permit more efficient use to be made of the available data. Therefore a random effects model is used for the purpose of estimation. Estimation is also carried out using pooled OLS. A panel for the period 1990-2005 is used with the observations taken every fifth year. The pooled OLS and random effects GLS results are reported in Table 4.

Table 4: Panel Data Estimation of Gender Differentials in Education at the Primary, Secondary and Tertiary Levels.

	(1)	(2)	(3)	(4)
Independent Variables	Dependent Variable: Enrolment Ratio Girls/Boys Primary and Secondary		Dependent Variable: Enrolment Ratio Girls/Boys Tertiary	
	Pooled OLS	Random Effects	Pooled OLS	Random Effects
Per Capita Income 1990	0.028 (0.012)**	0.02 (0.008)*	0.34 (0.04)***	0.17 (0.03)***
Exp. Per Student at Primary and Secondary Level	0.019 (0.012)	0.01 (0.01)	-	-
Exp. Per Student at Tertiary Level	-	-	0.094 (0.040)**	0.001 (0.02)
Buddhism Dummy	0.055 (0.029)*	0.06 (0.06)	0.157 (0.217)	0.21 (0.18)
Hinduism Dummy	-0.069 (0.033)**	-0.05 (0.03)**	-0.169 (0.098)*	-0.313 (0.088)***
Islam Dummy	0.051 (0.023)**	0.06 (0.044)*	0.094 (0.064)*	0.062 (0.152)
Roman Catholic Dummy	0.063 (0.019)***	0.048 (0.035)*	0.153 (0.058)***	0.151 (0.110)*
Democracy	0.013 (0.002)***	0.01 (0.005)***	0.018 (0.007)***	0.024 (0.012)**
Employment in Agriculture	-0.121 (0.025)***	-0.071 (0.017)***	-0.191 (0.080)**	-0.110 (0.076)*
Fertility Rate	-0.012 (0.001)	-0.011 (0.017)	-0.037 (0.030)	-0.145 (0.063)**
Time	0.002 (0.0012)*	-0.001 (0.0004)***	0.004 (0.002)**	-0.002 (0.0012)*
Colony Dummy	-0.018 (0.011)*	-0.03 (0.02)*	-0.130 (0.059)**	-0.106 (0.105)
R^2	0.50	0.47	0.69	0.62
Observations	225	225	205	205

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively.

The coefficients on the democracy index continue to be significant at the 1% and 5% levels. The coefficients on the time variable are significant at the 1%, 5% and 10% levels. Per capita income has a positive and significant impact on gender parity in enrolment, and employment in agriculture a negative and significant effect. Of the religion dummy variables, Hinduism has a significant negative effect on gender parity in enrolment and Roman Catholicism a positive significant effect. The coefficient on Islam is positive and significant in equations (1) – (3) and the coefficient on

colonialism negative and significant in the same three equations. The results are consistent with those obtained above under the cross sectional method.

Robustness Tests

A number of tests have been performed to ensure the robustness of the results.

Alternative Measures of Democracy

Two measures of democracy, the Polity 4 Democracy Index of Marshell and Jaggers (2006) and the Freedom House Political Rights Index (2009) are used to ensure the robustness of the results to the measure of democracy. The results are consistent under the two measures of democracy.

Dummy Variables

To test for regional differences, four regional dummy variables are defined for, (1) Africa, (2) the Middle East, (3) South East and South Asia and (4) South America and the West Indies, with Eastern Europe and Central Asia as the benchmark group (see Table 1) for the full sample. Given the significance of the Asia and Africa dummy variables, estimation is also carried out by dividing the full sample by region, see Tables 2 and 3.

Dividing Countries by Region

The sample is split by region to account for regional disparities. The results indicate regional differences as suggested by the initial graphical analysis in the Data Section. This led to estimation by panel data and the GMM technique to test the robustness of the results to the estimation method.

Panel Data Estimation

Given the region specific effects suggested by the cross sectional estimation (see Tables 2 and 3), panel data estimation is carried out in Table 4 to test for any country

specific effects. The results of the panel data estimation are similar to that of the cross sectional analysis, suggesting that the results are robust to the estimation technique.

GMM Estimation

The OLS estimates will be biased and inconsistent if gender parity in education were also a function of democracy. In order to correct for any endogeneity bias that may be present in the models, the equations in Table 1 are re-estimated using GMM estimation. Three instruments are chosen on the basis of Shea's (1996) partial R^2. These are the adult literacy rate, health expenditure as % of GDP and the % of the labour force with secondary education.

The democracy index continues to be significant at the 1% and 5% levels. The Time variable is positive and statistically significant in all equations except equations (2), (5) and (8). Per capita income and employment in agriculture are statistically significant once again as with the Africa and Asia and Hinduism and Islam dummy variables. The results are consistent with those obtained under the OLS method in Table 1 and also with the results obtained under panel data estimation in Table 4. Two diagnostic tests are carried out on the GMM estimates. A Durbin-Wu-Hausman test (1954, 1973, 1978) and the J statistic of Hansen *et al.* (1996). The Durbin-Wu-Hausman test statistic indicates that the null hypothesis of exogeneity is not rejected, and the J statistic, that the model is correctly specified. It can be concluded therefore that the results are robust to the estimation technique.

Table 5: Gender Differentials for the Full Sample: GMM Estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable							
	Enrolment Ratio Girls/Boys Primary and Secondary 2005				Enrolment Ratio Girls/Boys Tertiary 2005			
Per Capita Income 1990	0.09 (0.050)**	0.041 (0.022)**	0.032 (0.020)*	0.023 (0.014)*	0.223 (0.110)**	0.225 (0.112)**	0.227 (0.116)**	0.222 (0.10)**
Exp. Per Student at Primary Level	0.022 (0.016)*	0.011 (0.020)	0.010 (0.020)	0.010 (0.01)	-	-	-	-
Exp. Per Student at Secondary Level	0.01 (0.02)	0.01 (0.02)	0.008 (0.017)	0.013 (0.018)	-	-	-	-
Exp. Per Student at Tertiary Level	-	-	-	-	0.024 (0.015)*	0.015 (0.010)*	0.012 (0.120)	0.026 (0.017)*
Africa Dummy	-0.091 (0.045)**	-0.054 (0.05)*	-	-	-0.084 (0.055)*	-0.065 (0.043)*	-	-
Asia Dummy	-0.054 (0.031)**	-0.062 (0.044)*	-	-	-0.036 (0.021)**	-0.056 (0.036)*	-	-
Middle East Dummy	-0.152 (0.116)	-0.053 (0.035)*	-	-	-0.035 (0.027)	-0.053 (0.045)	-	-
South America Dummy	-0.081 (0.072)	-0.045 (0.044)	-	-	-0.024 (0.025)	-0.024 (0.033)	-	-
Buddhism Dummy	-	-	0.024 (0.022)	0.010 (0.098)	-	-	0.063 (0.075)	0.054 (0.047)
Hinduism Dummy	-	-	-0.035 (0.024)*	-0.045 (0.032)*	-	-	-0.044 (0.031)*	-0.021 (0.032)
Islam Dummy	-	-	0.043 (0.032)*	0.045 (0.030)*	-	-	0.036 (0.024)*	0.032 (0.024)**
Roman Catholic Dummy	-	-	0.025 (0.022)	0.026 (0.025)	-	-	0.023 (0.013)*	0.022 (0.015)*
Democracy (Polity4)	0.087 (0.046)**	-	0.043 (0.023)***	-	0.034 (0.015)***	-	0.025 (0.014)**	-
Democracy (Freedom House)	-	0.025 (0.011)**	-	0.021 (0.012)**	-	0.016 (0.007)***	-	0.019 (0.006)***
Employment in Agriculture	-0.032 (0.014)***	-0.012 (0.009)*	-0.023 (0.011)**	-0.022 (0.012)**	-0.013 (0.009)*	-0.014 (0.009)*	-0.015 (0.007)**	-0.016 (0.007)*
Fertility Rate	-0.032 (0.041)	-0.036 (0.032)	-0.024 (0.021)	-0.012 (0.010)	0.013 (0.242)	0.021 (0.014)*	-0.023 (0.030)	-0.028 (0.036)
Time	0.003 (0.001)***	0.001 (0.001)	0.002 (0.001)**	0.002 (0.001)**	0.002 (0.002)	0.002 (0.001)**	0.002 (0.001)**	0.002 (0.002)
Colony Dummy	-0.042 (0.019)**	-0.032 (0.015)**	-0.034 (0.018)**	-0.031 (0.018)**	-0.024 (0.019)	-0.030 (0.025)	-0.010 (0.011)	-0.012 (0.010)
Durbin-Wu-Hausman Test: p Value	0.19	0.13	0.15	0.14	0.19	0.13	0.15	0.16
J Statistic of Hansen: p value	0.21	0.16	0.26	0.23	0.21	0.20	0.23	0.19

Note: Standard errors reported in parenthesis. ***, **, *, significant at the 1%, 5% and 10% levels respectively.

5 Conclusion

This study investigates the reason for gender disparity in education at the primary and secondary, and tertiary levels. Democracy is consistently seen to impact upon

education at all levels of education. It can be argued that greater democracy leading to women in positions of leadership can promote the development of women who are less privileged. There also seems to be some basis for the argument that the duration of suffrage matters for greater gender parity in education. Gender equality is greatest in Eastern Europe and Central Asia, the region in which the duration of suffrage is longest in the study. In addition, the results demonstrate that regions in which there is an under-representation of girls in education, namely Asia and Africa, other factors such as income, the percentage of population employed in agriculture, colonialism and religious heterogeneity are also important. Income is an important variable in explaining the lack of gender parity in education. This is consistent with the view of Borooah and Paldam (2007), who show that low income is a constraint to achieving high levels of democracy. Although democratic institutions are in place in these regions, the operation of institutions can be far from ideal with low participation in the political process (Hadenius and Teorell 2005). These regions, in particular Africa, are also characterised by a high degree of religious fractionalisation. The hypothesis that greater religious heterogeneity slows down the process of democratization is supported in the work of Papaioannou and Siourounis (2005). In a study of the US, Alesina, Baqir, and Easterly (1999) find that more ethnically diverse US cities and counties devote less resources to public goods than more ethnically homogeneous cities and counties. Similarly, Goldin and Katz (1999) find less public support for higher education in US states characterised by greater religious heterogeneity. It is possible therefore that greater diversity creates problems in arriving at a general consensus with regard to a common set of policies (Hayo and Voigt 2005) required for the provision of public goods.

The results also lend support to the argument that colonialism has a negative impact on the school gender parity ratio. This is not surprising given that La Porta *et al.* (1999), Barro (1999), Londergran and Poole (1996) highlight the importance of historical factors in explaining the performance of governments. Colonial educational policies favoured homebound education for women (Fafunwa 1974; Mann 1985) which consequently led to lower enrolment ratios for girls. Even where girls pursued their education, there was a tendency for them to be influenced by their parents or relations to pursue careers that were perceived to be compatible with domestic responsibilities (Ezumah 2008). Another conclusion emerging from the study is the significant negative relation between employment in agriculture and the school gender ratio. Historical factors can also be said to explain the large proportion of women employed in the agricultural sector in Asia and Africa most countries of which were former colonies. During the colonial era, cash crops were introduced to the colonies with many women employed in cultivating these crops and working in factories that were in close proximity to these plantations. Women's employment in subsistence, plantation and household production can be said to have constrained them from attending school. Many post-colonial governments continued to prioritise male education, which may well explain the lower female enrolment ratios in Asia and Africa. The study also shows that investment in education at the primary level is important for greater gender parity. Despite the fact that steps have been taken by several of these countries to increase female enrolment, much remains to be done. It is important that the governments of these economies continue to take the necessary steps to increase girls access to education by designing policies specifically aimed at targeting girls through the provision of scholarships and subsidies, and compulsory

education programmes, as lower access to education will continue to restrict women to lower paid jobs.

Appendix

The data used in the empirical estimation come from the following sources:

- Enrolment Rates, Primary, Secondary, Tertiary 1990, 1995, 2000, 2005: UNESCO Literacy statistics: http://stats.uis.unesco.org/unesco/ReoportFolders/ReportFolders.aspx (downloaded January 2009), Human Development Reports, World Development Indicators.
- GDP per Capita 1990, 1995, 2000, 2005 (PPP adjusted): World Development Indicators and World Development Reports.
- Public Expenditure per Student, Primary, Secondary, Tertiary % of GDP Per Capita, 1990, 1995, 2000, 2005: UNESCO and Human Development Reports. Barro R and Lee J (2000). International Data on Educational Attainment: Updates and Implications. Centre for International Development Working Paper 42, Harvard.
- Employment in agriculture as a % of total employment 1990, 1995, 2000, 2005: World Development Indicators, Human Development Reports.
- Democracy Index: Marshall M and Jaggers K (2006). Polity IV Country Reports 2006. http://www.systemicpeace.org/polity/polity06.htm#nam (downloaded February 2009). Data for 1990, 1995, 2000, 2005.
- Political Rights Index: Freedom House (2009), Freedom of the World: 2005 http://www.freedomhouse.org/template.cfm?page=22&country=7460&year=2009 (downloaded February 2009). Data for 1990, 1995, 2000, 2005.
- Colonial State - Freedom House 2008 http://www.freedomhouse.org/template.cfm?page=35&year=2005 (downloaded November 2008).

- Fertility Rate Total, Births per Woman 1990, 1995, 2000, 2005 – World Development Indicators
- Export of Goods and Services as % of GDP 1990, 1995, 2000, 2005 – World Development Indicators.
- Year of Suffrage – Ramirez F, Soysal Y and Shanahan S (1997). Time variable calculated as the difference between 2005 (current year in the present study) and year of suffrage.
- Religious Affiliation of Country – The Encyclopedia of World Geography (1994) Bateman G and Egan (Eds.), Andromeda Oxford Limited, England.
- Instruments used in the GMM estimation: The adult literacy rate, health expenditure as % of GDP, the % of the labour force with secondary education in 2005 – World Development Indicators.

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