EDUCATIONAL GENDER GAP, INEQUALITY AND GROWTH:

A GENDER SENSITIVE ANALYSIS

Chiara Binelli, University College London[1]

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ABSTRACT

Adopting a gender-aware perspective, this paper investigates the controversial relationship of inequality and growth studying the effects of income disparity on the differences between male and female schooling in the presence of liquidity constraints and inefficient financial markets. In cultural contexts where male education is considered more profitable, financial markets' inefficiency has biased effects on human capital accumulation; given the significant contribution of women's education to economic prosperity, a theoretical model and a panel data analysis of sixty three countries for six five years periods from 1965 to 1994 show a negative impact of income inequality on economic growth through the disincentives to invest in female schooling. A financial markets' reform to improve efficiency and increase available liquidity could offer an important contribution to the closure of the gender educational gap.

KEYWORDS

Poverty feminization, intra-household allocation, educational gender gap, income inequality, economic growth, credit markets' imperfections.

[1] Department of Economics, University College London, Gower Street, London, WC1E 6BT.
E-mail: c.binelli@ucl.ac.uk

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1. INTRODUCTION

Of the world six billion people, one fifth suffers from a condition of extreme poverty, living on less than one dollar per day. Poverty is a multidimensional phenomenon, which does not identify a static condition, but rather a process where the assets that an individual owns or is able to acquire have a critical importance; inadequate access to basic economic resources, poor educational and health services combine with significant difficulties or nearly impossibility to take part to the social and political activities of a community.

In their analysis of developing countries, Michael Lipton and Martin Ravaillon (1995) have summarized the peculiar features of chronic poverty; together with high fertility and infant mortality rates, poverty hits women more than men. Female poverty presents distinctive traits and degrees of manifestation and it is related to the extent of gender inequality that varies among societies, shaped to a considerable extent by kinship rules; customary gender norms and values can lead to political, legal, economic, and educational inequalities that perpetuate women's lack of access to resources, control over decision making, and participation in public life. Poor women face a double disadvantage in access to resources and voice: they are poor, and they are women (*World Development Report 2000/2001*). Legal systems can constrain women from becoming independent economic actors; in most developing countries family laws are stacked against women, restricting their rights in divorce and inheritance of land and other productive resources. In many countries women continue to be denied basic legal rights; in Botswana, Lesotho, Namibia and Swaziland married women, according to both customary and common law, are under the permanent guardianship of their husbands and have no independent right to manage property; in Guatemala men have the right to restrict the kind of employment their wives can accept outside the house.

The available data confirm a wide diffusion of poverty feminization; according to the most recent estimates, women represent seventy percent of the world poor and the proportion of female population that lives in rural areas in conditions of extreme poverty has increased by fifty percent in the last twenty years (United Nations Fund for Women, 2000). Female differs from male poverty because of the expectations regarding behaviors, rights and access to productive resources that are associated to gender biased social norms. Two features, in particular, characterize female poverty:

- poverty hits women more often and for a longer time than men;
- female poverty shows very high degrees of intensity and it is often chronic.

One peculiar feature that identifies women's poverty is the lack of access to schooling; a significant gender educational gap characterizes most developing countries. According to the United Nations Educational, Scientific, and Cultural Organization' statistics, in the year two thousands women represent two thirds of the eight hundred seventy six millions of the world illiterate; in the same year, eighty-eight millions of children did not attend school; among them, three over five are female (UNESCO 2000). As shown in table 1 in Appendix A2, in all macro regions, with the exception of Southern Africa, there is a significant gender gap in illiteracy rate. Table 2 presents summary statistics from the United Nations database (*The World's Women 2000. Trends and Statistics*, United Nations Headquarters, New York); considering the population aged 15-24, in twenty-one countries for which data are available, more than one women over four is illiterate. Africa as a whole, with the exception of South Africa, shows the widest gender gap in literacy rate, with over forty percent of the illiterate being female. Together with gender differences in illiteracy rate, there exists a significant educational gender gap at the primary and secondary level. Table 3 in Appendix A2 presents gross enrollment ratios classified by gender; in all thirty-one countries under consideration the ratio of female to male students is less than four to five.

Robert Barro and Jong-Wha Lee (2000) have computed the ratio of female and male enrollment rate for forty years between 1960 and 2000 for more than one hundred countries. Table 4 in Appendix A2 has been obtained using the regional categorization of the two authors. As the data show, in the 1990s there has been a significant improvement in the gender educational gap; considering the developing countries as a whole, the ratio between female and male enrollment rate has increased from sixty three percent in 1990 to sixty seven percent in 1995 for the population aged twenty five or more and from sixty nine to seventy two percent for the population aged fifteen or more. However, confirming the trend of the past decades, the gender educational gap is still significant in Africa and South Asia with respect to South America and East Europe and to the rich countries in Western Europe, North America and New Zealand, where the difference between female and male schooling has almost disappeared; moreover, considering the overall sample made up of one hundred and seven countries, the average ratio of female to male secondary education is still below ninety percent.

Women's poor education has a strong negative impact for next generations' well being, since the burden of bearing and rearing children falls largely on mothers. Different authors have underlined the positive spillover effects of female education; on the one hand, many empirical studies have shown a negative correlation between mothers' educational level and fertility or infant mortality rate (e.g. Anne Hill and Elizabeth King 1995, Kalanidhi Subbarao and Laura Raney 1995). On the other, several econometric analysis have investigated the link between gender equality in resources' allocation, education and the growth rate of per capita gross domestic product; David Dollar and Roberta Gatti (1999) have shown that a more equitable distribution of resources between men and women leads to higher rates of per capita income growth; Stephan Klasen (1999) has performed cross country regressions that indicate how countries which invest more in girls' education have higher rates of economic growth.

Together with the analysis of the benefits produced by higher rates of female schooling, empirical research has focused on the factors that lead to under investment in women's education. Dollar and Gatti (1999) have emphasized the role of legal rights, political freedom and religion affiliation; countries that invest poorly in women education are characterized by social and cultural backwardness that limit their growth potential; moreover, they have found that more gender equality is associated with higher levels of family income. The analysis of Deon Filmer (1999) confirms the existence of a correlation between availability of economic resources and investment in female education: a wider educational gender gap characterizes the poorest countries with respect to the ones with a higher average per capita income.

Poverty feminization and gender differences in enrollment and attendance rates require an accurate analysis in order to understand the mechanisms that justify the preference towards male education. In particular, given the role of available wealth as a factor that influences educational choices, it is important to study the relationship between income distribution and human capital investment decisions. Oded Galor and Joseph Zeira (1993) were the first to underline the impact of resources' availability on human capital formation; in their model, in the presence of credit markets' imperfections, income inequality influences the growth process through investment in education. Inefficient financial markets make it difficult to obtain credits from banks that request high interest rates and significant collaterals as repayment guarantees; in the absence of government interventions and income subsidies, the lack of economic resources constraints the opportunity of human capital investments. Therefore, income inequality can have a negative impact on economic growth if most of the population is unable to finance educational expenses.

The literature that has analyzed investment in education and the relationship between inequality and growth has traditionally adopted a gender-neutral approach, considering the impact of resources' availability on an average measure of educational attainment; this approach appears to be both unsatisfactory and inconclusive. Given the significant spillover effects of female education and the persistent gender differences in the enrollment rate at the primary and secondary level, it is important to evaluate the impact of income inequality on the gender gap in education and not on the mean educational level. Customary gender norms influence investment decisions and credit markets' imperfections operate in a cultural and economic environment where male is considered more profitable than female education; as a consequence, inefficient financial markets penalize women's more than men's human capital accumulation.

Adopting a gender-aware perspective, this paper investigates the controversial relationship between inequality and growth studying the effects of income disparities on the differences between male and female schooling, in the presence of liquidity constraints and inefficiency of the financial markets. The gender sensitive approach that is developed is novel and offers two important contributions. First of all, it helps identifying credit markets' imperfections as a new factor that determines the educational gender gap; moreover, it is able to suggest a new possible explanation of the relationship between inequality and growth.

Building on the model of liquidity constraints proposed by Galor and Zeira (1993) and on the one by Ashish Garg and Jonathan Morduch (1998) on the influence of cultural and social factors on parents' investment choices, the paper develops an analytical framework that considers the impact of income inequality and spare resources on the gender gap in education; given the role of social norms that favor male education, the analysis considers human capital investment decisions both in the presence of credit markets' imperfections and in the context of financial market efficiency. The gender-sensitive model serves as a basis for the econometric testing of the effects of income inequality on economic growth via the educational gender gap.

The empirical analysis uses a methodology suggested by Roberto Perotti (1994), that has synthesized the main implications it is necessary to test in order to evaluate the role of credit markets' imperfections in the relationship between inequality and growth. The construction of a wide panel data sample made up of sixty-three countries with observations for six five-yearly periods between 1965 and 1994 and the use of fixed and random effects improve estimates' efficiency and lower the risk of biased estimates. The empirical results that will be presented offer plain support to the hypothesis of increasing under investment in female with respect to male education in the presence of high-income inequality and credit markets' imperfections. Given the positive effects of women's education on economic growth, the results show the existence of a negative impact of income inequality on growth through the disincentives to invest in female schooling.

2. THEORETICAL FRAMEWORK

The theoretical model developed in this paper evaluates the relationship between income inequality and human capital investment building on the seminal contribution of Galor and Zeira (1993, GZ thereafter); however, it introduces two important innovations with respect to the gender-neutral framework of GZ. First of all, since credit markets' imperfections operate in a social and economic context where gender biased social norms and widespread gender wage gap favor investment in male education, the analysis focuses on the impact of income inequality on the educational gender gap and not on a gender-neutral measure of average educational attainment. Moreover, Galor and Zeira's model considers the behavior of an individual that chooses between education and work; on the contrary, given the importance of family background and the significant path dependence that characterizes investment in education, the model that will be developed analyzes the factors that influence parents' decision to finance children's education, rather than the choice of a self-financing individual.

Secondly, theoretical analysis evaluates the influence of customs and traditions that promote a gender-biased impact of credit markets' imperfections. The presence of social and cultural factors that favor male education requires an analysis of investments in education even in the context of efficient financial markets; the model that will be presented will adopt the simple analytical structure developed by Garg and Morduch (1998) for the analysis of the factors that influence financing decisions of health care expenses by the parents in favor of the children.

In order to develop an empirically testable theoretical framework, the analysis will focus on the short run effects of credit markets' imperfections; the last section will propose the graphical representation used by Galor and Zeira's model to describe the evolution of the economic system in the long run.

2.1 *The analytical structure*

Let us consider a family composed by four individuals: one couple of parents and two children, one male and one female. For simplicity, let us assume that the husband and the wife share the same utility function that depends on their own and their children's well-being. Formally, for both of the parents the following relationship holds:

$$u = a * \log c + (1 - a) * \log b \qquad (1)$$

where u represents the utility level of each adult, c is the consumption level that is used as a proxy of the individual's well-being, b is the bequest that the parent leaves to the children and a is a parameter with values ranging between zero and one, measuring the degree of parental altruism.

CASE 1: *Investment in education in the presence of credit markets' efficiency*

Let us assume that the rate of return of financing E years of education of the son is given by the following function:

$$R_m = R_m(E)$$

Symmetrically, the rate of return of a female human capital investment is given by:

$$R_f = R_f(E)$$

Let us assume that both of the functions are concave and characterized by decreasing rates of returns; thus, $R_i^{'} > 0,\ R_i^{''} < 0 \ \ i = m, f$.

Gender biased labor markets and gender wage gap, customs and traditions as the practice of dowry, widespread in several low income countries, favor male education that is considered more profitable by the parents; in order to capture the preference towards male education, we assume that $R_m(E_i) > R_f(E_i)$ for any *i* additional year of schooling; assuming that male and female returns to education show a similar trend, it follows that the male curve is always above the female one[2].

The decision to finance children's human capital is based on a comparison between expected future benefits and actual costs. For the moment, let us assume that capital is perfectly mobile and individuals have free access to credits' markets. Borrowers and lenders face the same interest rate *r* > 0, constant over time. Under the assumption that parents are rational agents that maximize the utility function (1), the total number of schooling years financed for any child is obtained by equating marginal costs and benefits of the investment:

$$R_f^{'}(H_f) = R_m^{'}(H_m) = (1 + r) \qquad (2)$$

Having hypothesized that $R_m(E_i) > R_f(E_i)$ for any E_i and R '> 0, R'' < 0, the equilibrium level of female education E_f^* is lower than the male one E_m^*. Therefore, the educational gender gap shows up even in the absence of credit markets' imperfections, because of gender wage gaps, customs and traditions that lead to underestimate expected benefits associated to female schooling.

CASE 2: *Investment in education in the presence of credit markets' imperfections*

In the presence of credit markets' imperfections the borrowing interest rate is higher than the one faced by the lenders. In particular, creditors can access funds at an interest rate *r*, while they lend money at a rate $i_d > r$, in order to avoid significant losses due to moral hazard, since debtors

[2] Alternatively, it is possible to assume that the curves' shape is a function of the rate of return associated to different levels of cumulated human capital (see Garg and Morduch, 1998); this modification does not change the results of the model.

can avoid payment deciding to leave the country or declaring not to be able to repay the loan. Let us assume that, in order to prevent insolvency risk, the lenders decide to control borrowers' behavior, bearing a cost *z*. Creditors' control reduces debtors' incentives to avoid repayment; let us assume that, in order to escape the creditor, the debtor has to bear a cost $\beta * z$, where $\beta > 1$. An agent that borrows an amount of money *d* will have to pay an interest rate i_d that is able to cover the rate r and the cost *z* the creditor has to face in order to be able to lend the money.

As a consequence, in equilibrium, the following condition holds:

$$d * i_d = d * r + z \tag{3}$$

The lender will choose *z* trying to minimize the risk of borrowers' default; thus, in equilibrium:

$$d(1 + i_d) = b * z \tag{4}$$

Considering the two equations system made by (3) and (4) and substituting in (3) the expression for *d*, we have:

$$i_d = i = \frac{1 + b * r}{b - 1} > r \tag{5}$$

Equation (5) shows that the rate of interest on loans does not depend on the amount of money that has been lent. This result can be justified under the hypothesis that monitoring costs faced by the creditors are proportional to the amount of the loans; as the amounts increase, both the incentive to avoid repayment and the costs to monitor debtors' behaviors increase.

2.2 *Credit markets' imperfections: short run effects*

In the presence of credit markets' imperfections, the decision to finance children's education depends on the expected rate of return and on the interest rate that the individual faces in the financial markets. The costs to finance male and female education are different; in particular, let us assume that the amount of money necessary to finance male education is equal to g, while an investment in female education requires an income's share $h > g$.

In order to analyze investments' choices, let us distinguish among three different cases. First of all, let us consider a household where the amount of available resources is smaller than g. Parents have to apply for a loan in order to finance children's schooling; if expected benefits do not outweigh actual costs, they can decide not to finance education. Alternatively, they can borrow in the financial markets in order to pay for schooling expenses. Even if actual costs are higher, in the presence of gender-biased labor markets and customary gender norms, investment in male education can seem more profitable and the educational gender gap follows as a natural outcome of a rational behavior. In a second scenario a rich family has access to an amount of funds bigger than h; the parents will estimate the profitability of an investment in children's education as if they were facing efficient financial markets, since they are not subject to credits' constraints.

The third possible case is characterized by a family that has an amount of resources x such that $g \leq x < h$. If the parents decide to invest in male education they do not need to borrow money and the utility function becomes:

$$U_m(x) = \log[c_m + (x - g) * (1 + r)] \qquad (6)$$

where c_m and U_m indicate respectively the consumption level and the parents' utility level if they decide to finance only male education.

On the contrary, in order to invest in female education, it is necessary to access the financial markets and the utility function becomes:

$$U_f(x) = \log\left[c_f + (x-h)*(1+i)\right] \qquad (7)$$

The decision to invest in female education is profitable if and only if $U_f(x) \geq U_m(x)$, that is if and only if the following condition is satisfied:

$$x \geq k = \frac{c_m - c_f + h(1+i) - g(1+r)}{(i-r)} \qquad (8)$$

Due to the high borrowing interest rate, families that have an amount of resources that is smaller than *k* do not invest in female human capital. Given the important positive spillover effects of female education, (8) shows the negative effects of low income in the presence of inefficient financial markets. The model suggests the existence of a positive correlation between an increase in family income and a decrease in the educational gender gap; however, in social and cultural contexts characterized by a strong gender bias, improvements in households' welfare can be unable to promote a significant reduction of the educational gender gap.

2.3 *Credit markets' imperfections: long run effects*

In the analysis of the short run, the presence of credit markets' imperfections has been sufficient to justify the impact of an unequal resources distribution on human capital investment and economic growth. On the contrary, as underlined in the model developed by Galor and Zeira (1993), in the long run it is necessary to make a second important assumption: the non convexity of the human capital production technology. Under this assumption, it can be shown that stationary equilibriums exist and they are characterized by different average educational and income levels; on the contrary, if the production technology is convex, income distribution converges to a unique long run equilibrium where each family invests the same amount of resources to finance education[3]. Figure (1) below makes use of the graphical representation proposed by Galor and Zeira (1993) to analyze the dynamic evolution of the wealth distribution, in the context of the model of educational gender gap that has been developed in the previous sections.

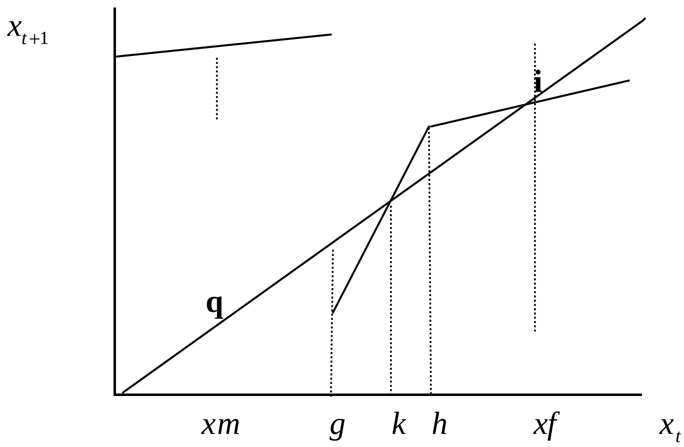

Figure (1)

Families with a level of available resources smaller than g need to borrow money in the capital markets in order to invest in education. Investment in female human capital is too expensive and unprofitable; the long run education equilibrium level will be represented by xm, with all the resources invested in male education. Families with available resources between g and k can avoid borrowing if they decide to invest only in male education. The high borrowing interest rates significantly increase the financing costs; as a consequence, the long run equilibrium level is again xm. Rich families with available wealth above k will finance both female and male education in equilibrium; if the amount of resources is greater than h, they can avoid borrowing in the financial market; if the level of wealth is between k and h, they need to borrow in the financial markets in

[3] The models by Glenn Loury (1981) and Abhijit Banerjee and Andrew Newman (1991) represent two significant contributions where the same long run equilibrium distribution is obtained starting from different initial distributional settings, in the presence of a convex production technology.

order to finance both male and female education. As in the short run, in the long run we expect a negative correlation between educational gender gap and average household income.

The economic environment that has been described is characterized by two distinct categories of families: rich households that decide to invest in both female and male education; poor families that do not have enough resources to finance human capital accumulation or decide to invest exclusively in male education. The setting is characterized by multiple long run equilibria and the final steady state where the economy will converge will depend on the initial degree of income inequality; a poor economy where the majority of the population has limited economic resources will be characterized by a significant educational gender gap and a persistent underdevelopment. On the contrary, a rich economy has enough resources to promote human capital investment and gender equality in education; however, in the presence of high income inequality, the educational gender gap will not be closed and the economic system will be characterized by an average wealth level which is smaller than the equilibrium level that could have been reached in the presence of a more equitable income distribution.

3. THE MODEL AND THE DATA

The model outlined in the previous section has analyzed the short and long run relationship between income inequality and the gender educational gap, in the presence of customary gender norms and credit markets' imperfections that influence parents' investment in children's education. In order to estimate the impact of income inequality on the educational gender gap in the context of inefficient financial markets, we use the methodology proposed by Roberto Perotti (1994) that has synthesized the main theoretical implications that can be tested in order to evaluate the role of credit markets' imperfections in the relationship between inequality and growth. In particular, three major implications can be empirically tested:

1) for a given degree of credit markets' imperfections, less income inequality leads to higher investment in education;

2) given an initial wealth distribution, more efficient financial markets lead to higher investment rates;

3) the importance of the wealth distribution as a factor that influences investment in education decreases as financial markets become more efficient.

The above implications will be tested in a gender sensitive perspective, evaluating the effects produced by credit markets' imperfections on the amount invested in male with respect to female education.

The empirical specification takes the following expression:

$$Gap_{it} = b_o + b_1 \ln gdppc1_{it} + b_2 Gini_{it} + b_3 PERF_{it} + b_4 INT_{it} + a_i + e_{it} \qquad (9)$$

where i is the individual's subscript and t the time subscript. gap_{it} is the educational gender gap at the beginning of period t; it is computed as the ratio between average years of male and female secondary schooling. $\ln gdppc1_{it}$ is the logarithm of real per capita income at the beginning of period t. $Gini_{it}$ is the income inequality index; since complete time series of this variable are not available for most of the countries in the dataset, for each period, the values of the year that is closest to the first year of the period will be used. $PERF_{it}$ represents a measure of credit markets' perfection; for this variable the values that refer to the first year of each period will be used. INT_{it} is the interaction term between Gini index and the variable of credit markets' perfection. a_i are the individual dummies that control for the influence of fixed time effects not included in the set of independent variables; e_{it} is the error term.

The data used to estimate equation (9) have been collected from different sources. Per capita income values have been taken from the *Global Development Network Growth Database* of the World Bank; the human capital variables come from Barro and Lee (2000) dataset that reports the five years periods average secondary school for a male and female sample of individuals aged fifteen years or more. In order to be able to make use of reliable statistics and to extend the sample to low and medium low income countries, the analysis will consider a thirty years period, from 1965 to 1994; moreover, given the availability of human capital data, six five years periods will be considered for each country. The values of the Gini index are taken from the dataset developed by Klaus Deininger and Lyn Squire (1996) on the basis of three criteria that increase data's reliability[4]. First of all, the data come from microeconomic studies on the families' consumption and expenditure behavior; secondly, the sample has to be representative of the entire country; finally, the measure of income or expenditure inequality considers all sources of earnings. In order to increase the significance of the obtained results and to compare them directly with previous analysis[5], the sample includes only the countries for which at least two observations for the Gini index are available; a description of variables and data's source together with summary statistics are presented in Appendix A1.

In the dataset there are sixty three countries, four of which are from Central and East Africa, five from Sub-Saharan Africa, sixteen from Latin America and the Caribbean, nine from East Asia and five from South Asia; four are Eastern European Transition countries, twenty are Western European and North American countries. Table 5 in Appendix A2 shows the values of the Gini index for each country in the six five-year periods. The averages computed for each period show that income inequality has not declined during the thirty years considered and at the end of the eighties the average level of the Gini index is higher than at the beginning of the sixties.

In order to evaluate the efficiency of the financial system, the econometric analysis will use three indexes built by Ross Levine, Norman Loayza and Thorsten Beck (2000) and the data on the loan-to-value ratio collected by Tullio Jappelli and Marco Pagano (1994) and Maria Concetta Chiuri and Tullio Jappelli (2000). The empirical studies that have analyzed the effects

[4] However, several authors have underlined significant limitations of Deininger and Squire dataset. For detailed discussions, see Andrew Atkinson and Andrea Brandolini (1999) and James Galbraith (2002).

of financial markets' imperfections have generally used the loan-to-value ratio, since it is a direct measure of the availability of credit to families. However, loan-to-value data are available only for twenty countries, with a medium-high level of per capita income; data shortage and sample selection bias reduce estimates' reliability[6].

In order to better evaluate the role of credit markets' efficiency, it is necessary to augment the sample's dimension; the three indexes built by Levine, Loayza, Beck (2000) are available for forty-five out of the sixty three countries in the sample and they seem to capture the main features of credit markets' efficiency. The first index measures the proportion of liquid liabilities on the gross domestic product, as a proxy of the overall dimension of the financial sector and the degree of diffusion of financial services. The second index considers the ratio of financial assets hold by the commercial and the central banks, as a measure of the importance of the commercial banks in the allocation of savings; an increase in the ratio indicates improved financial efficiency, under the hypothesis that commercial banks are more flexible and better able to identify opportunities of profitable investments than the central bank. The third index measures the amount of credit available to the private sector through the financial intermediaries as a percentage of the gross domestic product; this index directly evaluates the impact of credit markets' imperfections on private sector decisions, since it is a direct measure of the amount of liquidity available in the financial markets.

4. RESULTS' INTERPRETATION

The interpretation of the results obtained from the estimation of equation (9) offers a test of the validity of the gender sensitive theoretical model that has been developed. First of all, the model predicts a negative impact of income inequality on investment in education and, in particular, a positive correlation between the Gini index and the educational gender gap; thus,

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[5] Some examples are Robert Barro (2000), Klaus Deininger and Pedro Olinto (1999)

[6] For example, Roberto Perotti (1996) estimates the impact of the loan-to-value ratio on the average schooling rate; he does not obtain significant estimates.

the partial derivative of the variable *Gap* with respect to the inequality index *Gini*, $\partial Gap / \partial Gini = b_2 + b_4 PERF$, has to be positive. Moreover, in the presence of more efficient financial markets, the distribution of income should have a lower impact on investment decisions. The presence of efficient intermediaries that promote financial flows' mobility and do not request high collaterals to the borrowers reduces the importance of the initial income distribution for future investment decisions; as a consequence, we expect the coefficient of the variable INT , the interaction term between Gini index and the variable of credit markets' perfections, to be negative, that is $b_4 < 0$. Finally, given an initial resources' distribution, higher efficiency of the financial markets increases investment opportunities and thus favors a reduction of the gender educational gap. The absence of credit constraints and lower borrowing interest rates decrease the cost of human capital accumulation and promote investment in female education; as a consequence, the partial derivative of the variable *Gap* with respect to the index $PERF$, $\partial Gap / \partial PERF = b_3 + b_4 Gini$, should be negative.

Table 6 in Appendix A2 presents the results obtained estimating equation (9) with the four indicators of financial markets' development. LTV is the loan-to-value ratio, LLY the amount liquid liabilities, $PRIVO$ the proportion of credit available to the private sector as a percentage of the gross domestic product, $BTOT$ the ratio of the financial assets hold by the commercial banks and the value obtained summing them to the assets hold by the central bank. For each regression, the table reports the results of fixed or random effects estimation, according to the result obtained in the Hausman test.

The results offer plain support to the hypothesis of a significant effect of income inequality on the educational gender gap through credit markets' imperfections. First of all, there is a positive correlation between the Gini index and the educational gender gap; in each of the four specifications, the index of income inequality has a positive and significant coefficient at the five per cent level and the partial derivative $\partial Gap / \partial Gini = b_2 + b_4 PERF$ is positive[7].

Secondly, in each regression, the interaction term *INT* has a negative and significant coefficient at the five per cent level; this result confirms the hypothesis of a decreased importance of the income distribution, in the presence of more efficient financial markets. Moreover, the negative sign of the partial derivative $\partial Gap / \partial PERF = b_3 + b_4 Gini$ confirms the expectation of a reduced educational gender gap in the presence of more efficient financial markets[8]. As underlined in the theoretical model, in the presence of credit markets' imperfections, high borrowing interest rates penalize female more than male education. The econometric results show that the impact of more efficient financial markets depends on the initial level of income inequality. Since the variable *PERF* has a positive coefficient, the impact of improved financial markets on the educational gender gap increases as the Gini index is higher; in the presence of high-income inequality, financial markets' reforms could promote a significant increase in the amount of resources invested in female education. On the contrary, when income inequality is low, the value of the partial derivative decreases and tends to become positive. In the presence of low inequality, the importance of credit markets for human capital accumulation decreases; as underlined in the theoretical model, improvements in the financial system can be unable to influence investment decisions that are driven by individuals' preferences and social and cultural factors that favor male education.

The theoretical model has shown the importance of available economic resources to promote a reduction in the educational gender gap; in particular, the model has underlined the existence of a critical wealth level below which investment in female education becomes expensive and unprofitable. As a consequence, we expect a negative correlation between available income and

[7] The results obtained from the specifications that use *LTV*, *LLY*, *PRIVO*, *BTOT* respectively are the following: 0.0145, 0.0182, 0.0192 and 0.0112. In order to compute the partial derivative, the average value for each variable has been used.
[8] The results obtained from the specifications that use *LTV*, *LLY*, *PRIVO*, *BTOT* respectively are the following: -0.0192, -0.108, -0.0255, 0.0149. The positive value that is obtained from the regression that uses the variable *BTOT* has a

the educational gender gap; the econometric results offer again plain support to this prediction: in all specifications, the coefficient of the variable *lngdppc1* is negative and significant at the five per cent level, with the only exception of the one that uses the loan-to-value ratio[9].

5. INCOME INEQUALITY AND ECONOMIC GROWTH: NEW EVIDENCES

5.1 *Estimation of the engendered model*

In the extensive literature on credit markets' imperfections[10], different theoretical models have underlined a negative impact of income inequality on economic growth through the disincentives to invest in human capital. The estimates reported in table 6 in Appendix A2 support the prediction of a positive correlation between income inequality and the educational gender gap in the presence of inefficient financial markets, suggesting a negative relationship between inequality and growth through under investment in female education.

Although different theoretical models describe in details the mechanisms through which income inequality influences the growth process, empirical analysis have often made use of reduced form equations, that do not test explicitly the way income disparities impact on growth. The following econometric model is typically used[11]:

$$\begin{aligned} Growth_{it} = {} & d_o + d_1 Gini_{it} + d_2 \ln gdppc1_{it} + d_3 syrm_{it} + d_4 syrf_{it} + \\ & + d_5 BMP_{it} + a_i + h_t + e_{it} \end{aligned} \qquad (10)$$

The growth rate is estimated as a function of the initial level of inequality, income, female and male human capital, and black market premium, as a proxy for macroeconomic policies and

limited relevance, given the low reliability of this indicator with respect to the other two (see Levine, Loayza, Beck, 2000, pag.9).

[9] However, given limited availability and measurement errors that characterize this indicator (see Roberto Perotti, 1994), the obtained result does not modify the main conclusions.

[10] See for example Philippe Aghion, Eve Caroli and Cecilia García-Peñalosa (1999), Banerjee and Newman (1993) and Philippe Aghion and Patrick Bolton (1997)

[11] See for example Roberto Perotti (1996) and Kristin Forbes (2000)

trade markets distortions. Moreover, in order to improve estimates' significance and lower the risk of omitted variable bias, the specification includes individual and period dummy variables.

In this section we use an empirical gender sensitive model that adds to the basic structure represented by (10) the educational gender gap, as defined in section 3. The following specification will be tested:

$$\begin{aligned} Growth_{it} &= b_o + b_1 Gini_{it} + b_2 \ln gdppc1_{it} + b_3 syrm_{it} + b_4 syrf_{it} + \\ &+ b_5 BMP_{it} + b_6 gap_{it} + a_i + h_t + e_{it} \end{aligned} \qquad (11)$$

where *i* and *t* are the individual and period subscript respectively. *BMP* is the black market premium[12]; *syrf* reports the average female secondary schooling years at the beginning of each of the five years time intervals[13].

An efficient econometric technique that can be used to estimate (11) is fixed and random effects. However, in order to obtain unbiased estimates, it is necessary to assume the absence of endogenous variables in the set of independent variables; equation (11) does not satisfy this assumption, since the logarithm of per capita income can not be taken as exogenous. Rewriting equation (11) with the growth rate expressed as a difference between income levels and adding $\ln gdppc1_{it}$ to both sides of the equation, we obtain:

$$\begin{aligned} \ln gdppc1_{i,t+1} &= b_o + b_1 Gini_{it} + g \ln gdppc1_{it} + b_3 syrm_{it} + b_4 syrf_{it} + \\ &+ b_5 BMP_{it} + b_6 gap_{it} + a_i + h_t + e_{it} \end{aligned} \qquad (11')$$

where $g = b_2 + 1$.

[12] The data source is the *Global Development Network Database* of the World Bank and the values are the averages for each of the six time intervals.
[13] The data come from Robert Barro and Jong-Wha Lee (2000) dataset

In a synthetic expression we can write:

$$y_{i,t+1} = g * y_{it} + X'_{it} B + a_i + h_t + e_{it} \qquad (12)$$

where for simplicity the constant term b_o has been removed and $t = 1,.....,T$, $i = 1,.....,N$. y is the logarithm of the income level and X represents the vector of the explanatory variables different from y. Equation (12) specifies a dynamic autoregressive model with individual and time effects.

We make the following assumptions on the error term:

A1. $E(e_{it} | y_{i,t}) = 0$

A2. $E(e_{it}^2 | y_{i,t}) = s_e^2$

A3. $E(e_{it} e_{js} | y_{i,t}) = 0$, for any $i \neq j$, $s \neq t$

If the number of time intervals does not tend to infinity, even if $N \rightarrow \infty$, the estimates obtained with a fixed or random effects model are biased[14]; when T is finite, the probability limit of the Least Squares Dummy Variable Estimator (within) is different from zero. Since in our analysis t=6, the estimates obtained with a fixed or random effects estimator are inconsistent.

Under the same set of assumptions A1-A3 on the error term, Manuel Arellano and Stephen Bond (1991) have developed the Generalized Method of Moments (GMM) estimator that delivers unbiased results in the presence of endogenous explanatory variables. In order to eliminate the influence of the individual effects, the GMM estimator considers each variable in first differences and it uses the lags of each variable as instruments. Equation (12) can be rewritten as follows:

$$y_{i,t+1} - y_{it} = g\left(y_{it} - y_{i,t-1}\right) + \left(\mathrm{X}'_{it} - \mathrm{X}'_{i,t-1}\right)\mathrm{B} + \left(e_{it} - e_{i,t-1}\right) \qquad (13)$$

where all variables are expressed in deviation from each period average. For the third period, $y_{i,1}$ is an instrument for $\left(y_{i,2} - y_{i,1}\right)$, since it is correlated with $\left(y_{i,2} - y_{i,1}\right)$ and $E\left[y_{i,1}\left(e_{i3} - e_{i2}\right)\right] = 0$. In the fourth period, $y_{i,1}$ and $y_{i,2}$ are the instruments for $\left(y_{i,3} - y_{i,2}\right)$; in each period this procedure delivers the instruments for each of the variables expressed in first differences. As a consequence, the number of instruments grows with time and in the last period, *T*, there will be $\left(y_{i1}, y_{i2}, \ldots, y_{i,T-2}\right)$ instrumental variables. For any individual *i*, we can define the following instruments' matrix:

$$W_i = \begin{pmatrix} y_{i1} & 0 & 0 & 0 & 0 & 0 & . & . & . & . & . & 0 \\ 0 & y_{i1} & y_{i2} & 0 & 0 & 0 & . & . & . & . & . & 0 \\ 0 & 0 & 0 & y_{i1} & y_{i2} & y_{i3} & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . & . & . & . & . \\ 0 & 0 & 0 & 0 & 0 & 0 & . & y_{i1} & y_{i2} & y_{i3} & . & y_{i,T-2} \end{pmatrix}$$

If the panel is unbalanced, GMM estimator is computed deleting the rows of the W_i matrix with no observations and replacing with a zero the missing values in the included columns. The variation of the number of observations and time intervals among different individuals does not weaken the obtained estimates, under the assumption that the observations are independently

[14] Ruth Judson and Anne Owen (1996) report that the use of fixed effects when *t*=5 produces a bias greater than fifty percent for the lagged dependent variable and a bias of approximately three percent for the other coefficients (see Kristin Forbes 2000, page 876).

and randomly distributed[15]. Finally, if we assume that the explanatory variables are exogenous, the vector of variables Δx_{it} provides other instruments for the estimation of equation (13); in this case, the matrix W_i will have one more row, made of the vector of exogenous explanatory variables expressed in first differences.

The estimates obtained with GMM estimator are efficient if the variables in first differences in the vector $X_{i,t-s}$ are predetermined of at least one period, that is if $E\left(X_{it}^{'} u_{is}\right) = 0$ for any $s > t$. Moreover, the errors have to be serially uncorrelated, that is $E\left(e_{i,t}\, e_{i,t-s}\right) = 0$ for any $s \geq 1$; the test statistic for second order serial correlation from the first-step estimates can be used to check for this assumption[16].

Table 7 in Appendix A2 presents the estimates obtained for equation (11) with fixed effects, random effects and GMM estimator. The results differ significantly according to the estimation technique that has been used. A Hausman specification test rejects the assumption of no correlation between individual effects and explanatory variables[17]; random effects lead to biased estimates, fixed effects have to be chosen. However, the presence of the endogenous variable *lngdppc1* violates the fundamental assumption of exogenous explanatory variables that is necessary for the use of both fixed and random effects techniques. As already underlined, GMM estimation offers a possible solution to this problem, delivering consistent estimates even in the presence of endogenous regressors; a serial correlation test confirms the absence of serial correlation in the error terms, as requested for estimates' efficiency[18].

The coefficients in column (3) confirm the results obtained in the most recent analysis of the relationship between income inequality and economic growth[19]. As predicted by the models of conditional convergence, the coefficient of the initial level of income is negative and significant;

[15] For a detailed discussion on this topic, see Arellano and Bond (1991)
[16] For the coefficient estimates, Arellano and Bond (1991) recommend the use of the first-step results, due to the underestimation of the second-step standard errors.
[17] The P-value of the test statistic is 0.0000; thus, the null hypothesis is rejected at any significance level.
[18] The P-value of the test statistic in the second order serial correlation test is 0.8963; thus, the null hypothesis of absence of second order serial correlation can not be rejected at any standard significance level.

the sign of the correlation between growth rate and black market premium, female and male education coincides with the one estimated in the literature, even if the coefficients of these three variables are not significant. The results obtained with GMM estimator confirm the importance of including the gender educational gap in the set of regressors; the variable *gap* has a negative sign and is significant at the ninety-nine percent level. Finally, confirming a result obtained by different authors that have performed GMM estimation[20], Gini index is positively correlated with economic growth. A positive relationship between income inequality and growth may seem difficult to justify and counterintuitive. However, the results obtained with panel estimations on five years time intervals capture the short run effect of income inequality on the growth process; a positive relationship in the short run does not rule out the existence of a negative correlation in the long run.

In conclusion, the estimates show the complexity of the relationship between inequality and growth that is influenced by different factors with opposite influence. In particular, the positive direct impact of the Gini index has to be discounted by the indirect growth reducing effect due to the increase of the gender educational gap; therefore, it is necessary to further analyse the impact of inequality on growth, comparing the gender-sensitive model and the gender-neutral one.

5.2 *Engendered and gender-neutral model: a comparison*

The theoretical model developed in section 2 and the estimates obtained in section 3 suggest the existence of a relationship between income inequality and economic growth through the impact of income disparities on the gender educational gap, in the presence of credit markets' imperfections. In order to evaluate the net effect of inequality on growth, we can use equation (9) and (11) to estimate a two-equation model, as follows:

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[19] See Forbes (2000).

$$Growth_{it} = b_o + b_1 Gini_{it} + b_2 \ln gdppc1_{it} + b_3 syrm_{it} + b_4 syrf_{it} + \\ + b_5 BMP_{it} + b_6 gap_{it} + a_i + h_t + e_{it}$$

$$Gap_{it} = g_o + g_1 \ln gdppc1_{it} + g_2 Gini_{it} + g_3 PERF_{it} + g_4 INT_{it} + a_i + e_{it} \qquad (14)$$

As already underlined, the relationship between inequality and growth has been traditionally analysed with a gender-neutral equation as (10) above. This approach has two serious pitfalls; first of all, it does not include among the explanatory variables the significant variable *gap*. Secondly, it does estimate a reduced form model that does not investigate the mechanism through which income inequality impacts on growth.

Given the statistical significance of b_6, g_3 and g_4, a model that excludes *gap* delivers biased estimates; in particular, given the positive correlation between income inequality and gender gap, the omission of the variable *gap* should result in an underestimation of the impact of Gini index on the dependent variable. In order to measure the bias of the gender-neutral model, we compare the results obtained from the estimated impact of the Gini index in equation (10) and in the two-equation system (14); thus, we compare d_1 of the variable *Gini* from equation (10) with the partial derivative of the growth rate with respect to the inequality index in equation (14) $\partial Crescita / \partial Gini = b_1 + b_6 * (g_2 + g_4 PERF)$[21]. In the previous section, we have underlined the arguments that justify the choice of the GMM estimator; in what follows we omit the estimates from fixed and random effects models. Table 8 in Appendix A2 reports the coefficients estimated with the GMM estimator applied to equation (10) and to the first equation of system (14).

[20] See for example Abhijit Benerjee, Esther Duflo (2000), Kristin Forbes (2000), Hongyi Li, Hengfu Zou (1998)

[21] For the computation of the partial derivatives the average value of *LTV*, *LLY*, *PRIVO* and *BTOT* has been used.

Table 9 in Appendix A2 presents the computation of the partial derivatives of the growth rate with respect to the Gini index in the engendered model, considering each of the four indexes of financial markets' development included in the dataset. The results confirm the importance of including the gender educational gap in order to obtain an unbiased estimate of the impact of income inequality on economic growth; a comparison between the values reported in the second and in the third column of table 8 shows the distortion of the coefficients estimated in the gender neutral specification. The inclusion of the gender educational gap significantly modifies the impact of each explanatory variable on the dependent variable; in particular, the estimated impact of the Gini index changes from 0.0069 to 0.0084, confirming the expected downward bias when the educational gap is not included in the set of regressors.

The computations in table 9 offers a robustness' check of the estimates obtained with the gender-neutral model; the results show that the net impact of income inequality on growth estimated from system (14) tends to coincides with the impact estimated from equation (10). Since the partial derivatives have been computed with the average value of the credit perfections variables, a gender neutral equation as (10) seems to estimate correctly the impact of income inequality on growth only if the financial markets efficiency's indexes do not significantly vary from the average level; moreover, even if equation (10) delivers a correct estimate of the average impact of inequality on growth, it does not investigate the mechanism through which income disparities influence the growth process.

5.3 *Sensitivity analysis*

An empirical analysis of the relationship between income inequality and economic growth with the GMM estimator has been recently proposed by Kristin Forbes (2000) that has considered a gender-neutral reduced form model as the one given by equation (10). Forbes uses a sample of forty-five countries with observations for the Gini index for at least two consecutive time intervals. In this section, we use Forbes' sample for a sensitivity analysis of the results obtained with the estimation of the engendered model[22].

Table 10 in Appendix A2 contains the results obtained from the estimation of equation (9) with the four indexes of financial markets' development. As in table 6, the estimates confirm the hypothesis of a significant effect of income inequality on the educational gender gap through the inefficiencies of financial markets. In all four specifications, the Gini index has a positive and significant coefficient and the partial derivative $\partial Gap / \partial Gini = b_2 + b_4 PERF$ has a positive sign[23]. In all the regressions, the interaction term *INT* has a negative and significant coefficient; the expectation of a negative sign of the partial derivative $\partial Gap / \partial PERF = b_3 + b_4 Gini$ is confirmed in two cases over four[24]. Finally, the estimates support the expectation of a negative coefficient of per capita income; as predicted in the theoretical model, an increase in the available economic resources leads to a reduction of the gender educational gap.

The first column of table 11 in Appendix A2 presents the estimates obtained with the gender-neutral model used by Forbes[25]. The sign of the coefficients is the same as the one reported by the author; however, black market premium, female and male education are not significant, confirming the results obtained in the sample with sixty-three countries. The comparison with the results obtained from the gender-sensitive model shows once again the significance of the gender gap variable. Considering the positive correlation between *Gini* and *Gap*, the omission of the gender gap produces an underestimation of the impact of income

[22] The only difference with respect to the sample used by Forbes is the exclusion of Bulgaria, since this country is not included in the Barro-Lee dataset.

[23] Considering *LTV*, *LLY*, *PRIVO* and *BTOT*, the obtained results are respectively: 0,0145, 0,003, 0,003, -0,318. The negative value from the regression that includes *BTOT* does not modify the main conclusions, due to the low reliability of this indicator with respect to the other two (see Levine, Loayza and Beck, 2000).

[24] Considering *LTV* and *BTOT*, the obtained results are respectively: -0,018, -0,007; using *LLY* and *PRIVO*, the results are respectively 0,16 and 0,23.

[25] As indicator of macroeconomic policies distortions, Forbes uses PPPI, the investment price level; however, in the sensitivity analysis she shows how the black market premium is an alternative indicator that does not modify the conclusions of her analysis.

inequality on the growth rate; in the gender neutral specification the coefficient of the Gini index is lower than in the engendered model.

In order to evaluate the bias of the estimates when the gap variable is not included in the regression, table 12 in Appendix A2 presents the computation of the total effect of the Gini index on the dependent variable in system (14). Confirming the results obtained with the sample of sixty-three countries, the values reported in the fourth column, obtained with the average value of the financial efficiency's indicators, tend to coincide with the estimates of the Gini variable coefficient in equation (10); the gender-neutral specification correctly evaluates the impact of inequality on growth, when the financial efficiency's indexes do not encounter great variations.

The empirical analysis that has been developed underlines the importance of including the educational gender gap in order to obtain unbiased estimates. The results with the sixty-three and forty-four countries sample confirm the hypothesis of a relationship between income inequality and economic growth through a gender biased impact of credit markets imperfections on human capital accumulation.

6. CONCLUSIONS

The diffusion of poverty feminization and the preference toward male education have motivated a theoretical and empirical analysis in order to investigate the factors that lead to under invest in female schooling; this paper has developed a model of the relationship of income inequality and the educational gender gap in the presence of liquidity constraints and inefficient financial markets. In cultural contexts where male education is considered more profitable, inefficient financial markets have a gender biased impact on human capital accumulation; given the significant positive effects of women's education on economic growth, the results show the negative impact of income inequality through the disincentives to invest in female schooling.

The literature that has analysed investment in human capital and the relationship between inequality and growth has traditionally adopted a gender-neutral approach, considering the impact of resources' availability on an average measure of educational attainment. Given the significant spillover effects of female education and the persistent gender differences in enrolment and attendance rates at each schooling level, this approach is unsatisfactory; it is necessary to evaluate the impact of income disparities on the gender gap in education and not on the mean educational level.

The gender-sensitive analysis developed in this paper suggests a new explanation of the relationship between inequality and growth, through the impact of credit markets' imperfections on the educational gender gap. The empirical results offer strong support to the predictions of the theoretical model; the main findings can be summarised as follows:

1. Income inequality, measured with the Gini index, has a positive impact on the educational gender gap, defined as the ratio of male to female secondary schooling; an increase in income inequality leads to under invest in female with respect to male education.
2. Financial market efficiency has a negative impact on the educational gender gap; in the presence of liquidity constraints, high borrowing interest rates penalise female more than male education. More efficient financial intermediaries can promote women's education through a reduction of the costs of financing human capital accumulation.
3. The econometric results suggest the existence of a negative relationship between inequality and growth through the disincentives to invest in female education; a financial markets' reform to improve efficiency and increase available liquidity could offer an important contribution to the closure of the gender educational gap and to economic growth prospects through this channel.

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Appendix A1

VARIABLES' DESCRIPTION

Growth: growth rate of PPP-adjusted per capita gross domestic product. *Source*: Global Development Network Growth Database 2000.

lgdppc1: logarithm of PPP-adjusted per capita gross domestic product. *Source*: Global Development Network Growth Database 2000.

Gap: educational gender gap as a ratio of average male and female secondary school years. *Source*: Barro and Lee, 2000.

Syrm: average male secondary school years. *Source*: Barro and Lee, 2000.

Syrf: average female secondary school years. *Source*: Barro and Lee, 2000.

Gini: Gini index of income inequality. *Source*: Deininger and Squire, 1996.

Ltv: loan-to-value ratio, index of access to credit; it considers the collaterals required to obtain a loan for buying a house. *Source*: Jappelli and Pagano, 1994 and Chiuri and Jappelli, 2000.

Lly: liquid liabilities as a proportion of gross domestic product. Liquid liabilities are the sum of money, deposits and financial assets. *Source*: Levine, Loayza and Beck, 1999.

Privo: credit given to the private sector by financial intermediaries as a proportion of gross domestic product. *Source*: Levine, Loayza and Beck, 1999.

Btot: ratio of commercial banks' financial assets and the value obtained summing them with Central Bank's financial assets. *Source*: Levine, Loayza and Beck, 1999.

Bmp: black market premium, computed with the formula: [(black market exchange rate)/(official exchange rate-1)]*100. *Source*: Global Development Network Growth Database, 2000.

Int: interaction term between Gini index and financial markets efficiency's indicators.

SUMMARY STATISTICS

Variable	Obs	Media	Std. Dev.	Min	Max
growth	463	.1002504	.1483518	-.4362797	.7136038
lgdppc1	466	7.978451	.9450831	5.857933	9.801123
gap	461	2.146746	2.368982	.4742404	39.5
syrm	462	1.307998	1.073378	.03	5.374
syrf	463	1.010186	1.031485	.002	5.106
gini	264	39.99875	9.252704	21	61.9
ltv	92	73.73913	12.33495	50	95
lly	356	.4191604	.2420613	.064407	1.914396
privo	355	.3944883	.3195163	.0090594	2.059511
btot	360	.782754	.1866154	.1792692	1
bmp	440	52.53732	202.5083	-9.93	2792.36

Appendix A2

Illiteracy rate for the population aged 15 years and above **Table 1**

Regions	1980		2000	
	Women	Men	Women	Men
Africa				
Northern Africa	74	43	48	25
Southern Africa	33	35	16	21
Rest of Africa Sub-Sahara	73	51	51	33
Latin America and Caribbean				
Central America	31	26	22	18
South America	18	12	9	6
Asia				
East and Southeast Asia	27	12	12	5
South of Asia	65	44	50	30
West of Asia	48	27	25	13
Developed regions	8	4	3	1

Source: *Women's Indicators and Statistics Database* (Wistat), Version 4, CDROM

Illiteracy rate for the population aged 15 – 24 in the 1990s **Table 2**

	F	M
Africa		
Algeria	38	14
Benin	73	45
Burundi	52	40
Cameroon	29	15
Central Africa Rep.	65	37
Cotè d'Avoire	62	40
Djibouti	52	38
Egypt	49	29
Malawi	51	30
Mali	81	62
Mauritania	62	43
Morocco	54	29
Niger	90	75

	F	M
Africa (continued)		
Senegal	72	51
Sudan	41	22
Tunisia	28	7
Uganda	37	23
Zambia	28	20
Latin America		
Guatemala	29	18
Asia		
Nepal	67	32
Yemen	64	17

Source: *Women's Indicators and Statistics Database* (Wistat), Version 4, CDROM

Combined primary/secondary gross enrolment ratios, 1994/1996 Table 3

	F	M		F	M
North Africa			**Sub-Saharan Africa (continued)**		
Morocco	54	71	Senegal	37	48
			Sierra Leone	29	43
Sub-Saharan Africa			Somalia	8	16
Benin	35	63	Togo	59	92
Burkina Faso	16	26			
Central Africa Rep.	26	43	**South-East Asia**		
Chad	23	47	Cambodia	68	86
Cotè d'Avoire	38	58	Laos Rep.	63	80
Congo Rep.	41	62			
Djibouti	22	31	**South Asia**		
Ethiopia	20	33	Afghanistan	22	49
Gambia	46	62	Bangladesh	38	49
Ghana	50	64	India	62	81
Guinea	20	41	Nepal	53	94
Guinea-Bissau	27	50	Pakistan	26	53
Mali	20	33			
Mauritania	42	54	**West Asia**		
Mozambique	27	38	Iraq	58	73
Niger	14	23	Yemen	34	90
Nigeria	61	77			

Source: *Women's Indicators and Statistics Database* (Wistat), Version 4, CD-ROM

Female over male enrolment rate Table 4

		1960	1970	1980	1990	1995
World (107 Countries)	*Age >= 25 years*	86,4	83,9	83,6	83,1	84,3
	Age >= 15 years	86,7	84,7	84,3	85,5	85,4
Developing Countries	*Age >= 25 years*	48,5	49,7	55,9	63,1	67,4
	Age >= 15 years	55,7	57,2	62,5	69,3	71,8
East and North Africa	*Age >= 25 years*	51,3	43,9	49,7	56,9	63,1
	Age >= 15 years	51	50,5	58	69,1	73,3
Sub-Saharan Africa	*Age >= 25 years*	59,3	55,4	54	62,6	66,9
	Age >= 15 years	61,8	60,1	66	65	70,8
Latin America and Caribbean	*Age >= 25 years*	82,9	78,9	89,5	93,6	95,1
	Age >= 15 years	96,3	85	93,7	96,8	94,4
East Asia and Pacific	*Age>= 25 years*	49	57,2	67,9	76,1	80,3
	Age >= 15 years	58,8	67,5	76,1	83,7	85,6
South Asia	*Age >= 25 years*	25,3	29,2	35	44	49
	Age >= 15 years	31,4	36,8	41,9	51,9	55,4
Developed Countries	*Age >= 25 years*	93,3	92,3	93,5	91,3	93,7
	Age >= 15 years	94,7	93,9	95,2	96,1	95
Transition Countries	*Age >= 25 years*	85,9	88,6	89,2	92,2	100,9
	Age >= 15 years	88,2	90,6	90,7	94	105,1

Source: Barro, Lee (2000), "International Data on Educational Attainment. Updates and Implications" NBER W.P. 791

Gini Index

Table 5

Country	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89
Australia	.	32	.	39,3	37,6	41,7
Bangladesh	37,3	34,2	36	35,2	36	35,5
Barbados	.	36,9	.	48,9	.	.
Belgium	.	.	.	28,3	26,2	26,6
Bolivia	.	49,6	.	.	.	42,04
Brazil	.	57,6	61,9	57,8	61,8	59,6
Canada	31,6	32,3	31,6	31	32,8	27,6
Chile	.	45,6	46	53,2	.	55,9
China	.	.	.	32	31,4	34,6
Colombia	.	52	46	54,5	.	51,2
Korea	34,3	33,3	36	38,6	34,5	33,6
Costa Rica	.	.	44,4	45	47	46,1
Denmark	.	.	.	31	31	33,2
Dominique Rep.	.	.	.	45	43,3	50,5
Egypt	40	.	38	.	.	.
El Salvador	53	46,5	.	48,4	.	.
Fiji	.	46	.	42,5	.	.
Philippine	49,7	51,3	49,4	.	46,1	45,7
Finland	.	31,8	27	30,9	30,8	26,2
France	47	44	43	34,9	34,9	.
Germany	28,13	33,57	30,62	32,06	32,2	26
Japan	34,8	35,5	34,4	33,4	35,9	35
Jordan	.	.	.	40,8	.	36,1
Greece	.	.	41,7	.	39,9	41,8
Guatemala	.	.	.	49,7	.	59,06
Honduras	.	61,9	.	.	.	54
Hong Kong	.	.	39,8	37,3	45,2	42
India	37,7	37	35,8	38,7	38,1	36,3
Indonesia	40	37,3	.	42,2	39	39,7
Iran	.	45,4	42,3	.	42,9	.
Ireland	.	.	38,7	35,7	.	34,6
Italy	.	.	39	34,3	33,2	2,7
Jamaica	.	.	44,5	.	.	41,8
Kenya	48,8	.	.	59	57,3	.
Malaise	.	50	51,8	51	48	48,4
Mauritius	.	.	.	45,7	.	39,6
Mexico	55,5	57,7	57,9	50	50,6	55
Nepal	.	.	.	.	53	30,06
New Zealand	.	.	30	34,8	35,8	40,2
Norway	37,5	36	37,5	31,2	31,4	33,1
Holland	.	.	28,6	28,1	29,1	29,6
Pakistan	.	36,5	38,1	38,9	39	38
Panama	.	57	.	47,5	.	56,5
Peru	.	.	55	.	49,3	49,4
Poland	.	.	.	25	25,3	26,2

Portugal	.	.	40,6	36,8	.	35,8
United Kingdom	24,3	25,1	23,3	24,9	27,1	32,3
Senegal	.	50,15	43	.	.	.
Singapore	.	.	41	40,7	42	39
Spain	32	.	37,1	33,4	31,8	32,5
Sri Lanka	47	37,7	35,3	42	45,3	36,7
United States	34,6	34,1	34,4	35,2	37,3	37,8
Sweden	.	33,4	27,3	32,4	31,2	32,5
Thailand	41,3	42,6	41,7	.	43,1	48,8
Taiwan	32,2	29,4	31,2	28	29,2	30,1
Trinidad e Tobago	.	.	51	46,1	41,7	.
Tunisia	49	.	50,6	49,6	49,6	46,8
Turkey	.	56	51	.	.	44
Uganda	.	40,07	.	.	.	33
Hungary	25,9	22,9	22,8	21,5	21	23,3
Venezuela	.	.	47,7	39,4	42,8	53,8
Yugoslavia	31,18	.	32	34,73	32,4	31,88
Zambia	.	.	59	51	.	.
Average	38,85	41,66	40,38	39,54	38,5	39,79

Source: Deininger and Squire (1996)

Table 6

Financial efficiency indicators	LTV^	LLY	PRIVO	BTOT^
lgdppc1	-0,0967	-0,8287***	-0,6851***	-0,6805***
	(*0,994*)	(*0,195*)	(*0,209*)	(*0,119*)
Gini	0,1261***	0,0489***	0,0449***	0,127***
	(*0,027*)	(*0,017*)	(*0,012*)	(*0,027*)
PERF	0,0409***	2,5959*	2,2819***	5,691***
	(*0,013*)	(*1,399*)	(*0,831*)	(*1,564*)
INT	-0,0015***	-0,0682*	-0,0582***	-0,143***
	(*0,000*)	(*0,035*)	(*0,021*)	(*0,033*)
constant	-1,3564	6,6694***	5,5546***	2,2462**
	(*1,331*)	(*1,690*)	(*1,806*)	(*1,327*)
R-squared	0,71	0,22	0,20	0,23
# countries	63	63	63	63
Period	1965-1994	1965-1994	1965-1994	1965-1994

Notes: Dependent variable is the educational gender gap, computed as the ratio between male and female schooling. Standard errors are in parenthesis; R-squared is R-squared within for the fixed effects model, R-squared overall for the random effects one.
^estimates obtained with the random effects model
*significance level of 90%, **of 95%, ***of 99%

Table 7

Estimation technique	Fixed Effects (1)	Random Effects (2)	Arellano and Bond (3)
Gini	0,0067***	-0,0008	0,0084***
	(*0,002*)	(*0,001*)	(*0,003*)
lgdppc1	-0,2473***	-0,0487**	-0,4916***
	(*0,047*)	(*0,019*)	(*0,073*)
syrm	0,0027	0,0216	-0,00004
	(*0,037*)	(*0,026*)	(*0,047*)
syrf	0,031	-0,0011	0,0306
	(*0,039*)	(*0,028*)	(*0,047*)
BMP	-0,0001***	-0,0001**	-0,0002
	(*0,000*)	(*0,000*)	(*0,000*)
gap	-0,022***	-0,0191***	-0,0408***
	(*0,009*)	(*0,006*)	(*0,016*)
constant	1,855***	0,5845***	0,0208
	(*0,000*)	(*0,171*)	(*0,015*)
# countries	63	63	63
Period	1965-1994	1965-1994	1965-1994

Notes: Dependent variable is yearly average growth. Standard errors are in parenthesis. R-squared is R-squared within for fixed effects model, R-squared overall for the random effects one.
*significance level of 90%, **of 95%, ***of 99%

Table 8

Estimated Model	Reduced form gender-neutral (1)	Reduced form gender-sensitive (2)
Gini	0,0069***	0,0084***
	(*0,003*)	(*0,003*)
lgdppc1	-0,5266***	-0,4916***
	(*0,072*)	(*0,073*)
syrm	-0,024	-0,00004
	(*0,048*)	(*0,047*)
syrf	0,0453	0,0306
	(*0,049*)	(*0,047*)
BMP	-0,0002	-0,0002
	(*0,000*)	(*0,000*)
gap		-0,0408***
		(*0,016*)
constant	0,0363***	0,0208
	(*0,013*)	(*0,015*)
# countries	63	63
Period	1965-1994	1965-1994

Notes: Dependent variable is yearly average growth. Standard errors are in parenthesis. R-squared is R-squared within for fixed effects model, R-squared overall for the random effects one. *significance level of 90%, **of 95%, ***of 99%

Table 9

Impact of Gini Index on the growth rate	Direct impact (a)	Indirect impact (b)	Total impact (a+b)
LTV	0,0084	(-0,0408*0,0155)	0,0077
LLY	0,0084	(-0,0408*0,0202)	0,0075
PRIVO	0,0084	(-0,0408*0,022)	0,0075
BTOT	0,0084	(-0,0408*0,0113)	0,0079

Notes: The values in column (a) report the Gini coefficient obtained from model (2) in table 3. The indirect impact is computed by multiplying the coefficient of the educational gender gap variable from table 3 with the partial derivative of the gender gap with respect to the Gini index computed from equation 9.

Table 10

Financial efficiency indicators	LTV^	LLY	PRIVO	BTOT^
lgdppc1	-0,0967	-0,9996***	-0,9015***	-0,5273**
	(*0,994*)	(*0,188*)	(*0,198*)	(*0,213*)
Gini	0,1261***	0,0354*	0,0266*	0,1102***
	(*0,027*)	(*0,020*)	(*0,014*)	(*0,029*)
PERF	0,0409***	2,7204*	2,0555***	4,1585***
	(*0,013*)	(*1,413*)	(*0,789*)	(*1,562*)
INT	-0,0015***	-0,0661*	-0,0471**	-0,119***
	(*0,000*)	(*0,037*)	(*0,020*)	(*0,033*)
constant	-1,3564	8,5831***	8,028***	1,9913
	(*1,331*)	(*1,749*)	(*1,791*)	(*2,097*)
R-squared	0,71	0,22	0,20	0,36
# countries	44	44	44	44
Period	1965-1994	1965-1994	1965-1994	1965-1994

Notes: Dependent variable is the educational gender gap, computed as the ratio between male and female schooling. Standard errors are in parenthesis; R-squared is R-squared within for the fixed effects model, R-squared overall for the random effects one.

^estimates obtained with the random effects model

*significance level of 90%, **of 95%, ***of 99%

Table 11

Estimated Model	Reduced form gender-neutral (1)	Reduced form gender-sensitive (2)
Gini	0,0084***	0,0089***
	(*0,003*)	(*0,003*)
lgdppc1	-0,45***	-0,4076***
	(*0,067*)	(*0,068*)
syrm	-0,012	-0,0018
	(*0,045*)	(*0,044*)
syrf	0,0378	0,0294
	(*0,045*)	(*0,044*)
BMP	-0,0001	-0,0002
	(*0,000*)	(*0,000*)
gap		-0,035**
		(*0,016*)
constant	0,031**	0,0155
	(*0,012*)	(*0,014*)
# countries	44	44
Period	1965-1994	1965-1994

Notes: Dependent variable is yearly average growth. Standard errors are in parenthesis. R-squared is R-squared within for the fixed effects model, R-squared overall for the random effects one.

*significance level of 90%, **of 95%, ***of 99%

Table 12

Impact of Gini index on the growth rate	Direct impact (a)	Indirect impact (b)	Total impact (a+b)
LTV	0,0089	(-0,035*0,0145)	0,0084
LLY	0,0089	(-0,035*0,003)	0,0083
PRIVO	0,0089	(-0,035*0,0026)	0,0083
BTOT	0,0089	(-0,035*-0,0068)	0,009

Notes: The values in column (a) report the Gini coefficient obtained from model (2) in table 3. The indirect impact is computed by multiplying the coefficient of the educational gender gap variable from table 3 with the partial derivative of the gender gap with respect to the Gini index computed from equation 9.