Faculdade de Economia da Universidade de Coimbra
Grupo de Estudos Monetários e Financeiros (GEMF)
Av. Dias da Silva, 165 – 3004-512 COIMBRA, PORTUGAL
http://www4.fe.uc.pt/~gemf/ - gemf@sonata.fe.uc.pt

MARIA ADELAIDE DA SILVA DUARTE
MARTA CRISTINA NUNES SIMÕES

HUMAN CAPITAL INVESTMENT THROUGH EDUCATION AND ECONOMIC GROWTH

A panel data analysis based on a group of Latin American countries

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Maria Adelaide Silva Duarte
(maduarte@sonata.fe.uc.pt)

Marta Cristina Nunes Simões
(mcsimoes@sonata.fe.uc.pt)

Faculdade de Economia da Universidade de Coimbra
GRUPO DE ESTUDOS MONETÁRIOS E FINANCEIROS (GEMF)
Av. Dias da Silva, 165, 3004-512 Coimbra, PORTUGAL
http://www4.fe.uc.pt/~gemf

ABSTRACT

Our main goal is to ascertain whether investment in human capital through education (without differentiation, by gender, with gender gaps) can explain the steady state growth productivity levels and a potential convergence process in a sample of Latin American developing countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Trinidad&Tobago, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay and Venezuela). These countries will also be integrated in a larger sample with developed countries from Europe (Austria, Belgium, Denmark, Finland, France, the former Federal Republic of Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom).

We consider a neoclassical growth model with human capital as did Mankiw, Romer and Weil (1992) and later Knowles, Lorgelly and Owen (1998) who include both female and male education and gender gaps in education levels as explanatory variables. The consideration of human capital by gender and the quantification of its influence appear of major importance in the developing countries if the education of women in these countries produces positive social benefits. In these circumstances the educational policies by gender should be supported because, ceteris paribus, an increase in the levels of female schooling will produce positive total effects in the form of higher productivity levels.

The empirical analysis is based on panel data and the following estimation procedures are used: ordinary least squares (OLS), non linear least squares (NLLS), ordinary least squares with dummy variables (LSDV), ordinary least squares with first differences (OLSD) and non linear least squares with dummy variables (NLLSDV). We first present the results for the productivity equations and then for the convergence equations, considering our two samples and the different estimation procedures. The use of different samples and estimation techniques is intended to make our analysis more robust.

1 - Introduction

This presentation is part of a larger research project on human capital and its influence in economic growth. The aim of the project is twofold: to control for the quality of the data on human capital and its potential measures and to determine the most correct specification for the estimated equations which are derived from different theoretical growth models.

In this presentation we are trying to determine whether the Solow-Swan neoclassical growth model with human capital (known as the augmented Solow model) constitutes an immunisation of the 1956 model. This is why we introduce human capital in our model and analyse (theoretically and empirically) the determinants of the steady state growth equilibrium productivity levels and transition values in its presence. As far as the methodology used is concerned we consider solely the external critics to the theory and ignore the internal ones.

Our main goal is therefore to determine whether investment in human capital through education (without differentiation, by gender, with gender gaps) can explain the steady state growth productivity levels and a potential convergence process in a sample of Latin American developing countries (Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Trinidad&Tobago, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay and Venezuela). These countries will also be integrated in a larger sample with developed countries from Europe (Austria, Belgium, Denmark, Finland, France, the former Federal Republic of Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom).

The empirical analysis is based on panel data and the following estimation procedures are used: ordinary least squares (OLS), non linear least squares (NLLS), ordinary least squares with dummy variables (LSDV), ordinary least squares with first differences (OLSD) and non linear least squares with dummy variables (NLLSDV). We first present the results for the productivity equations and after for the convergence equations, considering our two samples and the different estimation procedures. The use of different samples and estimation techniques will, in our opinion, make our analysis more robust.

The consideration of human capital by gender and the quantification of its influence appear of major importance in the developing countries if the education of women in these countries produces positive social benefits. In these circumstances the education policies by gender should be supported because, ceteris paribus, just how is pointed out by Knowles, Lorgelly andOwen (1998)[1], an increase in the levels of female schooling will produce positive total effects in the form of higher productivity levels[2].

Aren't these policies supported by the beautiful African proverb that says,

«If we educate a boy, we educate one person. If we educate a girl, we educate a family – and the whole nation.»[3]

The presentation consists of six sections. In the first section, "Introduction", we define what we are trying to analyse and the methodology used. In section 2, "The resurgence of the neoclassical growth theory", we describe the theoretical bases of our work considering three aspects: the family of growth models used, the empirical methodology applied and, finally, the specific model that supports our estimates. In section 3, «Description of the twenty two Latin American countries», we briefly describe the financial and economic situation of our sample. We also define the data used on our estimates. Section 4, "Empirical analysis", is dedicated to the presentation of the results of our estimates as far as productivity and convergence equations are concerned. We consider for each equation two different samples and apply each of the five estimation methods mentioned above. "Analysis of the empirical results" is the title of section 5 where we interpret the results from the point of view of the influence of the different human capital variables used. Finally, on section 6, we conclude.

2 – The resurgence of the neoclassical growth theory

The theoretical framework of our analysis will be presented considering three aspects: the family of growth models where it belongs as far as modern growth theory is concerned; the empirical methodology applied and, finally, the description of the specific model that supports our estimates.

[1] Positive social benefits through the reduction of fertility, child mortality, and through the amelioration of family health levels, the rising of life expectancy and better school results. (Knowles, Lorgelly and Owen, 1998, p. 3).

[2] This is well expressed in the following statement taken from http://www.girlseducation.org/, the WWW site for The Partnership on Sustainable Strategies for Girls Education: «Girls' education is one of the most effective development investments a country can make. When a country educates its girls, it raises economic productivity, lowers maternal and infant mortality, reduces fertility rates, improves the health, well-being, and educational prospects of the next generation, promotes sounder management of environmental resources, and reduces poverty. It also meets a basic human right. Yet, today girls participation in school remains low in many countries, often lagging well behind boys' participation rates. It is estimated that of the 150 million children aged 6 to 11 years who are not in school, over 90 million are girls. In some countries, where gender disparities in educational opportunities are especially large, boys are almost twice as likely as girls to be enrolled in primary/basic education. Improving girls' educational opportunities is thus an important challenge for the global community».

[3] African proverb cited by J. Wolsensohen, in «Women and the Transformation of the 21st Century », Address to the Fourth UN Conference on Women, Beijing, 1995

2.1 – The theoretical framework

Growth theory gained a new breath in the mid 80's. This can be explained both on theoretical and on empirical grounds. Since the Solow-Swan model considered exogenous technological progress but pointed it as the major condition for growth, the most natural theoretical development would be to try and endogenize technological progress. Another major reason was the advances produced by Paul Krugman within international economics that were applied to growth theory by, for instance, Romer (1986) and Lucas (1988), such as non diminishing returns to scale.

Bur there were also empirical reasons for the regain of interest by growth theory. Maddison (1982), Summers and Heston (1991) and Barro and Lee (1993) constructed data bases with the major growth variables that could lead to international comparisons over long time periods. This lead to the elaboration of many empirical studies within growth economics aimed mainly at testing the predictions of the Solow-Swan model with technological progress as far as output per capita levels and growth rates are concerned.

The early studies consisted of cross-section regressions such as those of Barro (1991), Barro and Sala-I-Martin (1992), Mankiw, Romer and Weil (1992), Levine and Renelt (1992), Knowles and Owen (1995), Nonneman and Vanhoudt (1996), Murthy and Chien (1997), A.Fuente (1995a,b) and, with slightly different objectives, those of Baumol (1986) and Abramovitz (1986). Some of these studies considered that the economies in the different samples had the same structural parameters. This meant, according to the predictions of the Solow-Swan model, that the economies with lower initial levels of per capita capital stock (poorer economies) would growth faster than the initially richer economies during the transition to the steady state growth equilibrium situation. In the long run, all the economies would show the same levels and growth rates of real output per capita. These predictions were confirmed by the studies based on samples with homogenous countries like the OECD countries, but not by the studies that considered samples with both developed and developing countries.

The convergence mechanism based on diminishing marginal returns to scale seemed therefore not to be a valid explanation for the growth processes. It is not surprising thus that some economists considered that the development of growth theory should be made through the path of endogenous growth. However, the above mentioned empirical results generated a large controversy between the endogenous growth economists and the exogenous growth economists. The latter defended that those results do not invalidate the Solow-Swan model since the model only leads to the described predictions if identical structural parameters are considered for the different economies – they call this absolute or unconditional convergence. Barro and Sala-i-Martin (1991) developed a new convergence concept called conditional convergence. If one controls for the structural differences of the economies then the model predictions still apply. During the transition period it is possible therefore to have initially richer economies growing faster than initially poorer economies while in the steady state growth equilibrium situation there will be an equalisation of real output per unit of efficient labour growth rates but not of its levels. The difference between the latter will however remain constant.

2.2 – The empirical framework

Another major reason for the development of growth theory in the 80's lies on yet another empirical result, obtained by the above mentioned studies, that also seemed to invalidate the Solow-Swan model. In fact, if the introduction of the conditional convergence concept (also known as conditional β convergence) allowed to accept the qualitative predictions of the model the same could not be said about its quantitative predictions. In the early studies the estimated speed of convergence was quite low (around 2% per year) and lead to an estimated value of the capital share that was too high in comparison to the values obtained through the National Accounts (NA).

The next step was therefore to try and reformulate the Solow-Swan model in order to improve its quantitative predictions. This was first done by Mankiw, Romer and Weil (1992) through the consideration of another production factor, human capital[4]. The model became known as the Augmented Solow Model. This model improved the quantitative predictions of the Solow-Swan model since it allowed for estimated values of the capital share similar to the ones obtained through the NA. Barro and Sala-I-Martin (1995) changed in the same way the Cass-Koopmans-Ramsey model.

As far as the empirical methodology used in these studies is concerned they were mainly based on cross section data used to estimate equations for the steady state growth equilibrium values of the productivity levels or convergence equations with Ordinary Least Squares (OLS) or Non Linear Least Squares (NLLS). But these methods were the object of several criticisms which lead to the utilisation of panel data. First, panel data allows us to use a higher number of observations which is especially

[4] For a definition of human capital please refer to, Pritchett (1999), p5, footnote on page 4. Since we want to determine the influence of human capital through education we do not consider health factors included in the variable human capital but as a different variable.

useful for small samples. Second, it is possible to overcome the problem of biased estimators due to the presence of specific effects to each country. In the presence of specific effects the estimations will suffer from the omitted variable problem since they consider that A(0), the initial level of technology, non observable, is the same across the sample. If at least one of the estimators is correlated with A(0) then it will be biased. For instance, the less efficient countries are likely to be the ones with lower investment rates.

This problem can be solved using Least Squares with Dummy Variables (LSDV) which means considering a dummy variable for each country that represents the specific effect (initial technological level) to that country. The time specific effects can be treated in the same way although we have not done it due to the reduced dimension of our samples. Another possible way to eliminate the bias due to specific effects to the countries is to apply OLS to the first differences of the variables. We call this method OLSD (Ordinary Least Squares to the Differences).

Islam (1995) used the Minimum Distance method of Chamberlain to determine the specific effects in order to solve for the endogeneity problem that is usually associated to specific effects. This can happen because the specific effects are correlated with the exogenous variables which must therefore be replaced by instrumental variables. The problem lies afterwards in the choice of those instrumental variables.

There are also other problems associated with the utilisation of cross section data: heterogeneous parameters, the presence of outliers, uncertainty about the model specification, endogenous estimators and measurement errors. All these problems are better dealt with by using panel data since it allows for more degrees of freedom than the cross section analysis for the same period.

One must not think however that panel data analysis does not present any problems. Let us point out a criticism made by Durlauf and Quah (1998, p.53). If the specific effects are eliminated by centring the variables then we are eliminating just what we are trying to explain, the changes of the real output growth rate between the several countries.

Turning once again to the Augmented Solow model we must point out that the inclusion of human capital presents some difficulties. Human capital in the form of education is quite difficult to measure specially if we consider it as a stock variable. Since the investment in education is made not only by the Government but also by the students and their families it is quite difficult to measure all these contributions. This is why, in most of the current empirical studies, the enrolment rates for the different education levels, which are proxies for the investment rates in human capital through education, were replaced by proxies for the steady state level of the human capital through education variables, such as the average schooling years of the population with 15 years of age and more[5]. On the other hand, the quality of the data on human capital may not be very good[6]. When, for instance, in some developing countries, average schooling years rise a lot that doesn't mean necessarily that they will show a higher steady state productivity level because this kind of data doesn't control for the quality of education. In panel data analysis this may lead to estimated parameters on education statistically significant but with the wrong sign. For instance, the results may lead to the conclusion that higher levels of education lead to lower steady state productivity levels which is exactly the opposite of what the theory predicts. With the aim of eliminating these kind of problems some recent studies are dedicated to the improvement of the human capital proxies through the construction of better data bases for this variable, like those of Barro and Lee (1996, 2000) and Angel de la Fuente (2000).

Another point is that made by Angel de la Fuente (2000) who considers that the results of the panel data studies for convergence equations with human capital can at times be deceiving because the model is not correctly specified. He thinks that the initial technological levels can not be considered the same across all countries or non observable, but must be explained within the model.

In the author's opinion a model correctly specified implies considering both exogenous and endogenous characteristics that allow to control for two kinds of convergence mechanisms: one based on diminishing returns to factor accumulation (the one considered by the Solow-Swan model and the Augmented Solow model) and the other based on a technological catch up effect. The latter implies that a country that is a technological follower has a potential for faster growth than a country which is a technological leader since it can benefit from the leaders inventions through imitation. If the follower is indeed able to implement the imitations then we can say that there is technological diffusion and that there has been convergence due to technological catch up.

[5] Robert Solow considers that first of all one must decide on which measure of human capital to use. For him, learning is not a measure of human capital but an input to human capital production. See Solow (2000), p.154.
[6] See Pritchett (1999), p.3.

This model proposed by Angel de la Fuente enables us to improve the quantitative predictions of convergence, since it allows for higher speeds of convergence, due mostly to the consideration of the technological diffusion mechanism. The model was the developed by the author in Angel de la Fuente (1995) and is based on the models of Barro and Sala-I-Martin (1992) and MRW (1992) as far as the diminishing marginal returns convergence mechanisms is concerned. As for the technological catch up convergence mechanism it was based on the model developed by Dowrick and Nguyen (1989)[7]. We think that this kind of analysis is quite promising but in order to be able to apply it to our sample we must have adequate proxies for the technological differentials, a non observable variable. At the moment this is not yet possible.

2.3 – The theoretical model behind our estimates

This model was developed by Kowles, Owen and Lorgelly (1998) and can be considered an extension of the MRW (1992) model. In it is made a distinction between human capital based on education and human capital based on health factors. Also, human capital based on education is distinguished by gender. In the version that considers the education gender gap only one kind of human capital based on education can be considered, male or female.

2.3.1 – Hypothesis and types of solutions

The aggregate production function used is:

$$Y_{it} = K_{it}^{\alpha} H_{fit}^{\beta_f} H_{mit}^{\beta_m} X_{it}^{\varphi} (A_{it} L_{it})^{1-\alpha-\beta-\varphi} \quad (1)$$

The variables considered are defined in the following way: Y_{it} – Real GDP for country i on the date t, K_{it} – stock of physical capital, H_{itf} – stock of female educational human capital, H_{itm}– stock of male educational human capital, X_{it} – stock of health human capital, α, β_f, β_m et φ the shares of physical capital, female educational human capital, male educational human capital and health capital, respectively; A_{it}- the technological level and L_{it} – the labour force.

Due to the hypothesis of constant returns to scale the aggregate production function can be written in units of efficient labour:

7 Zvi Griliches thinks that the neoclassical theory has had great difficulty in treating the technological diffusion question because it implies a transition theory, that is, a desequilibrium theory. He also reminds us that one must not take average values for technological frontiers. For a better understanding on this subject see Krueger and Taylor (2000) p. 180.

$$y_{it} = k_{it}^{\alpha} h_{fit}^{\beta_f} h_{mit}^{\beta_m} x^{\varphi}_{it} \text{ avec } y_{it} = \frac{Y_{it}}{A_{it}L_{it}} \tag{2}$$

The labour force and the technological level grow exponentially at exogenous and constant growth rates:

$$L_{it} = L_{i0}e^{n_i t} \tag{3}$$

$$A_{it} = A_{io}e^{gt}, \ \forall_i g_i = g \tag{4}$$

The accumulation of physical capital, female educational human capital, male educational human capital and health capital are given by[8]:

$$\dot{k}_{it} = s_{k_i} y_{it} - (n_i + g + \delta) k_{it} \tag{5}$$

$$\dot{h}_{fit} = s_{hf_i} y_{it} - (n_i + g + \delta) h_{fit} \tag{6}$$

$$\dot{h}_{mit} = s_{hm_i} y_{it} - (n_i + g + \delta) h_{mit} \tag{7}$$

$$\dot{x}_{it} = s_{x_i} y_{it} - (n_i + g + \delta) x_{it} \tag{8}$$

If we consider diminishing marginal returns to scale to the factors that can be accumulated ($\alpha+\beta_f+\beta_m+\varphi<1$), we can say that there is a steady state solution to our model. In the long run the equilibrium levels of the factors (*) are given by:

$$k_i^* = \left(\frac{s_{k_i}^{1-\beta_f-\beta_m-\varphi} s_{hf_i}^{\beta_f} s_{hm_i}^{\beta_m} s_{x_i}^{\varphi}}{n_i + g + \delta} \right)^{\frac{1}{\eta}} \tag{9}$$

$$h_{fi}^* = \left(\frac{s_{k_i}^{\alpha} s_{hf_i}^{1-\alpha-\beta_m-\varphi} s_{hm_i}^{\beta_m} s_{x_i}^{\varphi}}{n_i + g + \delta} \right)^{\frac{1}{\eta}} \tag{10}$$

$$h_{mi}^* = \left(\frac{s_{k_i}^{\alpha} s_{hf_i}^{\beta_f} s_{hm_i}^{1-\alpha-\beta_f-\varphi} s_{x_i}^{\varphi}}{n_i + g + \delta} \right)^{\frac{1}{\eta}} \tag{11}$$

$$x_i^* = \left(\frac{s_{k_i}^{\alpha} s_{hf_i}^{\beta_f} s_{hm_i}^{\beta_m} s_{x_i}^{1-\alpha-\beta_f-\beta_m}}{n_i + g + \delta} \right)^{\frac{1}{\eta}} \tag{12}$$

with $\eta=1-\alpha-\beta_f-\beta_m-\varphi$ (13)

To obtain an expression for the natural logarithm of real output per unit of efficient labour depending on the investment rates of the different types of capital we must apply logs to equations (9), (10), (11) and (12) and substitute the expressions for $\ln(k^*_i)$, $\ln(h^*_{fi})$, $\ln(h^*_{mi})$ and $\ln(x^*_i)$ into equation (2) also in logs. We arrive at the following expression for lny*:

[8] $\dot{z}$ denotes the instantaneous growth rate of z.

$$\ln\left(\frac{Y_{it}}{L_{it}A_{it}}\right)^{*} = \frac{\alpha}{1-\alpha-\beta_f-\beta_m-\varphi}\ln(s_{k_i}) + \frac{\beta_f}{1-\alpha-\beta_f-\beta_m-\varphi}\ln(s_{hf_i}) + \\ + \frac{\beta_m}{1-\alpha-\beta_f-\beta_m-\varphi}\ln(s_{hm_i}) + \frac{\varphi}{1-\alpha-\beta_f-\beta_m-\varphi}\ln(s_{x_i}) - \\ - \frac{\alpha+\beta+\varphi}{1-\alpha-\beta_f-\beta_m-\varphi}\ln(n_i+g+\delta) \quad (14)$$

Considering equations (13) and (14) we can write equation (14) in per capita terms (in logs):

$$\ln\left(\frac{Y_{it}}{L_{it}}\right) = \ln A_{i0} + gt + \frac{\alpha}{\eta}\ln(s_{k_i}) + \frac{\beta_f}{\eta}\ln(s_{hf_i}) + \frac{\beta_m}{\eta}\ln(s_{hm_i}) + \frac{\varphi}{\eta}\ln(s_{x_i}) - \\ - \frac{\alpha+\beta+\varphi}{\eta}\ln(n_i+g+\delta) \quad (15)$$

Analysing equation (15) we can identify the determinants of real output per capita of an economy that finds itself in the steady state situation. Equation (15) tells us that the ln of real output per capita of country i on date t depends positively on the technological level and the investment rates for the different types of capital and negatively on ln $(n_i + g + \delta)$.

When we are trying to estimate equation (15) it might be important to rewrite it considering not the investment rates for the different kinds of human capital but its steady state levels since the data is usually more accurate for the latter. To do this we solve the system composed of equations (10), (11) and (12) in order to the logs of the three investment rates in human capital and replace them for the expressions found in equations (14) and (15):

$$\ln\left(\frac{Y_{it}}{L_{it}}\right) = \ln A_{i0} + gt + \frac{\alpha}{1-\alpha}\ln(s_{ki}) - \frac{\alpha}{1-\alpha}\ln(n_i+g+\delta) + \frac{\beta_f}{1-\alpha}\ln(h_{fi}^{*}) + \\ + \frac{\beta_m}{1-\alpha}\ln(h_{mi}^{*}) + \frac{\varphi}{1-\alpha}\ln(x_i^{*}) \quad (16)$$

We can rewrite equation (16) in order to take into account the influence of a new variable, the educational gender gap, that is, the difference between the ln of male educational human capital and the ln of female educational human capital. When we consider the gender gap we must loose one of the educational human capital variables, either the female educational human capital or the male educational human capital. We arrive then at equations (17) and (18). Equation (17) considers the gender gap variable and female educational human capital. Equation (18) considers the gender gap variable and male educational human capital.

$$\ln\left(\frac{Y_{it}}{L_{it}}\right) = A_{i0} + gt + \frac{\alpha}{1-\alpha}\left[\ln(s_{ki}) - \ln(n_i + g + \delta)\right] + \frac{\beta_f + \beta_m}{1-\alpha}\ln(h_{fi}^*) + \\ + \frac{\beta_m}{1-\alpha}\left[\ln(h_{mi}^*) - \ln(h_{fi}^*)\right] + \frac{\varphi}{1-\alpha}\ln(x_i^*) \tag{17}$$

$$\ln\left(\frac{Y_{it}}{L_{it}}\right) = A_{i0} + gt + \frac{\alpha}{1-\alpha}\left[\ln(s_{ki}) - \ln(n_i + g + \delta)\right] + \frac{\beta_f + \beta_m}{1-\alpha}\ln(h_{mi}^*) + \\ - \frac{\beta_f}{1-\alpha}\left[\ln(h_{mi}^*) - \ln(h_{fi}^*)\right] + \frac{\varphi}{1-\alpha}\ln(x_i^*) \tag{18}$$

2.3.2 – Estimated productivity levels equations

We first estimate a productivity equation similar to that of equation (16) but without considering educational human capital by gender in the tradition of MRW (1992). We then estimate equations (16), (17) and (18). In order to estimate these equations we must however introduce some changes.

The technological level A_{it}, which can not be measured, is divided into two terms A_{i0} and gt. A_{i0} is a constant for each country i and is considered as a specific effect to that country, represented by the constant a in the equations that follow. If we are considering or not the specific effects that depends on the estimation procedure used. If we do not consider the specific effects to each country then we are implicitly saying that A_{i0} is the same in all countries. As for the second term, we do not consider a specific time effect which means that it will be reflected in the error term.

Besides introducing the specific effect to each country we must also consider in our equations an error term (ε_{it}) and explain for which time period does our analysis apply. T represents the period duration (five years, for our sample) and t the dates with: t =1960-65; 1965-70;1970-75;1975-80;1980-85;1985-90.

We are now able to rewrite the productivity equations (16), (17) and (18) to obtain the ones we will estimate with panel data.

The unrestricted productivity equation with human capital without differentiation by gender is given by:

$$\ln\left(\frac{Y(T)}{L(T)}\right)_{it} = a + \frac{\alpha}{1-\alpha}\ln(s_{kit}) - \frac{\alpha}{1-\alpha}\ln(n_{it} + g + \delta) + \frac{\beta}{1-\alpha}\ln(h_{it}^*) + \\ + \frac{\varphi}{1-\alpha}\ln(x_{it}^*) + \varepsilon_{it} \tag{19}$$

The unrestricted productivity equation with human capital by gender is given by:

$$\ln\left(\frac{Y(T)}{L(T)}\right)_{it} = a + \frac{\alpha}{1-\alpha}\ln(s_{kit}) - \frac{\alpha}{1-\alpha}\ln(n_{it} + g + \delta) + \frac{\beta_f}{1-\alpha}\ln(h_{fit}^{*}) + + \frac{\beta_m}{1-\alpha}\ln(h_{mit}^{*}) + \frac{\varphi}{1-\alpha}\ln(x_{it}^{*}) + \varepsilon_{it} \quad (20)$$

To test for the validity of our model we must test not only equation (20) but also the restricted version of this equation that results from the relationship between the coefficients on $\ln(s_{ki})$ and $\ln(n_{it}+g+\delta)$.

The restricted productivity equation with human capital by gender is given by:

$$\ln\left(\frac{Y(T)}{L(T)}\right)_{it} = a + \frac{\alpha}{1-\alpha}\left[\ln(s_{kit}) - \ln(n_{it} + g + \delta)\right] + \frac{\beta_f}{1-\alpha}\ln(h_{fit}^{*}) + + \frac{\beta_m}{1-\alpha}\ln(h_{mit}^{*}) + \frac{\varphi}{1-\alpha}\ln(x_{it}^{*}) + \varepsilon_{it} \quad (21)$$

We present next the restricted versions of the productivity equations with the educational gender gap.

The restricted productivity equation with the educational gender gap and the female educational human capital variable (1) is given by:

$$\ln\left(\frac{Y(T)}{L(T)}\right)_{it} = a + \frac{\alpha}{1-\alpha}\left[\ln(s_{kit}) - \ln(n_{it} + g + \delta)\right] + \frac{\beta_f + \beta m}{1-\alpha}\ln(h_{fit}^{*}) + + \frac{\beta_m}{1-\alpha}\left[\ln(h_{mit}^{*}) - \ln(h_{fit}^{*})\right] + \frac{\varphi}{1-\alpha}\ln(x_{it}^{*}) + \varepsilon_{it} \quad (22)$$

The restricted productivity equation with the educational gender gap and the male educational human capital variable (2) is given by:

$$\ln\left(\frac{Y(T)}{L(T)}\right)_{it} = a + \frac{\alpha}{1-\alpha}\left[\ln(s_{kit}) - \ln(n_{it} + g + \delta)\right] + \frac{\beta_f + \beta_m}{1-\alpha}\ln(h_{mit}^{*}) - - \frac{\beta_f}{1-\alpha}\left[\ln(h_{mit}^{*}) - \ln(h_{fit}^{*})\right] + \frac{\varphi}{1-\alpha}\ln(x_{it}^{*}) + \varepsilon_{it} \quad (23)$$

We can impose further restrictions to these equations such as imposing that β_f and β_m are equal but with opposite signs in order to be able to say that the only educational variable that influences the steady state productivity level is the educational gender gap. This means testing if the coefficients on $\ln(h^*_{fi})$ or on the $\ln(h^*_{mi})$ in equations (22) et (21) respectively are significantly different from zero.

2.3.3 – Estimated convergence equations

We also investigate the existence of convergence in our samples, that is, we want to know if the diminishing marginal returns mechanism is sufficient to generate convergence in our samples. If we arrive at the conclusion that this is true then we also want to know what kind of convergence are we talking about. That is, we want to know which variables (specially the human capital ones) can explain the conditional convergence process[9].

The restricted convergence equation with human capital by gender is given by:

$$\left[\ln\left(\frac{Y_{it}}{L_{it}}\right)-\ln\left(\frac{Y_{it0}}{L_{it0}}\right)\right]\frac{1}{T}=a\theta+\frac{\alpha}{1-\alpha}\theta\left[\ln(s_{ki})-\ln(n_i+g+\delta)\right]+\frac{\beta_f}{1-\alpha}\theta\ln(h_{fi}^{*})+ + \frac{\beta_m}{1-\alpha}\theta\ln(h_{mi}^{*})+\frac{\varphi}{1-\alpha}\theta\ln(x_i^{*})-\theta\ln\left(\frac{Y_{ito}}{L_{ito}}\right)+\varepsilon_{it} \quad (24)$$

$$\theta=\frac{1-e^{-\lambda T}}{t-t_0} \quad (25)$$

$$\lambda=(1-\alpha-\beta-\varphi)(n_i+g+\delta) \quad (26)$$

We continue to consider the specific effects to each country as the sole specific effects. The time specific effects are included in the error term while t_0 represents the initial value for each period t[10].

λ represents the speed of convergence. It measures the speed at which an economy reaches its steady sate equilibrium situation when it departs from a desequilibrium situation supposing that its structural characteristics do not change during the transition period. If we consider that the capital shares are constant then the higher the labour force growth rate the higher the speed of convergence, ceteris paribus.

All equations like equation (23) are convergence equations. A convergence equation says that an economy's real output growth rate during the transition period depends negatively on the real output initial value. The poorer an economy is the faster it will grow during the transition period.

Based on the predictions from our theoretical model we can say that the steady state equilibrium situation is just an imaginary situation that can be represented by a hypothetical economy with the average characteristics of the sample. In these circumstances if we obtain an estimated coefficient on the initial output per capita with

[9]For a definition of the different types of convergence see Marta Simões (1999), pp. 17- 28.
[10] For instance t_0=1960, when t=1960-1965 and t_0=1985 when t=1985-1990.

the correct sign (negative) we can say that our sample has a group of economies that are not on the steady state equilibrium situation for the hypothetical economy.

Let us now present the restricted version of the convergence equations that we are going to estimate.

The restricted convergence equation with human capital without differentiation by gender is given by:

$$\left[\ln\left(\frac{Y_{it}}{L_{it}}\right)-\left(\frac{Y_{it0}}{L_{it0}}\right)\right]\frac{1}{T}=a\theta+\frac{\alpha}{1-\alpha}\theta\left[\ln(s_{kit})-\ln(n_i+g+\delta)\right]+\frac{\beta}{1-\alpha}\theta\ln(h_{it}^{*})$$
$$+\frac{\varphi}{1-\alpha}\theta\ln(x_{it}^{*})-\theta\ln\left(\frac{Y_{ito}}{L_{ito}}\right)+\varepsilon_{it} \qquad (27)$$

The restricted convergence equation with human capital by gender is given by:

$$\left[\ln\left(\frac{Y_{it}}{L_{it}}\right)-\ln\left(\frac{Y_{it0}}{L_{it0}}\right)\right]\frac{1}{T}=a\theta+\frac{\alpha}{1-\alpha}\theta\left[\ln(s_{kit})-\ln(n_{it}+g+\delta)\right]+\frac{\beta_f}{1-\alpha}\theta\ln(h_{fit}^{*})+$$
$$+\frac{\beta_m}{1-\alpha}\theta\ln(h_{mit}^{*})+\frac{\varphi}{1-\alpha}\theta\ln(x_{it}^{*})-\theta\ln\left(\frac{Y_{it0}}{L_{it0}}\right)+\varepsilon_{it} \qquad (28)$$

The restricted convergence equation with the educational gender gap and the female educational human capital variable (1) is given by::

$$\left[\ln\left(\frac{Y_{it}}{L_{it}}\right)-\ln\left(\frac{Y_{it0}}{L_{it0}}\right)\right]\frac{1}{T}=a\theta+\frac{\alpha}{1-\alpha}\theta\left[\ln(s_{kit})-\ln(n_{it}+g+\delta)\right]+\frac{\beta_f+\beta_m}{1-\alpha}\theta\ln(h_{fit}^{*})+$$
$$+\frac{\beta_m}{1-\alpha}\theta\ln\left[(h_{mit}^{*})-(h_{fit}^{*})\right]+\frac{\varphi}{1-\alpha}\theta\ln(x_{it}^{*})-\theta\ln\left(\frac{Y_{it0}}{L_{it0}}\right)+\varepsilon_{it} \qquad (29)$$

The restricted convergence equation with the educational gender gap and the female educational human capital variable (2) is given by::

$$\left[\ln\left(\frac{Y_{it}}{L_{it}}\right)-\ln\left(\frac{Y_{it0}}{L_{it0}}\right)\right]\frac{1}{T}=a\theta+\frac{\alpha}{1-\alpha}\theta\left[\ln(s_{kit})-\ln(n_{it}+g+\delta)\right]+\frac{\beta_f+\beta_m}{1-\alpha}\theta\ln(h_{mit}^{*})-$$
$$-\frac{\beta_f}{1-\alpha}\theta\ln\left[(h_{mit}^{*})-(h_{fit}^{*})\right]+\frac{\varphi}{1-\alpha}\theta\ln(x_{it}^{*})-\theta\ln\left(\frac{Y_{it0}}{L_{it0}}\right)+\varepsilon_{it} \qquad (30)$$

3 - Description of the twenty two Latin American countries

Before testing our model we will make a short description of the economic situation of the twenty two Latin American countries. Bearing in mind the main objectives of this study we will emphasise the male and female educational characteristics. At the end of this section there is also a description of the data used in our estimates.

3.1 – The economic situation of the Latin American countries

From the data on Real GDP per worker we see that in 1960 most of the countries show a Real GDP per capita between 2000 and 10000 dollars with the exception of Venezuela and Trinidad&Tobago which show higher values. From 1960 to around 1980 this variable grows steadily in all the countries but from there on growth is quite irregular (see fig.1). For instance, in 1990 Venezuela, Nicaragua and Guyana show lower GDP values than the initial ones. The next table shows that the values registered in 1990 are usually lower than the ones registered in one of the previous years (except Colombia).

FIGURE 1

Table 1. Real GDP per worker in 1985 international dollars*

Countries	1960	1965	1970	1975	1980	1985	1990
CRI	6830	8012	9473	10220	10899	9148	10040
DOM	4130	4544	5700	7104	8297	7082	6898
SLV	4371	5299	5488	6161	6093	5547	5485
GTM	5292	5784	6702	7639	9044	7358	7435
HTI	1673	1686	1639	1776	2344	2125	1990
HND	3268	3633	4133	4304	5204	4652	4464
JAM	4338	5336	6962	7149	5423	4726	5146
MEX	9517	11536	14086	16328	18890	17036	17012
NIC	5124	7303	7825	8443	6216	5900	4159
PAN	4739	6020	7677	8578	10094	10039	7999
TTO	16901	19331	20468	23008	31070	25529	19880
ARG	11339	12818	14472	16043	17828	14955	13406
BOL	3322	4005	5082	5746	6374	5623	5315
BRA	5549	5753	7400	10100	11788	10977	11041
CHL	8756	10169	11539	9173	11498	9768	11854
COL	5485	5989	7142	8217	9504	9276	10108
ECU	4459	4993	5768	8733	10776	9615	9032
GUY	5608	5563	6443	7850	5733	3573	2970
PRY	3575	3910	4301	5027	7658	6241	6383
PER	6309	8162	9340	10486	9261	8141	6847
URY	9784	9235	10420	10972	13053	10216	11828
VEN	20445	25039	26731	23889	22461	18362	17426

From the inspection of the values of the index numbers for Real GDP per worker considering the sample average as the base value we can not say definitely that there was not any convergence within the sample in spite of its poor growth performance (fig.2). Again, from 1980 onwards convergence to the average seems to stop.

FIGURE 2

However when we relate the Real GDP per worker initial value (1960) to its average growth rate there is indeed no evidence of a negative relationship between the two. This seems to dismiss the convergence hypothesis (Fig. 3).

FIGURE 3

Analysing the values of the «Investment-Real GDP» ratio we can say that, like Real GDP per worker, it shows many oscillations with 1990 values lower than others registered during the period (except Costa Rica and Chile) (Fig. 4).

FIGURE 4

Table 2. Ratio «Investment-Real GDP»*

Countries	1960	1965	1970	1975	1980	1985	1990
CRI	12.6	17.6	14.8	15.4	21.4	15.9	18.6
DOM	7.9	6.8	14.4	21.3	19.3	15.1	20.1
SLV	9.2	9.1	7.1	9.3	7.3	5.9	6.7
GTM	8.1	9.7	9.3	9.6	9.2	6.5	7.2
HTI	2.5	2.1	3.7	6.5	7.9	7.3	7.3
HND	11.5	13.4	16.1	14.1	16.6	11.7	13.5
JAM	31.1	26.7	31	25.8	12	14.6	17.2
MEX	14.5	16.9	17.7	19.1	21.4	15.3	15
NIC	8.6	12.7	11.7	10.9	11.2	13.9	8.5
PAN	15.9	17.9	25.8	27	22.2	15.2	15.9
TTO	15.7	12.2	7.8	13.9	17.7	15.4	10.6
ARG	17.4	16.1	18.5	17.4	19.6	12.3	11.5
BOL	17.7	21.8	21.2	29	14.5	5.2	5.1
BRA	18.9	19	19.8	26	22	15.6	15.2
CHL	20.4	21.5	21.6	20.6	14.5	19.8	26.4
COL	17.8	15.4	16.7	14	16	14.2	13.1
ECU	23	19.7	24.1	27.6	26.8	18.5	14.5
GUY	33	26.7	27	30.6	21	23	27.7
PRY	7.1	8.5	8.8	13.6	21.3	15.8	18.3
PER	18.7	18.7	12.9	20.2	23.2	12.5	16.1
URY	11.6	8.3	12.3	13.2	23	10.1	9.9
VEN	16.1	15.8	18.2	23.3	19.9	15.2	8.3

We can also try to shed some light into the results of our estimates on section 4 by relating Real GDP per worker values and average growth rates values to its main determinants in view of the theoretical models considered. Do higher investment rates lead to higher productivity levels (fig.5)? Or, in the same way, do higher levels of educational and health capital lead to more productive economies (fig.6 to 9)?

FIGURES 5 to 9

In fact our simple analysis leads to an optimistic conclusion about the relationships predicted by the theory. All control variables (investment rate, educational capital, female educational capital, male educational capital and health capital) influence in the expected manner (positively) the proxy for the Real GDP per worker steady state value.

When we try to do the same for the convergence predictions however the results are quite bad. None of the relationships tested seems to hold with the exception of the relationship between Real GDP and the investment rate but for a very low R^2 (Figs. 10 to 14).

FIGURES 10 to 14

Let us now turn to the data on education. Considering the data on the average schooling years of the population with 15 years of age and more we can say that in average the population in our sample is not a very educated one. But we must not forget that the average values hide quite different situations as shown by the standard errors values. Nevertheless, there was an effort to educate the population since the 1990 values are significantly higher than the 1960 ones. As for the gender gap, the male population has remained more educated than the female population (negative differential for all years). The differential narrowed in 1960 and 1965, widened in 1970, returned to its 1965 value in 1975 and diminished also in 1980. It was again higher in 1985 but never reached the former values. In 1990 it registered the lower value for the period.

Table 3. Average schooling years of the population with 15 years of age or more*

Years	Total Population	Women	Men	Differential
1960	3.38	3.19	3.58	-0.39
	(1.33)	(1.29)	(1.43)	
1965	3.42	3.24	3.61	-0.37
	(1.32)	(1.23)	(1.48)	
1970	3.80	3.58	4.03	-0.45
	(1.29)	(1.29)	(1.38)	
1975	4.12	3.94	4.31	-0.37
	(1.28)	(1.33)	(1.31)	
1980	4.78	4.63	4.92	-0.29
	(1.45)	(1.54)	(1.44)	
1985	5.05	4.89	5.22	-0.33
	(1.29)	(1.52)	(1.17)	
1990	5.44	5.33	5.55	-0.22
	(1.46)	(1.63)	(1.35)	

* standard deviation between brackets

Analysing the average growth rates of the schooling years in each country we can say that they all have invested on the education of its population between 1960 and

1990. The effort was higher on the education of the female population except in the case of Guatemala, Haiti, Honduras and Brazil.

Table 4. Average growth rate (1960-90) of the average schooling years of the population with 15 years of age or more

Countries	Total Population	Women	Men
COSTA RICA	0.0107	0.0108	0.0105
DOMINICAN REPUBLIC	0.0166	0.0183	0.0150
EL SALVADOR	0.0253	0.0279	0.0230
GUATEMALA	0.0235	0.0235	0.0237
HAITI	0.0439	0.0363	0.0488
HONDURAS	0.0270	0.0218	0.0310
JAMAICA	0.0208	0.0215	0.0203
MEXICO	0.0297	0.0309	0.0286
NICARAGUA	0.0160	0.0184	0.0136
PANAMA	0.0185	0.0189	0.0181
TRINIDAD&TOBAGO	0.0148	0.0168	0.0128
ARGENTINA	0.0146	0.0159	0.0133
BOLIVIA	-0.0022	0.0008	-0.0045
BRAZIL	0.0115	0.0078	0.0155
CHILE	0.0097	0.0103	0.0090
COLOMBIA	0.0128	0.0173	0.0080
ECUADOR	0.0201	0.0229	0.0175
GUYANA	0.0080	0.0101	0.0059
PARAGUAY	0.0174	0.0199	0.0151
PERU	0.0211	0.0267	0.0167
URUGUAY	0.0093	0.0105	0.0080
VENEZUELA	0.0179	0.0224	0.0140

3.2 – Description of the data used in our estimates

In our version of the Solow model the steady state productivity level depends on the investment rate, the effective labour force growth rate and the steady state values of educational (total, female and male) and health capital.

The data on Real GDP per worker was retrieved from the Penn World Tables (from now on PWT) Mark 5.6. The proxy for the steady state productivity level is the period average of Real GDP per worker for each of the 6 five years periods (1960-65, 1965-70, 1970-75, 1975-80, 1980-85, 1985-90). The average growth rates are also calculated for the same five year periods.

The proxy for the propensity to save was also taken from the PWT 5.6. We consider five year averages for the ratio «investment-Real GDP» for the six five year periods.

The labour force growth rate was calculated using the data from PWT 5.6 on Real GDP per worker, Real GDP per capita and the population. Following MRW (1992) and Islam (1995), we consider the technological progress growth rate and the depreciation rate constant for all countries and $g+\delta$ is equal to 0.05. The proxy for $\ln(n+g+\delta)$ is the natural log of the sum of the labour force growth rate and 0.05.

The data on education was taken from Barro and Lee (2000) and we consider average schooling years for the population with 15 years of age or more as proxies for the steady state value of educational human capital (total, female and male). The data refers to the years of 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2000 in some cases. We consider the initial value for each five year period.

As a proxy for the health human capital we used data for life expectancy at birth taken from Barro and Lee (1993), as did Lorgelly and Owen (1998) and Knowles and Owen (1995, 1997). To take into account possible non linearities in the data we consider the variable ln(x) = - ln(85-LE), where LE is life expectancy at birth. The values used refer to the initial value for each five year period.

4 - Interpretation of the econometric results for the productivity and convergence equations

We analyse the econometric estimations results with the main focus on the influence of the different educational capital variables on the dependent variable for the productivity equations and for the convergence equations.

First, we interpret the econometric results for each productivity equation taking only into account the level of significance of the educational capital variables since we are trying to control for the influence of the different educational capital variables upon the steady state productivity levels. The results obtained are better for the equations without differentiation or, on the contrary, are they better for the equations with differentiation, and in this case for which ones, based on the econometric quality of the results? Secondly, we do the same analysis for the other coefficients and afterwards we present an interpretation of the econometric outcomes based upon the productivity equations.

4.1 – Productivity equations interpretation

Educational capital coefficients: when we use the OLS method, the best results are obtained for the equation without differentiation. In fact, the educational capital coefficient is always significant and it has the right sign for the unrestricted model and for samples (1) and (2) and for the restricted model in the case of sample (2). Also, when we test the restriction for sample (1) the coefficient has the right sign and is significant.

The results for the productivity equation with differentiation but without gap are not good. Let us begin by saying that the restriction hypothesis is not accepted for any of the samples. For all the samples and model versions (unrestricted version and test of the restriction), the male educational capital coefficient has the right sign but it is only significant in the unrestricted model for sample (2). As for the female educational capital coefficient, it has always the right sign but it is never significant.

The results from the productivity equation with differentiation and with gap 1 are better than the results with the productivity equation with differentiation. Again, the restriction hypothesis is not accepted for any of the two samples. The female educational capital coefficient has always the right sign and it is always significant. As for the gender gap, it has always the right sign but it is only significant for the unrestricted model with sample (2).

The results from the productivity equation with differentiation and with gap 2 are similar to the results obtained with the productivity equation with gap 1. Again, the restriction hypothesis is not accepted for any of the two samples. The male educational capital coefficient has always the right sign and it is always significant. As for the gender gap, it has always the right sign but it is never significant.

When we use the LSDV method, the results are quite bad for all types of equations. With this method, the restriction hypothesis is never accepted. As far as the productivity equation without differentiation is concerned, the educational capital coefficient has always the wrong sign and it is never significant.

The results from the productivity equation with differentiation and without gap are the following. The male educational capital coefficient has always the right sign but is never significant. As for the female educational capital coefficient, it has always the wrong sign and it is never significant.

The results from the productivity equation with differentiation and gender gap (1) are bad. As for the female educational capital coefficient, it has always the wrong sign and it is never significant. The gender gap coefficient has always the right sign but it is never significant.

The results from the productivity equation with differentiation and gender gap (2) are even worst. The male educational capital coefficient as well as the gender gap coefficient have always the wrong sign and are never significant.

When we use the OLSD method, the results are quite bad for almost all types of equations. With this method, the restriction hypothesis is never accepted. As far as the productivity equation without differentiation is concerned, the educational capital coefficient has always the wrong sign except in the restricted model for sample (2) and it is never significant.

The results from the productivity equation with differentiation and without gap are the following: the male educational capital coefficient has always the right sign but it is only significant for the restricted model with sample (2). As far as the female educational capital coefficient is concerned, it has only the right sign for the restricted version with sample (1) and it is never significant.

The results from the productivity equation with differentiation and gender gap 1 are bad. In fact, the female educational capital coefficient has only the right sign for the restricted version with sample (1) and it is never significant. The gender gap coefficient has always the right sign but it is never significant.

The results from the productivity equation with differentiation and gender gap 2 are bad. In fact the male educational capital coefficient has only the right sign with the restricted model for both samples. The gender gap coefficient has only the right sign with the restricted model for sample (1).

When we use the NLLS method, the results obtained with the productivity equation without differentiation are good as far as the educational capital elasticity is concerned. In fact, the elasticity sign is always right and significant. As for the remaining productivity equations, without gender gap, with gender gap 1 and with gender gap 2, using again the NLLS method, the male and female elasticities have always the right sign but are not significant.

When we use the NLLDV method, the results obtained with the productivity equation without differentiation are bad in what concerns the educational capital elasticity. In fact, the elasticity sign is always wrong and it is never significant.

As for the remaining productivity equations, without gender gap, with gender gap 1 and with gender gap 2, using again the NLLDV method, the male educational capital elasticity has always the right sign but is never significant. As for the female educational capital elasticity, it has always the wrong sign and it is never significant.

Coefficient of the rate of investment in physical capital: as for the OLS method, the results are good for the productivity equations with differentiation, without and with both gender gaps for sample (2). The same applies to the other methods, LSDV and OLSD.

The results improve with the NLLSDV method, for all types of equations, model versions and samples; physical capital elasticity has the right sign and is significant.

The effective labour force coefficient: In fact with the OLS method the coefficient has the right sign and is significant for the equations with both gender gaps, for both models and for sample (2). The results are better with LSDV and OLSD and in general for the restricted version.

The health capital coefficient: with the OLS method, the health capital coefficient has the right sign for all types of equations, of models and samples and it is also significant except for the equations with differentiation but without gap and with gap 1 and 2 under the restricted model for sample (1).

With the LSDV method, the health capital coefficient has the right sign for all types of equations, of models and samples and it is also significant except for the equation with differentiation without gap under the restricted model for sample (2).

With the OLSD method, the health capital coefficient has the right sign for all types of equations, of models and samples and it is always significant also.

Overview of the productivity equations estimated: when we take into account all the coefficients, we can say that the productivity equation without differentiation estimated with OLS method achieves good results under the restricted model. All the coefficients have the right sign and are significant except the effective labour force coefficient which has the wrong sign although significant. Within it, all the elasticities have the right sign. For this type of productivity equation, the results concerning the educational coefficient become worse when we apply the LSDV and OLSD methods.

On the other hand, when we try to use accurate methods for direct estimation of elasticities, we have obtained better results with NLLS than with NLLSDV. For the former, the educational elasticity has the right sign and it is significant. The opposite applies to the later. We have also obtained good results with OLS for the productivity equations with gender gap (1) and (2). For the equation with gender gap (1) the influence of the female educational coefficient upon the productivity level is significant and has the expected sign. We should notice too the importance of the female coefficient for sample (1). But globally, the best results obtained with this equation are those for the restricted model with sample (2). Let us recall that in this case, the female elasticity estimated indirectly has the right sign. The same kind of analyse can be extended to the productivity equation with gender gap (2). With all the other methods, the results obtained are worse for these equations.

The methods used for direct estimation of the elasticities do not lead to better results for the educational elasticities estimated from the productivity equations with differentiation, with gender gap 1 and with gender gap 2.

4.2 – Convergence equations interpretation

<u>Educational capital coefficients</u>: in general the results obtained for the convergence equations concerning the educational coefficients are bad.

When we use the OLS method the results are quite bad. In fact, for the equation without differentiation the coefficient sign is always wrong and significant. As for the equation with differentiation but without gap, the male educational coefficient has only the correct sign for sample (2) but it is not significant, the female coefficient has always the wrong sign and is significant for sample (2) only. The results for the equations with gap are quite similar (that is, bad). In fact, the female educational coefficient in the equation with gap 1 has always the wrong sign and it is always significant. As for the gender gap coefficient, it is never significant and has the right sign only for the unrestricted model in sample (2).

When we use the LSDV method, the results improve only for the equation with differentiation but without gender gap, the male educational capital has always the right sign and is significant for sample (1). At the same time, the female educational coefficient has always the wrong sign but it is significant. In fact, for all the other equations, the sign of the educational coefficients is wrong, except for the gender gap coefficient on equation with gap (1) and for sample (1).

Also, the results obtained with the OLSD method are quite bad. The male educational coefficient has always the wrong sign and is always significant except for the equation with differentiation but without gap. As for the female educational coefficient, it has always the wrong sign and it is never significant. As for the gender gap coefficient, it has the right sign and it is not significant for the equation with gap 1. The opposite occurs for the equation with gap 2.

In what concerns the non-linear methods for the direct estimation of the elasticities (NLLS and NLLSDV), we cannot say that the results concerning female educational elasticity have improved. For any of the methods, male and female educational elasticities are never significant although with the right sign.

<u>The coefficient of the ln of the initial PIB</u>: in what concerns the coefficient of the ln of the initial PIB, we can say that with LSDV, OLSD and for all types of convergence equations and model versions, the coefficient has the right sign and is significant, which corresponds to the existence of convergence among the countries of the two samples. Nonetheless, the results obtained with the OLS method are very poor. In fact, and in spite of the coefficient right sign for all types of equations and model versions, it is only significant for the convergence equation with any kind of differentiation using the restricted model in samples (1) and (2) and LSDV and OLSD.

As for the non-linear methods that allow us to estimate directly the speed of convergence (LAMEDA), we can say that the NLLSDV method has improved the results because the speed of convergence coefficient has the right sign and it is significant. With NLLS, the speed of convergence coefficient is never significant.

The rate of investment on physical capital coefficient: the rate of investment on physical capital coefficient has always the right sign and it is always significant, for all methods, for all types of equations, for all model versions and samples.

Also, the physical capital elasticity estimated directly with the non-linear methods has always the right sign and it is always significant for both methods, NLLS and NLLSDV.

The effective labour force coefficient: in general the results obtained with all kind of methods lead to good results, especially if we consider the restricted version. With OLS the results are better for the convergence equation with any kind of differentiation. In the later case the coefficient has the right sign and is significant for both sample and for the restricted model as well as for the unrestricted version. The same applies to the following convergence equations, the one without differentiation and the one with differentiation.

As for the other methods, LSDV and OLSD, the coefficient has always the right sign and it is always significant for the restricted model in samples (1) and (2) and for the unrestricted model in sample (2).

The health capital coefficient: in what concerns the health capital coefficient, the results obtained are quite bad. In fact, with OLS the health capital coefficient has always the wrong sign and it is never significant except for the convergence equation without differentiation, for both models with sample (1).With LSDV the results are better for the convergence equations with differentiation for sample (2) under all the model versions, the coefficient has the right sign and is also always significant. The same thing occurs for the convergence equation with differentiation but without gender gap. But the best results are obtained with the OLSD method: the coefficient has the right sign and is always significant except for sample (1) and for both models with the convergence equations, the one without gap and the other with gap (2).

Finally, with the NLLSDV method we have obtained good results for the direct estimation of the health capital elasticity for the equations without gap, with gap 1 and with gap 2 but only for sample (2).

Overview of the convergence equations estimated: let us begin by saying that the use of the OLS method leads to bad results concerning convergence. In fact, only for the equation with gender gap 2 under the restricted model in sample (2) have we convergence. But with all the other econometric methods, there is convergence.

Generally, the results obtained with the convergence equations concerning the educational coefficients are very bad. As for the convergence equation without differentiation, we never obtain significant coefficients with the right sign for educational capital. The same is true for the direct estimation of educational capital elasticity. The better results are obtained with LSDV for the equation without gap in sample (2). In this case, the male educational coefficient has the right sign and it is significant, nonetheless, the female educational coefficient has always the wrong sign but it is significant. The same applies to the equation with gender (2). Notice that the female educational coefficient has never the right sign whatever the equation type, model versions and samples.

And notice also that the results do not improve when we take the convergence equations with differentiation and with gap.

As for the direct estimation of educational capital elasticities, the non-linear methods NLLS and NLLSDV do not lead to good results. The female educational elasticity is always significant but has the wrong sign, and we get the opposite result for the male educational elasticity.

5. General remarks

We based our study in a growth model that can be classified as an Augmented Solow-Swan model. Our main objective was to analyse the importance of education human capital for economic growth in a sample of 22 Latin American countries. We also considered a larger sample including the former 22 countries and 16 developed countries from Europe.

In what concerns the methodology applied we have used the methods that are, in our opinion, the most correct ones, although this option does not exclude the use of more traditional methods. Let us point out that we did not limit our analysis to solely one model since this could prevent us from identifying the importance of alternative hypothesis. This is why we have estimated our productivity and convergence equations with panel data using five different estimation procedures: ordinary least squares (OLS), ordinary least squares with dummy variables (LSDV), ordinary least squares applied to the differences of the variables (OLSD), non linear least squares (NLLS) and non linear least squares with dummy variables (NLLSDV).

As for our conclusions, based on our econometric results, we can say, as far as the productivity equations are concerned that we cannot exclude the importance of the female educational capital variable in the Latin American countries although the results are not very robust. Nevertheless, our results point to the importance of the human capital variable in general. We can also verify that, in spite of using more sophisticated methods it is not advisable to abandon in our analysis the OLS method, which we find to be a very interesting result. As for the convergence equations, the results are worse than the ones for the productivity equations. Although they do not deny that human capital influences the real output growth rates the influence obtained is the opposite to the one predicted by the theory.

These conclusions bring us once more to the question of the limits of our analysis. Let us recall the problem of the quality of the data. This problem could be overcome by considering instrumental variables, especially for the Latin American countries, but this would lead us to the endogeneity problem due to the difficulties in choosing the right instrumental variables. On the other hand, besides all the problems in finding accurate measures for the human capital variable we cannot forget that we do not have data on the quality of the education system outcomes for most of the countries. However, using different samples and different estimation procedures from the ones used, for instance, by Barro (1998) we arrive at similar results (especially with the non linear methods) – the female educational capital variable does not influence the steady state productivity levels. This result could be explained by the fact that the labour market does not make an efficient use of the female educational qualifications. This in turn can be due to cultural factors that act as entry barriers to the women in the labour market especially in the Latin American countries.

Another problem is the fact that our data refers to five-year periods which limits the availability of time series information. Therefore our estimations have a limited number of degrees of freedom. This was one of the reasons for not trying to control for the specific time effects.

Finally, we can not go on without making some kind of remark to the model specification. If this is one of the reasons for the lack of robustness of our results then a solution could reside on the consideration of yet another convergence mechanism. Together with the diminishing returns mechanism we could also consider a technological catch up mechanism. However, to follow this path we must have access to adequate proxies for the technological gaps, non-observable. This is not to our knowledge yet possible.

If we recall our previous analysis of the economic and educational situation of the Latin American countries we said that all the countries seem to have made a serious effort to improve the education levels of their populations. Although in the majority of countries the male population is more educated than the female population, the average number of years of schooling has improved for the whole population. The effort in educating the population has also been greater for the female population, which might allow it to recover from its backwardness. All these conclusions are important in a model that considers the technological catch up mechanism since to adopt new technologies a country needs to have a qualified population.

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Appendix A - Determination of the convergence equation

We start by applying natural logs to the aggregate production function and then we differentiate ln y_{it} in order to the time period:

$$\frac{d\ln(y_{it})}{dt} = \alpha\frac{\dot{k}_i}{k} + \beta_f\frac{\dot{h}_{f_i}}{h_f} + \beta m\frac{\dot{h}_{m_i}}{h_m} + \varphi\frac{\dot{x}_i}{x} \quad \textbf{(31)}$$

We then replace the capital stocks growth rates by their expressions taken from equations (5), (6), (7) et (8) and we arrive at:

$$\frac{d\ln(y_{it})}{dt} = \alpha\left[s_{k_i}\frac{y_{it}}{k_{it}} - (g+n_i+\delta)\right] + \beta_f\left[s_{k_i}\frac{y_{it}}{h_{fit}} - (g+n_i+\delta)\right] + \\ + \beta m\left[s_{k_i}\frac{y_{it}}{h_{fi_t}} - (g+n_i+\delta)\right] + \varphi\left[s_{k_i}\frac{y_{it}}{x_{it}} - (g+n_i+\delta)\right] \quad \textbf{(32)}$$

We now apply a first order development of the Taylor series to get a proxy for the steady state value of lny_{it} and we get:

$$\frac{d\ln y_{it}}{dt} \approx \sum_r \frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln r_{it}}\left[\ln r_{it} - \ln r_i *\right] \text{ avec } r=k,ef,em,x \quad \textbf{(33)}$$

Knowing that:

$$\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln r_{it}} \approx r_{it}\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta r_{it}} \quad \textbf{(34)}$$

We calculate the partial derivative for the right hand side member of equation (30) and we multiply it by the capital stock. Afterwards we replace the equilibrium capital stocks by their expressions and we get:

$$\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln k_{it}} \approx -\alpha(1-\alpha-\beta_f-\beta_m-\varphi)(n_i+g+\delta) \quad \textbf{(35)}$$

$$\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln h_{fit}} \approx -\beta_f(1-\alpha-\beta_f-\beta_m-\varphi)(n_i+g+\delta) \quad \textbf{(36)}$$

$$\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln h_{mit}} \approx -\beta_m(1-\alpha-\beta_f-\beta_m-\varphi)(n_i+g+\delta) \quad \textbf{(37)}$$

$$\frac{\delta\left[\frac{d\ln y_{it}}{dt}\right]}{\delta\ln x_{it}} \approx -\varphi(1-\alpha-\beta_f-\beta_m-\varphi)(n_i+g+\delta) \quad \textbf{(38)}$$

We replace equations (31) to (34) into (29) and get:

$$\frac{d\ln y_{it}}{dt} \approx -\lambda\begin{Bmatrix}\left[\alpha\ln k_{it} + \beta_f\ln h_{fi_t} + \beta_m h_{mi_t} + \varphi\ln x_{it}\right] - \\ -\left[\alpha\ln k_i * + \beta_f\ln h_{fi} * + \beta_m h_{mi} * + \varphi\ln x_i *\right]\end{Bmatrix} \quad \textbf{(39)}$$

$$\lambda = (1-\alpha-\beta_f-\beta_m-\varphi)(n_i+g+\delta) \quad \textbf{(40)}$$

Equation (35) can be rewritten considering the aggregate production function in logs:

$$\frac{d\ln y_{it}}{dt} \approx -\lambda\left(\ln y_{it} - \ln y_i^*\right) \quad (41)$$

We solve equation (41) in order to the distance between output per unit of efficient labour on date t and the equilibrium output per unit of efficient labour. We call this distance:

$$\chi_t = \ln y_{it} - \ln y_i^* \quad (42)$$

For equation (41) we can write:

$$\dot{\chi}_t \approx -\lambda \chi_t \quad (43)$$

We solve the differential equation above and get:

$$\chi_t = e^{-\lambda t}\chi_0 \quad (44)$$

We replace χ_t for its expression:

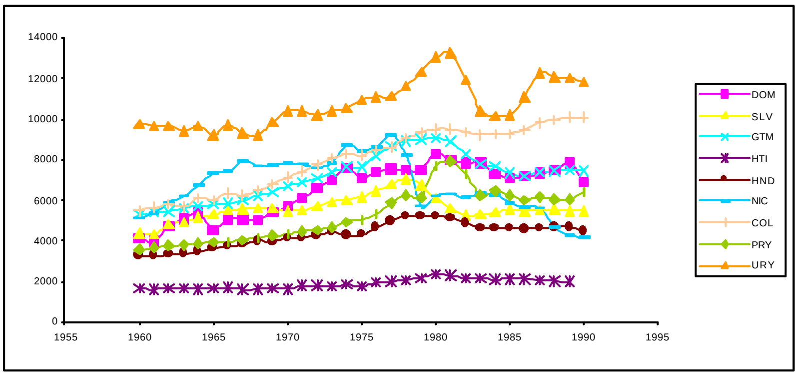
$$\ln y_{it} - \ln y_i^* = e^{-\lambda t}\left(\ln y_{i0} - \ln y_i^*\right) \quad (45)$$

Furthermore,

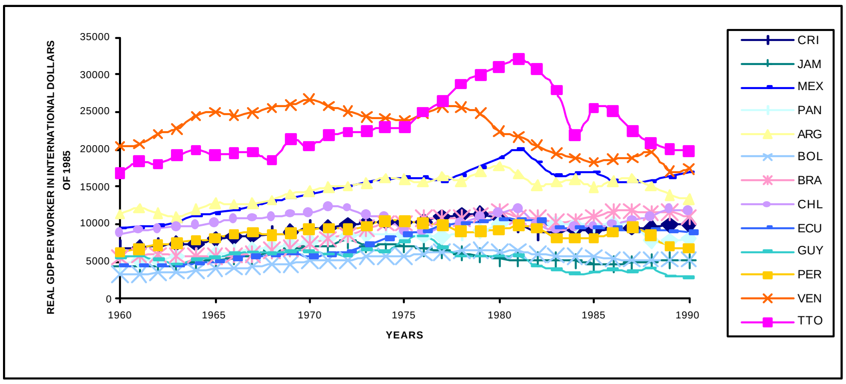
$$\ln y_{it} - \ln y_{io} = -(1 - e^{-\lambda t})\ln y_{io} + (1 - e^{-\lambda t})\ln y^* \quad (46)$$

Appendix B - Figures 1 to 14

FIG. 1– REAL GDP PER WORKER – 1960/1990

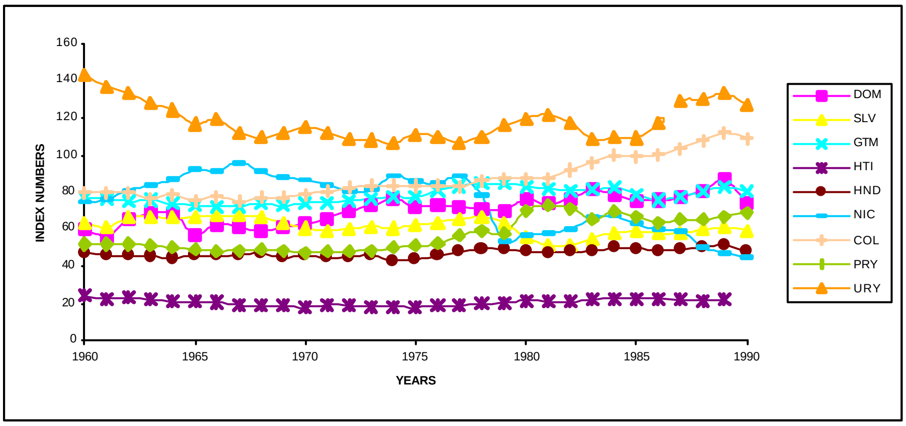


a)

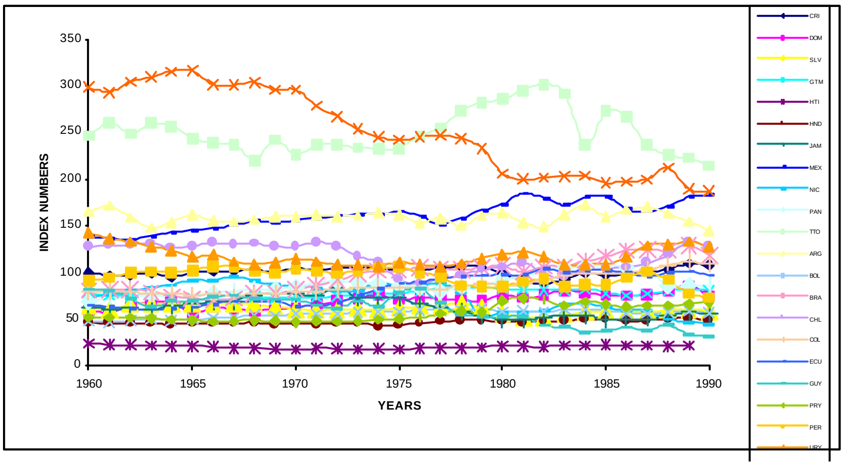


b)

FIG. 2– INDEX NUMBERS FOR REAL GDP PER WORKER (AVERAGE=100) – 1960/1990



a)



b)

FIG. 3– REAL GDP PER WORKER AVERAGE GROWTH RATE (1960-90) AND REAL GDP PER WORKER INITIAL VALUE (1960)

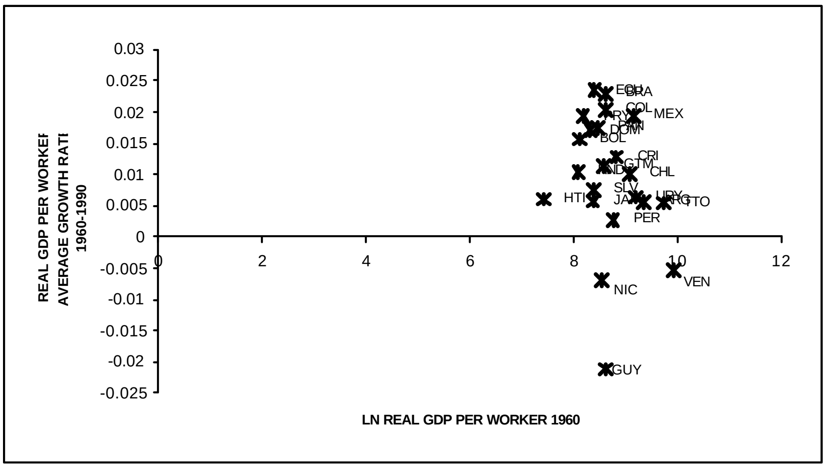
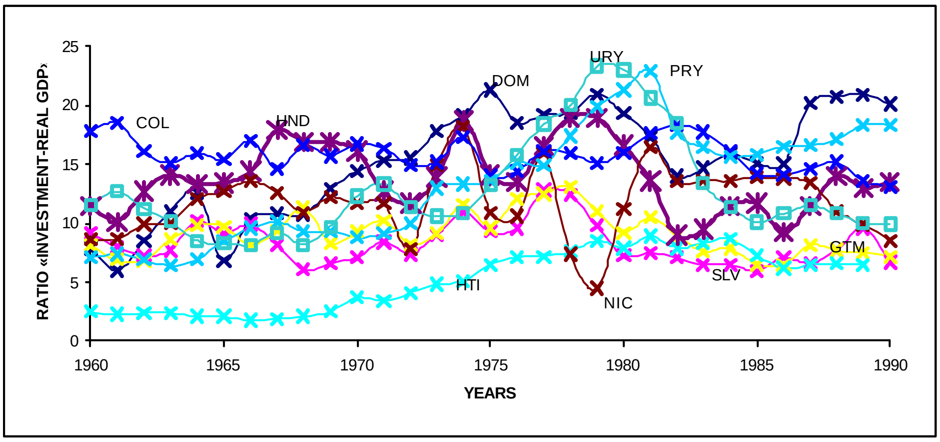
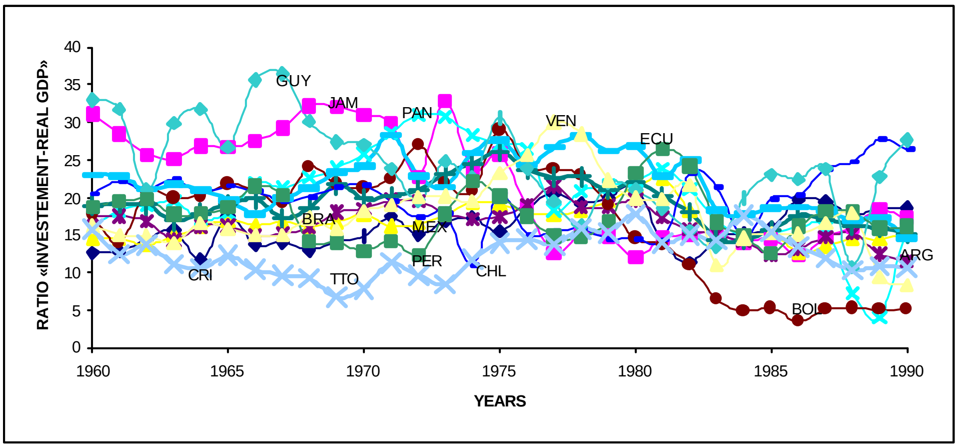


FIG. 4– RATIO «INVESTMENT – REAL GDP»



a)



b)

FIG. 5– REAL GDP PER WORKER AND INVESTMENT IN PHYSICAL CAPITAL

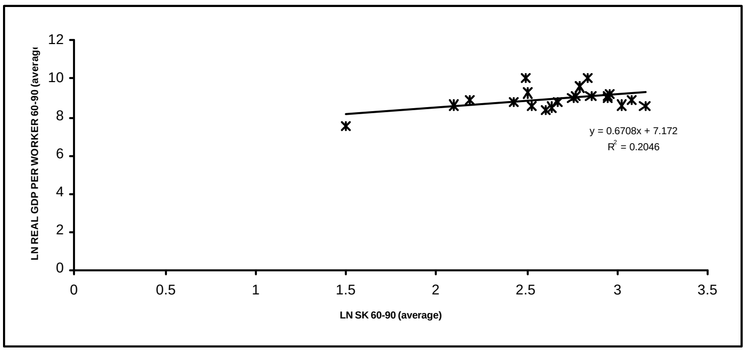


FIG. 6– REAL GDP PER WORKER AND EDUCATION

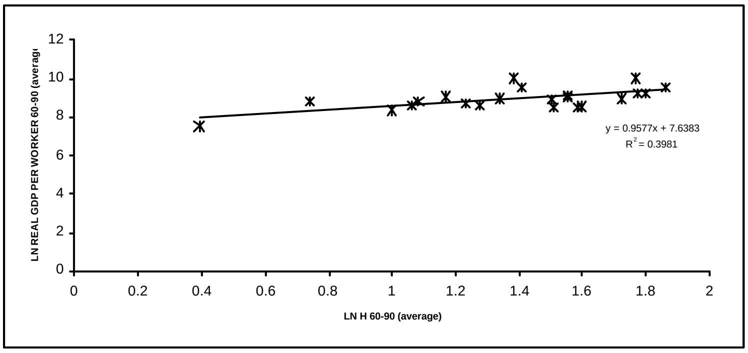


FIG. 7– REAL GDP PER WORKER AND MALE EDUCATION

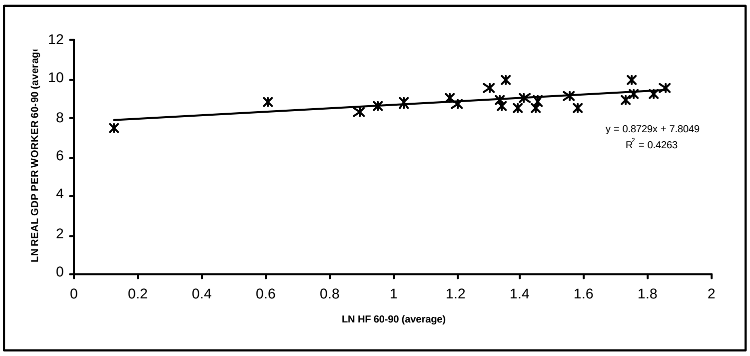


FIG. 8- REAL GDP PER WORKER AND FEMALE EDUCATION

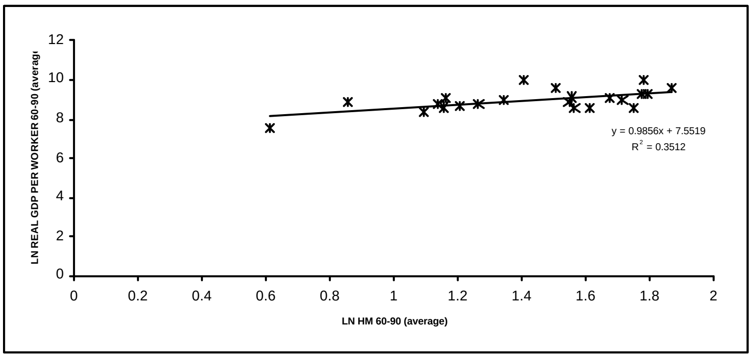


FIG. 9- REAL GDP PER WORKER AND LIFE EXPECTANCY

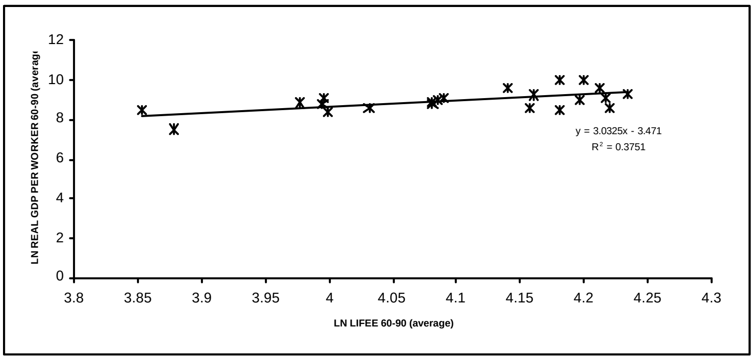


FIG. 10– AVERAGE REAL GDP PER WORKER GROWTH RATE AND PHYSICAL CAPITAL

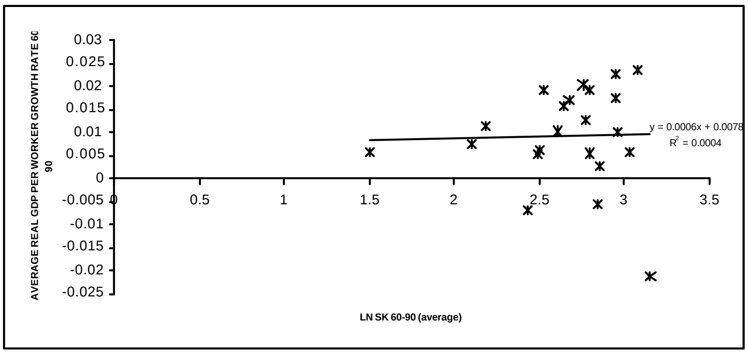


FIG. 11- AVERAGE REAL GDP PER WORKER GROWTH RATE AND EDUCATION

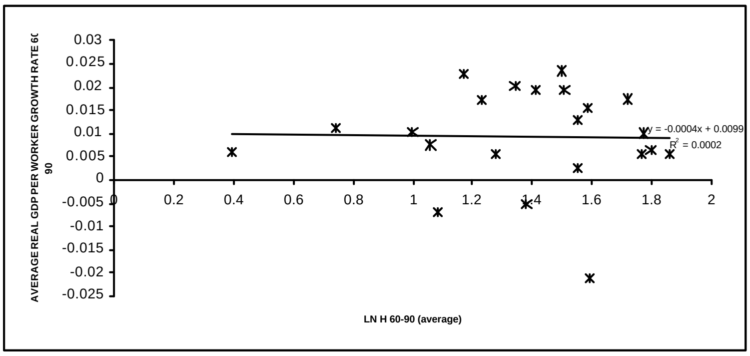


FIG. 12- AVERAGE REAL GDP PER WORKER GROWTH RATE AND MALE EDUCATION

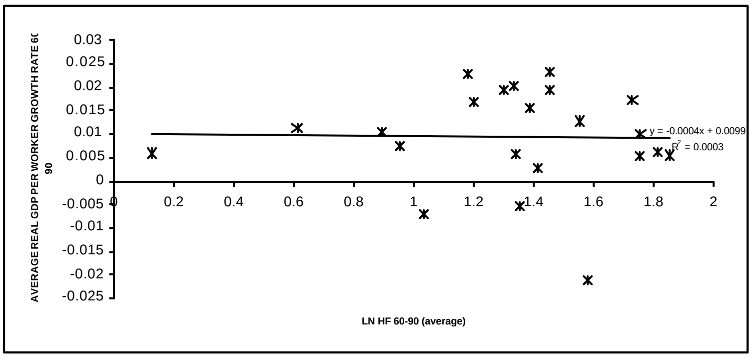


FIG. 13- AVERAGE REAL GDP PER WORKER GROWTH RATE AND FEMALE EDUCATION

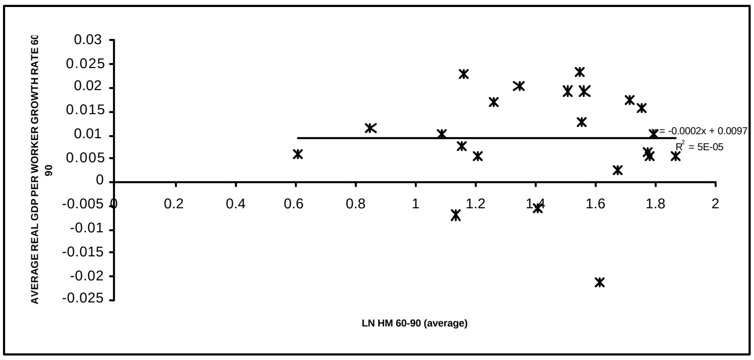
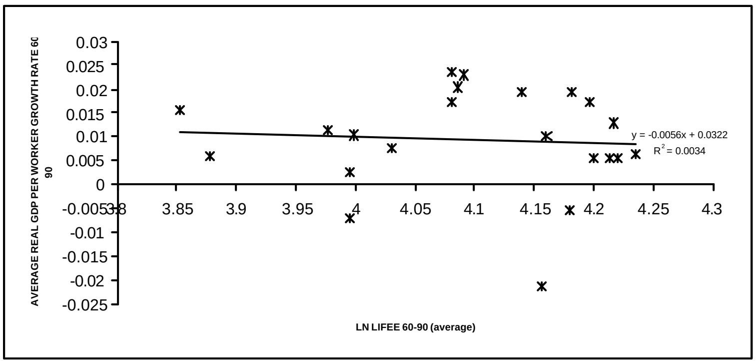


FIG. 14- AVERAGE REAL GDP PER WORKER GROWTH RATE AND LIFE EXPECTANCY



Appendix C – Estimations results

C.1 - Productivity equations results

C.1.1- Equations without differentiation of human capital by gender

Results for the steady state growth equilibrium productivity equation without differentiation (OLS)

	(1)	(2)		
Unrestricted model				
$\ln s_k$	0.0914	0.1925		
	(1.0109)	(2.8884)		
$\ln(n+g+\delta)$	0.8032	0.2595		
	(2.8294)	(1.393)		
ln(h*)	0.4724	0.429		
	(3.6975)	(5.2002)		
lnx*	0.5390	0.8268		
	(3.1517)	(7.7413)		
SEE*	0.4376	0.3653		
N, T-N-1	132, 127	228, 223		
Test of the restriction			***Restricted model***	**(2)**
$\ln s_k$	0.0467	0.1484	$\ln s_k - \ln(n+g+\delta)$	0.1244
	(0.5226)	(2.3221)		(1.9028)
$\ln(n+g+\delta)$	-0.0467	-0.1484	ln(h*)	0.4594
	(-0.5933)	(-2.3221)		(5.4362)
ln(h*)	0.6208	0.4973	lnx*	0.7635
	(5.2266)	(6.4502)		(7.7958)
lnx*	0.3787	0.7045	SEE	0.3696
	(2.3193)	(7.5723)		228, 224
SEE	0.4535	0.3704		
$\chi^2(1)$	9.9479	5.434		
Elasticities*				
ALPHA	0.0046	0.1292		0.1106
BETA	0.5931	0.4330		0.4086
PSI	0.3618	0.6135		0.6790

* Standard error of the estimate;

** Calculated from the model when testing the restriction or for the restricted model when the restriction is accepted in all the tables.

Results for the steady state growth equilibrium productivity equation without differentiation (LSDV)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.2198	0.1853
	(4.6256)	(4.073)
$\ln(n+g+\delta)$	0.3334	0.3482
	(1.8142)	(2.7970)
$\ln(h^*)$	-0.0551	-0.1123
	(-0.5596)	(-1.1822)
$\ln x^*$	0.5852	0.9720
	(3.7749)	(7.4673)
SEE	0.1551	0.1565
N, T-N-1	132, 107	228, 186
Test of the restriction		
$\ln s_k$	0.1913	0.1298
	(4.1105)	(2.9883)
$\ln(n+g+\delta)$	-0.1913	-0.1298
	(-4.1105)	(-2.9883)
$\ln(h^*)$	-0.0009	-0.0182
	(-0.0093)	(-0.1974)
$\ln x^*$	0.5992	0.9074
	(3.8671)	(7.0225)
SEE	0.1625	0.1654
$\chi^2(1)$	8.7091	16.7875
Elasticities		
ALPHA	0.1606	0.1149
BETA	-0.0008	-0.0161
PSI	0.503	0.8032

Results for the steady state growth equilibrium productivity equation without differentiation (OLSD)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.263	0.2665
	(5.6786)	(5.8117)
$\ln(n+g+\delta)$	0.2724	0.1812
	(2.2946)	(2.0206)
$\ln(h^*)$	-0.0202	-0.0038
	(-0.2514)	(-0.0485)
$\ln x^*$	0.5146	0.8030
	(3.3515)	(6.8676)
SEE	0.1175	0.1165
N, T-N-1	110, 106	190,186
Test of the restriction		
$\ln s_k$	0.183	0.1766
	(4.3563)	(4.2795)
$\ln(n+g+\delta)$	-0.183	-0.1766
	-(4.3563)	-(4.2795)
$\ln(h^*)$	0.0567	0.0565
	(0.7266)	(0.7218)
$\ln x^*$	0.4619	0.7243
	(3.0191)	(6.2650)
SEE	0.1258	0.1230
$\chi^2(1)$	16.8175	20.1985
Elasticities		
ALPHA	0.1547	0.1501
BETA	0.0479	0.0481
PSI	0.3904	0.6156

Results for the steady state growth equilibrium productivity equation without differentiation (NLLS)

	(1)	(2)
Elasticities		
ALPHA	0.0723	0.1106
	(0.7576)	(2.1395)
BETA	0.4567	0.4085
	(2.8466)	(4.5850)
PSI	0.4856	0.679
	(2.8374)	(6.0755)
SEE	0.4516	0.3696
N, T-N-1	132, 128	228, 224

Results for the steady state growth equilibrium productivity equation without differentiation (NLLSD

	(1)	(2)
Elasticities		
ALPHA	0.1542	0.1136
	(3.7758)	(2.6636)
BETA	-0.0119	-0.0672
	(-0.1179)	(-0.7292)
PSI	0.4884	0.8487
	(3.9096)	(8.4044)
SEE	0.1600	0.1620
N, T-N-1	132, 107	228, 187

C.1.2- Equations with differentiation but without gender gap

Results for the steady state growth equilibrium productivity equation without gender gap (OLS)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.0783	0.1929
	(0.8138)	(2.8991)
$\ln(n+g+\delta)$	0.8078	0.3028
	(2.8819)	(1.592)
ln(hf*)	0.323	0.0493
	(0.7727)	(0.2211)
ln(hm*)	0.164	0.3912
	(0.4402)	(1.6276)
lnx*	0.4982	0.8448
	(2.214)	(8.0327)
SEE	0.4387	0.3650
N, T-N-1	132, 126	228, 222
Test of the restriction		
$\ln s_k$	0.0127	0.1498
	(0.1359)	(2.3287)
$\ln(n+g+\delta)$	-0.0127	-0.1498
	-(0.1359)	-(2.3287)
ln(hf*)	0.6121	0.1831
	(1.5019)	(0.8461)
ln(hm*)	0.0449	0.3181
	(0.1213)	(1.3333)
lnx*	0.2617	0.7171
	(1.2358)	(7.7733)
SEE	0.4547	0.3708
$\chi^2(1)$	9.6504	6.3941
Elasticities		
ALPHA	0.0125	0.1303
BETAF	0.6044	0.1592
BETAM	0.0443	0.2767
PSI	0.2584	0.6237

Results for the steady state growth equilibrium productivity equation without gender gap (LSDV)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.2160	0.1807
	(4.4865)	(3.9270)
ln(n+g+δ)	0.316	0.3424
	(1.7086)	(2.7241)
ln(hf*)	-0.2017	-0.1924
	(-1.1631)	(-1.1257)
fln(hm*)	0.1368	0.0780
	(0.8731)	(0.4886)
lnx*	0.6097	0.9837
	(3.7923)	(7.4240)
SEE	0.1551	0.1566
N, T-N-1	132, 105	228, 185
Test of the restriction		
$\ln s_k$	0.1884	0.1266
	(3.9968)	(2.8786)
ln(n+g+δ)	-0.1884	-0.1266
	-(3.9968)	-(2.8786)
ln(hf*)	-0.2589	-0.1965
	(-1.5032)	(-1.1496)
fln(hm*)	0.2314	0.1632
	(1.5121)	(1.0311)
lnx*	0.6415	0.9303
	(4.0)	(7.0571)
SEE	0.1617	0.1651
$\chi^2(1)$	7.9562	15.8597
Elasticities		
ALPHA	0.1585	0.1124
BETAF	-0.2179	-0.1744
BETAM	0.1947	0.1449
PSI	0.5398	0.8258

Results for the steady state growth equilibrium productivity equation without gender gap (OLSD

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.2618	0.2689
	(5.6309)	(5.7618)
ln(n+g+δ)	0.2751	0.1805
	(2.3254)	(2.0139)
ln(hf*)	-0.0705	-0.0342
	(-0.6269)	(-0.3086)
ln(hm*)	0.0424	0.0311
	(0.4051)	(0.2829)
lnx*	0.5235	0.8040
	(3.3833)	(6.8513)
SEE	0.118	0.1168
N, T-N-1	110, 105	190, 185
Test of the restriction		
$\ln s_k$	0.1815	0.1757
	(4.2965)	(4.2306)
ln(n+g+δ)	-0.1815	-0.1757
	-(4.2965)	-(4.2306)
ln(hf*)	0.0045	-0.0147
	(0.0409)	(-0.1330)
ln(hm*)	0.0585	0.0770
	(0.5598)	(0.7031)
lnx*	0.4659	0.7255
	(3.0234)	(6.2521)
SEE	0.1264	0.1233
$\chi^2(1)$	17.0671	20.1235
Elasticities		
ALPHA	0.1536	0.1494
BETAF	0.0038	-0.0125
BETAM	0.0495	0.0655
PSI	0.3943	0.6171

Results for the steady state growth equilibrium productivity equation without gender gap NLLS

	(1)	(2)
Elasticities		
ALPHA	0.0533	0.1088
	(0.5011)	(2.0863)
BETAF	0.3813	0.1767
	(1.0243)	(1.0996)
BETAM	0.1058	0.2384
	(0.3327)	(1.3773)
PSI	0.4316	0.6781
	(2.0949)	(5.9542)
SEE	0.4525	0.3699
N; T-N-1	132, 127	228, 223

Results for the steady state growth equilibrium productivity equation without gender gap NLLSDV

	(1)	(2)
Elasticities		
ALPHA	0.1522	0.1105
	(3.7201)	(2.5708)
BETAF	-0.1967	-0.1928
	(-1.2116)	(-1.2910)
BETAM	0.1714	0.1202
	(1.1190)	(0.8372)
PSI	0.5175	0.8672
	(4.0315)	(8.3488)
SEE	0.1596	0.1619
N; T-N-1	132, 106	228, 186

C.1.3- Equations with gender gap(1)

Results for the steady state growth equilibrium productivity equation with gender gap (1) (OLS)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.0783	0.1929
	(0.8138)	(2.8991)
$\ln(n+g+\delta)$	0.8078	0.3028
	(2.8819)	(1.592)
ln(hf*)	0.487	0.4404
	(3.5974)	(5.244)
ln(hm*)-ln(hf*)	0.164	0.3912
	(0.4402)	(1.6276)
lnx*	0.4982	0.8448
	(2.214)	(8.0327)
SEE	0.4387	0.3650
N, T-N-1	132, 126	228, 222
Test of the restriction		
$\ln s_k$	0.0127	0.1498
	(0.1359)	(2.3287)
$\ln(n+g+\delta)$	-0.0127	-0.1498
	-(0.1359)	-(2.3287)
ln(hf*)	0.6570	0.5012
	(5.3064)	(6.2291)
ln(hm*)-ln(hf*)	0.0449	0.3181
	(0.1213)	(1.3333)
lnx*	0.2617	0.7171
	(1.2358)	(7.7733)
SEE	0.4547	0.3708
$\chi^2(1)$	9.6504	6.3941
Elasticities		
ALPHA	0.0125	0.1303
BETAF	0.6044	0.1592
BETAM	0.0443	0.2767
PSI	0.2584	0.6237

Results for the steady state growth equilibrium productivity equation with gender gap (1) (LSDV)

	(1)	(2)
Unrestricted model		
lns_k	0.2160	0.1807
	(4.4865)	(3.9270)
ln(n+g+δ)	0.316	0.3424
	(1.7086)	(2.7241)
ln(hf*)	-0.0649	-0.1144
	(-0.6031)	(-1.1279)
ln(hm*)-ln(hf*)	0.1368	0.0780
	(0.8731)	(0.4886)
lnx*	0.6097	0.9837
	(3.7923)	(7.4240)
SEE	0.1551	0.1566
N, T-N-1	132, 105	228, 185
Test of the restriction		
lns_k	0.1884	0.1266
	(3.9968)	(2.8786)
ln(n+g+δ)	-0.1884	-0.1266
	-(3.9968)	-(2.8786)
ln(hf*)	-0.0275	-0.0333
	(-0.2571)	(-0.3355)
ln(hm*)-ln(hf*)	0.2314	0.1632
	(1.5121)	(1.0311)
lnx*	0.6415	0.9303
	(4.0)	(7.0571)
SEE	0.1617	0.1651
$\chi^2(1)$	7.9562	15.8597
Elasticities		
ALPHA	0.1585	0.1124
BETAF	-0.2179	-0.1744
BETAM	0.1947	0.1449
PSI	0.5171	0.8258

Results for the steady state growth equilibrium productivity equation with gender gap (1) (OLSD)

	(1)	(2)
Unrestricted model		
lns_k	0.2849	0.287
	(6.4135)	(6.5395)
ln(n+g+δ)	0.2909	0.1864
	(2.411)	(2.0652)
ln(hf*)	-0.0281	-0.0031
	(-0.3354)	(-0.0388)
ln(hm*)-ln(hf*)	0.0346	0.254
	(0.3352)	(0.2325)
lnx*	0.5678	0.8330
	(3.7304)	(7.1985)
SEE	0.1133	0.1137
N, T-N-1	108, 103	188, 183
Test of the restriction		
lns_k	0.2162	0.2064
	(5.1859)	(5.077)
ln(n+g+δ)	-0.2162	-0.2064
	(-5.1859)	(-5.077)
ln(hf*)	0.0630	0.0623
	(0.7797)	(0.789)
ln(hm*)-ln(hf*)	0.0517	0.0726
	(0.5014)	(0.6677)
lnx*	0.558	0.7839
	(3.6667)	(6.7994)
SEE	0.1232	0.1211
$\chi^2(1)$	20.0569	23.7485
Elasticities		
ALPHA	0.178	0.171
BETAF	0.0093	-0.0103
BETAM	0.0425	0.060
PSI	0.4588	0.65

C.1.4- Equations with gender gap(2)

Results for the steady state growth equilibrium productivity equation with gender gap (2) (OLS)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.0783	0.1929
	(0.8138)	(2.8991)
$\ln(n+g+\delta)$	0.8078	0.3028
	(2.8819)	(1.592)
ln(hm*)	0.487	0.4404
	(3.5974)	(5.244)
ln(hm*)-ln(hf*)	-0.323	-0.0493
	(-0.7727)	(-0.2211)
lnx*	0.4982	0.8448
	(2.214)	(8.0327)
SEE	0.4387	0.3650
N, T-N-1	132, 126	228, 222
Test of the restriction		
$\ln s_k$	0.0127	0.1498
	(0.1359)	(2.3287)
$\ln(n+g+\delta)$	-0.0127	-0.1498
	-(0.1359)	-(2.3287)
ln(hm*)	0.6570	0.5012
	(5.3064)	(6.2291)
ln(hm*)-ln(hf*)	-0.6121	-0.1831
	(-1.5019)	(-0.8461)
lnx*	0.2617	0.7171
	(1.2358)	(7.7733)
SEE	0.4547	0.3708
$\chi^2(1)$	9.6504	6.3941
Elasticities		
ALPHA	0.0125	0.1303
BETAF	0.6044	0.1592
BETAM	0.0443	0.2767
PSI	0.2584	0.6237

Results for the steady state growth equilibrium productivity equation with gender gap (2) (LSDV)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.2160	0.1807
	(4.4865)	(3.9270)
$\ln(n+g+\delta)$	0.316	0.3424
	(1.7086)	(2.7241)
ln(hm*)	-0.0649	-0.1144
	(-0.6031)	(-1.1279)
ln(hm*)-ln(hf*)	0.2017	0.1924
	(1.1631)	(1.1257)
lnx*	0.6097	0.9837
	(3.7923)	(7.4240)
SEE	0.1551	0.1566
N, T-N-1	132, 105	228, 185
Test of the restriction		
$\ln s_k$	0.1884	0.1266
	(3.9968)	(2.8786)
$\ln(n+g+\delta)$	-0.1884	-0.1266
	-(3.9968)	-(2.8786)
ln(hm*)	-0.0275	-0.0333
	(-0.2571)	(-0.3355)
ln(hm*)-ln(hf*)	0.2589	0.1965
	(1.5032)	(1.1496)
lnx*	0.6415	0.9303
	(4.0)	(7.0571)
SEE	0.1617	0.1651
$\chi^2(1)$	7.9562	15.8597
Elasticities		
ALPHA	0.1585	0.1124
BETAF	-0.2179	-0.1744
BETAM	0.1947	0.1449
PSI	0.5398	0.8258

Results for the steady state growth equilibrium productivity equation with gender gap (2) (OLSD)

	(1)	(2)
Unrestricted model		
$\ln s_k$	0.2618	0.2689
	(5.6309)	(5.7618)
$\ln(n+g+\delta)$	0.2751	0.1805
	(2.3254)	(2.0139)
ln(hm*)	-0.0705	-0.0342
	(-0.6269)	(-0.3086)
ln(hm*)-ln(hf*)	0.0424	0.0311
	(0.4051)	(0.2829)
lnx*	0.5235	0.8040
	(3.3833)	(6.8513)
SEE	0.118	0.1168
N, T-N-1	110, 105	190, 185
Test of the restriction		
$\ln s_k$	0.1815	0.1757
	(4.2965)	(4.2306)
$\ln(n+g+\delta)$	-0.1815	-0.1757
	-(4.2965)	-(4.2306)
ln(hm*)	0.0045	-0.0147
	(0.0409)	(-0.1330)
ln(hm*)-ln(hf*)	0.0585	0.0770
	(0.5598)	(0.7031)
lnx*	0.4659	0.7255
	(3.0234)	(6.2521)
SEE	0.1264	0.1233
$\chi^2(1)$	17.0671	20.1235
Elasticities		
ALPHA	0.1536	0.1494
BETAF	-0.0495	-0.0655
BETAM	0.0533	0.053
PSI	0.3943	0.6171

C.2- Convergence equations

C.2.1- Equations without differentiation of human capital by gender

Results for the convergence equation without differentiation (OLS)

	(1)	**(2)**	
Unrestricted model			
lnPIB in	-0.0018	-0.0030	
	(-0.2834)	(-0.5059)	
lns$_k$	0.0324	0.0360	
	(5.8747)	(8.7220)	
ln(n+g+δ)	-0.0351	-0.0676	
	(-1.8347)	(-6.2146)	
ln(h*)	-0.0246	-0.0241	
	(-3.3859)	(-4.1412)	
lnx*	-0.0196	-0.0099	
	(-1.9021)	(-1.3341)	
SEE	0.0298	0.0245	
N, T-N-1	132, 126	228, 222	
c^2	**0.0208**	**7.0344**	
Restricted model		**Test of the restriction**	
lnPIB in	-0.0021	lnPIB in	-0.0089
	(-0.3329)		(-1.5966)
lns$_k$ - ln(n+g+δ)	0.0324	lns$_k$	0.0405
	(5.9077)		(10.7748)
ln(h*)	-0.0246	ln(n+g+δ)	-0.0405
	(-3.3553)		(-10.7748)
lnx*	-0.0194	ln(h*)	-0.0226
	(-1.9063)		(-3.8941)
SEE	0.0297	lnx*	-0.0024
			(-0.3553)
		SEE	0.0249
N, T-N-1	132, 127	N, T-N-1	228, 223
Elasticities			
ALPHA	0.9391		0.8198
BETA	-0.713		-0.4575
PSI	-0.5623		-0.0486
LÂMEDA[11]	0.0021		0.0091

[11] $\lambda=-[(\ln(1-5x\theta)/5]$.

Results for the convergence equation without differentiation (LSDV)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0613	-0.0439
	(-4.4065)	(-4.4526)
lns_k	0.0482	0.0419
	(6.0333)	(6.0909)
ln(n+g+δ)	-0.0105	-0.0477
	(-0.3757)	(-2.4271)
ln(h*)	-0.0582	-0.0605
	(-4.4310)	(-5.4725)
lnx*	0.0101	0.0271
	(0.4283)	(1.4342)
SEE	0.0247	0.0211
N, T-N-1	132, 105	228, 185
c^2	1.6364	0.0708
Restricted model		
lnPIB in	-0.0574	-0.0446
	(-4.1221)	(-4.7823)
lns_k - ln(n+g+δ)	0.0454	0.0426
	(6.1382)	(6.7841)
ln(h*)	-0.0559	-0.0608
	(-4.3136)	(-6.7841)
lnx*	0.007	0.028
	(0.3027)	(1.5335)
SEE	0.0247	0.0210
N, T-N-1	132, 106	228, 186
Elasticities		
ALPHA	0.4416	0.4885
BETA	-0.5438	-0.6972
PSI	0.0681	0.3211
LÂMEDA	0.0677	0.0505

Results for the convergence equation without differentiation (OLSD)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.1554	-0.1242
	(-8.2793)	(-8.6926)
lns_k	0.0719	0.0653
	(6.7146)	(6.7876)
ln(n+g+δ)	0.0127	-0.0388
	(0.4063)	(-1.7521)
ln(h*)	-0.0563	-0.054
	(-2.9406)	(-3.3131)
lnx*	0.0891	0.1135
	(2.3345)	(4.0912)
SEE	0.0277	0.0245
N, T-N-1	110, 105	190, 185
c	*6.3252*	*1.1654*
Restricted model		
lnPIB in	-0.1440	-0.1200
	(-7.7087)	(-8.7245)
lns_k - ln(n+g+δ)	0.0636	0.0610
	(6.2494)	(7.0016)
ln(h*)	-0.0517	-0.0523
	(-2.7143)	(-3.2341)
lnx*	0.0807	0.1077
	(2.1944)	(3.9864)
SEE	0.0285	0.0245
N, T-N-1	110, 106	190, 186
Elasticities		
ALPHA	0.3064	0.337
BETA	-0.2490	-0.289
PSI	0.3887	0.5950
LÂMEDA	0.255	0.1940

Results for the convergence equation without differentiation (NLLS)

	(1)	(2)
Elasticities		
ALPHA	0.9396	0.8855
	(5.8604)	(10.1955)
BETA	-0.7132	-0.5435
	(-2.1877)	(-3.3177)
PSI	-0.5628	-0.0812
	(-1.3485)	(-0.472)
LÂMEDA	-0.0021	-0.0054
	(-0.3531)	(-1.1581)
SEE	0.0297	0.0248
N, T-N-1	132, 128	228, 224

Results for the convergence equation without differentiation (NLLSDV)

	(1)	(2)
Elasticities		
ALPHA	0.4414	0.4882
	(6.2676)	(7.7065)
BETA	-0.5438	-0.6972
	(-2.7851)	(-4.0878)
PSI	0.0681	0.321
	(0.2821)	(1.7232)
LÂMEDA	0.0677	0.0505
	(3.6076)	(4.4721)
SEE	0.0247	0.0210
N, T-N-1	132, 106	228, 186

C.2.2- Equations with differentiation but without gender gap

Results for the convergence equation without gender gap (OLS)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0018	-0.0032
	(-0.2656)	(-0.5408)
$\ln s_k$	0.0336	0.0363
	(5.5296)	(8.7754)
$\ln(n+g+\delta)$	-0.0357	-0.0639
	(-1.1845)	(-5.7585)
ln(hf*)	-0.0230	-0.0248
	(-1.1845)	(-2.1579)
ln(hm*)	-0.0027	0.0013
	(-0.1539)	(0.1184)
lnx*	-0.0155	-0.0078
	(-1.2076)	(-1.0379)
SEE	0.0299	0.0245
N, T-N-1	132, 125	228,221
c^2	*0121*	*5.1128*
Restricted model		
lnPIB in	-0.0019	-0.0051
	(-0.3056)	(-0.8974)
$\ln s_k - \ln(n+g+\delta)$	0.0337	0.0402
	(5.5729)	(10.5375)
ln(hf*)	-0.0231	-0.0325
	(-1.1948)	(-2.8342)
ln(hm*)	-0.0025	0.0087
	(-0.1459)	(0.7644)
lnx*	-0.0153	-0.0016
	(-1.2100)	(-0.2294)
SEE	0.0298	0.0247
N, T-N-1	132, 126	228, 222
Elasticities		
ALPHA	0.9466	0.8874
BETAF	-0.6489	-0.7627
BETAM	-0.0702	0.1921
PSI	-0.4298	-0.0353
LÂMEDA	0.0019	0.0032

Results for the convergence equation without gender gap (LSDV)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0611	-0.0438
	(-4.6349)	(-4.5720)
lns_k	0.0471	0.0408
	(5.8604)	(5.9185)
ln(n+g+δ)	-0.0167	-0.0497
	(-0.6197)	(-2.5041)
ln(hf*)	-0.0917	-0.0758
	(-4.9774)	(-4.1418)
ln(hm*)	0.0271	0.0116
	(1.6898)	(0.8171)
lnx*	0.0215	0.0335
	(0.9714)	(1.8511)
SEE	0.0242	0.0208
N, T-N-1	132, 104	228, 184
χ^2	*1.1323*	*0.1706*
Restricted model		
lnPIB in	-0.0580	-0.0499
	(-4.3797)	(-4.9546)
lns_k - ln(n+g+δ)	0.0448	0.0418
	(5.9741)	(6.5798)
ln(hf*)	-0.0934	-0.0754
	(-5.1526)	(-4.0155)
ln(hm*)	0.0305	0.0108
	(2.0456)	(0.7307)
lnx*	0.0195	0.0348
	(0.9004)	(1.9945)
SEE	0.0242	0.0208
N, T-N-1	132, 105	228, 185
Elasticities		
ALPHA	0.4358	0.4558
BETAF	-0.9086	-0.8222
BETAM	0.2967	0.1178
PSI	0.1897	0.3795
LÂMEDA	0.0685	0.0574

Results for the convergence equation without gender gap (OLSD)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.153	-0.1222
	(-8.2758)	(-8.6171)
lns_k	0.071	0.0645
	(6.5442)	(6.6117)
ln(n+g+δ)	0.0142	-0.0394
	(0.4635)	(-1.7909)
ln(hf*)	-0.0717	-0.0658
	(-2.7757)	(-2.8320)
ln(hm*)	0.0054	0.0047
	(0.3240)	(0.3119)
lnx*	0.0976	0.1189
	(2.5784)	(4.3078)
SEE	0.0276	0.0244
N, T-N-1	110, 104	190, 184
χ^2	*6.5318*	*1.0629*
Restricted model		
lnPIB in	-0.1416	-0.1182
	(-7.6889)	(-8.6652)
lns_k - ln(n+g+δ)	0.0626	0.0604
	(6.1068)	(6.8257)
ln(hf*)	-0.0687	-0.0663
	(-2.6147)	(-2.8422)
ln(hm*)	0.0073	0.0067
	(0.4402)	(0.4374)
lnx*	0.0888	0.1136
	(2.4267)	(4.2196)
SEE	0.0283	0.0244
N, T-N-1	110, 105	190, 185
Elasticities		
ALPHA	0.3066	0.3382
BETAF	-0.3364	-0.3712
BETAM	0.0357	0.0375
PSI	0.4349	0.6361
LÂMEDA	0.2462	0.1788

Results for the convergence equation without gender gap (NLLS)

	(1)	(2)
Elasticities		
ALPHA	0.9463	0.8868
	(6.0098)	(10.0616)
BETAF	-0.6499	-0.7172
	(-0.9776)	(-2.4513)
BETAM	-0.0706	0.1920
	(-0.1116)	(0.6729)
PSI	-0.4302	-0.0355
	(-0.9037)	(-0.2029)
LÂMEDA	0.0019	0.0052
	(0.3227)	(1.1304)
SEE	0.0299	0.0247
N, T-N-1	132, 126	228, 222

Results for the convergence equation without gender gap (NLLSDV)

	(1)	(2)
Elasticities		
ALPHA	0.4357	0.4818
	(6.3466)	(7.6511)
BETAF	-0.9082	-0.8695
	(-2.8901)	(-3.2165)
BETAM	0.2961	0.1242
	(1.1007)	(0.5193)
PSI	0.1899	0.4018
	(0.8105)	(2.1736)
LÂMEDA	0.0685	0.0509
	(3.7198)	(4.5462)
SEE	0.0242	0.0208
N, T-N-1	132, 105	228, 185

C.2.3- Equations with gender gap(1)

Results for the convergence equation with gender gap(1) (OLS)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0018	-0.0032
	(-0.2656)	(-0.5408)
$\ln s_k$	0.0336	0.0363
	(5.5296)	(8.7754)
$\ln(n+g+\delta)$	-0.0357	-0.0639
	(-1.1845)	(-5.7585)
ln(hf*)	-0.0257	-0.0234
	(-3.3543)	(-4.0236)
ln(hm*)-ln(hf*)	-0.0027	0.0013
	(-0.1539)	(0.1184)
lnx*	-0.0155	-0.0078
	(-1.2076)	(-1.0379)
SEE	0.0299	0.0245
N, T-N-1	132, 125	228,221
c^2	*0121*	*5.1128*
Restricted model		
lnPIB in	-0.0019	-0.0051
	(-0.3056)	(-0.8974)
$\ln s_k - \ln(n+g+\delta)$	0.0337	0.0402
	(5.5729)	(10.5375)
ln(hf*)	-0.0256	-0.0238
	(-3.3358)	(-3.9257)
ln(hm*)-ln(hf*)	-0.0025	0.0087
	(-0.1459)	(0.7644)
lnx*	-0.0153	-0.0016
	(-1.2100)	(-0.2294)
SEE	0.0298	0.0247
N, T-N-1	132, 126	228, 222
Elasticities		
ALPHA	0.9466	0.8874
BETAF	-0.6489	-0.7174
BETAM	-0.0702	0.1921
PSI	-0.4298	-0.0353
LÂMEDA	0.0019	0.0032

Results for the convergence equation with gender gap(1) (LSDV)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0611	-0.0438
	(-4.6349)	(-4.5720)
$\ln s_k$	0.0471	0.0408
	(5.8604)	(5.9185)
$\ln(n+g+\delta)$	-0.0167	-0.0497
	(-0.6197)	(-2.5041)
ln(hf*)	-0.0646	-0.0641
	(-5.2645)	(-6.1479)
ln(hm*)-ln(hf*)	0.0271	0.0116
	(1.6898)	(0.8171)
lnx*	0.0215	0.0335
	(0.9714)	(1.8511)
SEE	0.0242	0.0208
N, T-N-1	132, 104	228, 184
c^2	*1.1323*	*0.1706*
Restricted model		
lnPIB in	-0.0580	-0.0499
	(-4.3797)	(-4.9546)
$\ln s_k - \ln(n+g+\delta)$	0.0448	0.0418
	(5.9741)	(6.5798)
ln(hf*)	-0.0629	-0.0646
	(-5.3932)	(-6.4420)
ln(hm*)-ln(hf*)	0.0305	0.0108
	(2.0456)	(0.7307)
lnx*	0.0195	0.0348
	(0.9004)	(1.9945)
SEE	0.0242	0.0208
N, T-N-1	132, 105	228, 185
Elasticities		
ALPHA	0.4358	0.4558
BETAF	-0.9086	-0.8222
BETAM	0.2967	0.1178
PSI	0.1897	0.3795
LÂMEDA	0.0685	0.0574

Results for the convergence equation with gender gap(1) (OLSD)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.153	-0.1222
	(-8.2758)	(-8.6171)
$\ln s_k$	0.071	0.0645
	(6.5442)	(6.6117)
$\ln(n+g+\delta)$	0.0142	-0.0394
	(0.4635)	(-1.7909)
ln(hf*)	-0.0664	-0.0611
	(-3.2345)	(-3.5069)
ln(hm*)	0.0054	0.0047
	(0.3240)	(0.3119)
lnx*	0.0976	0.1189
	(2.5784)	(4.3078)
SEE	0.0276	0.0244
N, T-N-1	110, 104	190, 184
c^2	*6.5318*	*1.0629*
Restricted model		
lnPIB in	-0.1416	-0.1182
	(-7.6889)	(-8.6652)
$\ln s_k - \ln(n+g+\delta)$	0.0626	0.0604
	(6.1068)	(6.8257)
ln(hf*)	-0.0614	-0.0597
	(-2.9474)	(-3.4379)
ln(hm*)	0.0073	0.0067
	(0.4402)	(0.4374)
lnx*	0.0888	0.1136
	(2.4267)	(4.2196)
SEE	0.0283	0.0244
N, T-N-1	110, 105	190, 185
Elasticities		
ALPHA	0.3066	0.3382
BETAF	-0.3364	-0.3718
BETAM	0.0357	0.0375
PSI	0.4349	0.6361
LÂMEDA	0.2462	0.1788

C.2.4- Equations with gender gap(2)

Results for the convergence equation with gender gap(2) (OLS)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0018	-0.0032
	(-0.2656)	(-0.5408)
$\ln s_k$	0.0336	0.0363
	(5.5296)	(8.7754)
$\ln(n+g+\delta)$	-0.0357	-0.0639
	(-1.1845)	(-5.7585)
ln(hm*)	-0.0257	-0.0234
	(-1.867)	(-4.0236)
ln(hm*)-ln(hf*)	0.0230	0.0248
	(1.1845)	(2.1579)
lnx*	-0.0155	-0.0078
	(-1.2076)	(-1.0379)
SEE	0.0299	0.0245
N, T-N-1	132, 125	228,221
c^2	*0121*	*5.1128*
Restricted model		
lnPIB in	-0.0019	-0.0051
	(-0.3056)	(-0.8974)
$\ln s_k - \ln(n+g+\delta)$	0.0337	0.0402
	(5.5729)	(10.5375)
ln(hm*)	-0.0257	-0.0238
	(-3.3715)	(-3.9257)
ln(hm*)-ln(hf*)	0.0231	0.0325
	(1.1976)	(2.8342)
lnx*	-0.0153	-0.0016
	(-1.2100)	(-0.2294)
SEE	0.0298	0.0247
N, T-N-1	132, 126	228, 222
Elasticities		
ALPHA	0.9466	0.8874
BETAF	-0.6489	-0.7174
BETAM	-0.0703	0.1921
PSI	-0.4298	-0.0353
LÂMEDA	0.0019	0.0032

Results for the convergence equation with gender gap(2) (LSDV)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.0611	-0.0438
	(-4.6349)	(-4.5720)
lns_k	0.0471	0.0408
	(5.8604)	(5.9185)
ln(n+g+δ)	-0.0167	-0.0497
	(-0.6197)	(-2.5041)
ln(hm*)	-0.0646	-0.0641
	(-5.2645)	(-6.1479)
ln(hm*)-ln(hf*)	0.0917	0.0758
	(4.9774)	(4.1478)
lnx*	0.0215	0.0335
	(0.9714)	(1.8511)
SEE	0.0242	0.0208
N, T-N-1	132, 104	228, 184
c^2	*1.1323*	*0.1706*
Restricted model		
lnPIB in	-0.0580	-0.0499
	(-4.3797)	(-4.9546)
lns_k - ln(n+g+δ)	0.0448	0.0418
	(5.9741)	(6.5798)
ln(hm*)	-0.0629	-0.0646
	(-5.3932)	(-6.4420)
ln(hm*)-ln(hf*)	0.0934	0.0754
	(5.1526)	(4.0155)
lnx*	0.0195	0.0348
	(0.9004)	(1.9945)
SEE	0.0242	0.0208
N, T-N-1	132, 105	228, 185
Elasticities		
ALPHA	0.4358	0.4558
BETAF	-0.9086	-0.8222
BETAM	0.2967	0.1178
PSI	0.1897	0.3795
LÂMEDA	0.0685	0.0574

Results for the convergence equation with gender gap(2 (OLSD)

	(1)	(2)
Unrestricted model		
lnPIB in	-0.153	-0.1222
	(-8.2758)	(-8.6171)
lns_k	0.071	0.0645
	(6.5442)	(6.6117)
ln(n+g+δ)	0.0142	-0.0394
	(0.4635)	(-1.7909)
ln(hm*)	-0.0664	-0.0611
	(-3.2345)	(-3.5069)
ln(hm*)-ln(hf*)	0.0717	0.0658
	(2.7757)	(2.8320)
lnx*	0.0976	0.1189
	(2.5784)	(4.3078)
SEE	0.0276	0.0244
N, T-N-1	110, 104	190, 184
c^2	*6.5318*	*1.0629*
Restricted model		
lnPIB in	-0.1416	-0.1182
	(-7.6889)	(-8.6652)
lns_k - ln(n+g+δ)	0.0626	0.0604
	(6.1068)	(6.8257)
ln(hm*)	-0.0551	-0.0597
	(-2.7511)	(-3.4379)
ln(hm*)-ln(hf*)	0.0659	0.0663
	(2.5581)	(2.8422)
lnx*	0.0888	0.1136
	(2.4267)	(4.2196)
SEE	0.0283	0.0244
N, T-N-1	110, 105	190, 185
Elasticities		
ALPHA	0.3066	0.3382
BETAF	-0.3227	-0.3712
BETAM	0.0529	0.037
PSI	0.4349	0.6361
LÂMEDA	0.2462	0.1788

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