# THREE ESSAYS ON GENDER WAGE DISCRIMINATION, FEMALE LABOR FORCE PARTICIPATION AND THE RETURNS OF PRIVATE AND PUBLIC EDUCATION IN URBAN PERU, 1985-2000

By

Rosario A. Basay

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Approved:

Professor Malcolm Getz

Professor Kathryn Anderson

Professor Stella Flores

Professor Marshall Eakin

To my loving parents, Juan and Margarita

To Alejandro and Alejandra, with gratitude and love

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# INTRODUCTION

Income inequality in Latin America is high and comparable to inequality in some of the poorest countries in the world. Income differences result from differential returns to productivity-enhancing human capital investments such as education and labor market experience; but they also result from inequality in access to markets or unequal participation in the power structure within countries. In the latter case, widening inequality often reflects a breakdown of social cohesion and detracts from economic productivity in the long run. Identifying and explaining the sources of inequality is necessary to improve social justice, help reduce poverty, and promote growth.

There is a close relationship between inequality in the labor income of workers and household income inequality. Fundamental factors that contribute to labor income differences include unequal access to market work, inequality in the distribution of quality education, and differentiated compensation for equal work. My research focuses on specific research questions within these general analytical areas: the incidence of gender wage discrimination in the labor market in urban Peru during 1985 and 2000, the identification of the most important factors that influence female labor force participation, and the analysis of the returns to private versus public education during those years.

Peru makes an exemplary case study of regional labor market and education policy changes. It experienced the three aforementioned trends and underwent a labor reform during the early 1990s, described as ‘one of the deepest labor market reforms in Latin America’ (IADB, 2001). At the same time, the notion that public education was

low in quality led to legislation in the mid-1990s facilitating private sector participation in the provision of educational services at all levels.

In the second chapter of my dissertation our goal is to explore the incidence of wage discrimination by gender, and to evaluate the impact that the labor reforms launched in the 1990s had on the gender wage gap in Peru. Utilizing the Oaxaca's decomposition analysis developed originally by Oaxaca (1973) and Blinder (1973) and extended later by Oaxaca and Ransom (1994), I decompose the wage gap into a part attributed to changes in levels of education and other human capital and regional differences and a part due to changes in the returns to these characteristics. This kind of decomposition has been useful in understanding the upper bound of gender discrimination, and has been a standard practice in empirical research. Our results indicate that the incidence of gender wage discrimination decreased since 1985 and after the reforms, but its magnitude is significant and highlights wage discrimination as a key policy issue to address in Peru.

The third chapter identifies the main determinants of female labor force participation since the 1980s and examines how the reforms changed the incentives for women to participate in market work. Using a probabilistic model of participation, I focus on the influence of family structure, location, ethnicity, and human capital investments. The results of the probit models by gender indicate that in Peru family structure and education levels are of greatest importance for labor force participation of women, with being head of household one the most crucial ones.

The fourth chapter tests the validity of a very commonly accepted notion in Latin American countries that the quality of education provided by the private sector is much

higher than the quality provided by the public sector based on the labor market returns that those educational paths render. The results of our linear wage equations report that the return to formal education is around 10% for the survey years, while the premium on earnings are increased as we move up the level of education: primary, secondary common, secondary technical, and college level. Also, our results in chapter 3 show that and that attending public schools represents a decrease in earnings compared to attending private schools, with differentiated impact per level of education.

The three essays contained in my dissertation use micro-level data from the Living Standard Measurement Study (LSMS) surveys of 1985, 1994, and 2000[1]. The former two surveys were conducted by the World Bank and the Instituto *Cuanto S.A.*, a Peruvian research group, while the survey of 2000 was designed and conducted entirely by *Cuanto S.A* and its questionnaire is very similar to that used in prior survey years. In all cases the surveys provide data for households from a nationally-representative sample, and include a household questionnaire that collects socio-economic information about families[2] and their individual members as well as a community questionnaire implemented only in rural areas. Geographic coverage of the LSMS surveys varies by year: the first survey (1985) covers the entire country while the 1991 covered 70 percent of the country's population. We have chosen the years (1985, 1994 and 2000) where the coverage is national. The samples are stratified into regions and can be grouped into rural

[1] The surveys in Peru are referred as 'Encuestas Nacionales de Hogares Sobre Medicion de Vida' or ENNIVs.

[2] For the purposes of the surveys, a household is defined as a person or collection of persons, whether related or not, that habitually live in the same dwelling**,** occupying it in part or in whole, and that habitually have eaten and slept in the household for at least 3 of the 12 months prior to the interview date. It is important in Peru to distinguish between 'dwelling' and 'household'. A dwelling is a house, apartment or independent living space in which one or more households may live. The sample frame excludes population groups that live in a communal dwelling such as army barracks, hotels, hospitals, asylums, monasteries, prisons, etc.

and urban areas being urban areas defined as those cities and towns with 2,000 or more inhabitants according to Census information.

It is my hope that the conclusions of the analyses contained in my dissertation provide a better understanding of the causes of disparities by gender and educational inequality within Peru that I believe to be an important component in any policy agenda aimed at reducing inequality in the Latin American region. Barriers to entry and economic performance by gender, ethnicity, or wealth are inconsistent with a vibrant and productive society.

# CHAPTER II

## GENDER WAGE DIFFERENCES IN LIMA, PERU 1985-2000

### Introduction

The analysis and understanding of gender wage differences in the labor market are crucial in any policy agenda that attempts to improve women's economic and social status in Peru. While being partly an issue of equality or fairness, gender differences in the labor market are also concerned with misallocation of resources as far as workers are not hired, promoted, or rewarded on the basis of their qualifications (Blau, Ferber and Winkler, 2005).

It has been suggested that the likelihood of being poor among female-headed households in Latin America is higher than among male-headed ones (Lampietti and Stalker, 2000); thus the ability to earn a living is one of the most important resources for women to fight poverty. Understanding the incidence of gender wage inequality is then a way to highlight the importance of the efforts to eliminate poverty and to promote a more efficient labor market. Several indicators illustrate the importance of the topic for the case of Peru:

- Female labor force participation has increased in general and by educational level: urban female workers with secondary education increased their labor force participation from 44.7% in 1991 to 51.2 % in 1997; also urban female workers with university degrees increased their participation from 58.9% in 1991 to 62.5% in 1997 (World Bank Gender Database for Latin America and the Caribbean).

This information suggests that wage income is of increasing importance for women.

- Female–headed households have increased in importance in the last decades.
- Education achievement of women has increased, but wages for educated women have not; also employment has not improved as much for educated women. While the percentage of working females with a college or high school degree increased from 68% in 1986 to 81% in 2000, for males these percentages were 78% and 84% (Ñopo, 2003). In terms of unemployment, female workers experienced usually higher unemployment rates since the 1990s. In 2004, while the average unemployment rate in Peru was 10.1%; the unemployment rate for females was 12.1% while for male workers it was 9.2% (ILO, 2006). Also, the fact that unemployment is more severe among the more educated workers reveals that there is an excess supply of qualifications that cannot find a use in the Peruvian labor market.
- There exists a gender wage gap in Peru. The gap in hourly wages has been estimated to vary around an average value of 0.45, that is, on average, males earned 45% more per hour than females in Lima during the period 1986-2000 (Ñopo, 2003). According to a survey made by a well-known Peruvian Institute (CUANTO, 2006), 88.9% of the population sampled believed that there was gender discrimination in the labor market in Lima, while 10.2% thought it did not exist.

The fact that on average, males earn more than females in yearly, monthly and per hour terms has been empirically tested to understand if those earnings differences are mostly due to gender differences in the observable characteristics of workers, or due to differences in their market rewards. The growing empirical literature has added sophistication to the tests, and has allowed the revision of traditional 'decompositions' of the gender wage gaps, and their results for the case of both developed and developing countries.

In this paper, my goal is to explore the impact that the labor reforms launched in the 1990s in Peru had on the gender wage gap in Lima. Utilizing Oaxaca's decomposition analysis developed originally by Oaxaca (1973) and Blinder (1973) and extended later by Oaxaca and Ransom (1994), I decompose the wage gap into a part attributed to changes in levels of education and other human capital and regional differences and a part due to changes in the returns to these characteristics. A change in returns indicate whether the market in more recent post-reform years rewards women and men more equally for their human capital investments than the market in the 1980s. Parts 1 and 2 in section I introduce the labor reforms of 1991 and 1995, and present a summary of the labor market in Peru, with emphasis on gender outcomes. Section II presents a discussion of the wage decomposition methodologies traditionally used in the literature to explore wage inequality by gender and some studies made for Peru. Section III presents our methodology, and our last sections IV and V show our empirical results and final conclusions.

## I. The Labor Market in Peru 1985-2000

After the return to democracy in 1980, the Peruvian economy performed reasonably well during the first two years of the presidency of Fernando Belaúnde (1980-1985), with growth rates of 4.7 and 4.5 percent in per capita GDP in 1980 and 1981 respectively. By 1982, however, due to international adverse circumstances, among them international recession and the Mexican debt crisis, growth contracted. Matters got worse in 1983, as the economic decline was led by the El Niño weather phenomenon that caused serious floods and drought on the northern coast and in the southern highlands, respectively (Paxson and Schady, 2004).

Alan García was elected president of Peru in 1985 and despite his early announcement of a 'heterodox' stabilization program, which relied on reduced foreign debt payments, price freeze, economic reactivation via wage increase, job creation programs and increased investment in education and health[3], in 1988 the country went into a deep recession and hyperinflation. Per capita GDP fell by approximately 28% during 1982-1985 (the last three years of his presidency), and the inflation rate reached astonishing levels of 667%, 3,399%, and 7,482% in 1988, 1989, and 1990. Real wages collapsed: in 1990 wage income in Lima was 15 percent of its 1987 level (Paxson and Schady, 2004).

The government of Alberto Fujimori which took office in 1990 opted for more orthodox economic remedies. Peru experienced one of the fastest trade liberalization processes and profound labor reforms in the region; the reforms were accompanied by a downsizing of the public sector, the start of a privatizing process, the abolition of all

[3] For a detailed analysis of the components and outcomes of the stabilization program implemented in 1985, see Iguíñiz, Basay and Rubio, 1993.

state-owned monopolies, and a tax reform. In addition, restrictions to capital accounts transactions were eliminated while the financial sector was deregulated (Saavedra and Torero, 2000).

## 1. The Labor Market Reforms in 1991 and 1995

Before the 1990s, the Peruvian labor market was found to be one of the most regulated markets not only in Latin America, but in the world, reporting higher average job security[4] than in OECD countries (Heckman and Pagés, 2000). Before the reforms, the Peruvian Constitution guaranteed job stability to workers that successfully completed the first three months in their jobs. The law also established that, as a compensation for being fired a worker was entitled to three salaries per year worked, apart from the legal costs incurred to prove that the firing was fair. An international comparison (Marquéz and Pagés, 1988) showed that Peru was among the countries where the costs of firing (or protection to workers) were the highest in Latin America and the Caribbean (Peru ranked in 6$^{th}$ place after Venezuela, Nicaragua, Bolivia, Colombia, and Honduras).

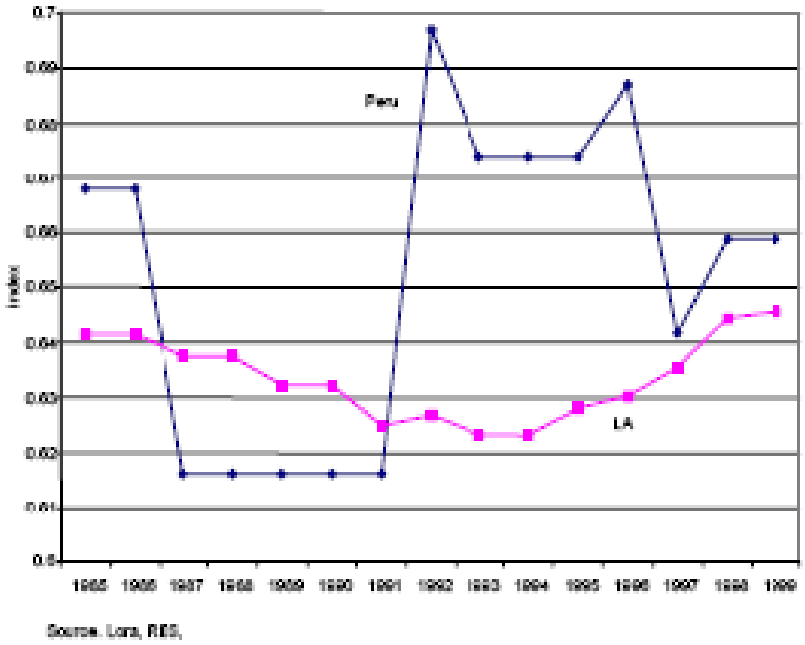
In 1991, the government introduced several changes aimed at reducing the extreme rigidity imposed by labor laws. In fact, the labor reform of 1991 has been described as 'one of the deepest labor market reforms in Latin America' (IDB, 2002), as represented by the index of labor market reforms developed by the Inter-American

[4] In their paper, job security legislation includes all those provisions that increase the cost of dismissing a worker. In Latin American countries, labor codes based on the civil law system regulate the permissible types, durations and the conditions of termination of labor contracts. Before labor reforms in the 1990s, labor codes in Latin America favored full-time indefinite employment over part-time, fixed-term or temporary contracts; while indefinite contracts carried severance pay obligations, temporary contracts could be terminated at no cost provided that the duration of the contract had expired.

Development Bank (Figure 1). This index considered labor legislation flexibility under four aspects: i) ease of hiring, ii) ease of layoff, measured according to the expected cost of layoff, iii) flexibility of work day, measured according to extra cost for extra work days and hours, and iv) social security contributions as a proportion of salaries (Lora, 2001).

After the reforms of 1991 and 1997, Peru was considered the country with the most flexible labor market in Latin America (Saavedra, 2000).

**Figure 1. Labor Market Reform**




Source: Lora, BID.

One important component of the labor reform in 1991 was the reduced red tape in the use of different types of temporary and fixed-term contracts and the abolition of job security for new hires in 1991 (Saavedra and Diaz, 1998). Until then, dismissals had to be approved by the government; if they were claimed as 'unjustified', the separated workers could choose between getting severance pay or being reinstated in

their jobs. The labor reform of 1991 removed the need for such governmental approval (MacIsaac and Rama, 2001) and also allowed the creation of job cooperatives and service enterprises, fostering the use of subcontracting mechanisms. Absolute employment stability was later abolished with the 1993 Constitution, in which job protection was limited to dismissals 'without just cause'. This allowed for the sanction of a law in 1995 that abolished job stability for all workers (Saavedra and Díaz, 1998).

Another important component of the labor reform in Peru involved the reform in retirement plans. In addition to severance pay, dismissed workers before 1991 were entitled to an end-of-service gratuity, known as Compensación por Tiempo de Servicio (CTS). This entitlement, created in 1963, involved gratuity amounts to half a month salary per year of service and was payable to all workers at the termination of their contracts, regardless of whether they were dismissed or they just quit or retired[5]. Since 1991, the gratuity had to be deposited twice a year in a Bank account under the worker's name; however there were more restrictions on the type of contract that allowed the receipt of those benefits (MacIsaac and Rama, 2001).

Unions were also greatly impacted by changes in labor laws. Prior to the reform of collective bargaining in 1992 -that followed the first waves of reforms in 1991- the collective bargaining process in Peru was very rigid and trial-like, designed for resolution by administrative decision. The system was reformed, increasing direct negotiation and conflict resolution by relaxing the collective negotiation process, introducing voluntary

[5] Prior to January 1991, the employer paid a maximum bonus of 10 minimum wages if the employee's wage was higher than that amount; employers were allowed to keep tenure bonus money until an employee left the firm (his only obligation being to register it in the firm's balance sheet as a liability). The system failed due to employer's lack of compliance in actually keeping tenure bonuses for workers (Saavedra and Torero, 2000).

arbitration as an alternative to state administrative decision, and eliminating state approval of agreements (O'Connell, 1999). The 1992 reform also increased collective autonomy through the protection of unions' right to register. The 1992 reform also increased union pluralism by allowing more than one union to exist in one firm. Another change of great importance referred to strikes activity, since the reform dictated that while on strike workers were not to receive pay until normal activities were resumed.

Another important element of the reform noted by Saavedra and Diaz (1998) was an initial series of attempts to reduce the public payroll through the offer of financial incentives since 1991; these incentives involved one-time cash settlements and enhancement in the employee's pension benefits.

It is worth mentioning that the labor reforms in Peru have been also associated with an important change in the labor market as well: according to Chacaltana (1999), the reform eliminated the strong legal distinction between blue-collar and white-collar workers, so that both were considered workers with the same severance payments and other benefits. Before the reforms the distinction was strong, with blue-collar workers receiving slightly more benefits than white-collar workers (making them more expensive for the employer), and having different payrolls with different payment frequencies since blue-collars were paid on a weekly basis, while white-collars were paid on a monthly. basis.

## 2. Labor Market Outcomes after the Reforms

### a) Growth and Labor Participation

Starting in 1992, coinciding with the recovery of the economy, female labor force participation increased more than male; the increase was especially important for young females age 14-18 and for women of more than 46 years (Pagés, 1999). An explanation for such evolution relates to the evolution of the GDP growth in Peru. During 1986 and 1992, there was a very low growth of employment so when the economy recovered and real wages increased, workers who had abandoned their jobs or were unemployed rejoined or joined the market, increasing participation. That was the case of young female workers and could explain the increase in the participation of female workers during the 1990s. The increase in the labor supply during economic recovery in Peru could reflect that the substitution effect is more powerful than the income effect, so when income increases there is more labor supplied in the market.

Labor reforms in the 1990s, especially the ones related to the reduction of firing costs and the increased use of temporary contracts could also help explain the increase in female employment as male workers show on average more years of work experience than female workers, the layoffs could have concentrated in the group of older male workers. In fact, Saavedra and Torero (2000) report that there is a clear downward trend in the mean tenure years after the reforms: in 1992-1993, right after the first changes in labor legislation, there was a sharp reduction in mean tenure (more pronounced among formal workers). In that regard, young workers or/and female workers with traditionally lower tenure would have benefited from the reforms.

When evaluating the effects of changes in non-wage benefits on employment, it is important to note however, that legally mandated benefits are unequally distributed: younger, poorer, less skilled, and female workers have a lower likelihood of being covered by legally mandated benefits than their more educated, prime-age, richer and male counterparts regardless of the size of the firm they are employed at (Marquéz and Pagés, 1988). Currently, worker's protection in Latin American labor markets is low in general. Comparing 2003 with 1990, the proportion of wage and salaried workers with social protection coverage declined in the region. In 2003, the percentage of wage and salaried workers in the formal employment sector with social security coverage (79.3%) was nearly triple that for workers in the informal employment sector (26.2%). The difference between these two sectors was especially high in four countries: nearly nine times as high in Nicaragua, seven times as much in Bolivia and Mexico, and close to five times as much in Peru (ILO, 2006).

**b) Temporal versus Permanent Employment**

In Peru, despite the reduction in firing costs for new workers under permanent contract in 1991, firms still preferred the use of temporary contracts for new hires. The share of workers under these contracts increased from 11% in 1991 to 22% in 1992 and most of the formal private employment growth observed during the nineties was explained by temporary contracts. Even after 1995, the year in which job security was completely eliminated, temporary contracts continued growing, covering 24% of private formal wage employment in 1997 (see Table 1).

**c) Segmentation in the Labor Market**

The reforms were followed by an economic expansion that began in 1992 and increased employment, both formal and informal. It is important to note, however, that despite the important proportion of women in informal economic activities in Peru, it has been noted that since 2000 women's informal employment increased mostly in micro-enterprises, which within the informal sector provided employment most closely resembling that of the formal sector (ILO, 2006). In comparison, in other countries in Latin America, women increased their share of informal sector employment as self-employed workers or domestic servants, the relatively more precarious categories of the informal employment sector.

**d) Unionization**

The reduction in union bargaining power and the increase in the requirements imposed by the 1992 Law in order to form a union reduced the availability of jobs in unionized firms for most types of workers. Also, the number of strikes fell from 613 in 1990 to only 36 in 1999, suggesting that the ability of unions to make use of effective political pressure diminished sharply during the 1990s (Saavedra and Díaz, 1998) .

How did declining union power affect wage inequality? Based on a study done for Mexico (Fairris, 2003), it has been suggested that if the dispersion of wages in the formal sector of the economy is much lower among union workers than among nonunion workers, then the dispersion-reducing effect of unions may be significant. Empirical results performed by Saavedra and Díaz (1998) found, however, that in the case of Peru unionized workers do not have a less dispersed earnings distribution, but that there exists

evidence of a union premium. The authors claim that given that the unionized workers employment shifted towards the richest deciles[6], a reduction in the number of workers that enjoy this premium, and in some cases the reduction of the premium itself, generated a reduction in wage inequality. The effect on gender wage inequality of such change in unionization has not been explored yet.

## II. Literature Review

A method to decompose wage gaps in terms of explained and unexplained characteristics was first suggested by Oaxaca (1973) and Blinder (1973) more than 30 years ago requiring the estimation of wage regressions that specify the relationship between wages and productivity-related characteristics for female and male workers. This kind of decomposition has been useful to understand gender discrimination and have been a standard practice in empirical research. Empirical studies based on this approach provided evidence consistent with both human capital differences and labor market discrimination in explaining the gender pay gap (Blau and Kahn, 1994). The wage gap measured this way however, has been for informing only about the average unexplained differences in pay, but not about the distribution of such unexplained differences.

Juhn, Murphy and Pierce (1993) extended the decomposition to consider not only observable characteristics, observable rewards, but unobserved heterogeneity. The basic assumption in the methodology developed by Juhn. Murphy and Pierce and Blau and Kahn (1994) is that one can identify male "comparables" for the women in the labor

[6] Note that contrary to what happens in developed countries, in Peru unionization is not concentrated among blue-collar workers, but is slightly more frequent among white-collar and post-secondary educated workers (Saavedra and Díaz, 1998).

market in terms of both measured and unmeasured characteristics and that the same factors will determine the relative rewards of women and of these comparable males. Thus, since women continue to have less experience than men and to be located in lower-paying sectors of the labor market, they will be increasingly penalized as the prices of measured skills have increased. In addition, labor-market discrimination or actual female deficits in unmeasured skills result in employers treating women as if they have lower unmeasured skills as well as lower measured skills. Thus, as the prices of unmeasured skills have increased, further downward pressure is put on female relative wages.

The method decomposes the difference in the gender pay gap into a portion due to gender-specific factors and a portion due to changes in the overall level of wage inequality. Suppose we have a male wage equation for worker i and year t:

(1) $Y_{it} = X_{it} B_t + \sigma_t \theta_{it}$ ; where $Y_{it}$ is the log of wage for individual i in year t; $X_{it}$ is a vector of explanatory variables, Bt is a vector of coefficients; $\theta_{it}$ is a standardized residual (i.e. with mean 0 and variance 1 for each year); and $\sigma_t$ is the residual standard deviation of male wages for that year (i.e. its level of male residual wage inequality). Then the male-female lof wage gap for year t is:

(2) $D_t = Y_{mt} - Y_{ft} = \Delta X_t B_t + \sigma_t \Delta\theta_t$ ; where the m and f subscripts refer to male and female averages, respectively; and a $\Delta$ prefix means the average male-female difference for the variable immediately following. Equation (2) states that the pay gap can be decomposed into gender differences in measured qualifications ($\Delta X_t$) and gender differences in the standardized residual ($\Delta\theta_t$) from the male equation multiplied by the money value per unit difference in the standardized residual ($\sigma_t$).

The difference in the gender pay gap between two years (0 and 1) can then be decomposed using (A):

$$D_1 - D_0 = (\Delta X_1 - \Delta X_0)B_1 + \Delta X_0(B_1 - B_0) + (\Delta\theta_1 - \Delta\theta_0)\sigma_1 + \Delta\theta_0(\sigma_1 - \sigma_0).$$

The first term : the "observed-X's effect" reflects the contribution of changing male-female differences in observed labor-market qualifications (X) to trends in the gender gap. The second term, the "observed-prices effect", reflects the impact of changing prices of observed labor-market qualifications for males. For example a rising male return to experience would weight the female experience deficit more heavily and hence raise the pay gap, ceteris paribus.

The third term, the "gap effect", measures the effect of changing differences in the relative wage positions of men and women after controlling for measured characteristics (i.e. whether women rank higher or lower within the male residual wage distribution). That is, it gives the contribution to the change in the gender gap between the two years that would result if the level of residual male wage inequality had remained the same and only the percentile rankings of the female wage residuals had changed. Finally the last term , the "unobserved-prices effect", reflects the impact of differences in residual inequality between the two years. It measures the contribution to the change in the gender gap that would result if the percentile rankings of the female wage residuals had remained the same and only the extent of male residual wage inequality had changed. All else being equal, the larger the penalty for being below average in the residual wage distribution, the larger the pay gap would be.

Still in the spirit of the Oaxaca's decomposition analysis, the semi-parametric approach used by DiNardo et.al. (1996) to study wage inequality focuses on the entire density of wages, instead of working with the means alone. Then, instead of asking for

example, as in Oaxaca's analysis, "how much would a worker, with the mean characteristics of the 1979 workforce have been paid in 1988?", they construct a counterfactual density of wages that would have prevailed in 1988 if the characteristics of workers had remained as in 1979. The question is then rephrased as, "what would the density of wages have been in 1988 if worker's attributes, such as their union status, had remained at their 1979 level?"

The authors present a semi-parametric procedure to analyze the effects of institutional and labor market factors on changes in the U.S. distribution of wages during 1979-88. By applying kernel density estimation methods (to construct counterfactual densities) to weighted samples, the procedure used by the authors contribute to the existing literature on wage inequality by identifying exactly where in the distribution of wages do institutional factors[7] exert the greatest impact. As in Oaxaca's analysis, DiNardos' decomposition ignores general equilibrium effects and depends on the ordering of the explanatory factors. In that sense, the counterfactual density is really "the density that would have prevailed if individual attributes had remained at their 1979 level and workers had been paid according to the wage schedule observed in 1988", since this procedure ignores the impact of changes in the distribution of individual attributes on the structure of wages in general equilibrium (p.1011, DiNardo, et.al. 1996).

The critical point in the estimation of counterfactual densities is to recognize that they can be rewritten in terms of actual densities with the help of "reweighting functions". Once an estimate of the reweighting function is obtained, it can be used to

[7] Five factors are considered: i)changes in real minimum wages, ii) changes in unionization, iii) changes in the distribution of worker's attributes other than unionization, including industry affiliation, iv) changes in the supply and demand of various categories of workers, and v) residual or "unexplained" changes.

estimate the counterfactual density by weighted kernel methods. Finally, the difference between the actual 1988 density and this hypothetical density represents the effect of changes in the distribution of workers' attributes.

In a study made for Lima, Peru, Ñopo (2003) challenged the linear specifications involved in the estimation of earnings equations behind the traditional Oaxaca's decomposition analysis of the gender gap in earnings. His study used a non-parametric technique –matching- to decompose gaps in terms of explained and unexplained components, paying special attention to the problem of gender differences in the supports. He considered the gender variable as a treatment and used matching to select sub-samples of males and females such that there are no differences in observable characteristics between the matched groups; after doing the matching and splitting the sample, the author decomposed the wage gap accounting for differences in the distribution of individual characteristics. Ñopo found that for the period 1986-2000 and for a sample of workers fourteen years and older in the metropolitan Lima area, there were no substantial differences that matter for the wage gap decomposition, that is, the linearity assumption did not make a great difference for the wage gap decomposition.

However, some of his results shed light on important features of the existing wage gap in urban Peru. One of the most interesting results comes from the fact that the average gender wage gap is mainly driven by gender differences in pay at the top percentiles of the wages distribution[8]; wages at the highest quintile of the distributions of wages for females and males explain more than one half of the average wage gap in Peru for the period of analysis. He also found evidence that, although the gender differences

[8] Emphasis in italic letters is ours.

in pay in the bottom percentiles of the distribution do not contribute considerably to the aggregate measure of gender differences in pay for 1986-2000, they are small in absolute terms but not in relative terms. The poorest male earns almost twice as much as the poorest female.

This matching analysis shares however, a common problem with some of other non-parametric techniques used to analyze the wage gap: the problem of dimensionality. The inclusion of many explanatory variables- the use of many matching characteristics- may reduce the chances of obtaining an adequate number of matched observations, limiting the possibility of exploring the distribution of unexplained differences in pay.

In another study for the case of Peru that could be representative of yet another set of studies that use experimental approaches to detect discrimination (such as Neumark, 1996, Bertrand and Mullainathan, 2004), Moreno, Ñopo, Saavedra and Torero (2004) analyzed the hiring processes for some specific occupations, using information of real job applicants from the job intermediation service of the Peruvian Ministry of Labor and Employment. To overcome the problems related to traditional audit studies, the authors designed a pseudo-audit study in which, instead of hiring auditors, they select them from a pool of applicants to a job intermediation service in Lima. They only hired a pool of monitors to observe the job postings, as well as the applicants and the interviewers at each firm. The occupations selected were those with high levels of intermediation through PROEMPLEO: accounting and administrative assistant, secretaries and salespersons. They interviewed 565 applicants representing 760 different applications to the 113 job postings offered by 91 firms.

The data tells that out of 760 applicants (individuals who were sent to job interviews), 127 were hired what translated into a success rate of 16.71%. Controlling for human capital and demographic characteristics, the authors analyzed the relationship between 'aimed wages' and the wages of applicants; using a simple linear model, they tried to explain the logarithm of the aimed wages of the individuals from a set of individual characteristics, including gender, race, and their wages in their last occupations. They found that the statistical relationship between the last wage and aimed wage is positive, and that all the proposed controls have statistically significant impacts in determining wages. The role of family pressure, parent education and marital status were also found positive and their estimation showed that females adjusted their aims by 7% to 8% below the average aimed wages of males. However, there is no evidence of racial differences in aimed wages.

## III. Methodology for Measuring the Incidence of Wage Discrimination: Decomposition Analysis

As noted in the previous chapter, the use of earnings functions in the study of discrimination usually involves the problem of sample selection bias. By a technique developed by Heckman (1979 and 1986), the problem of selectivity is addressed by including a term 'Lambda', also called the 'inverse Mill's ratio', in the wage equations, that enables us to utilize ordinary regression methods to estimate the wage equations. This term is directly found from our probit model of participation in the labor market for the group of workers that we think suffers from selectivity bias, in this way:

$LnW_{it} = X_{it}\beta_t + e_{it}$ (a wage-offer function) , i= male, female

where W is the weekly wage; X is a vector of observed human capital or productivity related variables; β is a vector of parameters representing the impact of these attributes on pay, and e is a stochastic error. Because we can not observe this function directly, we based our estimation on a sample of working individuals, then the expected observed wage is given by:

$E(\ln W_i \mid X_i \text{ in sample}) = X_i\beta + E(e_i \mid \text{in sample})$

When $E(e_i)=0$, the regression function for the observed sample is the same as the population regression function. Least squares estimators of β are going to be unbiased and the only cost of having an incomplete sample is a loss in efficiency. But in a case with non-random selection, the expected value of the error term does not equal zero and participation in the labor market depends on measures of the wage offer and the reservation value. Data are only available on $W_i$ if the reservation wage is greater than zero ($Y_i > 0$), while if $Y_i < 0$, there are no observations on $W_i$. So a function of participation is needed:

$Y_i = Z_i d + h_i$ ; where Z is a vector of variables affecting the labor market participation decision and h is a stochastic disturbance term that follows a normal distribution. Then:

$E(\ln W_i \mid X_i, Y_i > 0) = X_{i\beta} + E(e_i \mid Y_i > 0)$,
$E(\ln W_i \mid X_i, Y_i > 0) = X_{i\beta} + E(e_i \mid h_i > -Z_i d)$ and
$E(e_i \mid h_i > -Z_i d) = \sigma_{eh}/\sigma_{hh}\, E(h_i \mid h_i > -Z_i d)$,
$= \sigma_{eh}/\sigma_{hh}\sigma_h \, [\, f(Z_i\, d/\sigma_h) / \Phi(Z_i\, d/\sigma_h)\, ]$
where: $\lambda_i = f(Z_i\, d/\sigma_h) / \Phi\,(Z_i\, d/\sigma_h)$ = inverse Mill's ratio, where f(.) refers to the pdf, and Φ refers to the cdf.

This term Lambda (λ), predicted from this probit is included as an additional explanatory variable into the wage equation and the labor force participation rule is incorporated into the wage estimation. Measures of $\beta_i$ will be free of selectivity bias and it is guaranteed

that all population observations have an equal chance of being sampled. Lambda ($\lambda$) is an inverse monotonic function of the probability of participation , and its coefficient in the wage equation is the covariance between the errors in the probit and the wage equation. We estimate separate earnings regressions for men and women, respectively, as follows:

- $LnW_m = a_0 + a_1\ LNHOUR_m + a_2\ EXP_m + a_3\ EXP2_m + a_4\ MIGRANT_m + a_5\ PRIMARY_m + a_6 SECTECH_m + a_7 TECH + a_8 COLLEGE_m + a_9 \lambda_m + e$ ;
- $LnW_f = c_0 + c_1\ LNHOUR_f + c_2\ EXP_f + c_3\ EXP2_f + c_4\ MIGRANT_f + c_5\ PRIMARY_f + c_6 TECH_f + c_7 UNIVERSITY_f + c_8 \lambda_f + u$ ;

where W is the weekly primary wage; LNHOUR refers to the log of hours worked during the week; EXP refers to the number of years of experience in the labor market, measured by the age of the individual[9]; EXP2 refers to squared EXP; MIGRANT is a dummy variable taking the value of 1 if the person is migrant an 0 if not; PRIMARY is a binary variable that takes the value of 1 if the person has primary education, 0 otherwise; TECH takes the value of 1 if the person has tertiary but not university education, 0 otherwise; UNIVERSITY takes the value of 1 if the person has university education, 0 otherwise[10] and $\lambda$ refers to the factor of correction for selectivity bias.

The expected sign for the coefficients are as follows:

LNHOURS: (+). It is expected that the longer an individual works, the greater is her/his work effort and the higher her/his level of earnings.

[9] We should be aware that this proxy for labor experience might overstate the actual years of work experience since many female workers leave the labor force for some period due to household and chidbearing activities. Usually, studies on discrimination uses as proxy of actual experience the potential experience (age minus number of years of schooling minus six), but we could not use this proxy due to data inconsistencies in our survey.

[10] As in the case of the probit model, the control group for education variables is the secondary level of education.

EXP: (+) and EXP2: (-). The model of human capital states that the experience-earnings profile is concave, rising rapidly at first and flattening out, and ultimately falling. An additional year of labor experience will at first increase earnings (as new skills are acquired) but when the workers grow older, the pace of training slows and so does the rate at which productivity and earnings increases. This depreciation contributes to the downturn in average earnings near to retirement age.

MIGRANT: (-). It is expected that a person born in a rural area working in the city, will earn less than a person born in an urban area and working in a city.

PRIMARY, TECH and UNIVERSITY: (+). Based on the human capital theory, it is expected that education is positively related to earnings. The higher the investment in education the higher the level of earnings[11].

The coefficient for Lambda ($\lambda$) in the earnings equation is not a priori expected, but if found positive and significant, we will suspect that there was a problem of selectivity bias and that the unobserved factors which induce women/men to work are also directly related to female/male pay, respectively. Is found negative but significant, we will say that there was also a problem of selectivity bias and that the unobserved characteristics that earn a premium in the labor market also make a person less likely to participate in the labor market. If the value of the coefficient were found insignificant that would mean that there was not a problem of selectivity bias or self-selection in our samples.

[11] According to Andrade (1998), if women are part of the 'secondary sector' in a segmented labor market -low wages, bad working conditions, and little opportunity for advancement- education may not explain changes in labor productivity, and the coefficients for education variables may not be statistically significant.

**Oaxaca's Decomposition Analysis**

As developed by Oaxaca (1973) and Oaxaca and Ransom (1994), the difference in our earnings equations for men and women is:

$Ln(W_m) - Ln(W_f) = (C_m - C_f) + [(X_m)B_m - (X_f)B_f]$, where the first bracket refers to the respective constant terms in the male and female wage regressions functions, $X_m$ and $X_f$ are the average values of the male and female characteristics in the sample and $B_m$ and $B_f$ are the rewards to the characteristics estimated (coefficients in wage regressions). Rearranging the terms, following Oaxaca's procedure, we decompose the observed wage differential in:

- $Ln(W_m) - Ln(W_f) = [(C_m - C_f) + (X_f)(B_m - B_f)] + [(X_m - X_f)B_m]$ (evaluated at female means)
  (A) (B)

or: $= [(C_m - C_f) + (X_m)(B_m - B_f)] + [(X_m - X_f)B_f]$ (evaluated at male means);
(A) (B)

Where, the term A refers to the part of the pay gap attributed to differences in rewards or wage structure between men and women (wage discrimination or the 'unjustified' part of the pay gap) and B to the part of the difference attributed to the differences in the quantities of the characteristics held by men and women (or the 'justified' part for the pay gap), evaluated at female and male means, respectively. One should not assume that these two ways of decomposing the difference in wages may produce the same results. The former decomposition evaluates the potentially discriminatory components and the justified components of the pay gap if women were paid as men. The latter assumes that men are paid like women. However, both decompositions have produced very similar results in applied research (Psacharopoulos and Tzannatos, 1992), including the present study.

By replacing the estimates of the earnings functions in our decomposition equation, we can identify the percentage of the pay gap between men and women due to wage discrimination in the labor market.

## IV. Data Characteristics

This study uses micro-level data from the Living Standard Measurement Study (LSMS) surveys of 1985, 1994, and 2000 for Peru[12]. The former two surveys were conducted by the World Bank and the Instituto *Cuanto S.A.*, a Peruvian research group, while the survey of 2000 was designed and conducted entirely by *Cuanto S.A* and its questionnaire is very similar to that used in prior survey years. In all cases the surveys provide data for households from a nationally-representative sample, and include a household questionnaire that collects socio-economic information about families and their individual members as well as a community questionnaire implemented only in rural areas. Geographic coverage of the LSMS surveys varies by year: the first survey (1985) covers the entire country while the 1991 covered 70 percent of the country's population. We have chosen the years (1985, 1994 and 2000) where the coverage is national.

For the purposes of the surveys, a household is defined as a person or collection of persons, whether related or not, that habitually live in the same dwelling**,** occupying it in part or in whole, and that habitually have eaten and slept in the household for at least 3 of the 12 months prior to the interview date[13]. The samples are stratified into regions and can be grouped into rural and urban areas, being an urban area defined as a city or town with 2,000 or more inhabitants according to Census information.

The subsamples for urban Peru and its distribution by gender for the years 1985, 1994 and 2000 are as following:

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[12] The surveys in Peru are referred as 'Encuestas Nacionales de Hogares Sobre Medicion de Vida' or ENNIVs.

[13] It is important in Peru to distinguish between 'dwelling' and 'household'. A dwelling is a house, apartment or independent living space in which one or more households may live. The sample frame excludes population groups that live in a communal dwelling such as army barracks, hotels, hospitals, asylums, monasteries, prisons, etc.

**Table 1 Summary of Data by Geographic Areas and Gender**

| | 1985 | 1994 | 2000 |
|---|---|---|---|
| Urban | 55.27 | 62.38 | 65.38 |
| Rural | 44.73 | 37.62 | 34.62 |
| Female | 51.00 | 51.24 | 50.40 |
| Male | 49.00 | 48.76 | 49.60 |
| Total number of households | 4,913 | 3,623 | 3,000 |

Tables 2A, 2B and 2C provide descriptive statistics for the most important variables used in our study for the adjusted sample of the working and non-working population. We define the working population as those men and women between 10 and 65 years who reported at least one hour worked during the reference week, and the non-working population being those individuals who reported no hours worked during the same period.

**Table 2.A: Means and Standard Deviations of Sample Variables, 1985**

| | Female | | | | Male | | | |
|---|---|---|---|---|---|---|---|---|
| | Working | | Non-Working | | Working | | Non-Working | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Schooling* | 0.01 | 0.08 | 0.01 | 0.07 | 0.00 | 0.02 | 0.00 | 0.05 |
| Primary | 0.40 | 0.49 | 0.40 | 0.49 | 0.30 | 0.46 | 0.39 | 0.49 |
| Secondary Common | 0.39 | 0.49 | 0.44 | 0.50 | 0.42 | 0.49 | 0.47 | 0.50 |
| Secondary Technical | 0.04 | 0.20 | 0.04 | 0.20 | 0.05 | 0.23 | 0.03 | 0.16 |
| Tertiary (not university) | 0.05 | 0.21 | 0.03 | 0.17 | 0.05 | 0.23 | 0.02 | 0.13 |
| University | 0.10 | 0.30 | 0.08 | 0.27 | 0.16 | 0.36 | 0.09 | 0.28 |
| Years of Schooling | 9.04 | 3.86 | 8.65 | 3.32 | 10.02 | 3.76 | 8.48 | 3.20 |
| Age 10-19 | 0.16 | 0.36 | 0.46 | 0.50 | 0.16 | 0.36 | 0.63 | 0.48 |
| Age 20-29 | 0.28 | 0.45 | 0.24 | 0.43 | 0.28 | 0.45 | 0.21 | 0.41 |
| Age 30-39 | 0.25 | 0.43 | 0.11 | 0.31 | 0.23 | 0.42 | 0.06 | 0.24 |
| Age 40-49 | 0.17 | 0.38 | 0.08 | 0.26 | 0.16 | 0.37 | 0.04 | 0.19 |
| Age 50-59 | 0.11 | 0.31 | 0.07 | 0.26 | 0.12 | 0.33 | 0.03 | 0.17 |
| Age 60 and more | 0.04 | 0.19 | 0.04 | 0.20 | 0.04 | 0.21 | 0.03 | 0.17 |
| Head of Household | 0.12 | 0.33 | 0.04 | 0.19 | 0.57 | 0.50 | 0.11 | 0.31 |
| Married | 0.54 | 0.50 | 0.37 | 0.48 | 0.60 | 0.49 | 0.17 | 0.38 |
| Working Hours (weekly) | 33.75 | 22.41 | 0.00 | 0.00 | 45.83 | 20.88 | 0.00 | 0.00 |
| Migrant | 0.43 | 0.50 | 0.31 | 0.46 | 0.43 | 0.50 | 0.24 | 0.43 |
| Num. Of members in HH | 6.56 | 3.08 | 6.86 | 2.98 | 6.43 | 2.98 | 7.09 | 2.85 |
| Number of children under 6 | 0.55 | 0.88 | 0.54 | 0.87 | 0.60 | 0.91 | 0.46 | 0.81 |
| Labor experience (years) | 18.50 | 14.00 | 12.06 | 14.56 | 18.83 | 14.25 | 6.91 | 11.69 |
| Income of other members of the family** | 469.01 | 972.85 | 581.72 | 1045.49 | 325.54 | 549.58 | 503.05 | 851.17 |
| Sample Size | 2,246 | | 2,763 | | 3,202 | | 1,805 | |

* Persons that reported not having completed any level of education. ** In current Nuevos Soles

Source: LSMS, Peru 1985.

**Table 2. B: Means and Standard Deviations of Sample Variables 1994**

| | Female | | | | Male | | | |
|---|---|---|---|---|---|---|---|---|
| | Working | | Non-Working | | Working | | Non-Working | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Schooling* | 0.01 | 0.12 | 0.01 | 0.09 | 0.00 | 0.07 | 0.00 | 0.07 |
| Primary | 0.27 | 0.45 | 0.33 | 0.47 | 0.22 | 0.42 | 0.34 | 0.47 |
| Secondary Common | 0.40 | 0.49 | 0.49 | 0.50 | 0.47 | 0.50 | 0.48 | 0.50 |
| Secondary Technical | 0.02 | 0.13 | 0.01 | 0.10 | 0.02 | 0.13 | 0.01 | 0.10 |
| Tertiary (not university) | 0.12 | 0.33 | 0.07 | 0.26 | 0.10 | 0.30 | 0.05 | 0.21 |
| University | 0.17 | 0.38 | 0.09 | 0.29 | 0.18 | 0.39 | 0.12 | 0.32 |
| Years of Schooling | 10.66 | 4.09 | 9.33 | 3.41 | 10.82 | 3.79 | 9.15 | 3.30 |
| Age 10-19 | 0.10 | 0.30 | 0.42 | 0.49 | 0.11 | 0.31 | 0.63 | 0.48 |
| Age 20-29 | 0.29 | 0.45 | 0.23 | 0.42 | 0.27 | 0.45 | 0.20 | 0.40 |
| Age 30-39 | 0.28 | 0.45 | 0.12 | 0.33 | 0.25 | 0.43 | 0.05 | 0.23 |
| Age 40-49 | 0.20 | 0.40 | 0.09 | 0.28 | 0.18 | 0.39 | 0.03 | 0.16 |
| Age 50-59 | 0.10 | 0.30 | 0.09 | 0.28 | 0.13 | 0.34 | 0.04 | 0.20 |
| Age 60 and more | 0.03 | 0.18 | 0.05 | 0.22 | 0.05 | 0.21 | 0.05 | 0.21 |
| Head of Household | 0.14 | 0.35 | 0.04 | 0.20 | 0.56 | 0.50 | 0.12 | 0.33 |
| Married | 0.49 | 0.50 | 0.42 | 0.49 | 0.64 | 0.48 | 0.18 | 0.38 |
| Working Hours (weekly) | 40.17 | 21.44 | 0.00 | 0.00 | 49.67 | 21.22 | 0.00 | 0.00 |
| Migrant | 0.33 | 0.47 | 0.20 | 0.40 | 0.34 | 0.47 | 0.10 | 0.30 |
| Num. Of members in HH | 6.03 | 2.49 | 6.39 | 2.56 | 6.19 | 2.49 | 6.58 | 2.58 |
| Number of children under 6 | 0.38 | 0.73 | 0.47 | 0.79 | 0.51 | 0.83 | 0.38 | 0.72 |
| Labor experience (years) | 18.29 | 13.20 | 17.74 | 15.23 | 19.69 | 13.93 | 8.01 | 13.64 |
| Income of other members of the family** | 151.45 | 190.53 | 186.12 | 210.84 | 107.57 | 163.42 | 158.93 | 177.79 |
| Sample Size | 1,622 | | 2,641 | | 2,457 | | 1,577 | |

* Persons that reported not having completed any level of education. ** In current Nuevos Soles

Source: LSMS, Peru 1994.

**Table 2.C: Means and Standard Deviations of Sample Variables, 2000**

| | Female | | | | Male | | | |
|---|---|---|---|---|---|---|---|---|
| | Working | | Non-Working | | Working | | Non-Working | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Schooling* | 0.03 | 0.18 | 0.03 | 0.17 | 0.01 | 0.07 | 0.01 | 0.09 |
| Primary | 0.22 | 0.42 | 0.30 | 0.46 | 0.19 | 0.39 | 0.32 | 0.47 |
| Secondary Common | 0.42 | 0.49 | 0.48 | 0.50 | 0.50 | 0.50 | 0.48 | 0.50 |
| Secondary Technical | 0.00 | 0.06 | 0.00 | 0.06 | 0.01 | 0.08 | 0.00 | 0.05 |
| Tertiary (not university) | 0.16 | 0.37 | 0.08 | 0.28 | 0.13 | 0.33 | 0.06 | 0.24 |
| University | 0.15 | 0.36 | 0.09 | 0.29 | 0.17 | 0.37 | 0.12 | 0.32 |
| Years of Schooling | 10.56 | 4.36 | 9.27 | 3.69 | 10.95 | 3.75 | 9.17 | 3.47 |
| Age 10-19 | 0.11 | 0.31 | 0.41 | 0.49 | 0.11 | 0.31 | 0.64 | 0.48 |
| Age 20-29 | 0.28 | 0.45 | 0.20 | 0.40 | 0.26 | 0.44 | 0.18 | 0.39 |
| Age 30-39 | 0.26 | 0.44 | 0.13 | 0.34 | 0.25 | 0.43 | 0.05 | 0.21 |
| Age 40-49 | 0.20 | 0.40 | 0.11 | 0.31 | 0.20 | 0.40 | 0.03 | 0.18 |
| Age 50-59 | 0.11 | 0.32 | 0.10 | 0.29 | 0.13 | 0.34 | 0.05 | 0.22 |
| Age 60 and more | 0.03 | 0.18 | 0.05 | 0.22 | 0.05 | 0.21 | 0.05 | 0.21 |
| Head of Household | 0.11 | 0.31 | 0.05 | 0.22 | 0.52 | 0.50 | 0.13 | 0.33 |
| Married | 0.50 | 0.50 | 0.41 | 0.49 | 0.62 | 0.49 | 0.15 | 0.36 |
| Working Hours (weekly) | 39.62 | 22.63 | 0.00 | 0.00 | 50.49 | 22.39 | 0.00 | 0.00 |
| Migrant | 0.36 | 0.48 | 0.31 | 0.46 | 0.36 | 0.48 | 0.24 | 0.43 |
| Num. Of members in HH | 5.74 | 2.33 | 6.08 | 2.35 | 5.90 | 2.36 | 6.11 | 2.34 |
| Number of children under 6 | 0.35 | 0.67 | 0.37 | 0.67 | 0.41 | 0.70 | 0.27 | 0.57 |
| Labor experience (years) | 19.14 | 14.18 | 14.73 | 16.00 | 19.70 | 13.74 | 8.30 | 13.84 |
| Income of other members of the family** | 240.55 | 323.01 | 294.07 | 357.79 | 191.78 | 298.90 | 281.52 | 363.55 |
| Sample Size | 2,234 | | 2,730 | | 2,981 | | 1,672 | |

* Persons that reported not having completed any level of education. ** In current Nuevos Soles.
Source: LSMS, Peru 2000.

As predicted by human capital theory, working men and women reported a higher level of education than their non-working counterparts in all the survey years, although the difference was not very striking in terms of average years of schooling. A look at the information for levels of education however, shows that for all the survey years working males and females reported a much higher proportion completing tertiary education

compared to their non-working counterparts with the difference being especially significant in the year 2000.

In 1985, the difference between working women and men in terms of having completed primary and tertiary levels was noteworthy: 10 percentage points higher for primary level and 6 percentage points higher for tertiary level of education. This difference decreases over time: in 1994 the difference between male and female workers with respect to primary education was of 5 percentage points while female workers reported having even a slight higher percent of tertiary education than working males (29% compared to 28%).

In general, while the non-working population concentrates in the first levels of education, primary, secondary common and secondary technical, both working women and men hold higher levels of education. The jump in the proportion of working women with tertiary education from 1985 and 1994 is really impressive going from 15% to 29% while for working men the proportion of tertiary level of education went from 21% to 28%. This information confirms a Latin American trend with a labor force that has become more educated with female workers showing increasing educational achievement. It is worth observing from Tables 2A-2C that the proportion of female workers that reported having completed only primary level went from 40% in 1985 to 27% in 1994, and to 22% in the year 2000 while for men the percentage were 30% in 1985, 22% in 1994 and 19% in 2000. In terms of gender however, the difference in education by level has decreased dramatically over the years under study showing more equality in educational outcomes.

If we divide our sample by ranges of age, we observe similar characteristics for working women and men across the survey years: it is a young population with around 28% of working women and men being between 20 and 29 years old and around 25% of them having between 30 and 39 years of age. In the case of the non-working sample, even when the highest percentage concentrates in the youngest cohort of age (0-19 years), an increasing proportion of women, as opposed to men, concentrates in the range of 30-49 years of age. In 1985, the difference in the proportion of non-working women between 30 and 49 years was 9 percentage points while for both 1994 and 2000 the difference was 13 percentage points. This suggests that age may have different effects on male and female participation decisions in the labor market. Working men on average worked longer hours than working women.

As expected, being the head of the household seems to be important factor in the decision to work; 12% of working women were heads of household while only 4% of non-working women were in that position in 1985 with this proportion growing in 1994. In the case of men, more than half the male workers were head of their households in all the survey years. When observing the civil status of the working and non-working sample a few observations call our attention. Between 1985 and 1994, the difference in the proportion of married women when comparing the working with the non-working sample was very significant since 54% of working women were married while 37% of non-working women reported being married. That difference dropped in 1994 and 2000 where the proportion of married women among female workers was around 49% and 41% and 42% for non-working women. On the other hand, for men, the difference in civil status between the working sample and the non-working sample was high and

similar among the surveys years of 1985, 1994 and 2000. On average around 60% of working men were married while only 17% of the non-working groups held that civil status.

In the case of the total number of members in the family, it can be observed from Tables 2A-2C that in general for both groups of non-working men and women, the number is greater compared to the working sample, suggesting that the size of the family affects them in similar way. However, we can observe that working women have fewer children less than 6 years than non-working women with the exception of the year 2000 where the percentage of women living in households with children less than 6 years old was almost identical. An opposite situation is found for the case of men since for all the survey years a much higher percentage of male workers report living in households with children less than six years of age compared to their non-working counterparts. This information suggests that in the case of women, the number of dependable children is important to the decision to work outside the home. Another important variable presented in Tables 2A-2C is the income of other members in the households, or what we might call the 'need for income'. We can observe that in the case of working women, income earned by the other members of the household was higher for both non-working men and women than for workers in the three years of our study 1985, 1994 and 2000. These results suggest that family and income, but not necessarily marriages may have a relatively larger influence on Peruvian female labor participation in the market.

Table 3 shows the occupational distribution of male and female workers for 1985-1994 and the difference in the distribution by gender. In 1985, even when both men and women were heavily represented in sales, it is in the case of women that this occupation

is really important, concentrating for 33% of the working force, involving labor force working in sales in the informal sector; in 2000 however, the greatest proportion is found in the services sector that concentrates 41% of the female working sample. An interesting development across the survey years refers to the evolution in the participation of female workers in professional and managerial activities that doubled from 1985 to 2000. Compared to their male counterparts, we should note that only in 1985 male workers reported a higher concentration in professional activities while in 1994 and 2000 female workers take the lead. What is also noteworthy is the importance of the occupational group referred as non-agricultural workers for the male sample; these occupations –that mostly involve non-qualified or manual jobs- have maintained their importance since 1985 concentrating around 35% of male workers.

Tables 4A-C provide more detail with regard to education and wage differentials by both occupation and gender. We observe that men's wages are higher than women's for the seven occupational categories considered in the study. The mean wage for a professional man was found to be 124% higher than for women in 1985, 96% higher in 1994 and 60% higher in 2000, while the years of schooling held by men were almost identical for those three survey years. For this occupation, a convergence in average wages over time in terms of gender differences is likely to impact our analysis of the incidence of wage inequality over time.

We can also observe that for the case of office employees, or administrative personnel, the mean years of schooling was higher for women than for men for all the years considered; however, the average wage for this occupation was still higher for male workers than female. As we can see from these Tables (4A-4C), even if for most the

seven occupational groups considered, the average education level for men was slighter higher than women's, the advantage in wage differentials for men far exceeds the educational advantage.

**Table 3: Occupational Distribution by Gender (%), 1985, 1994, 2000**

| | 1985 | | | 1994 | | | 2000 | | |
|---|---|---|---|---|---|---|---|---|---|
| Occupational Groups | Total Urban | Female | Male | Total Urban | Female | Male | Total Urban | Female | Male |
| Professional | 9.59 | 8.98 | 10.04 | 16.20 | 18.16 | 14.86 | 16.58 | 17.79 | 15.68 |
| Managerial | 2.12 | 0.50 | 3.35 | 0.51 | 0.23 | 0.70 | 2.32 | 1.29 | 3.08 |
| Administrative | 8.46 | 9.09 | 7.98 | 7.73 | 8.91 | 6.93 | 5.23 | 6.16 | 4.54 |
| Sales | 26.14 | 33.10 | 20.87 | 30.86 | 43.76 | 22.06 | 13.87 | 17.71 | 11.05 |
| Services | 10.45 | 12.25 | 9.08 | 9.57 | 11.75 | 8.09 | 27.65 | 40.54 | 18.16 |
| Agriculture and others* | 17.76 | 24.51 | 12.66 | 9.13 | 5.33 | 11.73 | 10.60 | 7.20 | 13.11 |
| Non-agricultural workers | 25.49 | 11.56 | 36.01 | 26.00 | 11.86 | 35.64 | 23.74 | 9.31 | 34.38 |

*Source: LSMS, 1985, 1994 and 2000*.

A similar pattern is found when we analyze the differences in wages and education by economic activity, as shown in Tables 5A-5C. In 1985 in almost the nine categories analyzed, the average wage is higher for men than for women, even when the differences in education are not very important. In the case of the Commerce sector,

which includes retail and wholesale trade and involves 33% of the female labor force (as observed in Table 3), average wages for men were 73.8% higher than women in that economic activity, although the average years of education were only 13.4% higher. This case is a very representative one for working women in urban Peru also in 1994, because women in this sector account for 44% of the working force in that year. We should note however that in the year 2000 a change appears in terms of the relative wages for certain occupations such as Mining, Electricity, Construction and Transportation and Communications where female workers report slight higher wages than their male counterparts; in all those activities as well, the average years of formal education appear to be higher than those achieved by male workers.

**Table 4A: Wages and Education by Occupational Groups 1985**

| Occupational groups | Female | | Men | |
|---|---|---|---|---|
| | Wage* (nuevos soles) | Education (years) | Wage* (nuevos soles) | Education (years) |
| Professional | 305.0 | 14.7 | 682.8 | 15.0 |
| Managerial | 442.2 | 13.7 | 624.2 | 14.1 |
| Administrative | 272.0 | 12.1 | 321.8 | 11.6 |
| Sales | 197.1 | 8.0 | 385.3 | 9.2 |
| Services | 150.5 | 7.4 | 327.4 | 9.3 |
| Agricultural workers** | 59.0 | 6.9 | 227.1 | 7.4 |
| Non-Agricultural workers | 130.4 | 8.4 | 306.6 | 8.8 |

Source: LSMS, 1985.
* Weekly wages in principal and secondary jobs.
** Includes fishing, mining and hunting

**Table 4B: Wages and Education by Occupational Groups 1994**

| Occupational groups | Female | | Men | |
|---|---|---|---|---|
| | Wage* (nuevos soles) | Education (years) | Wage* (nuevos soles) | Education (years) |
| Professional | 87.19 | 14.89 | 171.03 | 15.38 |
| Managerial | 442.67 | 14.00 | 496.93 | 16.39 |
| Administrative | 99.43 | 13.30 | 127.39 | 12.26 |
| Sales | 62.99 | 9.09 | 123.66 | 10.25 |
| Services | 51.95 | 8.83 | 79.26 | 10.17 |
| Agricultural workers | 30.19 | 7.87 | 74.61 | 8.31 |
| Non-Agricultural workers | 70.42 | 9.50 | 101.11 | 9.58 |

Source: LSMS, 1994.
* Weekly wages in principal and secondary jobs.

**Table 4C: Wages and Education by Occupational Groups 2000**

| Occupational groups | Female | | Men | |
|---|---|---|---|---|
| | Wage* (nuevos soles) | Education (years) | Wage* (nuevos soles) | Education (years) |
| Professional | 182.53 | 15.34 | 291.17 | 15.21 |
| Managerial | 337.15 | 13.00 | 446.76 | 13.57 |
| Administrative | 152.77 | 13.64 | 203.95 | 12.72 |
| Sales | 82.41 | 8.43 | 116.61 | 9.38 |
| Services | 84.71 | 9.14 | 149.06 | 10.27 |
| Agricultural workers | 63.07 | 6.74 | 107.40 | 8.12 |
| Non-Agricultural workers | 83.65 | 10.22 | 145.39 | 9.88 |

Source: LSMS, 2000.
* Weekly wages in principal and secondary jobs.

**Table 5A: Wages and Educational by Economic Activity 1985**

| Economic Activity | Wage* | | School** | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| Agriculture | 55.35 | 207.7 | 6.9 | 7.3 |
| Mining | 275.0 | 524.3 | 7.3 | 10.1 |
| Manufacture | 164.7 | 299.6 | 8.9 | 9.6 |
| Electricity, water and gas | 393.4 | 514.2 | 12.2 | 11.9 |
| Construction | 178.4 | 283.9 | 13.8 | 7.9 |
| Commerce | 204.2 | 354.9 | 8.2 | 9.3 |
| Transportation & Communications | 448.8 | 488.4 | 11.4 | 9.5 |
| Financial Intermediation | 299.7 | 739.3 | 13.2 | 13.3 |
| Services | 211.9 | 385.9 | 11.1 | 11.4 |

** Nuevos soles. ** Years of formal education*

Source: LSMS, Peru 1985

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**Table 5B: Wages and Educational by Economic Activity 1994**

| Economic Activity | Wage* | | School** | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| Agriculture | 32.56 | 64.03 | 8.14 | 8.26 |
| Mining | 204.99 | 222.09 | 12.33 | 11.80 |
| Manufacture | 71.50 | 120.15 | 10.00 | 10.56 |
| Electricity, water and gas | 145.35 | 150.46 | 16.00 | 11.70 |
| Construction | 97.36 | 123.23 | 7.33 | 9.72 |
| Commerce | 66.67 | 114.32 | 9.21 | 9.98 |
| Transportation & Communications | 125.05 | 115.42 | 13.53 | 10.14 |
| Financial Intermediation | 136.43 | 234.09 | 13.47 | 14.18 |
| Services | 75.52 | 121.46 | 12.62 | 13.19 |

** Nuevos soles. ** Years of formal education*

Source: LSMS, Peru 1994.

**Table 5C: Wages and Educational by Economic Activity 2000**

| Economic Activity | Wage* | | School** | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| Agriculture | 63.85 | 97.92 | 6.79 | 7.96 |
| Mining | 284.15 | 274.05 | 13.67 | 11.44 |
| Manufacture | 105.43 | 186.55 | 10.76 | 10.52 |
| Electricity, water and gas | 279.07 | 201.83 | 15.00 | 12.00 |
| Construction | 206.57 | 180.35 | 15.50 | 9.69 |
| Commerce | 92.91 | 157.96 | 9.15 | 10.10 |
| Transportation & Communications | 177.23 | 147.91 | 12.28 | 10.37 |
| Financial Intermediation | 354.12 | 470.87 | 15.14 | 14.53 |
| Services | 125.98 | 207.98 | 11.93 | 12.90 |

** Nuevos soles. ** Years of formal education*

Source: LSMS, Peru 2000.

Data from our adjusted sample, distributed by status of employment (Table 6), suggest that a high percentage of working women and men are self-employed, however the proportion of women working as paid family workers (or as a relative that works for a wage in a family enterprise) is much higher than for men.

We can relate this situation to the distribution of the working population by size of establishment and by sex. Table 6 reports the distribution of workers by size of employment, where is noteworthy the concentration of female workers in enterprises with a number of 1-10 employees, this pattern suggests the importance of family enterprises as a source of employment, especially for women. Finally, we also observe how important is the public sector as employer for female workers (Table 6) and how dramatic was the reduction in unionized workers after the labor reforms of the 1990s (Table 7).

**Table 6 Distribution by Status of Employment and Type of Establishment (%): 1985-2000**

| | 1985 | | | 1994 | | | 2000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Female | Male | Total | Female | Male | Total | Female | Male |
| Self-employed | 55.82 | 68.79 | 46.03 | 40.40 | 42.00 | 40.00 | 37.53 | 39.00 | 37.00 |
| Paid family member | NA | NA | NA | 11.91 | 18.00 | 8.00 | 14.54 | 20.00 | 10.00 |
| Public sector laborer | NA | NA | NA | 3.71 | 2.54 | 4.31 | 4.29 | 3.78 | 4.58 |
| Private sector laborer | NA | NA | NA | 38.04 | 19.63 | 47.55 | 38.59 | 20.80 | 48.66 |
| Public sector employee | NA | NA | NA | 23.74 | 31.36 | 19.80 | 23.85 | 29.73 | 20.52 |
| Private sector employee | NA | NA | NA | 31.44 | 38.28 | 27.90 | 28.98 | 35.08 | 25.52 |
| Domestic worker | 6.73 | 16.00 | 1.00 | 3.08 | 8.19 | 0.44 | 4.29 | 10.61 | 0.71 |
| Have a secondary job | 9.09 | 17.07 | 6.19 | 10.81 | 10.00 | 11.00 | 10.46 | 10.00 | 11.00 |
| Distribution of sample according to type of establishment worked by size (%) | | | | | | | | | |
| Sole worker | 1.50 | 2.46 | 1.17 | 27.61 | 33.12 | 23.89 | 25.30 | 30.59 | 21.40 |
| 2-5 | 30.86 | 29.06 | 31.47 | 35.07 | 35.53 | 34.77 | 39.42 | 40.02 | 38.98 |
| 6-10 | 14.28 | 13.79 | 14.44 | 10.33 | 9.11 | 11.15 | 10.42 | 9.29 | 11.26 |
| 11-20 | 12.78 | 15.52 | 11.85 | 7.14 | 7.62 | 6.81 | 7.40 | 5.90 | 8.50 |
| 21-50 | 13.34 | 12.56 | 13.61 | 7.81 | 5.79 | 9.18 | 6.94 | 6.37 | 7.37 |
| 51-100 | 7.98 | 7.64 | 8.10 | 5.13 | 3.61 | 6.16 | 4.17 | 3.10 | 4.96 |
| 101-200 | 6.11 | 7.64 | 5.59 | 2.93 | 2.12 | 3.48 | 2.39 | 2.11 | 2.59 |
| 201 or more | 13.15 | 11.33 | 13.77 | 3.97 | 3.09 | 4.57 | 3.95 | 2.62 | 4.93 |

*Source: LSMS, 1985, 1994 and 2000.*

**Table 7: Unionization of the Labor Force 1985, 1994 and 2000**

| | 1985 | | 1994 | | 2000 | |
|---|---|---|---|---|---|---|
| | Female | Male | Female | Male | Female | Male |
| Unionized | 37.78 | 35.42 | 19.00 | 23.00 | 4.70 | 5.00 |
| Non-Unionized | 62.22 | 64.58 | 81.00 | 77.00 | 95.30 | 95.00 |

*Source: LSMS, 1985, 1994 and 2000.*

## V. Econometric Results

As a first step to evaluate the incidence of wage discrimination, the standard Mincerian earnings functions were estimated[14]. The dependent variable is the log of the weekly primary wage, and the independent variables are log of weekly hours worked, labor experience, a squared term for labor experience, educational levels and condition of migration. Tables 8A-8C presents the results of separate earnings regressions for men and women, both corrected for selectivity bias (with t-values in parentheses) for 1985, 1994 and 2000[15].

[14]As a complement to our analysis, a Wald test was done to evaluate the relevance of the variable 'gender' in the pooled sample wage regression. Results from that test reported that gender was statistically significantly (at 5% level) different from zero, and justified running by separate wage equations. Also, a Chow test was performed, showing that the coefficients were structurally different in both men and women's wage equations.

[15] From the estimated probit models for women and men, we were able to estimate the value of Lambda or the inverse Mills ratio and added it as a regressor (Lambda) in the earnings equations.

**Table 8A: Male and Female Wage Regressions Corrected for Selectivity 1985**

| Variables | Female* | Male |
|---|---|---|
| *Dependent variable: Ln (Wage)* | | |
| Constant | 2.196 | 4.116 |
| | (12.55) | (21.05) |
| Ln (hours) | 0.585 | 0.325 |
| | (13.20) | (7.75) |
| Experience | 0.063 | 0.038 |
| | (8.88) | (5.44) |
| Experience squared | -0.009 | -0.001 |
| | (-6.29) | (-3.8) |
| Migrant | -0.160 | -0.110 |
| | (-2.80) | (-3.34) |
| Primary Level | -0.650 | -0.421 |
| | (-8.93) | (-9.77) |
| Secondary Technical Level | 0.260 | -0.037 |
| | (4.15) | (-0.56) |
| Technical Tertiary Level | 0.723 | 0.211 |
| | (8.30) | (3.00) |
| College level | 0.661 | 0.526 |
| | (99.26) | (11.38) |
| Lambda | -0.204 | -0.788 |
| | (-1.15) | (-7.99) |
| R-squared | 0.268 | 0.251 |
| F-statistic | 64.33 | 92.45 |
| Sample size | 1,453 | 2,674 |

Note: t-statistics in parentheses.

* Corrected for heteroskedasticity with the White Heteroskedasticity-Consistent Standard Errors & Covariance.

**Table 8B: Male and Female Wage Regressions Corrected for Selectivity, 1994**

| Variables | Female* | Male |
|---|---|---|
| *Dependent variable: Ln (Wage)* | | |
| Constant | 1.957 | 2.485 |
| | (11.75) | (14.32) |
| Ln (hours) | 0.390 | 0.372 |
| | (9.48) | (9.48) |
| Experience | 0.044 | 0.043 |
| | (6.70) | (7.01) |
| Experience squared | -0.001 | -0.001 |
| | (-3.98) | (-5.16) |
| Migrant | -0.093 | -0.118 |
| | (-1.77) | (-3.12) |
| Primary Level | -0.435 | -0.281 |
| | (-6.12) | (-6.06) |
| Secondary Technical Level | -0.229 | -0.281 |
| | (1.46) | (-1.56) |
| Technical Tertiary Level | 0.360 | 0.344 |
| | (5.46) | (6.07) |
| College level | 0.681 | 0.677 |
| | (12.15) | (15.89) |
| Lambda | -0.187 | -0.244 |
| | (-1.53) | (-3.11) |
| R-squared | 0.256 | 0.259 |
| F-statistic | 43.83 | 66.53 |
| Sample size | 1,320 | 2,225 |

Note: t-statistics in parentheses.

* Corrected for heteroskedasticity with the White Heteroskedasticity-Consistent Standard Errors & Covariance.

**TABLE 8C: Male and Female Wage Regressions Corrected for Selectivity, 2000**

| Variables | Female* | Male |
|---|---|---|
| *Dependent variable: Ln (Wage)* | | |
| Constant | 2.221 | 2.838 |
| | (16.80) | (16.22) |
| Ln (hours) | 0.475 | 0.413 |
| | (14.98) | (10.86) |
| Experience | 0.025 | 0.029 |
| | (4.82) | (4.69) |
| Experience squared | -0.005 | -0.001 |
| | (-3.97) | (-3.01) |
| Migrant | -0.010 | -0.087 |
| | (-0.23) | (-2.60) |
| Primary Level | -0.286 | -0.250 |
| | (-4.83) | (-4.91) |
| Secondary Technical Level | -0.112 | 0.088 |
| | (-0.34) | (0.78) |
| Technical Tertiary Level | 0.422 | 0.334 |
| | (7.97) | (7.89) |
| College level | 0.879 | 0.667 |
| | (16.21) | (14.47) |
| Lambda | 0.237 | -0.288 |
| | (1.89) | (-3.70) |
| R-squared | 0.283 | 0.221 |
| F-statistic | 71.94 | 61.61 |
| Sample size | 1,774 | 2,637 |

Note: t-statistics in parentheses.

* Corrected for heteroskedasticity with the White Heteroskedasticity-Consistent Standard Errors & Covariance.

In 1985 the coefficient on selectivity, Lambda, was found to be statistically insignificant for the sample of women, meaning that in 1985 for urban Peru there was no evidence of self-selection of women in the samples; for men however the problem of selectivity was corrected as explained in the previous section. In 1994 and 2000, the samples of men presented selectivity biases as well so the correction was necessary. All the coefficients for our productive characteristics (as presented in Tables 8A-8C) are

already corrected. As we can observe, the elasticity of income to hours worked is higher for women than for men in all the survey years; a one percent increase in weekly hours worked led to a 0.48 percent increase in earnings for women and 0.41 percent increase in earnings for men in 2000. However, the difference in elasticities of income to hours worked by gender has been greatly reduced since 1985.

The returns for labor experience are relatively higher for women than for men in almost all our survey years; an additional year of labor experience results in an increase of 6% in women's earnings and an increase of 3% in the case of men for 1985. After the labor reform, the returns of labor experience were reduced dramatically for women but increased for men. The experience-squared term is significant and negative for both regressions in all years, indicating a concave shape to the experience-earnings profile for both male and female workers[16]. A very interesting variable was the condition of migrant on the earning equation. The condition of migrants was found to be statistically significant in both regressions for almost all the survey years, and the negative sign on the coefficients indicates that a person, men or women, born in a rural area, but working in a city, earns less than a person born in the city and working there too. These results might reflect the fact that migrants usually receive education of lower quality than people living in the cities (Felices, 1996) or might be reflecting a situation of discrimination by origin in the labor market. Before the reforms, in the case of women this disadvantage

[16] We should keep in mind, however, that the proxy of labor work experience used in this study (age of the individuals-years of education -5) might add some measurement errors and may not represent the potential accumulated experience in the labor market, especially in the case of women. Women's interrupted participation in the labor market might go against the use of this variable as the best proxy of labor experience, although there is evidence in Peru that the importance of public jobs for women discouraged interruptions in the labor market (Felices, 1996).

was higher when compared to male workers; being a migrant decreased their earnings 15%, while for men this decrease is around 10%[17]. It is commonly found in Latin American countries, that a significant percentage of migrant women do not have a home of their own in the city, and they work as live-in domestic servants, being paid lower wages compared with women from urban areas that work to support or to help support their households (Szasz, 1995). Cultural differences between males and females also help to explain these findings. After the reform however the impact of this condition on female earnings was greatly reduced, while for male workers, the impact remained at around the same level.

In terms of formal education, for both female and male workers, holding primary levels of education represented a reduction in their earnings compared to the group of workers with a secondary level of education (control group). Having superior technical education and university studies represents an advantage, in terms of earnings, compared to the group of workers having secondary education. However, we can observe a strong difference in the returns to the highest level of education; in the case of women, having university studies represents a much higher increase in their earnings compared to the reference group, with the difference increasing over time and after the reforms. The difference in the returns to higher levels of education by gender was highest in 2000.

Using the information reported in Tables 8A-8C we are able to estimate the percentage of the wage gap between men and women which can be attributed to differences in endowments (the 'justified' part of the pay gap) and to differences in the

[17] We should be reminded that the impact of the coefficient for a dummy variable in a semi-log equation is interpreted as: $e^{ß} - 1$ where ß is the estimated coefficient for the dummy variable in the earning equation. In similar way we estimate the impact for the dummy variables of education level.

rewards of these characteristics (the 'unjustified' part or wage discrimination). Tables 9A-9C show the final results for the Oaxaca's decomposition exercise. We can observe that the incidence of wage discrimination has been declining over time since 1985, with the differences in the human capital endowments between men and women explaining 19% of the wage gap in 1985, 23% in 1994 and 26% in 2000 (evaluated at female means); while 81% could be attributed to differences in labor market rewards to the characteristics taken into account in our analysis for 1985, 77% in 1994 and 74% in 2000. Despite the decrease in the incidence, the magnitude of the upper bound of wage discrimination or the part of the pay gap between men and women not explained by differences in productive characteristics held by those groups of workers represent an important policy issue to address. The preliminary estimates from our decomposition analysis suggest that wage discrimination still constitutes a significant problem in the labor market of urban Peru.

**Table 9A: Decomposition of Male-Female Differential 1985**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Male Means | 0.3645 | 0.7718 | 1.1363 |
| Evaluated at Female Means | 0.2191 | 0.9171 | 1.1363 |

| Percentage of Male Pay Advantage due to: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Male Means | 32.07 | 67.93 | 100 |
| Evaluated at Female Means | 19.28 | 80.72 | 100 |

**Table 9B: Decomposition of Male-Female Differential, 1994**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Male Means | 0.1505 | 0.4397 | 0.5902 |
| Evaluated at Female Means | 0.1328 | 0.4574 | 0.5902 |

| Percentage of Male Pay Advantage due to: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Male Means | 25.51 | 74.49 | 100 |
| Evaluated at Female Means | 22.51 | 77.49 | 100 |

**Table 9C: Decomposition of Male-Female Differential, 2000**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Female Means | 0.1744 | 0.4250 | 0.5994 |
| Evaluated at Male Means | 0.1566 | 0.4428 | 0.5994 |

| Percentage of Male Pay Advantage due to: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Female Means | 29.09 | 70.91 | 100 |
| Evaluated at Male Means | 26.12 | 73.88 | 100 |

## VI. Conclusions and Policy Implications

- Women's decision to participate in the labor market strongly depends on education and demographic aspects. Being head of household was found to be one of the strongest determinants of female labor force participation, while marital status and the presence of children under six years were negatively correlated with the probability to work outside the home. Holding primary, technical and university education increases female participation in the market.
- After the labor reform, the returns of labor experience were reduced dramatically for women but increased for men. The more concave shape of the female age profile of participation relative to men suggest that age influences women's decision to participate in the labor market in a different way. More adult women enter the market, while for men participation seems to be more stable among all age groups. This delay in participation might be related to expectations for higher education and training or related to a context of economic crisis, where women 'wait' to get a proper job according to their qualifications. After the reforms, however, younger women are more likely to participate due to the elimination of labor restrictions to temporary contracts and part-time employment.
- No evidence of selectivity bias in the samples of working men and women was found in 1985, but corrections for selectivity were performed for 1994 and 2000.
- Education was found to have a strong impact on earnings for both men and women. However, we can observe a strong difference in the returns to the highest level of education; in the case of women, having university studies represents a much higher increase in their earnings compared to the reference group (secondary level of

education), with the difference increasing over time and after the reforms. The difference in the returns to higher levels of education by gender was highest in 2000.

- Being a migrant reduces earnings for both men and women, suggesting the existence of another kind of discrimination on selection in the market. In the case of women this disadvantage is higher compared to male workers, given that being a migrant reduces women's earnings more than men's.
- Female labor in Peru is, on average, rewarded less than male labor in the market. Male-female human capital differences explained, on average, only about 32% of the gender wage gap in 1985, 26% in 1994 and 29% in 2000. Despite the decrease in the incidence of wage discrimination since 1994, the magnitude of the upper bound of wage discrimination or the part of the pay gap between men and women not explained by differences in productive characteristics held by those groups of workers represent an important policy issue to address. The estimates from our decomposition analysis suggest that wage discrimination still constitutes a significant problem in the labor market of urban Peru.
- Results on wage discrimination suggest that an expansionary educational policy (e.g. promotion of educational or skill augmenting programs) is not enough to increase women's participation in the economy and to improve women's welfare. Given the finding that women earn lower wages not because they are less skilled than men but that a large proportion of the wage gap cannot be explained by skills, there are reasons to believe that labor market discrimination plays an important role and efforts should be also done to promote equality between female and male real wages. As a result, policy makers should pay attention to policies that promote more egalitarian

wage distributions in Peru.

# APPENDIX A

# DECOMPOSITION ANALYSIS

**Table 10: Decomposition of Male-Female Differential 1985**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Male Means | 0.3645 | 0.7718 | 1.1363 |
| Evaluated at Female Means | 0.2191 | 0.9171 | 1.1363 |

| Percentage of Male Pay Advantage due to: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Male Means | 32.07 | 67.93 | 100 |
| Evaluated at Female Means | 19.28 | 80.72 | 100 |

**Table 11: Decomposition of Male-Female Differential, 1994**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Male Means | 0.1505 | 0.4397 | 0.5902 |
| Evaluated at Female Means | 0.1328 | 0.4574 | 0.5902 |

| Percentage of Male Pay Advantage due to: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Male Means | 25.51 | 74.49 | 100 |
| Evaluated at Female Means | 22.51 | 77.49 | 100 |

**Table 12: Decomposition of Male-Female Differential 2000**

| Male Pay Advantage due to differences in: | | | Observed Wage |
|---|---|---|---|
| | Human Capital Endowments | Wage Structure | Differential |
| Evaluated at Female Means | 0.1744 | 0.4250 | 0.5994 |
| Evaluated at Male Means | 0.1566 | 0.4428 | 0.5994 |
| **Percentage of Male Pay Advantage due to:** | | | **Observed Wage** |
| | Human Capital Endowments | Wage Structure | Differential (%) |
| Evaluated at Female Means | 29.09 | 70.91 | 100 |
| Evaluated at Male Means | 26.12 | 73.88 | 100 |

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## CHAPTER III

# FEMALE LABOR FORCE PARTICIPATION IN URBAN PERU: 1985-2000

### Introduction

The study of the causes and the consequences of the dramatic increase in female labor force participation in developed countries in the past decades has been crucial to the field of labor economics. As male participation and hours of work showed smaller variance in both cross section and time series analyses while female participation showed great variation, it has been even argued that without much of an exaggeration, women gave 'birth' to modern labor economics, especially labor supply (Goldin,1995). In Latin American countries, the increase in the number of women joining the labor market in the past three decades has also represented a revolutionary development that is not only shaping the study of labor markets but challenging policy making aimed at maximizing the potential of women's work in the economic development of the region. Data from household survey documenting both formal and informal work for pay reveals that the proportion of women in the labor force that was 20 per cent in 1970 increased to almost 50 percent in 2000 in Latin America (Piras, 2004).

It has been argued that in some developing countries, the study of factors influencing women's choices in the labor market or the gender wage gap are somehow irrelevant due to the fact that paid labor force outside the household represents an insignificant source of family income (Mammen and Paxson,2000). In Latin American countries, however, the analysis of household survey data from 18 countries (including

Peru) reveals that at the end of 1990s women were contributing, on average, 35 per cent of household labor income (Piras, 2004). This fact alone makes the understanding of what influences women's decisions to join the labor market a relevant subject of study.

Female labor force participation is a good measure of well-being for women for several reasons. There seem to exist considerable evidence that as women move towards more involvement in market work, they gain freedoms in politics, in the society and in their own households (Goldin, 1995). Within a household, an increase in income in the hands of the mother is estimated to have a bigger impact on her family's health compared to when the father has control over income; Thomas (1990) estimated that in terms of child survival probabilities[18], the effect is almost 20 times bigger. The bargaining power that females have within their households in terms of the allocation of resources is strengthen by the command of income earned in the market place. From a broader point of view, the impact of female work on the reduction of poverty and income inequality is considerable. When questioning the causes for the high inequality levels in Latin American countries, Hausmann and Skékely (1999) find that female labor force participation has an important role in explaining the gap between the households in the top 10% in the income distribution and the poorest 30%:

> "Why is inequality in Latin America so high? The structure of the economy, geography, culture, ethnicity, and many other general and social factors are important explanations, but when one looks at the personal characteristics of the rich and poor, there are three key variables that make the difference: fertility, female participation, and education." (Page 3)

[18] For the case of Brazil.

Besides its income generating capabilities or enhanced individual finacial security (and for their households), increased female labor force participation changes gender relations in a positive way by improving the self-esteem of women, their sense of respect and dignity as individuals and by changing the value given to females by other members of their households and their communities (Piras,1994). With economic independence, strategic life choices such as postponing the age of marriage and childbearing, or leaving abusive relations are more likely.

To date, despite the existence of several regional studies on gender and its impact on the labor markets in Latin America, as will be observed in the literature review section, the studies that examine the determinants of female labor force participation in Peru are few and date from the 1990s (Garavito, 1994; Felices, 1996; Gill, 1992; Khandker, 1992). This essay identifies the main determinants of female labor force participation in urban Peru since the 1980s and examines how the labor reforms of 1991 and 1997[19] changed the incentives for women to participate in market work. I focus on the influence of family structure, location, ethnicity, and human capital investments. The impact of the reform is evaluated by comparing the impact of these characteristics on work in the pre- and post-reform periods utilizing linear probability models of analysis (probit equations of labor force participation).

Our results show that family structure is key for understanding female force participation in Peru. Being head of the household was found to be positively correlated with the probability of participation for both men and women although being head of a household has a higher impact for women than for men, especially after the labor

[19] Outlined in Chapter 1.

reforms. The economic context in 1994 seemed to encourage women that are heads of households to look for paid jobs. In terms of civil status, we found that married women are less likely to work than those who are single, widowed, or separated, as being married reduces the probability to participate in market work for 1994 and 2000. On the other hand, the presence of dependent children was found to be restrictive of female participation in the labor market during 1985 and 1994, although that variable became insignificant in explaining participation in 2000. Lastly, our education variables show that college level of education has a significant impact on labor participation in the case of women in 1994 and 2000.

## II. Literature Review

The presence of studies of gender differentials in the labor market and more specifically, on female labor force participation became stronger in Latin America in the 1990s in the form of regional reports that compiled the experience of countries based on national survey data from most countries in Latin America and the Caribbean (LAC). One of the most cited and influential ones, recognized as the "first fact-finding report on the status of women in the LAC countries" (Pagés and Piras, 2004) reported findings from 15 countries, including Peru, and was prepared by George Psacharopoulos and Zafiris Tzannatos, under the sponsorship of the World Bank. The majority of studies in their report covered different survey years varying by availability of data, but most of them were done for the 1980s. The studies confirmed that women's decisions to work for pay and enter the labor force was greater as they entered adulthood and to the age of 40 to 45 years (after controlling for fertility); if they resided in urban areas; the higher their

education qualifications; the more general -rather than technical/vocational- their education was; the lower their family responsibilities, and the lower other income and family wealth was (Psacharopulos and Tzannatos, 1992).

A decade ago, León (2000) used individual-level data from household survey for Argentina, Bolivia, Brazil. Chile, Costa Rica, Mexico, Uruguay, and Venezuela to examine the experiences of women in the labor markets during the 1980s and 1990s and found that Latin American female labor force participation reached a maximum between the age at first marriage and the end of the reproductive cycle (age 25 to 44), a pattern unlike the one observed for developed countries (Duryea, Cox Edwards and Ureta, 2004). Despite this study (León, 2000) only examines trends in time without a model of participation, the evidence presented suggests that during the 1980s and 1990s the increase in labor force participation of married women was more significant than the increase in participation for women aged 25 to 34, women living with their parents, or females that were heads of their households.

Given the importance of specific human capital and family structure variables used in most studies of participation, I find it useful to report the main findings of these studies according to the relationships found between them and the probability of female participation for the case of Latin American countries, and for Peru in particular.

**a) Number of Children and Participation**

In most of the studies done for Latin America (Psacharopoulos and Tzannatos, 1992; Pagés and Piras, 2004; Atal, Ñopo and Winder 2009; León, 2000; Tenjo, Ribero and Berna, 2004), an important variable included in the analysis is the presence of young

children in the household. Under the assumption that women make individual decisions about their participation in market work, the presence of young children is expected to increase the reservation wage, lowering the probability of participation. This happens either because women have to pay for child care, or because the productivity of women is higher in household production. The pattern observed between participation and the number of children is negative for most Latin American countries, the number of children has a negative effect in participation and the impact is sharper in the formal sector. On average, women with 5 or more children participate ten percent less than do women with less than 2 children (Hausmann and Székely, 1999).

An interesting examination is the distinction made between female participation in the formal versus the informal sector, this later a sector that traditionally concentrates female workers[20]. It seems reasonable to assume that women have more difficulty entering the formal sector if the commitment to fixed schedules, to a certain numbers of hours worked, or the limitations on absenteeism that characterizes the jobs in the formal sector represent a barrier for them. As observed by Hausmann and Székely (1999), women who do work in the formal sector must rely on a network of support that can help deal with unpredictable events at home that may involve relatives or domestic servants and may be costly. Given the traditional role of women in Latin America, this restriction

[20] Currently, women have a significant presence in the region's informal sector and some authors have argued that this fact may provide a potential explanation for wage disparities since gender wage gaps are usually larger in the informal sector than in the formal sector. Possible explanations include small impact of education on wages in the informal sector, contrasting with the larger effect of experience, where for the most part, women have a disadvantage over men (Atal, Ñopo and Winder, 2009).

applies to women but much less to men, and is one reason why men have less difficulty in joining the formal sector.

In Peru, studies on market participation are not very numerous and have concentrated on wages rather than on female participation (Garavito, 1996, Felices, 1997, Piras and Ripani, 2005; Atal, Ñopo and Winder 2009). Utilizing an augmented version of a standard earnings function to include variables of "motherhood"[21], a recent study (Piras and Ripani, 2005) found a penalty for having children less than 7 years old in terms of wages varying however with the level of education of the mother: there is hourly wage differential of 11 percent less for mothers with a high school diploma or more, but it does have a significant effect on mothers who have less than high school education.

**b) Number of members in the family and participation**

As mentioned before, the presence of family members in a household that can share the care of young children impacts female labor participation as well. As noted by Connelly (1992), the presence of other potential caretakers (such as older siblings or other adults) may most likely lower the amount that parents pay for child care, increasing the probability of employment. As in many other developing countries, households in Latin America host extended families that include members other than the head, spouse and their children, so the presence of other females offers a potential substitute for paid child care.

[21] The model has as dependent variable the natural logarithm of the hourly wage in the respondent's current job, while the variables of motherhood include: number of children 0-6, number of children 7-12 and number of children 13-18. Other socioeconomic variables included age, age squared, tenure in current job, head of household status and ethnicity (Piras and Ripani, 2005).

In a study for the city of Lima, Peru in 1990, Gill (1992) found that the number of members in the household that hold jobs raised the probability of working outside the home for women and men, which was a very unexpected result. The author did not report any possible explanation for this phenomenon; however he found interesting evidence that the presence of older girls (potential substitutes for adult females in the household work) increases the probability of female market participation.

**c) Age and Participation**

Since studies (Psacharopoulos and Tzannatos, 1992) show that women's labor participation rates increase with age (generally seen in women up to 45), a relative increase in the age composition of the population can significantly alter the aggregate participation rate. In fact, it has been estimated that the increase in the average age of working women in the region explains 20 percent of the increase in female participation rates during the 1990s (Piras, 2004).

In Peru, Gill (1992) found the age profile of participation to show an inverse U-shape in 1990, with women entering the market later (due to childbirth and childbearing) and staying longer. Late departure may be caused by lower retirement benefits in jobs traditionally held by women, the pure income effect of lower lifetime savings of women relative to men, or the longer life spans of women (Gill, 1992).

**d) Civil status or/and headship and participation.-**

It is expected too, that being head of a family impacts the decision to participate in female market work. In developing countries, female headship is more frequent in

Latin America and the Caribbean and in sub-Saharan Africa in comparison to Asia and the Near East; among the factors fostering the rise of female-headed households in large cities in Latin American countries are the creation of households headed by migrant women[22], marital disruption and increases in unpartnered[23] adolescent fertility (Buviníc and Rao Gupta, 1997). In Brazil, separated and widowed women (often household heads) are more likely than married women to be in the labor force, while single women are more likely than married women to participate in market work (Evans and Saraiva, 1993).

In Peru, Gill (1992) found that married and cohabiting women have a labor force participation rate of about 33 percent compared to a rate of 47 percent for single women; other things being equal, married and cohabiting men are more likely to be working in the market than single men. Gill also found that being head of the household significantly increases the likelihood of being a labor market participant for both men and women.

**e) Education and Participation**

The achievements in schooling in Latin American women in the past decades have been very impressive and are sure to impact their participation in the labor market. Duryea, Edwards and Ureta (2004) found that the increases in female schooling accounted for 30 percent of the overall increase in female participation rates during the 1990s. In a study made for Brazil, Evans and Saraiva (1993) found that labor force participation rises with each level of education, although the increases are largest at the

[22] Similarly, Sandra Rosenhouse (1994) relates the higher concentration of female-headed household in urban areas to the high rates of female urban migration in Latin American countries, especially in the case of urban Peru.
[23] Single, separated, divorced or widowed.

higher levels. An interesting remark in this study is the noted difference with the process of development in Western Europe and the United States, where the availability and consumption of time-saving appliances and goods that facilitate housework are specially relevant for married women that plan either to participate in market work or increase their number of working hours (Coen-Pirani, León and Lugauer, 2010)[24] . Instead, in Latin American countries, the availability of low-cost services from workers such as maids, washer-ladies, gardeners, etc. represent an important factor for more educated women that plan to join the labor market. Evans and Saravia (1993) observe that "throughout the country, more educated women have a tremendous incentive to work in the labor market and use part of their earnings to hire less educated women to do the housework".

For the case of Peru, the impact of education on participation differed according to the level of education and to the year of the survey studied. For 1985-86, Khandker (1992) found that for Peru as a whole (urban and rural areas together), the probability that a woman joins the wage market is about 10 percent higher if both men and women had vocational training and if they completed secondary school, the probability changed to 5 percent. However, women's participation increases more as women attain higher education and the gain was the highest if they attain post-secondary levels of education.

It should be noted that in spite of the increased level of education of women in the region, the challenges faced even by the most educated women are many. An example of these difficulties are highlighted by Pagés and Piras (2010) when examining the percentage of women presidents and chief executive officers (CEOs) in the largest 100

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[24] According to the authors' estimates, household appliances account for a large portion of the observed increase in participation by married women during the 1960s.

companies in Latin America today: women are presidents or CEOs in only 3 percent of the top 100 companies in Argentina, Colombia, and Mexico; while for Ecuador and Peru the figure is lower (2 percent) and even lower for Brazil (1 per cent).

## III. Methodology

We use a simple probit model to analyze the probability of labor force participation for both men and women. The probit model is defined as: $P(Y=1| X) = \Phi(B' X)$, where $\Phi( )$ is the standard normal cumulative distribution function and vector X gathers information about the characteristics that influence the decision to participate in the labor market. The set of parameters B' reflect the impact of changes in X on the probability of participation[25]. Participation in the labor market depends on the household status (being head or not of the household), marital status, the 'need' for income, measured by the income earned by the rest of the family members, the number of children under six years, the total number of members in the household, age and education. Thus, the model takes the form:

- $Y_i = b_{0i} + b_{1i}\, HEAD_i + b_{2i}\, MARRIED_i + b_{3i}\, OTHINC_i + b_{4i}\, CHILD06_i + b_{5i}\, TOTMEM_i + b_{6i}\, AGE1_i + b_{7i}\, AGE2_i + b_{8i}\, AGE3_i + b_{9i}\, AGE4_i + b_{10i}\, AGE5_i + b_{11i}\, PRIMARY_i + SECTECHb_{12i} + b_{13i}\, TECH_i + b_{43i} COLLEGE + u_i$ ;

[25] It is important to note that the parameters of the model, like those of any nonlinear regression model are not the direct marginal effects. To get the marginal effect on the binary dependent variable we need to estimate: $\partial(\Phi(B'X)/\partial X = f(B'X)B$, where f(.) is the density function that correspond to the cumulative distribution ($\Phi$). Given that these effects vary with the values of X, in interpreting the estimated model, it is useful to calculate them at the means of the regressors and, when necessary, other pertinent values. The computation of the derivatives in this way is useful when the variable is continuous, but for dummy variables, we analyze the effect on the whole distribution by computing Prob(Y=1) over the range of B'X (using the sample estimates) and with the two values of the binary variable (Greene, 1993). This procedure is followed in our study.

Where Yi corresponds to a binary variable that takes the value of 1 if the ith individual participate in the labor market and 0 when not[26]; HEAD is a dummy variable that takes the value of 1 if the individual is head of the household, 0 if not; MARRIED is a dummy variable that takes the value of 1 if the person is married or living with a person by common law, and 0 if single, separated or widowed; OTHINC is the total income (from wages in primary and secondary jobs) received by the rest of the family (calculated by household income – individual's income); CHILD06 is the total number of children under six years of age in the household; TOTMEM is the total number of members in the household; AGE1 is a dummy variable that takes the value of 1 for a range of age between 20 and 29, and 0 for other age; AGE2 takes the value of 1 is range is between 30 and 39, 0 if not; AGE3 takes the value of 1 if range is between 40 and 49, 0 if not; AGE4 takes the value of 1 if the range is between 50 and 59, 0 if not; AGE5 takes the value of 1 if the person has an age of 60 or more, 0 if not; PRIMARY is a binary variable that takes the value of 1 if the person has primary education, 0 otherwise; SECTECH takes the value of 1 if the person has technical secondary school, 0 otherwise; TECH takes the value of 1 if the person has tertiary but not university education, 0 otherwise; and COLLEGE takes the value of 1 if the person has university education, 0 otherwise. Our control group for age variables is the youngest cohort of age (between 10 and 19) and the control group for education variables is the secondary level of education, or what the survey refers as secondary common (instead of secondary technical).

The probit model is applied to our samples of men and women, separately. We expect the signs of the coefficients to be as follows:

[26] A person participates in the labor market when reporting at least one hour worked during the reference week of the survey.

HEAD: (+), for both cases, men and women under the assumption that an individual who heads a household is more likely to work for pay to support the family.

MARRIED: (-) for the case of women and (+) for the case of men. Married women are expected to have a lower probability of participation than unmarried women, because of their traditional role in the family (childbearing and household production). The opposite situation is expected for men.

OTHINC: (-) for the cases of both, women and men. Family income, coming from the spouse or other relatives living in the household measures the 'need for income' in the family and is expected to have a negative impact on participation.

CHILD06: (-) for the case of women and (+) for the case of men. The larger the number of children a woman has to take care of, the lower her probability of participation. The opposite situation is expected for men.

TOTMEM: The sign on the coefficient for this variable may be positive or negative for women. On one hand, a larger household may have a positive impact on participation because of the greater demand for income or because the presence of non-working adults who can provide childcare. On the other hand, the size of the household may raise women's activities at home and lower their probability of participation in the labor market. For the case of men, a positive sign is expected.

PRIMARY, SECTECH, TECH and COLLEGE: (+) for both men and women. The assumption is that the more educated an individual is, the higher his/her probability of participation.

The signs of the coefficients for the AGE variables are not clear a priori, and they will define an age-profile of participation for both men and women. In general, we might

expect younger individuals to have lower probability to work, for study reasons, but the economic situation might encourage them to enter earlier. In the case of married women, it might happen that they decide to 'wait' till their children go to school to enter the market, increasing the probability of entry at an adult age.

## IV. Econometric Results: Analysis of the Probit Models

Tables 1A-1C report the results of the probit estimation of the work participation functions for women and men, summarizing the effects of some key variables on their decision to participate in the labor market. The parameters of the models reported in those tables however, are not the marginal effects, as they vary with the values of the regressors, but their signs and statistical significance give us valuable information on the direction of the effect of the variables on labor force participation. Tables 2A-2C report the estimated marginal effects on the probability of work for both groups and for all the survey years.

**Table 1A: Probit Estimates for labor Force Participation 1985**

| | Women | | Men | |
|---|---|---|---|---|
| Variables | Coefficient | P>\|z\| | Coefficient | P>\|z\| |
| Constant | -0.7608 | 0.000 | -0.4222 | 0.000 |
| Head | 0.4662 | 0.000 | 0.3253 | 0.000 |
| Married | -0.0339 | 0.554 | 0.4364 | 0.000 |
| Other Family Income | -0.0000 | 0.265 | 0.0000 | 0.733 |
| N of children under 6 | 0.0109 | 0.661 | 0.0285 | 0.332 |
| N of family members | 0.0060 | 0.370 | -0.0076 | 0.336 |
| Age 20-29 | 0.7604 | 0.000 | 0.9111 | 0.000 |
| Age 30-39 | 1.0796 | 0.000 | 1.2055 | 0.000 |
| Age 40-49 | 1.0363 | 0.000 | 1.0168 | 0.000 |
| Age 50-59 | 0.5677 | 0.000 | 0.9137 | 0.000 |
| Age 60 and more | 0.2313 | 0.058 | 0.3405 | 0.008 |
| Primary level | 0.1243 | 0.007 | 0.0864 | 0.109 |
| Secondary Technical | -0.1781 | 0.060 | 0.1594 | 0.141 |
| Tertiary technical* | 0.0836 | 0.385 | 0.2165 | 0.073 |
| College | -0.0673 | 0.326 | -0.1512 | 0.022 |
| Sample size | 4,634 | | 4,646 | |
| Log Likelihood | -2926.31 | | -2257.63 | |
| Wald Chi2 (14df) | 528.78 | | 1102.30 | |
| Probability > Chi2 | 0.0000 | | 0.0000 | |

* but not university.

**Table 1B: Probit Estimates for labor Force Participation 1994**

| | Women | | Men | |
|---|---|---|---|---|
| Variables | Coefficient | P>\|z\| | Coefficient | P>\|z\| |
| Constant | --0.9525 | 0.000 | -0.7990 | 0.000 |
| Head | 0.4986 | 0.000 | 0.3173 | 0.001 |
| Married | -0.2170 | 0.000 | 0.5622 | 0.000 |
| Other Family Income | -0.0003 | 0.044 | -0.000 | 0.853 |
| N of children under 6 | -0.0999 | 0.002 | 0.0780 | 0.038 |
| N of family members | -0.0085 | 0.339 | 0.0095 | 0.381 |
| Age 20-29 | 0.9211 | 0.000 | 1.1727 | 0.000 |
| Age 30-39 | 1.3194 | 0.000 | 1.4678 | 0.000 |
| Age 40-49 | 1.2736 | 0.000 | 1.4039 | 0.000 |
| Age 50-59 | 0.7234 | 0.000 | 0.9440 | 0.000 |
| Age 60 and more | 0.2173 | 0.104 | 0.2853 | 0.037 |
| Primary level | 0.1408 | 0.010 | -0.3299 | 0.621 |
| Secondary Technical | 0.3765 | 0.036 | 0.3901 | 0.079 |
| Tertiary technical* | 0.2436 | 0.001 | 0.0066 | 0.946 |
| College | 0.2471 | 0.000 | -0.2879 | 0.000 |
| Sample size | 4,020 | | 4,646 | |
| Log Likelihood | -2369.90 | | -2257.63 | |
| Wald Chi2 (14df) | 596.92 | | 1102.30 | |
| Probability > Chi2 | 0.0000 | | 0.0000 | |

* but not university.

**Table 1C: Probit Estimates for labor Force Participation 2000**

| | Women | | Men | |
|---|---|---|---|---|
| Variables | Coefficient | P>\|z\| | Coefficient | P>\|z\| |
| Constant | -0.7266 | 0.317 | -0.7229 | 0.000 |
| Head | 0.0827 | 0.000 | 0.2826 | 0.002 |
| Married | -0.3160 | 0.000 | 0.5270 | 0.000 |
| Other Family Income | -0.0003 | 0.000 | -0.0002 | 0.021 |
| N of children under 6 | 0.0138 | 0.665 | 0.0934 | 0.030 |
| N of family members | -0.0148 | 0.081 | 0.0101 | 0.315 |
| Age 20-29 | 1.0360 | 0.000 | 1.2127 | 0.000 |
| Age 30-39 | 1.3199 | 0.000 | 1.6096 | 0.000 |
| Age 40-49 | 1.3762 | 0.000 | 1.5040 | 0.000 |
| Age 50-59 | 1.0810 | 0.000 | 1.0003 | 0.000 |
| Age 60 and more | 0.6687 | 0.000 | 0.4912 | 0.000 |
| Primary level | -0.0595 | 0.202 | -0.1648 | 0.003 |
| Secondary Technical | 0.1233 | 0.704 | 0.0298 | 0.928 |
| Tertiary technical* | 0.2365 | 0.000 | -0.0924 | 0.252 |
| College | 0.1836 | 0.003 | -0.2918 | 0.000 |
| Sample size | 4,964 | | 4,653 | |
| Log Likelihood | -3017.53 | | -2135.23 | |
| Wald Chi2 (14df) | 747.47 | | 1449.45 | |
| Probability > Chi2 | 0.0000 | | 0.0000 | |

* but not university.

**Table 2A: Partial Derivatives and Slope Parameters for the Probit Model 1985**

| Variables | Women | Men |
|---|---|---|
| Head | 0.1829 | 0.1071 |
| Married | -0.0135 | 0.1436 |
| Other Family Income | -0.0000 | 0.0000 |
| Number of children under 6 | 0.0043 | 0.0095 |
| Number of family members | 0.0024 | -0.0026 |
| Age 20-29 | 0.2948 | 0.2587 |
| Age 30-39 | 0.3984 | 0.2966 |
| Age 40-49 | 0.3776 | 0.2513 |
| Age 50-59 | 0.2206 | 0.2280 |
| Age 60 and more | 0.0920 | 0.1023 |
| Primary level | 0.0495 | 0.0286 |
| Secondary technical | -0.0701 | 0.0509 |
| Tertiary technical* | 0.0333 | 0.0679 |
| College level | -0.0267 | -0.0521 |

* But not university.

Continuous variables: Other Family Income, N of children under 6, N of family members; the rest of variables are dummy variables.

**Table 2B: Partial Derivatives and Slope Parameters for the Probit Model 1994**

| Variables | Women | Men |
|---|---|---|
| Head | 0.1961 | 0.1094 |
| Married | -0.0824 | 0.1939 |
| Other Family Income | -0.0000 | -0.0000 |
| Number of children under 6 | -0.0381 | 0.0273 |
| Number of family members | -0.0032 | 0.0033 |
| Age 20-29 | 0.3536 | 0.3331 |
| Age 30-39 | 0.4882 | 0.3612 |
| Age 40-49 | 0.4701 | 0.3303 |
| Age 50-59 | 0.2824 | 0.2526 |
| Age 60 and more | 0.0848 | 0.0927 |
| Primary level | 0.0542 | -0.0116 |
| Secondary technical | 0.1483 | 0.1215 |
| Tertiary technical* | 0.0950 | 0.0023 |
| College level | 0.0962 | -0.1051 |

* But not university.

Continuous variables: Other Family Income, N of children under 6, N of family members; the rest of variables are dummy variables.

**Table 2C: Partial Derivatives and Slope Parameters for the Probit Model 2000**

| Variables | Women | Men |
|---|---|---|
| Head | 0.0328 | 0.0978 |
| Married | -0.1237 | 0.1822 |
| Other Family Income | -0.0001 | -0.000 |
| Number of children under 6 | 0.0054 | 0.0329 |
| Number of family members | -0.0058 | 0.0036 |
| Age 20-29 | 0.3932 | 0.3389 |
| Age 30-39 | 0.4771 | 0.3823 |
| Age 40-49 | 0.4861 | 0.3513 |
| Age 50-59 | 0.3976 | 0.2657 |
| Age 60 and more | 0.2591 | 0.1508 |
| Primary level | -0.0234 | -0.0593 |
| Secondary technical | 0.0489 | 0.0104 |
| Tertiary technical* | 0.0939 | -0.0332 |
| College level | 0.0729 | -0.1075 |

* But not university.

Continuous variables: Other Family Income, N of children under 6, N of family members; the rest of variables are dummy variables.

Our results can be summarized as following:

1. For all the survey years, being head of the household is positively correlated with the probability of participation and is statistically significant for both men and women. However, being head of a household has a higher impact for women than for men, especially after the labor reforms. In 1994, for women, being head of a household increases their probability of participation by 0.20 while for men it does so by 0.11. The economic context in 1994 seems to encourage women that are heads of households to look for a job in the labor market. These results agree with recent findings for most Latin American countries, where being head of a household was

found to be one of the strongest determinants of female labor force participation[27].

2. Married women are less likely to work than those who are single, widowed, or separated, as being married reduces the probability to participate in market work for 1994 and 2000. We found a different situation for the case of men, where being married increases their probability of participation by 0.14 in 1985, by 0.19 in 1994 and by 0.18 in 2000. This situation reinforces findings of previous studies for the case of Peru (Garavito, 1997, Gárate and Ferrer, 1995 and Felices, 1996), and refers to a situation where marriage allows female specialization in household production rather than in the market. Interesting, however, is the fact that being married was found not to be a significant variable in 1985 but had a significant and negative effect on participation after the reforms of 1990s.

3. Income earned by the rest of the family members was not significant for both men and women at the 5% level in 1985, but after the reforms it was a significant variable representing a negative effect on female participation. Again in 2000 it was found to be significant for women and having a negative impact representing the fact that higher income of the rest of the family decreases the probability of participation.

4. The presence of children under six years of age, measured by the number of children of that age in the household, was found to be statistically significant only in the case of women and men for 1994 (after the reforms), decreasing the probability of participation by 0.04 for each child in the case of women and increasing participation in the case of men (by 0.03). This result suggests that, especially for women, the

[27] /. Psacharopoulos and Tzannatos (1992) found this situation in the cases of Colombia, Panama, Uruguay, Venezuela and Guatemala.

presence of dependent children inhibited their participation in the labor market during those years, although that variable became insignificant in explaining participation in 2000. The descriptive statistics show that after the reforms, women seem to have fewer kids.

5. The total number of members in the household does not affect participation of men or women. The coefficients were statistically insignificant for most of the survey years.

6. The age profile of participation is an inverted U-shape for both men and women, but is more curved for women than more men. For women, the probability of participation is high between the ages of 30 to 39 years and 40 to 49 years, while men report a more stable probability of participation for these same age ranges. These results suggest that adult women have a higher probability of entering the labor market compared with young women, as our reference group of age was the youngest one. This delay in participation might be related to pregnancy or to expectations for higher education and training or related to a context of economic crisis, where women 'wait' to get a proper job according to their qualifications. Education characteristics for working women analyzed in the previous chapter support this last proposition. An interesting result when examining participation probabilities by age for women is the dramatic increase in the participation of young women after the reforms. Labor reforms in the 1990s, especially the ones related to the reduction of firing costs and the increased use of temporary contracts could help explain the increase in young female employment (as male workers show on average more years of work experience than female workers, the layoffs could have concentrated in the group of older male workers (Saavedra and Torero, 2000).

The variables referring to the levels of education showed mixed results and in some cases, unexpected signs. College levels of education were found to be significant in the case of women increasing their probability of participation in 1994 and 2000, suggesting that education is a more important variable for women affecting their decision to enter the labor force. For men however, higher level of education seems to be a negative impact on participation. The high impact found for the tertiary or superior technical education in the case of women agree with a situation increasingly common in urban Peru, where women are more likely than men to seek education in academies and technical institutes.

## V. Conclusions and Policy Implications

- For 1985-2000, being head of the household was found to be an important variable affecting labor participation for women and men, but stronger for women after the labor reforms of 1990s in Peru. The discussion initiated in the 1990s (Rosenhouse, 1994; Buviníc and Rao Gupta, 1997; Galdelman, 2008) about the importance or usefulness of "headship" in understanding the impact of anti-poverty programs or policies affecting the labor markets in Latin America is reinforced by these findings from the Peruvian case.
- Legislation should help lower the cost of child care, as it has been found that the presence of young children in a household impact participation rates negatively, especially for women. Reducing the burden of care and domestic work at home for women should be a necessary step, as should be the promotion of flexibility at the workplace to accommodate a better work-life balance for families and business (Pagés and Piras, 2010).

- Adult women have a higher probability of entering the labor market compared with young women during 1985-2000, and this situation is accentuated especially after the labor reforms of the 1990 most likely due to the reduction of firing costs and the increased use of temporary contracts that helps to explain the increase in young female employment.
- In general, this study finds that family structure does matter for female labor force participation and should be taken seriously in any attempt to change the vulnerable situation of female workers in Latin America and in Peru in particular.

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# Chapter IV

## RETURNS OF PUBLIC AND PRIVATE EDUCATION BY LEVELS IN PERU1985-2000

### Introduction

The difference between private education and public education is important in Latin America. Wolff and de Moura (2005) reported that on average for the region, private institutions accounted for 26 percent of preschool enrollment, 16 percent of primary enrollment, 25 percent of secondary enrollment, and 36 percent of higher education enrollment. The fact that private enrollment increases with the level of education seems to reflect the fact that parents do not view primary education as critical to entering more selective higher education institutions, while the perceived stagnant or low governmental support of higher education is linked to lower quality of educational services provided by public higher institutions and a related increased demand for private alternatives at that level. Another explanation can be that public schools set increasingly worse with the level.

Policy discussion about improving the quality of education in Latin America, and in Peru in particular, usually involves an assessment of the differences in the quality of educational services provided by private versus public schools at all levels of education. In some studies (e.g. a study of the United Kingdom by Wright, 1999), the assumption of a higher quality of education provided by private institutions compared to public ones enables the comparison of earnings returns of persons attending those schools to indirectly evaluate the effect of school quality.

Even though it seems to be commonly accepted that in Latin America, on average, the quality of the education provided by the private sector is better than the one provided by the public system, for the case of Peru, empirical studies have not provided enough quantitative support for this claim (Calónico and Ñopo, 2007). Most of the studies made for Peru (Rodríguez, 1993; Yamada, 2006) report the returns to years of education or levels of education (if primary, secondary, tertiary technical and university) but do not provide information about the returns in terms of the type of school attended (private, public or religious). Those studies found that investing in education in Peru has high private profitability, with primary education reporting the highest return (Rodríguez, 1993) while tertiary non-university (or technical) education shows returns that are lower. This goes in accordance to the findings of Psacharopoulos and Patrinos (2002), who find that middle income countries report private average rates of return very high for primary levels.

The few studies that have explored the differences in the private or public provision of educational services (Saavedra and Maruyama (1999), Calónico and Ñopo, 2007) indicate that the greatest private-public differences in returns to schooling are found at the primary and secondary levels. Moreover, an interesting suggestion from Calónico and Ñopo (2007) is related to the differences in returns by birth cohorts; private-public differences have been increasing for younger generations, while older cohorts do not show significant private-public differences in returns to schooling.

My goal in this third essay is to estimate the impact on earnings by different paths of education, for persons that completed public and private schools (or institutions) for their primary, secondary (common and technical) and tertiary education (technical and

college education) for the years 1985-2000 for urban Peru. The choice of urban areas only for this study relates to the fact that of the country's 27,400 public primary schools at the end the 1990s, 4,400 are in urban areas, and only 500 of its 5,600 secondary schools serve rural areas (Navarro, 2005). The estimation of linear wage equations will be used for that purpose, controlling for several individual and socioeconomic characteristics, and for individuals' occupations.

The results from the estimation of our models show that the impact of having attended public school is very significant for all the years of our survey, resulting in a negative premium on earnings in the order of 19%, 39% and 14%, for 1985, 1994 and 2000, respectively. The average returns for education (as measured in years of schooling was found to be around 10% for all the survey years, while the impact by level of education on earnings was found to be increasing as the level of education goes from primary to tertiary. For 2000, a key finding is the negative effect of having attendance at a public institution of education has on earnings, with the exception of college education (that showed no statistical significance in our results). The effect is however higher at the secondary level of education than at the primary level, with a substantial negative premium over earnings (-31%) although this figure decreases to -26% when controlling for occupation.

# I. The Peruvian Education System in the Latin American Context

## 1. History of Public School Systems in Latin America

Latin American public school systems were developed during the second half of the nineteenth century under the guidance of the educational philosophy of cultural liberalism where an oligarchic state (that had basic control of the ownership of the land) was considered the main agent in charge of education. After the experience of the oligarchy, new models of government included state interventionism inspired by the experience of welfare states from industrialized societies, despite the lack of several conditions that set them apart from the original models. These included the lack of unemployment insurance and welfare benefits (Torres and Puiggrós, 1997). During the first decades of the twentieth century, countries in the region granted public education systems a major role in the integration and modernization of Latin America and mass schooling was seen as necessary to build responsible citizenship and to increase social mobility.

During the early phase of the industrialization in Latin America in the 1960s, school enrollment in the region showed the highest rate of growth in the world (Torres and Puiggrós, 1997). However, differences in school enrollment increased and educational expenditures declined in relation to GNP in several countries in the region. In the late sixties, when educational systems faced an explosion of demand at all levels, there was a serious lag in curricular content in relation to the cultural, scientific and technological advances that were occurring worldwide, and a lack of training for work and political preparation of citizens. With the exception of Mexico and to a lesser extent

Venezuela and Brazil, countries did not carry out the reforms necessary to respond to such demands. Most of the systems accentuated their problems and in the late eighties it was public knowledge that quality of education was not appropriate to meet the social demands (Torres and Puiggrós, 1997).

Another important feature of the school system in Latin America that goes hand by hand with the reported problems of school quality is the traditional emphasis given to the completion of the first grade of primary education as the gate for further progress in school. In spite of timely enrollment too many students are enrolled in first grade, and most of them are repeaters; in the period 1980-87 close to two age cohorts were enrolled in first grade and the average age of the first grade student was higher than it should be (Schielfelbein, 1997). Given the large age variance, students (and teachers) find it more difficult to follow the age-specific curriculum, intensifying the problem of grade repetition in Latin America. Several problems have traditionally been associated with high repetition ; these include low self-esteem of students, reduced teacher efficiency due to age-heterogeneity, inequity in educational outcomes, and wastage of public resources allocated to education (Schiefelbein, 1997).

An historical feature of the school system in Latin America that has been mainly absent in the literature, is its association with corruption at the public level. Many countries of the region emerged from repressive military regimes or authoritarian governments during the past two decades, where the state was powerful and intrusive. It is believed (Arnove, 1997) that in authoritarian regimes, school systems are more likely to be used as instruments of the government; even in democratic regimes, state bureaucracies at all levels of government (from the federal to municipal) are often

characterized by corruption. Often, public office is considered entitlement to personal enrichment, and this system of 'special treatment or preference' leads to incompetent and unnecessary personnel being hired. Needed funds and equipment may never reach schools and school children, unless they reside in areas with the greatest political influence (Arnove, 1997). Therefore, at the least there are reasons to suspect that corruption problems might have also historically been related to the crisis in school quality in Latin America.

Even though the public sector is dominant in almost all countries in Latin America, it is very important to note that the public sector is far from homogeneous both in terms of enrollment and in terms of quality of education. In certain countries, the existence of private institutions of higher education is extremely low (Cuba, Uruguay) while in others (Brazil, Colombia) the private sector is dominant in terms of enrollments. In countries like Peru and Mexico, the public sector is clearly dominant in terms of enrollment, but private higher education has developed partly in response to problems of politics and quality in the public sector; here private institutions have a disproportionate share of high quality instructional programs (Winkler, 1990). In terms of quality, the heterogeneity is also big. In Brazil, for example, private institutions arose between the period of 1960 and 1980 as the result of policies of promotion, not to compensate for lower quality in the public sector. As a result, the public institutions of Brazil and Colombia remain the most prestigious in those countries; high quality private institutions exist there, but unlike Peru and Mexico, private institutions have a disproportionate share of low quality instructional programs (Winkler, 1990).

## 2. The Peruvian Education System

Compared to most countries of Latin America, the Peruvian education system reports one the highest enrollment ratios at all levels of education (primary, secondary and tertiary). According to the Ministry of Education in Peru, by 1999, 96.9 percent of children aged 6 and 11 were attending school, as were 85.9 percent of children between 12 and 16, and 62.3 percent of those aged less than five years old (MINED 2001). These results have led to the conclusion that Peru has already achieved a mass education system of nearly developed-country standards in terms of coverage, with quite high completion rates at the primary and secondary levels[28] (The World Bank, 2006).

However, the differences within the country, between urban and rural areas, are striking, of the country's 27,400 public primary schools, 4,400 are in urban areas; on the other hand, only 500 of its 5,600 secondary schools serve rural areas (Navarro, 1995).

The problem of low quality of education in Peru has received more attention in the past years, due to more evidence than ever of crisis in the school system. Peru produces a large number of high school graduates or college graduates, but this go hand in hand with a decline in the quality of education or skills actually achieved by those graduates. As proxied by learning levels measured by international assessments such as the Programme for International Student Assessment (PISA), the quality of education has

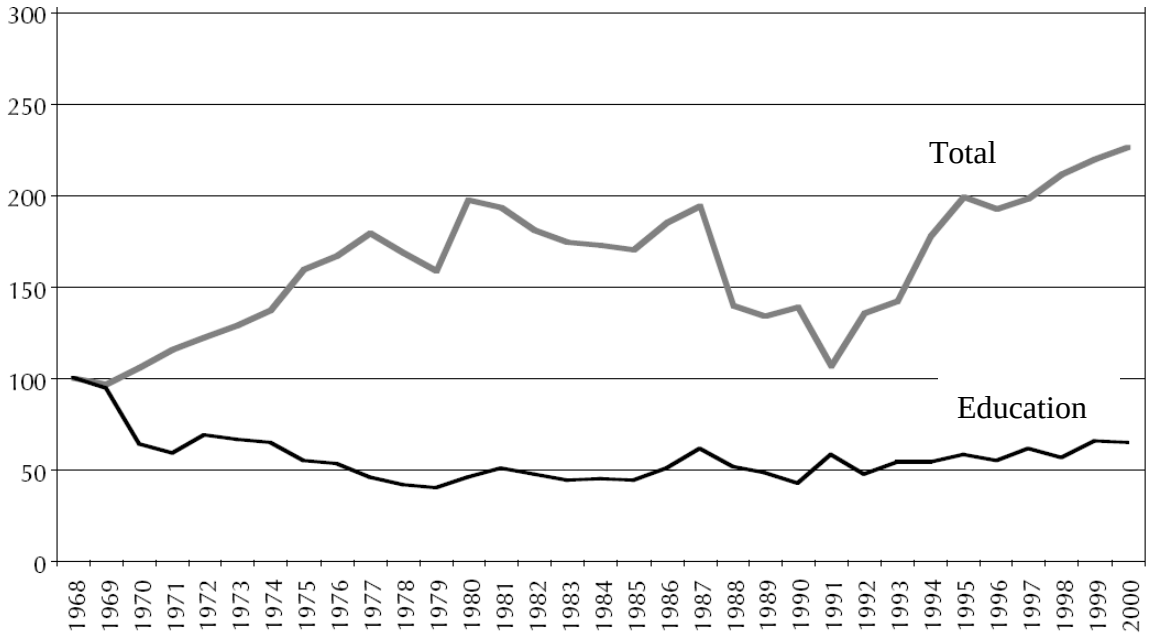
[28] It should be pointed out that the enrollment figures traditionally reported in educational statistics do not include private short term "cram" courses designed to prepare students for universities' entrance exams (called cursinhos in Brazil and academias in Peru), which are expanding throughout the region (Wolff, 2001).

not been impressive. Peru scored 327 in the combined reading scale in PISA while the other of Latin America countries scored 411 on average (The World Bank, 2006).

Several explanations have been discussed in relationship to the low quality of education in Peru. On the supply side there are problems of infrastructure, classroom facilities and teaching materials, curricular design and application, and quality of teaching staff. In 1997, 20 percent of public school teachers had never taken education courses; in rural areas, only 50% of schools were staffed with university-educated teachers (The World Bank, 2006). A trend that is usually associated with the lower quality of schooling in Peru is the performance of public spending in the education sector as can be observed in Figure 1:

**Figure 1[29]: Public Spending on Education**

**Real Nuevos Soles**



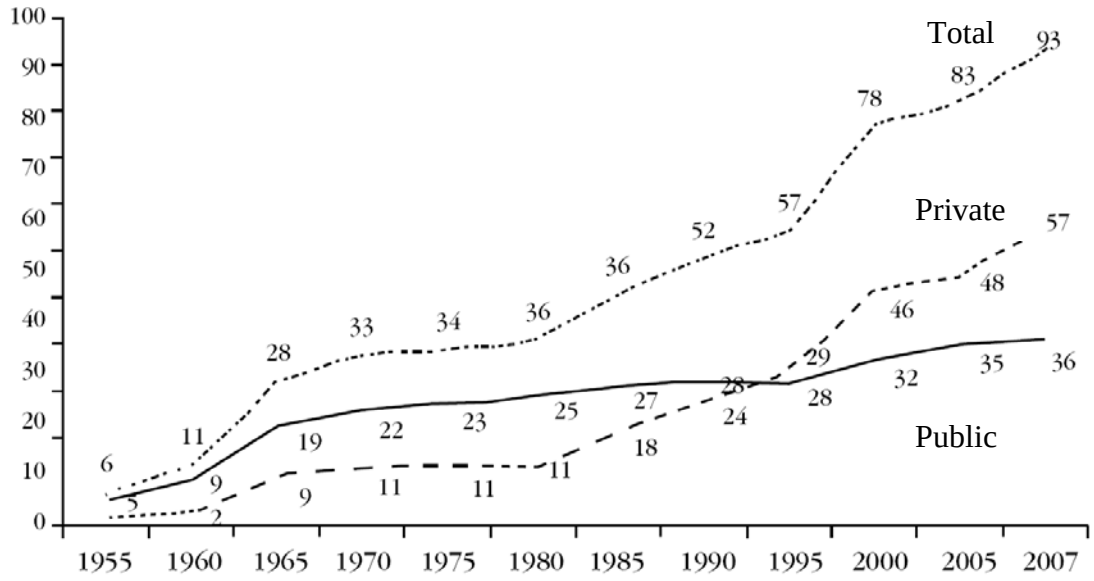

[29] The light line shows real total spending of the government while the darker line represents real spending in education (the source of this figure is Guadalupe, 2002).

Years

On the demand side, problems related to absenteeism, dropout, repetition and late advancement to the next grade have been pointed out (Reimers, 1991; Guadalupe, 2002). Also in reference to management, it has been said that the decision-making is overly centralized in the responsible ministries and management is split between Ministry of Education in Lima and the Ministry of the Presidency in the municipalities, and this division adds to the inefficiency of the educational system. The result is that there is no accountability at either sector, ministry, municipal or individual school level (Navarro, 1995). We should remember that in Peru, the organization and functioning of public schools is governed by regulations drawn up by the Ministry of Education (MINED) which sets the study program and assessment criteria, prescribes the degree of parental involvement and establishes the organizational structure and staffing levels based on the number of pupils. In general, there is no accreditation system in place to measure the performance of public and private schools system.

In terms of reforms, during the years of our study, the main reform in the education sector was related to the tertiary level of education. The legislative decree 882 under the 'Law of the Promotion of Investment in Education' in 1996 allowed universities in Peru to act like profit-seeking firms. This reform accelerated the creation of private colleges and institutions of tertiary studies throughout the country, as can be seen in Figure 2, the total number of universities (the line above) increased sharply, as well as the number of private ones (line in between). The growth in public universities was not that impressive (Díaz, 2008).

**Figure 2: Number of Universities in Peru, 1955-2007**




## II. Data Characteristics

This study uses the micro-level data from the Living Standard Measurement Study (LSMS) surveys of 1985, 1994, and 2000 for Peru[30]. The former two surveys were conducted by the World Bank and the Instituto *Cuánto S.A.*, a Peruvian research group, while the survey of 2000 was designed and conducted entirely by *Cuánto S.A* and its questionnaire is very similar to that used in prior survey years. Regarding the educational variables, the surveys asks individuals to report the type of school-private, public or religious- they attended for each level of education completed: primary, secondary, technical superior studies or college. In case the person attended both private and public

[30] The surveys in Peru (in Spanish) are referred as 'Encuestas Nacionales de Hogares Sobre Medición de Vida' or ENNIVs.

school for the same level, the survey collects the type of school the individual attended most of the time.

In 1985-86, the LSMS covered 4,913 households, 55% in urban and 45% in rural areas; in 1994, the LSMS covered 3,623 households; 62% in urban areas and 38% in rural areas, while in 2000 the LSMS covered 3,000 households; 66% in urban areas and 34% in rural areas. Our analysis uses information for men and women, between the age of 21 and 65 who are employed (reporting at least an hour worked during the week of the survey) and reside in urban areas[31].

Table 1 presents some basic descriptive statistics of the working sample regarding type of employment, income, years of education, gender, and some family charateristics. We observe the average age in our sample is around 37 years for the three survey years, and that the proportions of females and males have not varied much during the period of study. The proportion of married individuals in our sample however, decreased by three percentage points due mainly to the increase in the divorce rate among women; Table 1.B reports the same variables for the female sample. The proportion of married women declined from 62% in 1985 to 54% in 1994, and to 56% in 2000. In the male sample however (Table 1.C), the proportion of married individuals remained relatively stable at around 72-73%. These figures indicate that civil status might have affected the changes in returns to schooling during 1985 and 1994, so it is a variable we will control for during our analysis. The figures for educational achievement show that the Peruvian labor force became more educated from 1985 to 2000, following the trend initiated in the 1960s in

[31] Urban areas are defined as those cities and towns with 2,000 or more inhabitants according to Census information.

the country; the average years of formal schooling in 2000 was 11 years, a figure higher than in most Latin American countries.

**Table 1.A: Means and Standard Deviation of Sample Variables, 1985-2000**

| Variables | Mean | Std Dev | Mean | Std Dev | Mean | Std Dev |
|---|---|---|---|---|---|---|
| | 1985 | | 1994 | | 2000 | |
| Age | 37.69 | 11.68 | 37.79 | 11.47 | 38.13 | 11.48 |
| Head | 0.46 | 0.50 | 0.45 | 0.50 | 0.40 | 0.49 |
| Female | 0.43 | 0.49 | 0.41 | 0.49 | 0.43 | 0.50 |
| Married | 0.68 | 0.47 | 0.65 | 0.48 | 0.65 | 0.48 |
| Single | 0.23 | 0.42 | 0.24 | 0.43 | 0.25 | 0.44 |
| Divorced | 0.00 | 0.07 | 0.01 | 0.07 | 0.00 | 0.06 |
| Migrant | 0.46 | 0.50 | 0.37 | 0.48 | 0.38 | 0.49 |
| Years of education | 9.96 | 4.02 | 11.00 | 4.02 | 11.08 | 4.13 |
| Total members in HH | 6.29 | 2.98 | 6.02 | 2.50 | 5.78 | 2.36 |
| Total children in HH | 3.14 | 2.10 | 2.95 | 1.84 | 2.73 | 1.63 |
| Wage* | 338.79 | 870.28 | 104.91 | 127.30 | 158.66 | 206.28 |
| Hours worked | 43.26 | 21.91 | 47.35 | 21.13 | 48.22 | 22.23 |
| White Collar | 0.42 | 0.49 | 0.59 | 0.49 | 0.56 | 0.50 |
| Blue Collar | 0.53 | 0.50 | 0.40 | 0.49 | 0.40 | 0.49 |

*Source: LSMS, Peru 1985; LSMS, Peru 1994, and LSMS, Peru 2000.*
** current Nuevos Soles*

An important change from 1985 to 2000 refers to the increasing importance of white-collar jobs and the decline, of blue-collar jobs. This change that goes hand in hand with the increase in the supply of education in the country. A look at the desaggregated tables by gender (Table1.B and Table 1.C) tells us that this increase happened especially for female workers, since the proportion of females working in white-collar jobs increased from 49% in 1985 to 68% in 2000. For male workers, there was an impressive decline in blue-collar jobs of 11 percentage points during the same period of time. The

variables that show an increasing trend for both females and males during 1985 and 2000 are the proportion of migrant workers[32], and total hours worked per week.

**Table 1.B: Means and Standard Deviation of Female Sample Variables, 1985-2000**

| | 1985 | | 1994 | | 2000 | |
|---|---|---|---|---|---|---|
| Variables | Mean | Std Dev | Mean | Std Dev | Mean | Std Dev |
| Age | 37.39 | 11.37 | 36.99 | 10.95 | 37.54 | 11.24 |
| Head | 0.15 | 0.35 | 0.16 | 0.37 | 0.13 | 0.33 |
| Married | 0.62 | 0.48 | 0.54 | 0.50 | 0.56 | 0.50 |
| Single | 0.20 | 0.40 | 0.27 | 0.45 | 0.27 | 0.44 |
| Divorced | 0.01 | 0.09 | 0.01 | 0.09 | 0.01 | 0.07 |
| Migrant | 0.46 | 0.50 | 0.36 | 0.48 | 0.38 | 0.49 |
| Years of education | 9.29 | 4.09 | 10.87 | 4.22 | 10.80 | 4.51 |
| Total members in HH | 6.35 | 2.99 | 5.95 | 2.50 | 5.70 | 2.35 |
| Total children in HH | 3.19 | 2.11 | 2.94 | 1.85 | 2.71 | 1.63 |
| Wage* | 214.31 | 290.18 | 74.62 | 90.37 | 118.53 | 143.08 |
| Hours worked | 35.26 | 22.51 | 41.15 | 21.14 | 41.30 | 22.30 |
| White Collar | 0.49 | 0.50 | 0.72 | 0.45 | 0.68 | 0.47 |
| Blue Collar | 0.38 | 0.49 | 0.22 | 0.42 | 0.22 | 0.42 |

*Source: LSMS, Peru 1985; LSMS, Peru 1994, and LSMS, Peru 2000.*
** Nuevos Soles*

It has been argued that in the case of Peru (Saavedra and Maruyama, 1999), the socioeconomic *status* of the families might have a big impact on the returns to schooling, since its correlation with the average years of education achieved can be very strong. In that sense, its omission in the equation of returns to education can produce an upward bias. A good indicator for the status of a family can be found in the education of parents, however, in our survey years, only the LSMS of 1985 contains this information. In its place, we use the condition of having migrated from the rural areas to the city.

[32] Workers that were born in rural areas but moved to the city. Unfortunately the survey do not report the number of years that they have been living away from home.

**Table 1.C: Means and Standard Deviation of Male Sample Variables, 1985-2000**

| | 1985 | | 1994 | | 2000 | |
|---|---|---|---|---|---|---|
| Variables | Mean | Std Dev | Mean | Std Dev | Mean | Std Dev |
| Age | 37.92 | 11.90 | 38.36 | 11.80 | 38.58 | 11.64 |
| Head | 0.69 | 0.46 | 0.65 | 0.48 | 0.60 | 0.49 |
| Married | 0.72 | 0.45 | 0.73 | 0.44 | 0.71 | 0.45 |
| Single | 0.25 | 0.43 | 0.23 | 0.42 | 0.24 | 0.43 |
| Divorced | 0.00 | 0.05 | 0.00 | 0.06 | 0.00 | 0.06 |
| Migrant | 0.46 | 0.50 | 0.37 | 0.48 | 0.38 | 0.49 |
| Years of education | 10.42 | 3.90 | 11.09 | 3.89 | 11.29 | 3.81 |
| Total members in HH | 6.25 | 2.97 | 6.07 | 2.50 | 5.83 | 2.36 |
| Total children in HH | 3.11 | 2.09 | 2.97 | 1.83 | 2.75 | 1.63 |
| Wage* | 411.60 | 1066.30 | 123.97 | 142.58 | 185.99 | 236.12 |
| Hours worked | 49.25 | 19.40 | 51.69 | 20.01 | 53.43 | 20.71 |
| White Collar | 0.39 | 0.49 | 0.51 | 0.50 | 0.49 | 0.50 |
| Blue Collar | 0.61 | 0.49 | 0.49 | 0.50 | 0.50 | 0.50 |

*Source: LSMS, Peru 1985; LSMS, Peru 1994, and LSMS, Peru 2000.*
** Nuevos Soles*

Table 2.A presents a more detailed look at educational achievement by level of education (primary school, secondary common and technical, superior studies in technological institutes and in colleges) and it also reports the proportion of individuals whose parents have received formal education (at any level). As expected given the dramatic increase in the number of schools in the urban areas and the increase in average school enrollment for the Peruvian population, the proportion of workers reporting no education has decreased during the period of study, although for female workers (see Table 2.B) despite decreasing from 9% to 5% in 1994, in 2000 the proportion is still around five percentage points. For male workers however, the proportion of individuals reporting no education in 2000 was 1%.

**Table 2. A: Educational Variables, 1985-2000**

| | 1985 | | 1994 | | 2000 | |
|---|---|---|---|---|---|---|
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std Dev. |
| No Education | 0.05 | 0.21 | 0.01 | 0.10 | 0.02 | 0.14 |
| Primary | 0.34 | 0.48 | 0.22 | 0.41 | 0.19 | 0.40 |
| Secondary Common | 0.37 | 0.48 | 0.45 | 0.50 | 0.44 | 0.50 |
| Secondary Technical | 0.06 | 0.23 | 0.01 | 0.12 | 0.00 | 0.07 |
| Tertiary Technical | 0.06 | 0.24 | 0.11 | 0.31 | 0.15 | 0.36 |
| College | 0.16 | 0.37 | 0.21 | 0.41 | 0.18 | 0.39 |
| Private education | 0.14 | 0.34 | 0.08 | 0.28 | - | - |
| Public education | 0.86 | 0.34 | 0.92 | 0.28 | - | - |
| Father went to school | 0.83 | 0.37 | - | - | - | - |
| Mother went to school | 0.61 | 0.49 | - | - | - | - |

*Source: LSMS, Peru 1985; LSMS, Peru 1994, and LSMS, Peru 2000.*

We observe that the proportion of workers with secondary education (common) increases from 1985 to 2000, from 37% to 44%; and superior education in technical institutions became more important representing 15% in 2000; college education increased as well, showing the biggest increase during 1985 and 1994 (from 16% to 21%). It is interesting to note that in 1985, the proportion of workers whose father attended school was quite high (83%), while their mothers attended school in 61% of the cases; by 1985 then, the difference between the educational achievement by gender for older generations seems to be stronger than the one found for the younger generations in our samples of workers. A look at these figures dissagregated by gender however, shows that 58% of the mothers of female workers attended school , while for males this figure is 63%; 82% of the fathers of female workers attended school and for males it was 84% .

Regarding the attendance at private versus public schools, we observe in Table 2.A that an important proportion of workers (females and males) attended public schools

during the years of our study. Table 2.B shows the distribution of education by type of school attended and by gender, although unfortunately, only the survey for 2000 let us distinguish between attendance at public and private schools by level of education. We observe that public education is dominant for males, and increased from 87% to 92% in 1994; for female workers too, the presence of public education is also important and 88% of female workers attend public school in 1994, and the attendance in private institutions of education represented 12% in that year (8% only for male workers).

An important development in the level of tertirary education has been the increase in the presence of technological instutions. In 1985, while 6% of our female sample attended these institutes, in 1994 13% did. As in other parts of the developing world, the opening of opportunities in non traditional technical carreers might have helped this result.

**Table 2.B: Educational Variables for Female Sample 1985-2000**

| | 1985 | | | | 1994 | | | | 2000 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Female | | Male | | Female | | Male | | Female | | Male | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Education | 0.09 | 0.29 | 0.01 | 0.11 | 0.06 | 0.23 | 0.01 | 0.10 | 0.04 | 0.19 | 0.01 | 0.07 |
| Primary | 0.41 | 0.49 | 0.30 | 0.46 | 0.27 | 0.45 | 0.22 | 0.41 | 0.22 | 0.41 | 0.18 | 0.38 |
| Secondary Common | 0.34 | 0.47 | 0.38 | 0.49 | 0.37 | 0.48 | 0.45 | 0.50 | 0.38 | 0.49 | 0.48 | 0.50 |
| Secondary Technical | 0.05 | 0.22 | 0.06 | 0.24 | 0.02 | 0.12 | 0.01 | 0.12 | 0.00 | 0.06 | 0.01 | 0.08 |
| Tertiary Technical | 0.06 | 0.23 | 0.06 | 0.24 | 0.13 | 0.34 | 0.11 | 0.31 | 0.17 | 0.38 | 0.14 | 0.35 |
| College | 0.12 | 0.33 | 0.19 | 0.39 | 0.20 | 0.40 | 0.21 | 0.41 | 0.17 | 0.38 | 0.19 | 0.39 |
| Private education | 0.15 | 0.36 | 0.13 | 0.34 | 0.12 | 0.33 | 0.08 | 0.28 | - | - | - | - |
| Public education | 0.85 | 0.36 | 0.87 | 0.34 | 0.88 | 0.33 | 0.92 | 0.28 | - | - | - | - |
| Father went to school | 0.82 | 0.39 | 0.84 | 0.36 | - | - | - | - | - | - | - | - |
| Mother went to school | 0.58 | 0.49 | 0.63 | 0.48 | - | - | - | - | - | - | - | - |

*Source: LSMS, Peru 1985; LSMS, Peru 1994, and LSMS, Peru 2000.*

**Table 3.A: Public and Private Education in 2000**

| | Mean | Std.Dev. |
|---|---|---|
| Attended Primary Level in Public School | 0.93 | 0.25 |
| Attended Primary Level in Private School | 0.06 | 0.24 |
| Attended Secondary Level in Public School | 0.91 | 0.29 |
| Attended Secondary Level in Private School | 0.08 | 0.28 |
| Attended Tertiary Level in Public Institution | 0.64 | 0.48 |
| Attended Tertiary Level in Private Institution | 0.36 | 0.48 |

*Source: LSMS, Peru 2000.*

Table 3.A reports attendance by type of school and by level of education, disaggregated by gender in 2000. We observe that at the primary and secondary levels, public school attendance is dominant both for female and male workers, but is slightly lower for female than for males. The difference in terms of type of school attended happens mainly at the tertiary level of education, where 40% of female workers attended private institutions and 32% of male workers did. This is not surprising given the findings of previous studies done for Peru (McLauchlan, 1994; Calónico and Ñopo, 2007 ), that highlight the increasing number of students who decide to attend public primary and secondary schools, but switch to a private provider at the tertiary level. The increased attendance at technical institutions of tertiary education in the period of study, as seen in Table 2.B, also explains this result, older generations used to attend public schools for primary and secondary levels, and then chose public colleges for superior studies, younger generations seem to choose another path (Calónico and Ñopo, 2007).

**Table 3. B: Public and Private Education for Females and Males in 2000**

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. |
| Attended Primary Level in Public School | 0.93 | 0.26 | 0.93 | 0.25 |
| Attended Primary Level in Private School | 0.07 | 0.25 | 0.06 | 0.24 |
| Attended Secondary Level in Public School | 0.90 | 0.30 | 0.92 | 0.28 |
| Attended Secondary Level in Private School | 0.09 | 0.29 | 0.08 | 0.27 |
| Attended Tertiary Level in Public Institution | 0.60 | 0.49 | 0.68 | 0.47 |
| Attended Tertiary Level in Private Institution | 0.40 | 0.49 | 0.32 | 0.47 |

*Source: LSMS, Peru 2000.*

Tables 4.A-4.C show the distribution of levels of education within occupations for our whole sample for the years 1985, 1994 and 2000. In line with our discussion before about the increasing importance of technical tertiary education, we can observe the increase in its importance for professional and managerial occupations that demand a more educated labor. In 2000, a rather surprising figure is the high proportion of workers with tertiary education in occupations that traditionally employ workers with secondary or primary education (sales and services, non-agricultural workers). The high rates of unemployment for educated workers might be behind this result, as well as the change in the service sectors that included more sophisticated fields and activities.

**Table 4. A: Occupations and Educational Levels, 1985**

| | Professional | | Managerial | | Administrative | | Sales | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.25 |
| Primary | 0.02 | 0.15 | 0.06 | 0.24 | 0.06 | 0.25 | 0.43 | 0.49 |
| Secondary Common | 0.17 | 0.38 | 0.25 | 0.43 | 0.53 | 0.50 | 0.39 | 0.49 |
| Secondary | 0.03 | 0.18 | 0.06 | 0.23 | 0.07 | 0.26 | 0.04 | 0.20 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Technical | | | | | | | | |
| Tech Tertiary | 0.20 | 0.40 | 0.08 | 0.27 | 0.09 | 0.29 | 0.04 | 0.18 |
| University | 0.58 | 0.49 | 0.56 | 0.50 | 0.24 | 0.43 | 0.10 | 0.30 |

| | Services | | Agric. Workers | | Non-Agric.Workers | |
|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.04 | 0.19 | 0.13 | 0.34 | 0.03 | 0.16 |
| Primary | 0.44 | 0.50 | 0.60 | 0.49 | 0.40 | 0.49 |
| Secondary Common | 0.37 | 0.48 | 0.26 | 0.44 | 0.44 | 0.50 |
| Secondary Technical | 0.07 | 0.25 | 0.04 | 0.19 | 0.08 | 0.26 |
| Technical Tertiary | 0.03 | 0.17 | 0.02 | 0.15 | 0.04 | 0.19 |
| Technical University | 0.07 | 0.26 | 0.06 | 0.23 | 0.05 | 0.21 |

*Source: LSMS, Peru 1985.*

**Table 4. B: Occupations and Educational Levels, 1994**

| | Professional | | Managerial | | Administrative | | Sales | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.21 |
| Primary | 0.01 | 0.12 | 0.00 | 0.00 | 0.04 | 0.20 | 0.34 | 0.47 |
| Secondary Common | 0.16 | 0.37 | 0.19 | 0.40 | 0.49 | 0.50 | 0.42 | 0.49 |
| Secondary Technical | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.14 |
| Technical Tertiary | 0.20 | 0.40 | 0.10 | 0.30 | 0.21 | 0.41 | 0.10 | 0.30 |
| Technical University | 0.61 | 0.49 | 0.71 | 0.46 | 0.25 | 0.43 | 0.11 | 0.31 |

| | Services | | Agric. Workers | | Non-Agric.Workers | |
|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.06 | 0.24 | 0.10 | 0.31 | 0.01 | 0.10 |
| Primary | 0.32 | 0.47 | 0.46 | 0.50 | 0.28 | 0.45 |
| Secondary Common | 0.49 | 0.50 | 0.41 | 0.49 | 0.54 | 0.50 |
| Secondary Technical | 0.01 | 0.11 | 0.03 | 0.16 | 0.02 | 0.13 |
| Technical Tertiary | 0.09 | 0.28 | 0.05 | 0.22 | 0.07 | 0.26 |
| Technical University | 0.08 | 0.28 | 0.04 | 0.19 | 0.08 | 0.27 |

*Source: LSMS, Peru 1994.*

**Table 4. C: Occupations and Educational Levels, 2000**

| | Professional | | Managerial | | Administrative | | Sales | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.18 |
| Primary | 0.01 | 0.10 | 0.04 | 0.19 | 0.03 | 0.16 | 0.30 | 0.46 |
| Secondary Common | 0.14 | 0.35 | 0.30 | 0.46 | 0.39 | 0.49 | 0.51 | 0.50 |
| Secondary Technical | 0.00 | 0.06 | 0.00 | 0.00 | 0.01 | 0.09 | 0.00 | 0.06 |
| Technical Tertiary | 0.29 | 0.46 | 0.25 | 0.43 | 0.31 | 0.47 | 0.10 | 0.30 |
| Technical University | 0.54 | 0.50 | 0.37 | 0.48 | 0.25 | 0.44 | 0.05 | 0.23 |

| | Services | | Agric. Workers | | Non-Agric.Workers | |
|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| No Education | 0.03 | 0.17 | 0.05 | 0.22 | 0.01 | 0.11 |
| Primary | 0.24 | 0.43 | 0.41 | 0.49 | 0.21 | 0.41 |
| Secondary Common | 0.49 | 0.50 | 0.45 | 0.50 | 0.59 | 0.49 |
| Secondary Technical | 0.01 | 0.08 | 0.00 | 0.00 | 0.01 | 0.08 |
| Technical Tertiary | 0.11 | 0.31 | 0.06 | 0.24 | 0.12 | 0.32 |
| Technical University | 0.11 | 0.31 | 0.02 | 0.16 | 0.07 | 0.26 |

*Source: LSMS, Peru 2000.*

An interesting result regarding type of employment and educational attainment, relates to the distribution of educational levels in the public or private sectors. As observed in Tables 5.A-5.C, there has been a decline in the proportion of workers with lower levels of education (primary and secondary) from 1985 to 2000, while the increase in tertiary education (both technical and university) has been important. The process of privatization that followed the government of president Fujimori and the attempts to reduce the bureaucracy during the 1990s, explain this result. In 2000, the proportion of

workers with secondary levels of education was much higher in the private sector ( 51%) than in the public sector (25%).

**Table 5. A Educational Attainment in the Public Sector, 1985-2000**

| | Public Sector | | | | | |
|---|---|---|---|---|---|---|
| | 1985 | | 1994 | | 2000 | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Education | 0.01 | 0.08 | 0.00 | 0.06 | 0.00 | 0.05 |
| Primary | 0.14 | 0.35 | 0.06 | 0.24 | 0.04 | 0.19 |
| Secondary Common | 0.34 | 0.48 | 0.25 | 0.44 | 0.25 | 0.43 |
| Secondary Technical | 0.06 | 0.24 | 0.01 | 0.08 | 0.01 | 0.07 |
| Tertiary Technical | 0.13 | 0.33 | 0.21 | 0.41 | 0.30 | 0.46 |
| College | 0.33 | 0.47 | 0.47 | 0.50 | 0.39 | 0.49 |

*Source: LSMS, Peru 1985, LSMS, Peru 1994, and LSMS, Peru 2000.*

**Table 5. B: Educational Attainment in the Private Sector, 1985-2000**

| | Private Sector | | | | | |
|---|---|---|---|---|---|---|
| | 1985 | | 1994 | | 2000 | |
| Variables | Mean | Std.Dev | Mean | Std.Dev | Mean | Std.Dev |
| No Education | 0.01 | 0.11 | 0.02 | 0.12 | 0.01 | 0.09 |
| Primary | 0.24 | 0.43 | 0.17 | 0.38 | 0.13 | 0.34 |
| Secondary Common | 0.46 | 0.50 | 0.48 | 0.50 | 0.51 | 0.50 |
| Secondary Technical | 0.07 | 0.25 | 0.01 | 0.10 | 0.01 | 0.08 |
| Tertiary Technical | 0.07 | 0.25 | 0.14 | 0.34 | 0.16 | 0.36 |
| College | 0.16 | 0.37 | 0.20 | 0.40 | 0.19 | 0.39 |

*Source: LSMS, Peru 1985, LSMS, Peru 1994, and LSMS, Peru 2000.*

## III. Methodology

The measurement of private returns to education in its most common form finds its foundation in the seminal work of Mincer (1974), more specifically in his human capital earnings function where the log of individual earnings is a linear function of education and labor market experience. The model recognizes the concavity of earnings with respect to market experience, including the term experience squared in its functional form:

(1) $Logy = a + bS + cX + dX^2 + e;$

where y represents earnings, S represents years of completed education, X represents the number of years the person has worked since finishing school (often replaced by "potential experience" as we did in our previous chapters), and e is a statistical residual.

The belief behind this model is that education affects earnings through its effect on labor productivity. The more education individuals acquire, the better they are able to absorb new information, acquire new skills, and familiarize themselves with new technologies. By increasing their human capital, workers enhance the productivity of their labor and of the other capital they use at work. However, despite the vast evidence of a positive and strong relationship between educational and increased productivity in the empirical literature, social scientists have been cautious to infer that in fact the higher earnings are caused by their higher education, or is it because individuals with greater ability have chosen to acquire more education. To 'untie' this knot, the empirical literature in labor economics and educational research offers various possibilities and methodologies (for a comprehensive review see Card, 1986 and Chiswick, 1997).

An important characteristic in equation (1) is that it represents the logarithm of earnings as a linear function of formal education attainment, so that each additional year of education (assuming S is measured in years of completed education) has the same proportional effect on earnings, holding constant the labor market experience. Assuming these conditions are satisfied, then the coefficient 'b' of the variable S in equation (1) represents the effect of education in the labor market, or the so called 'return to education', or as discussed in the Handbook of Labor Economics (Willis, 1986), 'b' would be the internal rate of return to the investment in education, assuming that education is free and that students do not have earnings during their time spent in school (Card, 1986).

This study adopts equation (1) as our basic model to measure returns to education in urban Peru, controlling for socioeconomic and family variables, as well as for occupations and estimated by Ordinary Least Squares (OLS). Apart from the estimation of equation (1) including variables of public versus private schooling:

(2) $Logy = a + bS + cX + dX^2 + PublicSchool + e;$

we estimate models where the educational variables are dummy variables that represent *the levels of education* completed by the individuals: primary level, secondary level and tertiary level of education relative to no education for all the survey years 1985, 1994 and year 2000. Apart from the control variables included in the estimation of (1), we explore the effect of having studied in public or private schools or educational institutions. Data available in the 2000 survey allow us to estimate the levels of education by type of school attended (either public or public); we can therefore measure the returns to having attended public school versus private school, at different levels of education.

In our study, the samples of workers are older than 21, and we assume they have completed most of their formal education. The control variables included in our models are individual characteristics ( civil status, age, gender), family background variables (individual being migrant or having been born in a rural area and migrated to the urban area) and for individuals' occupations.

The model as described below would take the following functional form:

(3) $\ln yi = \alpha_i + \beta_{1i}S_{1i} + \beta_{2i}S_{2i} + \beta_{3i}S_{3i} + \beta iXi + \varepsilon i$

where $S_1$ represents primary education ($S_1$=1 if person completed primary level of education), $S_2$ ($S_2$=2 if represents secondary education, either common or technical), and $S_3$ represents tertiary education ($S_3$=1 if person completed tertiary level of education either technical or university) . We note that this aggregation of tertiary education is not ideal since technical studies at the tertiary level differs from college education in terms of years of completion (roughly the difference is two years) as highlighted by Calónico and Ñopo (2007). The variables included in the vector of control variables (X) are found in our survey as following:

"Married" =1 if married or cohabitating, 0 otherwise,

"Migrant": =1 if born in a rural area and migrated to an urban area, 0 otherwise,

"Female": =1 if female, 0 otherwise,

"Exper": refers to labor market experience, proxied by potential labor experience, calculated as 'age - years of education - 6',

"Exper2= the square of variable "exper",

"Occupations"=seven types of occupations (professional, managerial, sales, services, administrative, agricultural and non-agricultural workers).

For the 2000 survey, the model of earnings includes the variables,

"Primpublic": =1 if attended primary level at a public school,

"Primprivate": =1 if attended primary level at a private school,

"Secpublic":= 1 if attended secondary level common or technical at a public school,

"Secprivate":= 1 if attended secondary level common or technical at a private school,

"Tertpublic": =1 if attended tertiary level, technical or college, at a public school, and

"Tertprivate": =1 if attended tertiary level, technical or college, at a public school.

## IV. Empirical Findings

The results of the first model (equation 1 in our methodological section) are summarized in Table 6. Despite its simplicity, it indicates the importance of differentiating between attending a public versus a private school (or institution) in terms of earnings for the years 1985, 1994 and 2000. By including a dummy variable in a linear wage equation, PUBLICEDU, where PUBLICEDU =1 if the person attended public schools at any level, primary, secondary or tertiary; and =0 if the person attended a private school (or institution) at any level), controlling for personal characteristics (married, gender, being head of household, and labor market experience), we observe some interesting results. For 1985, 1994 and 2000 attending public school (at any level of education) causes a reduction in their earnings on the order of 19%, 39% and 14%, respectively[33]. These results are a strong indication that differentiating among paths of education according to the nature of the provider of educational services (either public or

[33] We should be reminded that the impact of the coefficient for a dummy variable in a semi-log equation is interpreted as: $e^{ß} - 1$ where ß is the estimated coefficient for the dummy variable in the earning equation.

private), is of increasing importance in Peru and it is worthy of further analysis. We can also observe that the returns to years of education stayed basically stable at around 10% during the survey years, with a slight decrease between 1985 and 1994. In 2000, completing one more year of formal education in urban Peru increased earnings in 10.21%.

**Table 6: Estimates of Earnings Equation with the Inclusion of Public School Attendance, 1985-2000**

| | 1985 | | | 1994 | | | 2000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Coeff.** | **T** | **P>\|t\|** | **Coeff.** | **T** | **P>\|t\|** | **Coeff.** | **T** | **P>\|t\|** |
| Experience | 0.047 | 8.87 | 0.00 | 0.045 | 9.90 | 0.00 | 0.017 | 4.02 | 0.00 |
| Experience2 | -0.000 | -7.63 | 0.00 | -0.001 | -8.46 | 0.00 | -0.000 | -2.35 | 0.01 |
| Married | 0.063 | 1.75 | 0.07 | 0.050 | 1.54 | 0.12 | 0.071 | 2.33 | 0.01 |
| Female | -0.504 | -13.4 | 0.00 | -0.390 | -11.8 | 0.00 | -0.385 | -12.68 | 0.00 |
| Head | 0.229 | 5.63 | 0.00 | 0.195 | 5.36 | 0.00 | 0.150 | 4.46 | 0.00 |
| Years of Education | 0.096 | 20.35 | 0.00 | 0.084 | 19.92 | 0.00 | 0.102 | 23.81 | 0.00 |
| Public School (PUBLICEDU) | -0.188 | -4.25 | 0.00 | -0.391 | -8.08 | 0.00 | -0.142 | -3.35 | 0.00 |
| Constant | 3.971 | 40.90 | 0.000 | 3.192 | 34.52 | 0.000 | 3.336 | 46.39 | 0.00 |
| Size of Sample | 4,637 | | | 3,653 | | | | 4,521 | |
| F-value | 159.48 | | | 151.98 | | | | 150.53 | |
| Prob > F | 0.0001 | | | 0.0001 | | | | 0.0001 | |
| R-squared | 0.2309 | | | 0.2522 | | | | 0.2071 | |

The results for the estimation of equation (2) in our methodological section, including dummy variables for levels of education are reported in Table 7, for 1985 and 1994. A difference with the original model apart from the inclusion of levels of education

is the inclusion of the variable 'migrant' (as discussed in the methodological part). At first glance our results show the statistical significance of all our variables in the year 1985; however in 1994, being married, studying primary and secondary technical appear with no statistical significance. The signs on the coefficients, however, are as expected. On the other hand, the premium on earnings of being head of the household decreases from 1985 to 1994, and the condition of being a migrant worker decreases earnings for both survey years, with special importance in 1994 (15%).

Regarding the levels of education we can appreciate that in 1985 having studied at the primary and the secondary levels and completed technical and college studies had a positive strong impact on earnings. An interesting result is that as the level of education rises, the impact on earnings becomes stronger; having studied at highest level of education (university studies) represents almost an increase in 290% compared to 46% in the case of primary education. The premium for attending college is really impressive in Peru. We have to be very careful however, in the way we interpret these results, since those coefficients do not report an average increase in earnings given that we increase a year more of college studies or primary studies, because for that purpose the variables should be expressed as years of university studied or years of completed primary studied. The coefficient in this case gives us an indication of the premium of just having studied college or primary education versus not having studied at those levels at all. That is the reason why the percentage increases are so high, compared to for example the returns to years of education found in Table 6 (around 10%). In 1994, despite some of the educational levels showing no statistical significance, tertiary levels of studies were significant and important in their effects on earnings.

**Table 7: Estimation of the Earnings Equation with Levels of Education, 1985 and 1994**

| | 1985 | | | 1994 | | |
|---|---|---|---|---|---|---|
| | Coeff. | T | P>\|t\| | Coeff. | t | P>\|t\| |
| Experience | 0.04 | 8.24 | 0.00 | 0.04 | 9.47 | 0.00 |
| Experience$^2$ | 0.00 | -7.17 | 0.00 | 0.00 | -8.40 | 0.00 |
| Married | 0.08 | 2.14 | 0.00 | 0.06 | 1.71 | 0.09 |
| Head | 0.25 | 6.20 | 0.03 | 0.22 | 5.94 | 0.00 |
| Female | -0.49 | -12.84 | 0.00 | -0.36 | -10.78 | 0.00 |
| Primary | 0.38 | 2.16 | 0.00 | 0.03 | 0.19 | 0.85 |
| Seccom | 0.90 | 4.99 | 0.03 | 0.31 | 2.01 | 0.04 |
| Sectech | 0.89 | 4.71 | 0.00 | 0.12 | 0.63 | 0.53 |
| Technical | 1.24 | 6.58 | 0.00 | 0.63 | 4.00 | 0.00 |
| College | 1.36 | 7.40 | 0.00 | 0.91 | 5.83 | 0.00 |
| Migrant | -0.08 | -2.57 | 0.00 | -0.16 | -5.05 | 0.00 |
| Constant | 4.01 | 21.09 | 0.00 | 3.43 | 21.28 | 0.00 |
| Size of Sample | 4,637 | | | 3,653 | | |
| F-value | 95.66 | | | 84.63 | | |
| Prob>F | 0.0001 | | | 0.0001 | | |
| R-squared | 0.2195 | | | 0.224 | | |

For the survey year of 2000, our data allow us to distinguish whether an individual attended all the levels of education (without the distinction of technical however) at a public or private institution. The results of the estimation of the models of earnings with the inclusion of levels by type of education attended are shown in Table 8. We should note that the second model (B) controls for occupation, as described in our methodological section. The key finding of this estimation are the negative effects of attending public institutions of education on earnings, with the exception of college education (that showed no statistical significance in our results). The effect is however higher at the secondary level of education than the primary level, with a substantial

negative premium over earnings (-31%) although this figure decreases to -26% when controlling for occupations (model B). We should also note that when controlling for occupations, the variable of tertiary education recovers statistical significance and shows that in 2000, attending college in a public institution reported a negative impact on earning of the order of 10% versus having attended college at a private institution. An interesting result is that in this case, the impact is smaller than the one reported for lower levels of education, both primary and secondary.

**Table 8: Estimation of the Earnings Equation with Levels of Education, and by Type of School Attended, 2000**

| | Model A | | | Model B* | | |
|---|---|---|---|---|---|---|
| | Coeff. | T | P>\|t\| | Coeff. | t | P>\|t\| |
| Experience | 0.04 | 5.41 | 0.00 | 0.05 | 5.96 | 0.000 |
| Experience$^2$ | 0.00 | -4.97 | 0.00 | 0.00 | -5.26 | 0.000 |
| Married | 0.14 | 2.72 | 0.01 | 0.13 | 2.67 | 0.008 |
| Head | 0.25 | 4.30 | 0.00 | 0.20 | 3.55 | 0.000 |
| Female | -0.21 | -4.20 | 0.00 | -0.25 | -5.20 | 0.000 |
| Primary Public | -0.35 | -3.35 | 0.00 | -0.33 | -3.36 | 0.001 |
| Secondary Public | -0.37 | -3.64 | 0.00 | -0.31 | -3.21 | 0.001 |
| Tertiary Public | -0.01 | -0.32 | 0.75 | -0.10 | -2.18 | 0.029 |
| Constant | 5.22 | 64.09 | 0.00 | 4.90 | 53.92 | 0.000 |
| Size of Sample | 4,521 | | | 4,521 | | |
| F-value | 38.67 | | | 37.72 | | |
| Prob>F | 0.0001 | | | 0.0001 | | |
| R-squared | 0.1778 | | | 0.2712 | | |

** controlling for occupations.*

## V. Conclusions

Our study shows that the returns to formal education in a linear earnings model that includes the attendance to public or private institutions of education and that control for personal characteristics, was around 10% for the years of the survey. The inclusion of levels of education as dummy variables in our model resulted in the observation that the premium of attending college is really impressive in Peru. In 1985 having studied at the primary level, at the secondary level and having followed technical and colleges studies had a positive strong impact on earnings. An interesting result is that as the level of education rises, the impact on earnings becomes stronger; having studied at the highest level of education (university studies) represents almost an increase in 290% compared to 46% in the case of primary education.

For 2000, where our data allow the distinction between attending public or private institutions of education by level, a key finding is the negative effect that having attended public institutions of education have on earnings. The effect is however higher at the secondary level of education than for primary level, with a substantial negative premium over earnings (-31%) although this figure decreases to -26% when controlling for occupations. The variable of tertiary education, statistically significant when the model controls for occupations, shows that in 2000, attending college in a public institution reported a negative impact on earning of the order of 10% versus having attended college at a private institution. An interesting result is that in this case, the impact is smaller than the one reported for lower levels of education, both primary and secondary.

The question of causality however, remains uncovered since it is likely that, as Calónico and Ñopo (2007) point out:

> "...families who were able to send their children to a private primary and secondary school did so because their household's different economic situation. it is not unreasonable to expect as well that these families also invested more than other families in the human capital formation of their children, and not only in school. It is also expected that these families enjoyed better social networks, which allowed their children to find better jobs and hence achieve higher earnings"

We hope that in our study, the control for the condition of migrant worker helps in this direction.

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