Economic volatility and returns to education in Venezuela: 1992–2002

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Preliminary evidence suggests that the rates of return to education in Venezuela have been declining since the 1970s. This study rigorously estimates the returns to education in Venezuela for the period 1992 to 2002 and links them to earlier available estimates from the 1980s. Consistent cross-sections from the *Encuesta de Hogares por Muestro* are used to document falling returns to schooling and educational levels until the mid-1990s, followed by increasing returns thereafter. Quantile regression analysis is used to provide further insight into the within skill group changes in returns over time.

I. Introduction

Measures of inequality with respect to education and skills have changed, sometimes dramatically, over the last two decades. Increasing skill differentials have been clearly observed for the United States and, to a lesser extent, other developed countries such as Portugal, Denmark and Italy, while falling returns have been documented for Sweden, where returns declined considerably, particularly at the university level and more so for women (Palme and Wright, 1998), and, recently, Austria (see Asplund and Pereira, 1999; Harmon *et al.*, 2001; Fersterer and Winter-Ebmer, 2003; see Psacharopoulos and Patrinos, 2004 for a review of studies). Evidence for developing countries is scarce. One can hypothesize that significant developments in the returns to education and skills have taken place in the developing world, given the volatility in the evolution of incomes and poverty in many developing countries.

Venezuela experienced a significant increase in poverty incidence during the 1980s (especially during the recessionary period from 1982 to 1985). Poverty followed a decreasing trend until 1992, after a 3-year period of growth, bringing poverty incidence to pre-1985 levels. Post-1992 stagnant growth, however, resulted in poverty levels resuming an ascending path (Mosconi and Alvarez, 1996). During the 1990s, economic performance exhibited sharp fluctuations, with a year of strong growth usually followed by a sharp decline one or two years later. This pattern seems to be continuing into the next decade.

In Venezuela, while there has been a consistent increase in the overall level of schooling of the labour force since the mid-1970s, the returns to schooling have decreased over time, but in the last two years have started to increase again. This suggests that until recently the supply of human capital in the labour market has been expanding at a faster rate than has the demand for human capital, thereby lowering the rate of return to schooling. The results for Venezuela in the first two years of the new century are in line with what happened in other middle-income countries in Latin America in the 1990s – such as Mexico, Brazil and Chile (e.g., Lachler, 1998; Blom *et al.*, 2001) – where the returns to secondary and tertiary education increased over time, and where the overall rate of return to schooling also increased. It signals

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Table 1. Returns to schooling and average years of schooling by sex: 1975–2002

	Rate of return (%)			Average years of schooling		
	All	Men	Women (corrected for selectivity)	All	Men	Women
1975*	13.7	–	–	4.6	–	–
1984*	11.2	–	–	6.6	–	–
1987*	10.7	10.0	13.1	6.9	–	–
1989*	9.6	9.4	11.3	7.7	–	–
1992	8.8	8.4	11.9	8.0	7.6	8.7
1995	8.0	8.0	9.6	8.2	7.7	9.1
1996	7.6	7.4	10.1	8.4	7.9	9.4
1997	9.2	9.1	11.7	8.3	7.8	9.3
1998	9.0	9.2	10.5	8.7	8.0	9.9
1999	9.2	9.1	11.9	8.7	8.0	9.9
2000	8.0	7.9	9.4	8.7	8.0	9.9
2001	9.4	9.1	11.3	8.8	8.1	10.0
2002	10.4	9.9	12.7	8.9	8.3	10.1

Sources: * signifies estimates from Psacharopoulos and Alam (1991), Fiszbein and Psacharopoulos (1993), Psacharopoulos and Steier (1988), authors' estimates for 1992–2002.

that the demand for educated labour was not increasing in Venezuela in the 1990s, most likely due to the economic downturn, but that in the last two years education has become more profitable.

II. Data

The study uses consistent cross-sections from the *Encuesta de Hogares por Muestro* conducted by the National Statistical Office of Venezuela (OCEI). The data used are for survey years 1992, 1995, 1996, 1997, 1998, 1999 and 2000. The survey instrument for 1992 involved a shorter questionnaire compared with post-1992 questionnaires but a much larger sample (over 300 000 observations for 1992 compared to about 65 000 to 80 000 in later surveys).

The working sub-sample used in this study in deriving returns to an additional year of schooling and education levels, as well as returns by quantile, consists of workers aged 15 to 65, working for wages.

III. Results

Educational attainment in Venezuela, measured by the years of completed education of the selected sub-sample, has been increasing steadily from 4.6 years in 1975 to 8.2 years in the mid-1990s. Subsequently the increase has been rather slow and by the year 2002 it stood at 8.9 years (Table 1). Women complete more

years of education than men and this was the case for every year examined. In year 2002, women who were employed for wages in Venezuela completed, on average, 10.1 years of education compared with 8.3 years for men. Furthermore the education gap by sex seemed to be widening during the 1990s, increasing from about 1.1 years in 1992, to 1.5 in 1996 and to 1.8 in 2002.

In deriving returns to education, the earnings function method is used (Mincer, 1974), which involves the fitting of the equation in its simplest form as:

$$\ln Y_i = \alpha + \beta S_i + \gamma_1 EX_i + \gamma_2 EX^2 i + \gamma_3 Z_i + \varepsilon_i \quad (1)$$

where $\ln Y$ is the natural logarithm of monthly earnings, S is the number of years of schooling of individual i, EX and EX^2 are the years of experience and its square, and Z is a vector of control variables comprising compensatory factors. Pereira and Martins (2004a) use a meta-analysis and provide support for the use of the simple Mincerian function as opposed to an extended specification which includes covariates whose value can depend on education.

For purposes of comparison with other similar studies and earlier results for Venezuela, only one compensatory variable is used, namely the natural logarithm of monthly working hours. In this semi-log specification, the coefficient on $S(\beta)$ is interpreted as the private rate of return to one additional year of schooling, averaged across all levels of education and all individuals in the sample. For small values of β (say, 0.10 or less), applying the rule regarding natural logarithms results in values of the rate of return to
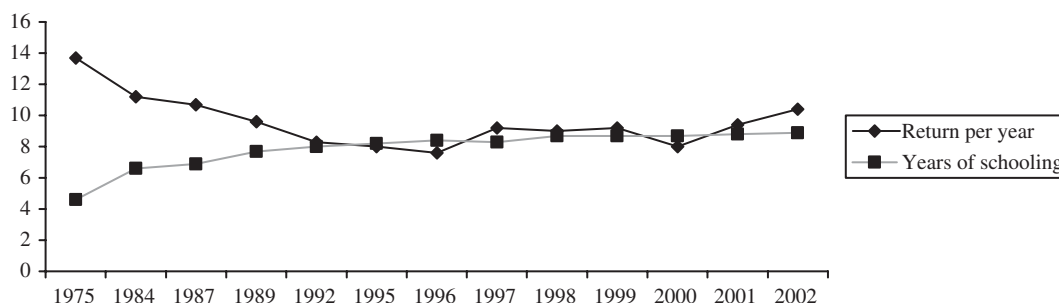
Fig. 1. Return to schooling and average years of schooling (All): 1975–2002

schooling within a fraction of 1% of the derived coefficient, β.

The earnings function method is also used to estimate returns to different levels of schooling, by converting the continuous years of schooling variable into a series of dummy variables representing the levels of schooling. After fitting the extended earnings function:

$$\ln Y_i = \alpha + \beta_1 PRIM_i + \beta_2 SEC_i + \beta_3 HIGHER$$
$$+ \beta_4 UNIV_i + \gamma_1 EX_i + \gamma_2 EX_i^2 + \gamma_3 Z_i + \varepsilon_i \quad (2)$$

where *PRIM*, *SEC*, *HIGHER* and *UNIV* refer to dummy variables for primary, secondary, higher and university education, from the formulas:

$$r_{(PRIM)} = \beta_1 / S_{PRIM} \quad (3)$$

$$r_{(SEC)} = (\beta_2 - \beta_1)/(S_{SEC} - S_{PRIM}) \quad (4)$$

$$r_{(HIGHER)} = (\beta_3 - \beta_2)/(S_{HIGHER} - S_{SEC}) \quad (5)$$

$$r_{(UNIV)} = (\beta_4 - \beta_2)/(S_{UNIV} - S_{SEC}) \quad (6)$$

where S_{PRIM}, S_{SEC}, S_{HIGHER} and S_{UNIV} are the total number of years of schooling for each successive level of education. However, it is incorrect to assume that primary school graduates forgo earnings for the entire duration of their studies. Therefore, only three years of forgone earnings for primary school graduates are assumed.

Mincerian earnings functions are estimated for men and women, and estimates with sample selection for women, using Heckman's two-step procedure, which involves an earnings equation (see Annex Table 1):

$$\ln Y_i = \mathbf{X}_i \boldsymbol{\beta}_i + \sigma_{\varepsilon vi} \lambda_i + \varepsilon_i \quad (7)$$

and a participation equation:

$$Ii = (\boldsymbol{\theta}'_i z_i + v_i > 0) \quad (8)$$

where λ_i is a vector of inverse Mills' ratios, with parameters derived from a probit model which models the determinants of labour market participation. $\mathbf{X}$ and $\mathbf{Z}$ are vectors of explanatory variables, $\boldsymbol{\beta}$ and $\boldsymbol{\theta}$ are vectors of coefficients, ε and v are the disturbance terms of the earnings and selection equations, and $\sigma_{\varepsilon vi}$ is the covariance of the two error terms. Female labour force participation in Venezuela has been steadily increasing during the 1990s, from about 50% in 1992 to 63.2% in 2002. The pattern of employment of women, with respect of sector of employment is similar to that of men.

The overall return to one additional years of schooling steadily declined in the 1970s, 1980s and through the mid-1990s (Table 1). The benefits decline from 13.7% in 1975 to 8% in 1995, and 7.6% in 1996. Since then, returns have exhibited an increasing trend, reaching 9.4% in 2001 and 10.4% in 2002. Returns for men are consistently lower than returns for women and the difference in returns has been between 1.3 (in 1998) and 3.0 (in 1992) percentage points.

Until the early 1990s, the returns to schooling were decreasing, while average years of schooling were increasing (Fig. 1). After that, both indicators exemplify apparent stability or stagnation. For the last two years returns to schooling increased, while years of schooling did not change. Declining returns over the last 25 years (except for last two years, which may be an aberration) may be a disincentive to schooling in Venezuela.

The changing shares of employment in the different sectors of the Venezuelan economy during the 1990s are shown in Table 2 (see also Fig. 2). Participation in the informal sector has been continuously increasing, mirrored by a continuous decrease in formal sector participation, and this is the case for both men and women.[1] During the same period, the share of wage

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[1] Pagan and Tijerina-Guajardo (2000) find that in Mexico, the relative employment share of the informal sector fell from 15% in 1987 to 10% in 1993.

and salary employees in the labour market shows a declining trend, while the share of the self-employed has been steadily increasing.

Returns to schooling estimated by sector (formal versus informal) are presented in Table 3 (see also Fig. 3). The returns in the formal and informal sectors over time follow the pattern of the overall returns, showing considerable decline. Returns in the informal sector exhibit less variability, ranging from only 5.7% to 7.3% during the whole ten year period. Returns in the formal sector are higher than returns

in the informal sector and the spread is increasing after 1996.

To complement the results on the returns to schooling, we look at education premiums by level and sex (see Appendix Table 2). The interest here is to document which levels are associated with falling earnings premiums over time and whether the developments are similar for both males and females. Since there is very little evidence of sample selection in Venezuela, rates of return to education by level were derived from OLS regressions.

Overall the results follow the trend observed in the results on returns to schooling (see Table 4). Primary and secondary premiums are relatively stable during the decade for both men and women, while university premiums are more volatile, exhibiting a falling trend from 1996 to 2000 and an increasing trend thereafter. Females, with few exceptions, enjoy higher education premiums compared to males for all education levels. Premiums for secondary education (compared to primary) are of comparable magnitude to primary premiums (compared to no education), with primary premiums being slightly higher than secondary premiums. University premiums (compared to secondary) for males mirror the developments in male returns to schooling. They declined from 0.62 in 1992

Table 2. Shares of sectors of employment: 1992–2002

	Formal	Informal	Employees	Self-employed
1992	65.3	34.7	71.4	19.9
1995	54.5	45.5	67.8	26.9
1996	54.9	45.1	67.3	27.6
1997	53.1	46.9	68.1	26.6
1998	51.1	48.9	64.9	29.5
1999	49.2	50.8	62.3	31.2
2000	48.0	52.0	60.5	33.1
2001	47.6	52.4	60.8	29.9
2002	46.0	54.0	62.4	29.3

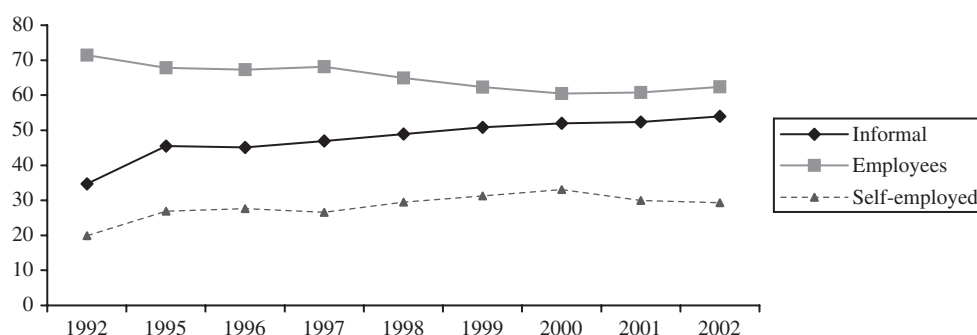*Source*: *Encuesta de Hogares por Muestro.*

Fig. 2.   Shares of employment for informal sector, employees and self-employed: 1992–2002

Table 3. Returns to schooling (Mincer Equations) by sector*: Formal vs. Informal, 1992–2002

	Formal			Informal		
	All	Men	Women	All	Men	Women
1992	8.8	8.9	9.7	6.5	5.8	8.2
1995	7.0	7.4	7.9	7.3	7.3	7.7
1996	7.1	7.1	8.9	6.9	7.2	7.5
1997	8.5	8.6	10.0	6.8	7.3	7.3
1998	9.1	9.3	10.7	7.0	7.9	6.8
1999	8.8	9.1	10.2	6.5	7.0	6.7
2000	7.0	7.2	7.9	5.7	6.3	5.7
2001	8.6	8.4	10.6	6.2	6.8	6.4
2002	9.7	9.4	11.7	6.7	7.4	6.6

Source: *Encuesta de Hogares por Muestro.*
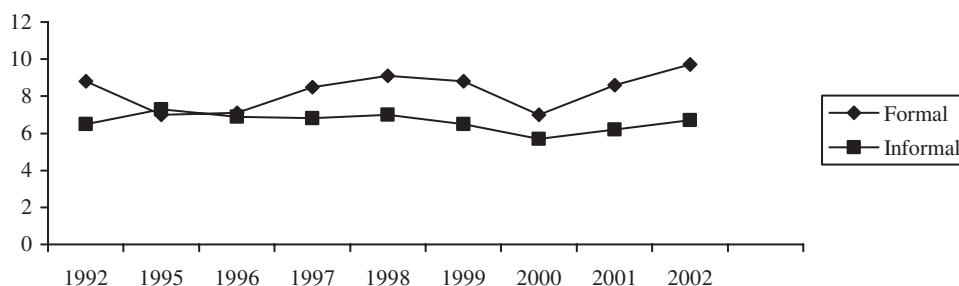*Note*:*All sectors of employment included in the sample.

Fig. 3.   Rates of return by sector (formal vs. informal): 1992–2002

Table 4. Implied private rate of return to education per year, by level (%): 1992–2000

	All	Males	Females
1992			
Primary (vs. none)	16	17	18
Secondary (vs. primary)	17	15	22
Higher (vs. secondary)	n/a	n/a	n/a
University (vs. secondary)	12	12	10
1995			
Primary (vs. none)	18	18	20
Secondary (vs. primary)	16	16	20
Higher (vs. secondary)	12	12	11
University (vs. secondary)	8	8	8
1996			
Primary (vs. none)	15	17	16
Secondary (vs. primary)	14	14	20
Higher (vs. secondary)	13	9	18
University (vs. secondary)	12	11	11
1997			
Primary (vs. none)	16	17	22
Secondary (vs. primary)	18	18	23
Higher (vs. secondary)	13	13	11
University (vs. secondary)	11	11	12
1998			
Primary (vs. none)	16	18	16
Secondary (vs. primary)	18	19	21
Higher (vs. secondary)	13	13	14
University (vs. secondary)	10	10	10
1999			
Primary (vs. none)	17	20	11
Secondary (vs. primary)	16	19	22
Higher (vs. secondary)	10	9	12
University (vs. secondary)	10	9	9
2000			
Primary (vs. none)	15	15	19
Secondary (vs. primary)	17	18	18
Higher (vs. secondary)	11	10	12
University (vs. secondary)	8	7	10
2001			
Primary (vs. none)	15	16	16
Secondary (vs. primary)	18	19	20
Higher (vs. secondary)	13	14	13
University (vs. secondary)	11	9	12
2002			
Primary (vs. none)	17	18	19
Secondary (vs. primary)	19	18	22
Higher (vs. secondary)	13	13	14
University (vs. secondary)	13	13	14

Source: *Encuesta de Hogares por Muestro.*

to 0.40 in 1995, rebounded in 1996, and subsequently declined for the 1997 to 2000 period, before increasing again in 2001 and 2002.

The reasons for the observed developments in returns to schooling and education premiums relate to changes in the supply of more educated workers which, depending on economic activity, may or may not be compensated by a corresponding demand for skills. During the 1990s, the Venezuelan economy was characterized by: (a) sharp fluctuations in economic activity; (b) volatile but, overall, decreasing real incomes; and (c) a steady increase in poverty. During the same period, a lack of opportunities in the formal sector resulted in an increasing number of workers moving into the informal sector, where returns to education are low and poverty is endemic.

Returns to schooling and real wages

There is a close association between real wages and returns to schooling in Venezuela (Fig. 4). It suggests that the overall return to schooling has been shaped by the effects of economic volatility on the demand and supply of skills. Furthermore, it seems that the real wage is leading the developments in the rate of return to schooling. Based on this relationship, one would predict that the rate of return may dip following the increases in years 2001 and 2002, given that growth has been negative in recent years.

The relationship between the real wage and returns to schooling suggests the danger of a vicious cycle; lack of sustained dynamism in the economy leads to depressed earnings, falling profitability of investing in education (especially primary), and reduced incentive to send children to school (especially given the high incidence of poverty). At the same time reduced opportunities in the formal sector of the economy result in those without skills ending up in the informal sector, where wages are low and poverty incidence is high, with significant intergenerational problems.
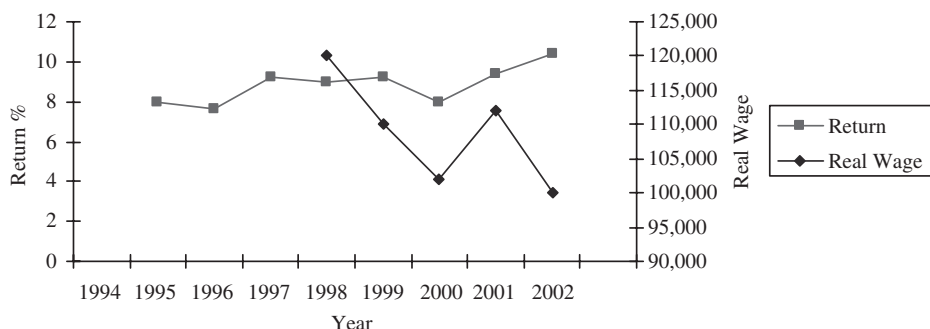
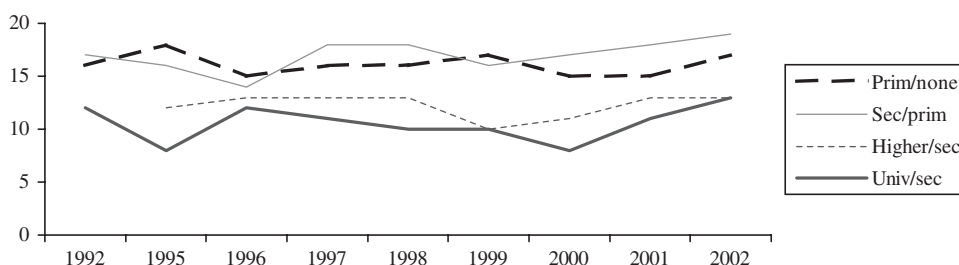**Fig. 4.** **Returns to schooling and real wage (*bolivares*) in Venezuela: 1994–2002**

Fig. 5. **Internal rate of return by education level: 1992–2002**

Returns to education in Venezuela during the 1990s were driven by the returns to tertiary education (see Fig. 5), which fluctuate sharply with the level of economic activity. On the other hand, returns to primary and secondary education have been relatively stable at 15–20%. In such an environment, one would expect that many children from poor families would be dropping out of primary and secondary school, while children from wealthier families would complete secondary education so that they enter university which provides better prospects (a steeper age-earnings profile). There is, however, emerging evidence that demand for educated labour is on the increase in Venezuela. Returns to tertiary education (and to some extent, secondary) have been on the increase at the turn of the century. These developments are in line with what was happening in the 1990s in other middle-income Latin American counties – such as Argentina, Brazil and Mexico (e.g., Lachler, 1998; Blom *et al.*, 2001; Fiszbein *et al.*, 2004) – where the returns to secondary and tertiary education have been increasing, along with the overall return to schooling.

Quantile regressions

The ordinary least squares (OLS) regression relies on the mean of the conditional distribution of the dependent variable. When it is suspected that various exogenous variables influence parameters of the conditional distribution of the dependent variable other than the mean, quantile regressions are particularly useful, because they allow the full characterization of the conditional distribution of the dependent variable, rather than the conditional mean only. In short, the quantile regressions method allows an investigator to differentiate the contribution of regressors along the distribution of the dependent variable. In particular, the estimation of returns to education entails much more than the fact that, on average, one more year of education results in a certain percentage increase in earnings.

The quantile regression model (Buchinsky, 1994) can be outlined as:

$$\ln w_i = X_i\beta_\theta + u_{\theta I}$$
$$X_i\beta_\theta = (\text{Quantile})_\theta(\ln w_i|X_i)$$

(9)

where X_i is a vector of exogenous variables; β_θ is the vector of parameters; $(\text{Quantile})_\theta(\ln w_i|X_i)$ is the θth conditional quantile of $\ln w$ given X, with $0 < \theta < 1$. The θth quantile is derived by solving the problem (using linear programming):

$$\min_{\beta \in R^k} \sum_i \rho_\theta(\ln w_i - X_i\beta_\theta)$$

(10)

where $\rho_\theta(\varepsilon)$ is the check function defined as $\rho_\theta(\varepsilon) = \theta\varepsilon$ if $\varepsilon \geq 0$, and $\rho_\theta(\varepsilon) = (\theta - 1)\varepsilon$ if $\varepsilon < 0$. Standard errors

are bootstrap standard errors. The median regression is obtained by setting $\theta = 0.5$ and similarly for other quantiles. As θ is varied from 0 to 1, the entire distribution of the dependent variable, conditional on X, is traced.

The quantile approach has a number of useful features, in addition to allowing the full characterization of the conditional distribution of the dependent variable, such as: (a) the linear programming representation of the quantile regression model makes estimation easy; (b) the quantile regression objective function is a weighted sum of absolute deviations, resulting in a robust measure of location, so that the estimated coefficient vector is not sensitive to outlier observation on the dependent variable; (c) when the error term is non-normal, quantile regression estimates may be more efficient than OLS estimators (Buchinsky, 1998).

Estimated returns to education at different quantiles (0.10, 0.25, 0.50, 0.75 and 0.90) can provide further insight into within-skill group changes and differences in returns at the upper and lower level of the income distribution, as well as differences by sex. It is found that the developments in returns over time are sharply different between sexes (Table 5; see also Figs 6 and 7). For all years examined and within each year, male returns exhibit a steady increase as one goes to higher income quantiles, especially after the third quintile, and the same is true for the return to labour market experience. Men in higher quantiles of the earnings distribution in Venezuela, therefore, enjoy higher returns to an additional year of schooling (and experience), compared with their counterparts at lower quantiles. Looking at the difference in returns across the male earnings distribution over time, it is found that the difference in returns between the 90th and the 10th quantile increases in the post-1995 period compared to the first part of the 1990s. This may mean that the high earners (at each educational level) are benefiting more over time, compared with the low earners and that the effect of education upon earnings across the income distribution has become more acute.

Female returns follow the opposite pattern from that of male returns. Female returns are highest at the lowest (10th) quantile and steadily decline until the third quantile. For 1992 and 1995 the decline is for the 75th or the 90th quantile. For 1998 and 2000 the decline tapers off or slightly rebounds by the 50th quantile. Finally, for 2002, returns rebound after the 50th quantile. Possible reasons for the difference in patterns between men and women in Venezuela could be: (a) there is significant heterogeneity in the labour market; and (b) discrimination in the labour market

Table 5. Quantile regressions: returns to schooling by quantile, 1992–2000 (dependent variable: logarithm of monthly earnings)

	Males	Females
1992		
10th quantile	7.2	13.0
25th quantile	7.4	10.7
50th quantile	7.9	9.7
75th quantile	9.1	10.1
90th quantile	9.9	10.8
1995		
10th quantile	7.7	3.8
25th quantile	8.0	11.6
50th quantile	7.6	9.5
75th quantile	7.8	8.4
90th quantile	9.0	8.4
1998		
10th quantile	7.9	13.1
25th quantile	7.7	11.5
50th quantile	8.5	10.9
75th quantile	10.3	11.0
90th quantile	11.5	11.7
2000		
10th quantile	6.9	1.1
25th quantile	7.2	9.6
50th quantile	7.8	8.7
75th quantile	9.0	9.5
90th quantile	9.9	9.9
2002		
10th quantile	8.6	13.4
25th quantile	8.7	12.3
50th quantile	9.0	12.2
75th quantile	10.3	12.6
90th quantile	11.1	12.5

Source: *Encuesta de Hogares por Muestro*; see Annex Table 3.

against women limits the earnings potential of the most able.

Increasing returns with quantiles have been observed for a series of countries in Europe – Portugal, Austria, Finland, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom, while only for Germany and Greece the returns-quantiles profile was found to be negative. Such international differences provide evidence that the interaction between education systems and labour market institutions on wage inequality is not identical across countries (Pereira and Martins, 2004b). Increasing returns as one goes from the lower to the higher end of the earnings distribution could be interpreted as an indication of complementarity between ability and education (or skills), with more able workers benefiting from additional investment in education
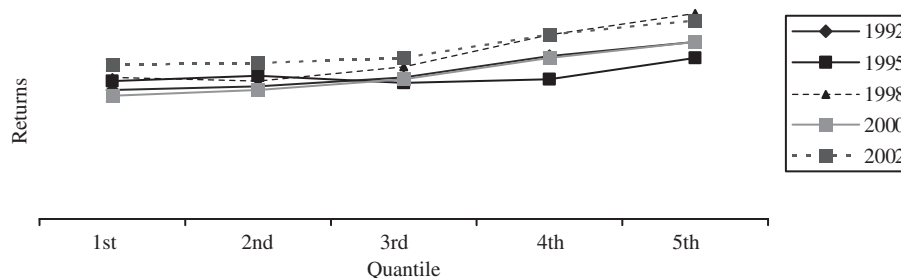
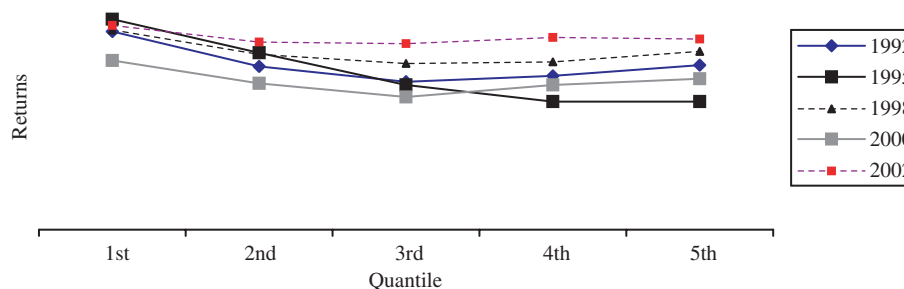**Fig. 6.   Returns to schooling by quantiles, males: 1992–2002**

Fig. 7.   Returns to schooling by quantiles, females: 1992–2002

(see Mwabu and Schultz (1996) on South Africa). This would be the case for males but not for females in Venezuela. Among males, the increasing quantile returns, besides the aforementioned countries in Europe, follow the pattern observed for whites in South Africa. Among females, there is no tendency for the returns to increase with quantiles (with some evidence that quantile returns are actually decreasing), suggesting that there is no tendency for ability to bias returns upward; this pattern of quantile returns matches that observed for Africans in South Africa (as well as in Germany and Greece). However, there are other countries for which education is a substitute for unobserved ability, including Mexico (Patrinos and Metzger, 2004), the Philippines (Sakellariou, 2004) and Ethiopia (Girma and Kedir, 2004). Also, in a careful analysis of ability and education, Denny and O'Sullivan (2004) find that education is a substitute for ability in the case of the United Kingdom. The implication for the case of Venezuela is that education is a good investment that would help reduce inequality over time.

IV. Conclusion

This study has estimated the returns to education in Venezuela for the period 1992 to 2002 and linked them to earlier available estimates from the 1970s and 1980s. Using consistent cross-sections from the *Encuesta de Hogares por Muestro* it documented falling returns to schooling and educational levels until the mid-1990s, followed by increasing returns thereafter.

The overall return to an additional year of schooling was steadily declining in the 1970s, 1980s and through the mid-1990s. Since then, returns have been exhibiting an increasing trend. Returns to education by level follow the trend observed in the results on returns to schooling. Primary and secondary premiums are relatively stable during the decade for both men and women, while university premiums are more volatile, exhibiting a falling trend from 1996 to 2000 and an increasing trend thereafter. Females, with few exceptions, enjoy higher education premiums compared with males for all education levels.

The reasons for the observed developments in returns to schooling and education premiums relate to the effect of the swings in economic activity in Venezuela on the demand and supply of education and skills. During the 1990s, the Venezuelan economy was characterized by sharp fluctuations in economic activity, volatile but, overall, decreasing real incomes and a steady increase in poverty incidence. During the same period, lack of opportunities in the formal sector resulted in an increasing number of workers moving into the informal sector, where returns to education are low and poverty is endemic.

Lack of sustained dynamism in the economy leads to a vicious cycle of depressed earnings, falling profitability of investing in education, and reduced incentive to send children to school (especially given the high incidence of poverty). At the same time reduced opportunities in the formal sector of the economy result in those without skills ending up in the informal sector, where wages are low and the poverty incidence is high, with significant intergenerational problems.

Using quantile regression analysis it is found that the developments in returns over time are sharply different between males and females. For all years examined and within each year, male returns exhibit a steady increase as one goes to higher income quantiles. Men in higher quantiles of the earnings distribution in Venezuela, enjoy higher returns to an additional year of schooling (and experience), compared with their counterparts at lower quantiles. Female returns follow the opposite pattern from that of male returns. They are highest at the lowest (10th) quantile and decline thereafter. Increasing returns as one goes from the lower to the higher end of the earnings distribution could be interpreted as an indication of complementarity between ability and education (or skills), with more able workers benefiting from additional investment in education. In Venezuela, this would be the case of males but not for females. For females, education is a good investment that allows those less well endowed with ability to increase their earnings.

It is also found that the difference in returns between the high and low earners increases in the post-1995 period compared to the first part of the 1990s. This may mean that the high earners (at each educational level) are benefiting more over time, compared with the low earners and that the effect of education upon earnings across the income distribution has become more acute.

Acknowledgements

References

Asplund, R. and Pereira, P. T. (Eds) (1999) *Returns to Human Capital in Europe: A Literature Review*, ETLA, Helsinki.

Blom, A., Holm-Nielsen, L. and Verner, D. (2001) Education, Earnings and Inequality in Brazil, 1982–98: Implications for Education Policy, World Bank Policy Research Working Paper 2686, Washington DC.

Buchinsky, M. (1994) Changes in the US wage structure 1963–1987: an application of quantile regression, *Econometrica*, **62**, 405–58.

Buchinsky, M. (1998) Recent advances in quantile regression models, *Journal of Human Resources*, **33**, 88–126.

Denny, K. and O'Sullivan, V. (2004) *Can Education Compensate for Low Ability? Evidence from British Data*, Institute for Fiscal Studies WP04/19, London.

Fersterer, J. and Winter-Ebmer, R. (2003) Are Austrian Returns to Education Falling Over Time?, *Labour Economics*, **10**, 73–89.

Fiszbein, A. and Psacharopoulos, G. (1993) A cost-benefit analysis of educational investment in Venezuela: 1989 update, *Economics of Education Review*, **12**, 293–8.

Fiszbein, A., Giovagnoli, P. I. and Patrinos, H. A. (2004) Estimating the Returns to Education in Argentina: 1992–2002, Policy Research Working Paper 3715, Washington, DC: World Bank.

Girma, S. and Kedir, A. (2003) Is education more beneficial to the less able? Econometric evidence from Ethiopia, Discussion Papers in Economics from Department of Economics No. 03/1, University of Leicester.

Harmon, C., Walker, I. and Westergaard-Nielsen, N. (Eds), (2001) *Education and Earnings in Europe: A Cross-Country Analysis of the Returns to Education*, Edward Elgar, Cheltenham.

Lachler, U. (1998) Education and earnings inequality in Mexico, World Bank Policy Research Working Paper 1949, Washington, DC.

Mincer, J. (1974) *Schooling Experience and Earnings*, Columbia University Press, New York.

Mosconi G. M. and Alvarez, C. (1996) Poverty and the Labor Market in Venezuela: 1982–1995, Inter-American Development Bank Working Paper No. SOC96-101, Washington, DC.

Mwabu, G. and Schultz, P. T. (1996) Education returns across quantiles of the wage function: alternative explanations for returns to education by race in South Africa, *American Economic Review Papers and Proceedings*, **86**, 335–9.

Pagan, J. A. and Tijerina-Guajardo, J. (2000) Increasing wage dispersion and the changes in relative employment and wages in Mexico's informal sector: 1987-1993, *Applied Economics*, **32**, 335–47.

Palme, M. O. and Wright, R. E. (1998) Changes in the rate of return to education in Sweden: 1968–1991, *Applied Economics*, **30**, 1653–63.

Patrinos, H. A. and Metzger, S. (2004) Returns to education in Mexico: an update, World Bank/ Universidad de las Americas, Puebla, Mexico (processed).

Pereira, P. T. and Martins, P. S. (2004a) Returns to education and wage equations, *Applied Economics*, **36**, 525–31.

Pereira, P. T. and Martins, P. S. (2004b) Does education reduce wage inequality? Quantile regressions evidence from 16 countries, *Labour Economics*, **11**, 355–71.

Psacharopoulos, G. and Alam, A. (1991) Earnings and education in Venezuela: an update from the 1987 Household Survey, *Economics of Education Review*, **10**, 29–36.

Psacharopoulos, G. and Patrinos, H. A. (2004) Returns to investment in education: a further update, *Education Economics*, **12**, 111–34.

Psacharopoulos, G. and Steier, F. (1988) Education and the labor market in Venezuela: 1975–1984, *Economics of Education Review*, **7**, 321–32.

Sakellariou, C. (2004) The use of quantile regressions in estimating gender wage differentials: a case study of the Philippines, *Applied Economics*, **36**, 1001–7.

Appendix

Table A1. Mincer equations (by sex): 1992–2000 (Dependent variable: logarithm of monthly earnings)

Variable	Males	Females without sample selection	Females with sample selection
1992 Years of schooling	0.084 (128.8)	0.110 (113.1)	0.11.9 (95.5)
Experience	0.037 (56.5)	0.031 (33.6)	0.029 (31.0)
Experience squared	−0.0005 (36.9)	−0.0004 (18.8)	−0.0003 (16.4)
Log(hours)	0.550 (38.1)	0.254 (15.3)	0.523 (45.0)
Constant	3.987 (72.6)	4.640 (70.7)	3.488 (70.5)
λ (Participation)	–	–	0.097 (8.8)
R^2-adj.	0.335	0.380	–
Sample size	41 341	22 769	59 827 (censored: 35 463)
1995 Years of schooling	0.080 (43.8)	0.099 (39.5)	0.096 (24.6)
Experience	0.036 (21.5)	0.026 (11.2)	0.021 (7.9)
Experience squared	−0.0005 (14.1)	−0.0003 (5.3)	−0.0002 (3.9)
Log(hours)	0.419 (18.1)	0.377 (12.2)	0.591 (25.5)
Constant	7.607 (83.0)	7.466 (61.5)	6.792 (56.6)
λ (Participation)	–	–	−0.043 (1.5)
R^2-adj.	0.196	0.228	–
Sample size	10 843	5817	17 652 (censored: 11 936)
1996 Years of schooling	0.074 (34.4)	0.103 (36.9)	0.101 (27.9)
Experience	0.038 (18.1)	0.026 (10.0)	0.025 (9.5)
Experience squared	−0.0005 (13.0)	−0.0003 (6.1)	−0.0003 (5.7)
Log(hours)	0.396 (14.6)	0.562 (24.6)	0.560 (24.3)
Constant	8.229 (78.3)	7.137 (77.9)	7.174 (64.8)
λ (Participation)	–	–	−0.019 (0.6)
R^2-adj.	0.158	0.279	–
Sample size	9312	5885	15 579 (censored: 9699)
1997 Years of schooling	0.091 (39.0)	0.120 (36.4)	0.117 (27.3)
Experience	0.037 (17.0)	0.025 (8.7)	0.024 (8.1)
Experience squared	−0.0005 (11.2)	−0.0003 (4.3)	−0.0002 (3.8)
Log(hours)	0.440 (14.1)	0.567 (22.3)	0.564 (22.0)
Constant	8.502 (70.9)	7.576 (74.0)	7.658 (59.7)
λ (Participation)	–	–	−0.044 (1.1)
R^2-adj.	0.179	0.269	–
Sample size	9248	5647	15 601 (censored: 9966)
1998 Years of schooling	0.092 (45.1)	0.112 (39.3)	0.105 (25.1)
Experience	0.044 (23.0)	0.032 (13.3)	0.031 (12.0)
Experience squared	−0.0006 (15.1)	−0.0004 (8.0)	−0.0004 (6.9)
Log(hours)	0.390 (17.2)	0.642 (33.0)	0.635 (32.3)
Constant	8.951 (101.6)	7.675 (97.9)	7.839 (72.3)
λ (Participation)	–	–	−0.084 (2.07)
R^2-adj.	0.224	0.333	–
Sample size	9949	6393	15 823 (censored: 9440)

(*continued*)

Table A1. Continued

Variable	Males	Females without sample selection	Females with sample selection
1999 Years of schooling	0.091 (44.4)	0.113 (44.5)	0.119 (29.9)
Experience	0.035 (18.0)	0.021 (8.8)	0.020 (8.1)
Experience squared	−0.0004 (10.8)	−0.0002 (3.0)	−0.0002 (3.2)
Log(hours)	0.554 (21.8)	0.493 (17.0)	0.670 (32.7)
Constant	8.558 (87.6)	8.492 (74.2)	7.728 (74.4)
λ (Participation)	–	–	0.022 (0.6)
R^2-adj.	0.268	0.350	–
Sample size	7693	4212	12 776 (censored: 7898)
2000 Years of schooling	0.079 (45.7)	0.094 (43.2)	0.101 (22.6)
Experience	0.038 (21.1)	0.027 (12.6)	0.028 (12.1)
Experience squared	−0.0005 (13.6)	−0.0003 (6.8)	−0.0004 (6.9)
Log(hours)	0.386 (20.7)	0.309 (14.7)	0.311 (14.7)
Constant	9.408 (128.9)	9.502 (112.8)	9.349 (77.0)
λ (Participation)	–	–	0.078 (1.7)
R^2-adj.	0.244	0.296	–
Sample size	9383	5315	14 229 (censored: 8914)
2001 Years of schooling	0.091 (51.5)	0.113 (51.1)	0.118 (28.8)
Experience	0.039 (22.0)	0.025 (11.4)	0.025 (10.7)
Experience squared	−0.0005 (13.5)	−0.0002 (4.3)	−0.0002 (5.1)
Log(hours)	0.423 (25.0)	0.347 (16.8)	0.653 (40.0)
Constant	9.248 (140.1)	9.265 (111.6)	8.097 (81.6)
λ (Participation)	–	–	−0.044 (0.9)
R^2-adj.	0.340	0.406	–
Sample size	7786	4388	12 358 (censored: 7400)
2002 Years of schooling	0.099 (54.0)	0.127 (54.7)	0.132 (32.8)
Experience	0.045 (24.7)	0.033 (14.1)	0.032 (12.9)
Experience squared	−0.0006 (17.2)	−0.0004 (7.0)	−0.0004 (6.9)
Log(hours)	0.487 (27.9)	0.581 (28.4)	0.756 (45.1)
Constant	9.016 (131.7)	8.299 (100.9)	7.604 (77.4)
λ (Participation)	–	–	0.005 (0.1)
R^2-adj.	0.366	0.457	–
Sample size	7720	4735	12 609 (censored: 7325)

Source: *Encuesta de Hogares por Muestro.*
Notes: *t*-values in parentheses (*z*-values for selection equation). Determinants of the selection equation are: years of education, age, age squared, marital status and number of children in the household.

Table A2. Earnings premium by level of education (by sex): 1992–2000 (Dependent variable: logarithm of monthly earnings)

Variable	Males	Females
1992 Primary	0.347 (28.8)	0.370 (15.7)
Secondary	0.657 (53.2)	0.879 (36.4)
Higher	n/a	n/a
University	1.281 (93.0)	1.492 (59.2)
Experience	0.040 (59.7)	0.036 (37.4)
Experience squared	−0.0006 (41.1)	−0.0005 (23.3)
Log(hours)	0.569 (39.0)	0.211 (12.3)
Constant	3.987 (71.2)	4.945 (71.3)
R^2-adj.	0.329	0.352
Sample size	41 039	22 663
1995 Primary	0.365 (12.2)	0.402 (7.8)
Secondary	0.695 (21.3)	0.811 (15.0)
Higher	1.057 (23.8)	1.144 (17.9)
University	1.107 (28.4)	1.228 (21.4)

Table A2. Continued

Variable	Males	Females
Experience	0.037 (21.8)	0.031 (13.0)
Experience squared	−0.0005 (16.1)	−0.0005 (8.6)
Log(hours)	0.444 (18.5)	0.382 (12.1)
Constant	7.701 (80.6)	7.679 (59.2)
R^2-adj.	0.175	0.198
Sample size	11 000	5881
1996 Primary	0.337 (9.0)	0.324 (5.1)
Secondary	0.627 (15.4)	0.731 (11.0)
Higher	0.892 (11.7)	1.267 (14.4)
University	1.184 (20.1)	1.399 (18.2)
Experience	0.038 (17.6)	0.031 (10.6)
Experience squared	−0.0006 (14.0)	−0.0005 (7.9)
Log(hours)	0.455 (16.6)	0.376 (11.1)
Constant	8.155 (74.2)	8.194 (57.7)
R^2-adj.	0.130	0.197
Sample size	8534	4441
1997 Primary	0.341 (9.6)	0.450 (7.0)
Secondary	0.717 (1.103)	0.914 (13.7)
Higher	(18.3) (20.6)	1.232 (16.0)
University	1.277 (26.2)	1.508 (21.1)
Experience	0.039 (17.8)	0.034 (11.6)
Experience squared	−0.0006 (13.4)	−0.0005 (8.1)
Log(hours)	0.537 (17.9)	0.290 (8.5)
Constant	8.357 (70.2)	8.915 (61.9)
R^2-adj.	0.168	0.209
Sample size	9283	5082
1998 Primary	0.376 (10.9)	0.327 (4.6)
Secondary	0.767 (20.4)	0.759 (10.4)
Higher	1.169 (24.6)	1.184 (15.2)
University	1.261 (30.1)	1.269 (17.1)
Experience	0.045 (22.9)	0.036 (13.9)
Experience squared	−0.0007 (16.7)	−0.0005 (9.5)
Log(hours)	0.375 (15.3)	0.507 (15.8)
Constant	9.218 (93.5)	8.607 (61.2)
R^2-adj.	0.210	0.245
Sample size	9828	5494
1999 Primary	0.399 (11.6)	0.228 (3.8)
Secondary	0.780 (20.8)	0.667 (10.6)
Higher	1.045 (21.6)	1.022 (14.9)
University	1.255 (28.9)	1.222 (18.8)
Experience	0.037 (18.4)	0.031 (12.1)
Experience squared	−0.0005 (12.8)	−0.0004 (8.0)
Log(hours)	0.562 (21.6)	0.512 (17.0)
Constant	8.712 (84.4)	8.889 (70.4)
R^2-adj.	0.233	0.309
Sample size	7693	4212
2000 Primary	0.305 (10.6)	0.379 (7.8)
Secondary	0.669 (21.1)	0.747 (14.8)
Higher	0.980 (23.8)	1.110 (20.0)
University	1.034 (28.7)	1.223 (23.4)
Experience	0.040 (22.0)	0.033 (15.1)
Experience squared	−0.0006 (15.9)	−0.0005 (10.4)
Log(hours)	0.398 (20.9)	0.323 (15.1)
Constant	9.545 (123.2)	9.658 (102.5)
R^2-adj.	0.217	0.279
Sample size	9383	5315

(*continued*)

Table A2. Continued

Variable	Males	Females
2001 Primary	0.331 (10.3)	0.323 (5.8)
Secondary	0.718 (20.7)	0.728 (12.6)
Higher	1.125 (26.9)	1.121 (18.3)
University	1.176 (30.2)	1.351 (22.9)
Experience	0.041 (22.7)	0.031 (13.7)
Experience squared	−0.0006 (16.0)	−0.0004 (8.4)
Log(hours)	0.445 (25.6)	0.363 (17.1)
Constant	9.399 (129.1)	9.628 (99.2)
R^2-adj.	0.308	0.376
Sample size	7786	4388
2002 Primary	0.360 (11.1)	0.377 (6.7)
Secondary	0.738 (21.0)	0.827 (14.1)
Higher	1.122 (26.2)	1.241 (19.8)
University	1.389 (35.4)	1.550 (25.8)
Experience	0.047 (24.8)	0.041 (16.6)
Experience squared	−0.0007 (19.4)	−0.0006 (11.5)
Log(hours)	0.516 (29.0)	0.599 (28.3)
Constant	9.192 (124.0)	8.689 (89.7)
R^2-adj.	0.343	0.424
Sample size	7720	4735

Source: *Encuesta de Hogares por Muestro*.
Note: *t*-values in parentheses.

Table A3. Quantile regressions returns to schooling, 1992–2000 (Dependent variable: logarithm of monthly earnings)

Variable	Males	Females
1992 *10th quantile*		
Years of schooling	0.072 (49.6)	0.130 (59.8)
Experience	0.037 (36.6)	0.036 (16.3)
Log(hours)	0.648 (15.1)	0.300 (11.7)
25th quantile		
Years of schooling	0.074 (75.5)	0.107 (61.4)
Experience	0.036 (40.2)	0.029 (27.7)
Log(hours)	0.450 (16.6)	0.214 (10.3)
50th quantile		
Years of schooling	0.079 (128.7)	0.097 (87.0)
Experience	0.036 (64.9)	0.027 (29.3)
Log(hours)	0.446 (29.0)	0.125 (9.7)
75th quantile		
Years of schooling	0.091 (105.3)	0.101 (107.0)
Experience	0.039 (47.2)	0.030 (26.1)
Log(hours)	0.413 (21.6)	0.244 (9.6)
90th quantile		
Years of schooling	0.099 (72.4)	0.108 (74.9)
Experience	0.042 (29.4)	0.032 (18.9)
Log(hours)	0.493 (18.2)	0.388 (16.6)
1995 *10th quantile*		
Years of schooling	0.077 (22.7)	0.138 (33.2)
Experience	0.036 (12.8)	0.022 (6.0)
Log(hours)	0.486 (9.3)	0.727 (12.1)
25th quantile		
Years of schooling	0.080 (47.2)	0.116 (55.3)
Experience	0.035 (15.2)	0.028 (13.5)
Log(hours)	0.468 (13.9)	0.697 (17.0)

(*continued*)

Table A3. Continued

Variable	Males	Females
50th quantile		
Years of schooling	0.076 (43.8)	0.095 (37.4)
Experience	0.031 (22.4)	0.025 (14.0)
Log(hours)	0.421 (15.9)	0.573 (21.4)
75th quantile		
Years of schooling	0.078 (37.2)	0.084 (27.5)
Experience	0.034 (21.4)	0.021 (11.2)
Log(hours)	0.356 (8.1)	0.444 (11.0)
90th quantile		
Years of schooling	0.090 (39.1)	0.084 (25.5)
Experience	0.042 (17.3)	0.022 (8.1)
Log(hours)	0.219 (3.4)	0.312 (5.3)
1998 *10th quantile*		
Years of schooling	0.079 (15.6)	0.131 (30.2)
Experience	0.052 (14.2)	0.036 (6.4)
Log(hours)	0.716 (14.7)	0.907 (20.5)
25th quantile		
Years of schooling	0.077 (70.1)	0.115 (34.1)
Experience	0.034 (23.3)	0.035 (13.4)
Log(hours)	0.505 (21.0)	0.873 (27.9)
50th quantile		
Years of schooling	0.085 (45.3)	0.109 (27.4)
Experience	0.036 (25.2)	0.031 (15.4)
Log(hours)	0.376 (8.9)	0.673 (28.5)
75th quantile		
Years of schooling	0.103 (67.4)	0.110 (36.8)
Experience	0.047 (34.2)	0.026 (10.7)
Log(hours)	0.253 (5.0)	0.492 (13.0)
90th quantile		
Years of schooling	0.115 (36.6)	0.117 (23.0)
Experience	0.057 (19.1)	0.035 (10.3)
Log(hours)	0.216 (3.0)	0.292 (7.2)
2000 *10th quantile*		
Years of schooling	0.069 (26.4)	0.111 (31.5)
Experience	0.038 (10.9)	0.038 (6.0)
Log(hours)	0.691 (16.9)	0.562 (10.2)
25th quantile		
Years of schooling	0.072 (44.5)	0.096 (36.7)
Experience	0.031 (16.0)	0.029 (10.8)
Log(hours)	0.504 (37.0)	0.425 (14.4)
50th quantile		
Years of schooling	0.078 (45.9)	0.087 (33.8)
Experience	0.032 (38.5)	0.022 (8.7)
Log(hours)	0.374 (11.5)	0.244 (7.0)
75th quantile		
Years of schooling	0.090 (43.8)	0.095 (34.4)
Experience	0.043 (35.3)	0.020 (5.7)
Log(hours)	0.192 (6.6)	0.146 (3.1)
90th quantile		
Years of schooling	0.099 (64.2)	0.099 (26.3)
Experience	0.051 (19.0)	0.017 (4.3)
Log(hours)	0.160 (7.0)	0.107 (4.7)
2001 *10th quantile*		
Years of schooling	0.071 (21.2)	0.115 (24.8)
Experience	0.037 (10.3)	0.029 (5.2)
Log(hours)	0.642 (21.6)	0.542 (9.9)
25th quantile		
Years of schooling	0.073 (26.2)	0.103 (24.7)
Experience	0.032 (13.7)	0.027 (8.0)
Log(hours)	0.481 (15.7)	0.394 (10.9)

(*continued*)

Table A3. Continued

Variable	Males	Females
50th quantile		
Years of schooling	0.083 (53.0)	0.105 (35.4)
Experience	0.031 (21.7)	0.023 (10.7)
Log(hours)	0.364 (18.6)	0.269 (9.0)
75th quantile		
Years of schooling	0.102 (50.5)	0.115 (35.2)
Experience	0.040 (19.2)	0.022 (7.6)
Log(hours)	0.308 (14.5)	0.206 (6.2)
90th quantile		
Years of schooling	0.109 (42.2)	0.122 (38.6)
Experience	0.048 (13.4)	0.023 (6.7)
Log(hours)	0.243 (5.7)	0.211 (5.3)
2002 *10th quantile*		
Years of schooling	0.087 (27.1)	0.134 (26.8)
Experience	0.050 (11.7)	0.038 (6.5)
Log(hours)	0.754 (22.1)	0.807 (14.0)
25th quantile		
Years of schooling	0.087 (31.1)	0.123 (30.8)
Experience	0.039 (17.7)	0.039 (11.7)
Log(hours)	0.539 (18.3)	0.645 (15.2)
50th quantile		
Years of schooling	0.090 (41.1)	0.122 (40.4)
Experience	0.038 (20.3)	0.031 (12.4)
Log(hours)	0.390 (14.3)	0.478 (17.4)
75th quantile		
Years of schooling	0.103 (54.3)	0.126 (47.9)
Experience	0.044 (20.1)	0.029 (9.5)
Log(hours)	0.303 (8.4)	0.346 (9.8)
90th quantile		
Years of schooling	0.111 (42.0)	0.125 (43.2)
Experience	0.048 (16.6)	0.020 (4.3)
Log(hours)	0.251 (7.7)	0.296 (8.1)

Source: *Encuesta de Hogares por Muestro*.
Note: *t*-values in parentheses.