Productivity and Household Investment in Health - The Case of Colombia

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New Haven, January 29, 1999

SUMMARY

The purpose of this study is to understand how public and private investments in health in Colombia are related to future earnings of individuals. The returns to good health of individuals and the determinants of the health production function are analyzed. The magnitude of the returns to having good health status is identified through the direct effect of health variables on earnings of individuals. Regional (rural-urban) and gender aspects are considered separately. The significant IV estimates showed that one more day of disability decreased male rural earnings by 33% and female by 13%, that having a disability in a given month decreased the earnings of an urban male by 28% and by 14% for an urban female, and that having one more centimeter of stature increased urban female earnings by 6.9% and urban male earnings by 8%. These returns to height are larger than those found in some other countries and reveal that investments in nutrition may be as important as investments in education for future increases in productivity and growth. Estimations of health production functions showed that it would be desirable to increase social security coverage in rural areas in order to see a lower incidence or duration of illness in these regions. However, in urban areas, where the system of social security is more developed, social security may only increase the tendency to report illness. In general, wealthier individuals tend to have better health and the interaction between non-labor income of the individual and adequate housing affects positively the health status of individuals. Policies oriented to increase the coverage of basic services in households, such as electricity, potable water or sewage, have a negligible effect on height and, through height, on productivity. Policies oriented to provide more adequate housing translate into better health conditions and productivity for individuals.

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[3] The authors are thankful to T. P. Schultz and W. Savedoff for their invaluable comments and suggestions as well as to other participants in the Red de Centros and different seminars where previous versions were presented. Pablo Sanabria provided useful research assistance. This work could not have been completed without the support of the Economic Growth Center at Yale University.

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1. Introduction

The purpose of this study is to understand the ways in which public and private investments in health in Colombia are related to the future earnings of individuals. The effects of having good health as well as the determinants of health production functions are studied at the individual level. The paper attempts to identify the magnitude of the returns of having good health status through the direct effect of health variables on the earnings of individuals. Regional (rural-urban)[4] and gender aspects are considered separately. The aim of this study is to make use of the information in the optimal design of policy interventions that may enhance health and increase labor productivity among low income and disadvantaged groups.

This is the first study to analyze the links between primary indicators of health and individual labor productivity in Colombia and how additional public expenditures in health may improve individuals' health. Investments in health, as well as investments in schooling, have an impact on an individual's productivity. Household resource allocation and consumption decisions determine nutritional status and health of children and adults within the household. These decisions have an impact on adult anthropometric measures such as height or body mass index [BMI], acute and chronic morbidity, the patterns of illness and disability.

Human capital has many forms besides schooling. Migration, the capacity to avoid unwanted fertility, and health outcomes are also forms of reproducible human capital. The framework set up by Mincer (1974) is enriched to allow for additional forms of human capital besides schooling. Schultz (1997) analyzes how state and family investments influence the formation of reproducible human capital and how these in turn affect labor earnings and growth. The main questions he studies are what determine the household demand for human capital and what are the wage returns of human capital stock in the labor market. Schultz (1997) finds that adult height is an important determinant of adult productivity, and that it emerges as inversely correlated to chronic health problems among the middle aged and elderly. Moreover, results show that height is inversely related to mortality and consequently directly related to length of productive life. Fogel (1994) also finds that height and BMI are related to male mortality at later ages, and to chronic diseases at ages between 20 and 50. This study confirms that height is positively related to individual earnings in Colombia.

According to Schultz and Tansel (1997), most studies that measure morbidity are related to high-income countries and focus on chronic disabilities among the elderly (degenerative diseases). Other studies have analyzed the productivity effects of nutrition in developing countries (Behrman, 1993, Deolalikar, 1988, Behrman and Deolalikar, 1988, Sahn and Alderman, 1988), and extensive literature has focused on child morbidity and malnutrition effects for children (Rosenzweig and Wolpin, 1988, Rosenzweig and Schultz, 1982a, 1983). Schultz (1984) has analyzed the relation between child mortality and public program interventions. Adult health status measures, such as height, reflect both cumulative health, early childhood conditions, and nutrition investments undertaken by the parents of the individual (Strauss and Thomas, 1995, Martorell and Habicht, 1986). In addition, changes in height over time may be attributed to changes in reproducible human capital investments or in disease environments (Fogel, 1994). Thomas and Strauss (1997) used household urban Brazilian data containing height and BMI, and found that height has a large and significant effect on wages for males and females. Based on this evidence, this study focuses on the relationship between height and other indicators of current health of adults and their productivity. Exploring this relationship will help to identify policy tools to improve adult health outcomes and promote growth efficiently and equitably.

Strauss and Thomas (1995, 1997) have used survey data from urban Brazil to show that different dimensions of health such as height, BMI, calories intake and protein intake, affect the wages of men and women

[4] The patterns of illness in Colombia differ highly among rural and urban areas, and communicable diseases occur more frequently in rural areas. In 1993 approximately 30% of colombian population was located in rural areas (UNDP,1998).

positively, even after controlling for education. They find that relative to the returns to education without controlling for health, the estimated returns to education with health controls were 45% smaller for literate men and 30% smaller for men with secondary education or more. Schultz (1996) finds that the estimated wage returns to schooling are reduced between 10% and 20% with the addition of three other human capital inputs in the regression: migration, BMI and height. In this paper, however, it is found that the returns to education are almost invariant to the introduction of health in the earnings equations. They change from 9.7% without height to 9.1% with height for urban men and from 9.6% without height to 9.0% with height for urban women. They are identical when the dummy for disability or the number of days disabled is included in the IV estimates of the earnings equation.

This study finds significant and positive effects of height on wages. A taller man receives hourly earnings 8% higher per centimeter and a woman receives hourly earnings 7% higher per centimeter. The size of the returns in Colombia are in line with the those found in Ghana (Schultz, 1996), where a one centimeter increase is associated with a 5.7% wage gain for males and 7.5 % for females, using instrumental variables and holding constant for BMI and migration. In Cote d'Ivoire, the effect of male height is not significantly associated with a wage gain based on instrumental variable estimates, holding constant for BMI and migration. These estimated returns to height in Colombia reveal that investments in nutrition may be of greater importance for future labor productivity and growth.

Strauss and Thomas (1995) find that the effects of nutrition on height and adult productivity are subject to diminishing returns. The proportionate increase in height due to better nutrition may be greater for those who are especially malnourished. As a consequence, human capital returns are expected to be higher at lower levels of investments. In this way, if nutritional programs were targeted to the poor, it would help to reduce income inequalities and promote efficient growth. Although information on nutritional programs to test this was unavailable for this study, the models tried to capture non-linear returns to adult health outcomes by introducing height in linear and quadratic specifications in the earnings function. However, this study relies on the linear specification because the quadratic did not yield more precise estimates.

The approach used in this paper to evaluate health related programs is an integrated human capital demand and wage framework presented in Schultz (1997) in which it is necessary to coordinate many types of data, some not readily available. Two household labor market surveys were used to collect information on hourly earnings, labor force participation, non-labor income and assets, as well as measures of human capital stocks, such as height and disability.

The unit of analysis is the individual. The health indicators expected to be associated with current productivity of workers are a dummy for having been disabled[5] in the last month, the number of days disabled in the last month, and height. These are indicators of human capital because they can be affected by social investments, although they may vary across individuals due to genetic or environmental factors not controlled by the individual, family or society. Based on an extended earnings function that includes health measures as human capital stocks in addition to schooling, productivity gains associated with these forms of human capital in Colombia are estimated. The possibility that health measures may be endogenous or measured with error is taken into account by the use of instrumental variable estimation.

Section 2 describes data sources and main characteristics of each survey, as well as the health indicators. Section 3 shows descriptive statistics of the data. Empirical specification issues, estimation and policy simulations, are discussed further in Section 4. Section 5 contains the main conclusions derived from the analysis.

[5] Not able to attend work because of illness.

2. The Data

This section describes the main sources of data and the variables used for the study. Apart from two major household surveys conducted by DANE[6], different sources were consulted to obtain regional data on environmental factors. That data was merged with the individual household survey data, so that each individual was linked to the characteristics of his or her community.

The "Encuesta de Caracterización Socioeconómica" [CASEN] is a national survey collected in 1993, which has specific modules on health, education and child mortality. The survey interviewed 27,271 households, 22,257 in the urban area and the remaining 5,014 in rural areas. The size of the sample of individuals with positive wages or earnings between 18 and 70 years old is 35,395, of which 64% are male and 74% live in urban areas.

From this survey two indicators of health were used, which will be the dependent variables of the health production functions:

1) Disability: a dummy variable equal to one if the individual reports that he was not able to work in the month before the survey because of his illness[7], and
2) Number of days disabled: the actual number of days of work lost because of the specific illness[8] (as reported by the individual).

The variables to describe the individuals' characteristics are age, education, the log of hourly earnings, whether or not the person is a salaried worker, the non-labor income and whether the individual lives in a house or apartment.

In order to explain the health outcomes, a series of variables that describe the environmental factors was constructed from CASEN. By averaging the observations in rural and urban areas in each "departamento,"[9] the following community characteristics were linked to each individual:

1) Availability of credit (either from the public or private sector), to buy a house in the "departamento" by rural and urban sub-areas;
2) Education level in the "departamento" by rural and urban sub-areas (illiteracy rates, primary and secondary coverage);
3) Percentage of persons affiliated to social insurance in the "departamento" by rural and urban sub-areas; and
4) Infrastructure conditions (water, electricity) in the "departamento" by rural and urban sub-areas.

The "Instituto Geográfico Agustín Codazzi" provided information regarding environmental factors used to account for health outcomes:

[6] Departamento Administrativo Nacional de Estadística.
[7] A preceding question included in the survey was: during the last month did you have any illness, accident, and dental problem or health problem? The question used here is: during the last month did you not go to work or did not do your ordinary activities because of the illness or health problem mentioned above? (in Spanish: "durante el último mes dejó usted de asistir al trabajo o realizar sus actividades ordinarias debido a la enfermedad o problema de salud señalado antes?"). The answers to these two questions were either "yes" or "no".
[8] The actual question used here says in Spanish: "cuántos días estuvo incapacitado o en cama durante el último mes?" Which can be translated as: for how many days during the last month did you not go to work or did you stay in bed? and in the questionnaire there is a space for the interviewer to write the number of days.
[9] Colombia is divided in 26 departamentos.

1) Temperature, altitude, and rain in each municipality;
2) Distance from each town to the capital of the "departmento," where major hospitals are located;
3) Average times to reach schools in the municipality;
4) Average times to reach hospitals in the municipality;
5) Availability of water in the municipality;
6) Availability of electricity in the municipality;
7) Availability of primary schools in the municipality;
8) Availability of secondary schools in the municipality;
9) Availability of hospitals in the municipality; and
10) Availability of health centers in the municipality.

The Ministry of Health provided information regarding coverage of vaccination programs by municipality,[10] number of hospitals available in each municipality and "quality" of those hospitals,[11] among others. From another external source[12] an index of the kilometers of paved roads per population and area in each "departamento" was obtained.

The urban part of the "Encuesta Nacional de Hogares - Etapa 74" [ENH-91[13]] was collected in December of 1991. It is a household survey that covers the eleven major cities of Colombia: Bogotá; Cali; Medellín; Barranquilla; Bucaramanga; Manizales; Pasto; Cúcuta; Pereira; Ibagué, and Montería. Surrounding metropolitan areas of the cities are included. These cities represent close to 40% of the entire population of the country, about 70% of the urban population, and the smallest of these cities at the time of the survey had at least two hundred thousand people.

The urban part of ENH-91 is the only survey in Colombia that includes the height of persons,[14] which is used here as the adult health outcome. This survey does not include the information about previous illness or lost days of work. The sample was between ages 18 and 70 years old, but the age range is restricted in some estimations and figures (the wages and health equations are estimated for those between 18 and 60 years old). This restriction is made because we believe that after age 60 individuals may shrink (not necessarily reflecting childhood nutritional status) and before age 18 the individual may still be growing. From all persons who earn positive wages or earnings, those with unreasonable heights (less than 135 cm.) were excluded,[15] leaving a working sample of 23,910 adults.

The variables to describe the individuals' characteristics are age, education, the log of hourly earnings, whether the person is a salaried worker, the non-labor income and whether the house where the respondent lives is owned by him or his family (owner-occupied housing).[16]

In order to explain adult height, the environmental health factors derived from ENH-91 were:

1. Percentage of households in the community with access to basic services (water, sewerage and electricity);[17]

[10] This is measured as a percentage of coverage relative to the vaccination goal of the Ministry of Health for that municipality.
[11] A number between 1 – 6 to indicate the level of attention (from attending minor wounds to performing major medical interventions) in the institution.
[12] Economica Consultores (1996).
[13] We will refer to this survey as ENH-91 to emphasize the year in which it was taken.
[14] This survey also includes a rural area, but for the rural area it does not have the height of individuals.
[15] The number of observations dropped at this stage was approximately 7% of the total sample.
[16] In Spanish: "casa propia".
[17] The survey provides information of access to each service separately. The dummy variable used to construct the "percentage of households in the community with access to basic services" was one when the house has access to all three basic services, and zero otherwise.

2. Percentage of households in the community with favorable population density according to poverty standards.[18]

The characterization of the community where the individual lives was made first by city and, within each city, by strata. In Colombia the major cities are divided into six socioeconomic strata depending on the economic capabilities of the households, in order to charge differential rates for public services such as water, electricity and telephone.[19] Persons know the strata of their houses.[20]

It is assumed that the place of residence of the individual is exogenous, although people may have migrated to a specific area or community due to the variables treated here as exogenous, introducing potential bias in our estimates (Rosenzweig and Wolpin, 1988).[21]

3. Descriptive statistics of the Colombian data

Two samples were consulted. The first sample (CASEN) is that of persons who lived in rural or urban areas in 1993, were earning a wage or had positive labor earnings, and were between 18 and 70 years old. This sample is 36% female and 64% male, only 9% have more than 13 years of schooling, and 8% have zero years of schooling. 46% have partial or complete primary schooling and 74% live in urban areas. This sample is used to estimate the models with disability and the number of days disabled. The second sample (ENH-91) is only urban. It includes the health variable height. We used wage earners or individuals with positive labor earnings between 18 and 60 years old. 59% of this sample are males and 41% females, 4% have zero years of schooling and 13% have more than 13 years of education. The main characteristics of the samples and health indicators are reported in Tables 1 to 4.

In general, illness is more frequent for women than for men and it increases with age. Illness is more common among the less educated than for the more educated (within rural and urban populations), and it occurs more frequently for rural than urban residents at all levels of education. The patterns for disability and number of days disabled observed in Tables 1 and 2 are similar to each other. However, the number of days disabled diminishes with education until 12 years of schooling, but it oddly increases at 13 or more years of schooling in the urban areas. Notice that this only happens for days disabled but not for disability. As shown in Table 1, the percentage of more educated individuals who suffer disability is lower than among the less educated at all levels of education. This result is contrary to what was found in Ghana and Cote d'Ivoire by Schultz and Tansel (1992), where the propensity of adults to report illness was positively related to education. The average number of days disabled may increase for urban residents with more than 13 years of schooling because they may have higher expectations about their health, be more able to perceive illness, or more willing to seek professional advice (Johansson, 1991). In addition, more educated individuals may have more resources to indulge their illnesses and consume more days disabled when they are ill.

Figure 1 shows the histogram of number of days disabled for the population with positive number of days disabled. The bulk of this sample (78%) has fewer than ten days of disability, 10% have 15 days disabled, and 7% of the sample have been disabled for the entire past month (they may be chronically disabled).

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[18] I. e., the percentage of households in the community without overcrowding in the houses, based on DANE’s definition of overcrowding.

[19] Since there are only 11 cities, a second characterization that gave more variability to the community variables for the sample was needed. Using strata, which was also provided by the survey, allowed to have 66 different values for the community variables.

[20] Sometimes the interviewer is ordered to ask the respondent for a receipt from the electricity, phone or water companies, to check that the information of strata is accurate.

[21] In this paper we do not try to explain migration decisions, because the surveys do not provide sufficient information on migration histories or height information on rural population.

The patterns of height summarized in Table 3 refer to the whole sample between 18 and 70 years old, not only to the labor market participants. They indicate that between young (18-24) and old (60-70) age groups, women have gained 2.88 cm. and men have gained 2.91 cm. Most of the gain occurs between age groups 45-59 and 60-70 suggesting that gains from nutrition to height may be subject to sharply diminishing returns. However, part of the gain observed between these two age ranges may be due to the fact that old people shrink for biological reasons, therefore the gain may be overstated. The best educated have an 8.36 cm. advantage over the zero year educated, although this result mix age and class. There is less than one cm. gain within all the education groups and across ages (between youngest and oldest age groups), except for the group with zero years of schooling, where there was a 2 cm. gain. Across education groups (between zero and more than thirteen years of schooling) and within age groups, the gap has declined from 9 cm. for the oldest to 5 cm. for the youngest. However, for the 25-34 years old, the gap remains 9 cm.

Figure 2 shows the trends in height for the entire population aged 25 to 55 in 1991, in relation to their dates of birth. Figure 3 shows the same, but only for labor force participants. There is a secular increase in height similar in shape and size to the one observed in Brazil by Strauss and Thomas (1998). As seen in Table 3, the slope in the trend-line is steeper for females than males. Additionally, comparing the slopes in Figure 2 and Figure 3, the slopes for labor force participants are higher than for the entire population. This may indicate that the urban labor market may have been selecting individuals who have higher child nutritional levels. Figure 2 implies an estimate that in Colombia the height gains per decade are approximately 0.65 cm. for urban men and 0.71 cm. for urban women.[22]

To our knowledge, this is the first time secular height gains have been quantified in Latin America except for Brazil. This type of information is available for some European countries, some African countries, and Brazil. Thomas and Strauss (1998) show that in the United States the mean male stature increased 1.25 cm. per decade between 1910 and 1950. The relative figure in Vietnam was 1.05 cm. per decade and in Brazil 0.77 cm. per decade. Fogel (1994) uses historical European data on stature and weight and reports that in Sweden, between the third quarter of the last century and the third quarter of this century, mean male height increased 0.81 cm. per decade and in France 0.64 cm. per decade. For the same period, the increase per decade in male stature in Norway was 0.57 cm. and 1.07 cm. in Denmark. Schultz (1996) reports that the gain of height per decade has been almost 1.33 cm. for men and 1 cm. for women in Cote d'Ivoire, and 0.66 cm. for men and 0.33 cm. for women in Ghana. Although the figures across countries are not strictly comparable because they have been taken in different periods of time and at different historical and economic moments of each country, they help to understand that the order of magnitude of height changes in Colombia are similar to the evidence from other countries in the world.

The main question of this study is whether or not health and productivity are related at the level of an individual. Tables 4 shows the mean values of the logarithm of hourly earnings for males and females, by education ranges and by different values of the health indicators. On average, labor earnings of persons that were disabled in the last month are lower than of those who were healthy, although this is not true for females with more than 13 years of schooling. For both males and females, those who earn higher wages on average are those who had between 15 and 29 days disabled and more than 13 years of schooling. A very small percentage of the population lies in this category. These tables show that taller individuals (men and women) earn more at all education levels.

4. Estimation of Productivity of Health Investments

[22] The age ranges in these Figures are restricted to avoid bias at the ends of age range. Younger people may still be growing and therefore have a lower height than their actual adult height, and older people may shrink. The growth reported here is free of biological growth or shrinkage.

To assess the returns to health investments a Mincerian earnings function is estimated that depends on human capital. This section is divided into 5 subsections. In subsection 4.1, Mincerian log earnings equations are estimated considering the health indicators as hourly earnings determinants. In subsection 4.2, the selection bias introduced by considering only individuals with positive labor earnings is corrected. Subsection 4.3 analyzes the connection between local health policy instruments and the adult health outcomes, similar to the one analyzed by Strauss and Thomas (1995). Once these health equations are estimated, the results are used to construct instrumental variable estimators of health that are inserted in the original hourly earnings equation. This procedure generates estimators of health that are free of noise and that better indicate the relationship between health status and productivity of adults. The instrumental variable estimation of earnings is shown in subsection 4.4. Subsection 4.5 simulates the way in which changes in policy variables are likely to affect lifetime earnings. The sample means and standard deviations of the variables used in this section are shown in Tables A1 and A2 in the Appendix.

4.1 Hourly earnings Equations

An earnings function is estimated of the type:

$$log\ (w_i) = a + S\ b_j X_{ji} + S\ c_k\ C_{ki} + S\ d_h\ H_{hi} + f_i \qquad (1)$$

where $\boldsymbol{w_i}$ is the productivity measure (hourly earnings), $\boldsymbol{X_{ji}}$ contains only exogenous endowments that are not modified by the individual or family, $\boldsymbol{C_{ki}}$ are reproducible forms of human capital, and $\boldsymbol{H_{hi}}$ are the health status indicators. In this section, the health status indicators are assumed to be exogenous to the hourly earnings function and not correlated with the errors $\boldsymbol{f}$ in equation (1). The parameters $\boldsymbol{a}$, $\boldsymbol{b}$, $\boldsymbol{c}$ and $\boldsymbol{d}$ are estimated, the error term $\boldsymbol{f}$ is assumed to be zero mean independently distributed, $\boldsymbol{i}$ refers to individuals, and $\boldsymbol{j}$, $\boldsymbol{k}$ and $\boldsymbol{h}$ refer to the specific variables in the sets denoted $\boldsymbol{X}$, $\boldsymbol{C}$ and $\boldsymbol{H}$ respectively. The sample includes wage earners and also the non-wage workers with positive earnings.

Among the exogenous endowments $\boldsymbol{X}$, age and age squared are included. The variable in $\boldsymbol{C_{ki}}$ is the number of years of schooling. Although a dummy variable for migration (equal to one if the person lives in a different place from where she did five years before the survey, and zero otherwise) was initially included in set $\boldsymbol{C}$, this did not affect substantially the coefficients of health or education in any manner, therefore these results are not reported.

As health status indicators $\boldsymbol{H_{hi}}$, three variables are considered in separate regressions:

1. a dummy variable that is one when the person did not go to work at least one day in the previous month because of illness (incidence of disability);
2. the number of days that the person was disabled in the previous month[23] (duration of disability); and
3. height of individual (measured in centimeters).

The "number of days disabled" uses the threshold of inability to work to make the sickness less subjective, and adds the information on how long the individual is incapacitated, although much of the information is contained in the first binary variable "disability." However, as the empirical results show, both variables explain more or less the same facts. On the other hand, height for adults is used as an indicator of child nutritional status, exposures to diseases and variation in other environmental factors (Schultz, 1997).

The equation was estimated with and without domestic servants but the parameters did not differ.[24] Similarly, the model was estimated separately for wage earners and self-employed, without uncovering

[23] The persons who were not disabled in the previous month had a value of zero in this variable.

many interesting differences. These factors are summarized in terms of two dummy variables, one for domestic service, and one for wage earners. The working assumption is that they are exogenously determined. Similarly, although in estimating equation (1) the human capital variables may be correlated with the error, education is treated as an exogenous variable. The earnings function was estimated separately for men and women, taking into account that some of the health status and control variables may differ by sex, in particular, height. The earnings function was also estimated separately for rural and urban areas, though they are linked by the choice of migration.

The hourly earnings regressions are shown in Table 5. A surprisingly weak correlation is observed between wages and the number of days disabled and disability. The variables are not significant and do not even have the expected signs. Otherwise, the basic log earnings regressions are plausible. Because the health variables may themselves be simultaneously determined and measured with error, a next step of instrumenting for health status is undertaken. The model is also estimated excluding the health variables from the right hand side of equation (1). Notice that the returns to education are not altered by the inclusion of health variables in the regressions.

The regressions with height show that this variable is significant and has the correct sign. Height benefits men's earnings more than women's earnings (comparing the coefficient of the linear term for males and females). Quadratic terms in height and in number of days disabled are included to check for non-linearities, and only height and height squared are significant. Along the relevant interval of height (1.35 to 2 meters) the productivity effects of height were always increasing and convex. In additional regressions (not included) it was found that height and education are positively correlated in Colombia, so that when controlling for education, the coefficient of height drops markedly.[25] Estimations of the model for the whole sample with a gender dummy, indicated that being a female is negatively related to productivity, a result that had already been found in other studies (Ribero y Meza, 1997). Similarly, the rural areas have lower productivity, a result also previously documented by Leibovich et al. (1997). The age variables are significant and have the expected signs.[26]

Being a salaried worker exerts different effects in the two data sources. With the survey of 1993 that includes urban and rural sectors (CASEN), a salaried worker has higher wages. The variable is positive and significant for rural males and females and urban females, but not significant for urban males. In the urban survey of 1991 (ENH-91), the effect of being a salaried worker is negative for males and positive for females. Domestic servants have systematically lower earnings[27].

4.2 Hourly earnings Equations with Selection Bias Correction

When an earnings equation is estimated to calculate the returns to human capital in the population based only on a sample of individuals who are participating in the market, the estimated returns may be biased (Heckman, 1979). The selection bias may be particularly serious in estimations of female earnings, because relatively fewer women make the decision to enter the labor force. If other variables that determine the decision of participation and are unrelated to the market wage offers are observed, it is possible to obtain

[24] I.e. that the coefficients of all the other variables except for the intercept are the same when domestic servants are included or excluded from the sample.

[25] In similar earnings equations, the coefficients of (height/100) without education were 2.1 and 1.5 for men and women respectively. When education is included they drop to 0.71 and 0.47 respectively. These coefficients are significant.

[26] When the regressions involve quadratic terms in the explanatory variables and the coefficients are significant, the critical values are reported at the bottom of the tables. These are calculated by differentiating totally the fitted equation of the model with respect to the variable of interest, equating the derivative to zero and solving for the optimal value.

[27] When the model was estimated with the domestic servants in the CASEN sample and the dummy for domestic servant (this regressions are not reported), the same pattern was found, but the variable is not significant for rural males.

corrected estimates of the returns to human capital, by joint estimation of the probability of receiving positive earnings and equation (1).

The econometric model to estimate has two parts:[28]

1. Probit for Labor Force Participation (Selection Mechanism):

$$z_i^* = \gamma p_i + u_i$$

$$z_i = 1 \text{ if } z_i^* > 0$$

$$z_i = 0 \text{ if } z_i^* \leq 0$$

$$Prob(z_i = 1) = \Phi(\gamma p_i)$$

$$Prob(z_i = 0) = 1 - \Phi(\gamma p_i) \quad (2)$$

$z_i = 1$ when the individual i participates in the labor market, and $z_i = 0$ when individual i does not participate in the labor market. Φ is the standard normal cumulative distribution function, the error term u is assumed to be distributed with mean zero and variance one, i refers to individuals and γ are the parameters estimated in the probit model. The variables p_i determine the decision of participation and are exogenous to the market wage offer. In theory, the individual will enter the market if the wage offer he or she receives is higher than his or her reservation wage. It is theoretically appealing to consider variables such as non-labor income as determinants of the probability of working, because those variables determine the reservation wages of individuals and may affect their entrance into the labor market.

2. Hourly earnings Equation:

$$\log(w_i) = \alpha + \Sigma \beta_j X_{ji} + \Sigma \chi_k C_{ki} + \Sigma \delta_h H_{hi} + \varphi_i, \text{ observed if } z_i = 1$$

$$(u_i, \varphi_i) \sim Bivariate\ Normal(0,0,1,\sigma_\varphi^2,\rho) \quad (3)$$

The hourly earnings equation (3) is equal to equation (1), but it is observed only when the individual is a participant in the market. σ_φ is the standard deviation of the error term φ, and ρ is the correlation coefficient between the error terms u and φ. The variables z_i and p_i are observed for a random sample of individuals, but $\log(w_i)$ is observed only when $z_i = 1$. The model to estimate is:

$$E[\log(w_i) | z_i = 1] = \alpha + \Sigma \beta_j X_{ji} + \Sigma \chi_k C_{ki} + \Sigma \delta_h H_{hi} + \rho\ \sigma_\varphi\ \lambda(\gamma p_i) \quad (4)$$

where $\lambda(\gamma p_i) = \phi(\gamma p_i) / \Phi(\gamma p_i)$ and ϕ is the standard normal probability density function.

Besides age and education, the additional variables used to explain participation in the labor force p_i were non-labor income,[29] the dummy for living in a house or apartment,[30] a dummy variable for having adequate

[28] The model is based on Greene (1997).

[29] Non–labor income is defined as the sum of four variables in the survey. The actual question of the survey is: did you receive money in the last month from any of the following concepts: a) interest (yes, no, amount), b) rent (yes, no, amount) c) pensions or retirement benefits (yes, no, amount) and d) monetary assistance (yes, no, amount). Since non-labor income was not a very powerful instrument for explanation of participation in the labor force, other housing variables were used as proxies for wealth. Notice that non-labor income is measured as the level of the individual and not for the family.

floors[31] in the house, and a dummy for being the owner of the house where the individual lives.[32] These variables proxy the individual's non human wealth and are expected to reduce his or her likelihood of participating in the labor force. When the l's coefficient is positive and significant, the unobservables that contribute to the probability of participation are positively associated with receiving higher market earnings, for reasons not accounted for in the earnings equation. When the coefficient for l is negative and significant, the opposite happens. It is not obvious a priori what sign to expect for l.

The results of this estimation for females are shown in Table 6. The variables explaining participation in the labor force are significant and have the expected signs. The non-labor income and the other proxies for wealth diminish the probability of participation for the rural and urban samples, except for adequate floors in the rural sample.

The returns to schooling in Table 6 are basically equal to the ones shown in Table 5 for the urban areas,[33] but they are smaller (less than one third) for the rural areas. The significance of the coefficient for l indicates that the returns to schooling estimated without the Heckman correction are not biased for the urban sample, but they are biased for the rural sample. According to the sign of l, rural women who work, holding the observables in equations (2) and (3) constant, are those who would be paid less.

The productivity effects of disability remain non-significant after the correction. The coefficients of height and height squared change when selection bias is corrected, but the derivatives of earnings with respect to height evaluated at the sample mean remain equal with and without the correction. The parameter l is significant in the specifications of column (5), (7) and (8) but for the others remains insignificant.[34]

The model was also estimated for males, but these results are not reported. The negative effect of the wealth proxies on participation that was found for females, holds for males. However, for males the parameter l was insignificant, implying no sample selection bias. In the absence of selection bias, the uncorrected estimates are more efficient as well as consistent (Heckman, 1979).

4.3 Health Equations

In this section the determinants of the observed health outcomes are explored. Using information on individual's education and wealth, local prices (***O***) and the community health infrastructure prices and policies (***P***), the model tries to account for the individual indicators of health status (***H***). The estimated equation is:

$$H_i = g + S\, c_l X_{li} + S\, h_j O_{ji} + S\, r_k P_k + t_i \qquad (5)$$

where ***g, c, h,*** and ***r*** are estimable parameters, ***t*** is the error term, ***l, j*** and ***k*** index the sets of exogenous endowments to the individual (***X***), private opportunities (***O***) and public policies (***P***) respectively, and ***i*** indexes the individual. Equation (5) was estimated with Probit models when the health variable is the

[30] The survey question for "tipo de vivienda" (type of housing) has four options: 1. "Casa" (house) 2. "Apartamento" (condominium or apartment) 3. "Cuarto o cuartos" (Room or rooms) and 4. "Otro: vivienda móvil, refugio natural, carpa, etc." (Others: trailer, natural refuge, tent, etc.). The dummy built here takes the value 1 when the answer was 1 or 2 and zero when the answer was 3 or 4.

[31] Adequate floors are defined as those made of tile, brick, carpet, marble or hard wood. The alternatives were cement or dirt ("tierra").

[32] This variable, called "owner-occupied housing", is a dummy variable equal to 1 if individual lives in a house that is owned by him or his family, and 0 if he lives in a place rented or other.

[33] Notice that in these cases the coefficient for l is not significant.

[34] Although the correction for selection bias was found relevant in some cases, in the rest of the paper it is ignored, because it is particularly difficult to implement instrumental variables together with selection bias correction.

dichotomous variable for "disability." The model was estimated with ordinary least squares when the health variables were "number of days disabled in the last month"[35] and "height."

When the health variables are "disability" and "number of days disabled in the last month," the data are rural and urban for the year 1993. Age of the individual is specified as an exogenous endowment.[36] Considering that wealth might shift health outcomes positively (given that wealthier individuals have more resources to spend on health), non-labor income and a dummy to indicate the type of housing[37] were specified as individual private opportunities (***O***). Using data from CASEN and from other sources,[38] a list of variables to describe the community-specific environment (***P***) were matched to sample clusters. The variables ***P*** are defined for 52 regions (approximately twice the number of "departamentos," since most of the regions have rural and urban areas).[39] At the municipality level, characteristics that were expected to be related to the health outcomes were climate,[40] availability of health centers, enrollment in social security,[41] transportation infrastructure, transportation time to reach hospitals, transportation time to reach schools, availability of water and electricity. Among those, few result in significant correlations and some of them have a counterintuitive sign. At the "departamental" level, the only significant variable was the number of yearly transfers from the central government to the "departamento" for health.[42]

Regional differences in Colombia are very important. Levels of earnings, formality of labor markets, levels of education and health are in general worse in coastal regions than in the interior. Particularly the Pacific coast is known to be the poorest region in the country. Although the variable altitude may capture some of these regional differences,[43] there are cultural, racial and institutional differences that persist among these regions that go beyond the climate. In order to capture some differences due to these elements, two regional dummy variables were introduced, one for living in a "departamento" on the Pacific coast and one for living in a "departamento" on the Atlantic coast.[44]

When the health indicator is height, the data is only for the urban population in the year 1991.[45] At the individual level the model controls for age,[46] non-labor income, and a dummy to indicate owner-occupied housing.[47] The variables that capture environmental health risks (***P***) are two indicators constructed at the city level, from the ENH-91. The first one measures availability of basic services in the households of the community where the person lives[48]. The second one measures percentage of houses in the community that are not overcrowded. City and strata define the communities or sample clusters for urban areas.

The estimation results are in Table 7. Age is an important factor that explains the three health indicators, with older individuals tending to have worse health. The coefficients of age and age squared are individually

[35] Since the variable is truncated at zero and 30, Tobit models were also, but the results do not differ substantially from the OLS.
[36] Since older individuals tend to have lower levels of health, age and age squared were taken into account to capture possible diminishing returns.
[37] The same variable "lives in house or apartment" defined in Section 4.2.
[38] The Ministerio de Salud and the Instituto Geográfico Agustin Codazzi.
[39] Some regions are only urban and others are only rural.
[40] Altitude, temperature and yearly average rainfall in each municipality.
[41] In 1993 approximately 25% of urban residents and 8% of rural residents were affiliated or beneficiary of the Social Security Institute for health services, 10% of the Colombian population used private health care, and 5% were covered by other services.
[42] Other variables that were available but not included in this final model were: the number of primary and secondary schools, the number of hospital beds, average times to reach schools, average daily hours in schools.
[43] Coastal regions are closer to the level of the sea.
[44] The reference category was living in the interior.
[45] It was impossible to find for 1991 the same information found for 1993 at the municipality level.
[46] Age is more important for height than for the other health outcomes.
[47] The same variable "owner-occupied housing" defined in Section 4.2.
[48] The availability in the community of each basic service separately, was insignificant. The variable used here, that aggregates the availability of the three basic services (electricity, water and sewage) in the households, provided significant estimates.

significant for the number of days disabled, and jointly significant for the probability of having a disability.[49] The negative effects of age on health are larger in rural than urban areas, and for females more than males. Non-labor income is not significant, but the wealth proxy "living in a house or apartment" is negatively related to the number of days disabled and to the incidence of disability, and is significant in the urban samples. Home ownership is positively related to height. These results coincide with the intuition that wealthier individuals tend to have better health, controlling for the individual and community characteristics listed in Table 7.

The number of hospitals or clinics per capita is not significant, except for the explanation of the number of days disabled for the male urban sample. In this case, however, this variable has a counterintuitive sign that implies that more hospitals or clinics per capita led to more days disabled in this sub-sample.

In the rural areas the model shows the expected negative sign for the variable "percentage of people directly enrolled or beneficiaries of social security," and it is significant when the health outcome is the number of days disabled. The econometric model reveals that a 10% increase of the percentage enrolled would reduce the mean disability for a man in rural areas by more than 0.2 days. The incidence of disability for rural females would be reduced by two percentage points with that same increase. In urban areas, however, the "percentage of people directly enrolled or beneficiaries of social security" has a positive coefficient on disability, although theoretically the access to social insurance is expected to improve health. This may be due to the fact that in urban regions there are more individuals who are affiliated with social security[50] and they may tend to report more disabilities because they can more readily access diagnostic services, but not necessarily because they are more frequently ill.

Health outcomes were expected to be affected by the coverage of electricity, because almost all households in rural areas have access to potable water,[51] but the coverage of electricity is still low.[52] However, electrification did not show any significance. Climate variables such as altitude[53] were significant in the rural samples for the number of days disabled, with a negative sign, which implies that in places with higher altitude health tends to be better. The negative sign of the coefficient for altitude was expected, given that the regions closer to the level of the sea are more humid and the prevalence of communicable diseases is more common. This coincides with a general perception that the lowlands in Colombia are less healthy (Rosenzweig and Schultz, 1982b).[54] Estimations with altitude and altitude squared (these regressions are not reported) suggested that non-linearities in the effect of altitude on our health indicators are not strong.

The distance in kilometers between the municipality and the capital of the "departamento"[55] is an approximation of commuting time or the price of metropolitan health services. This variable was significant only for the explanation of the number of days of disability of the rural male sample; more distance to the capital of the "departamento" implies more days of disability. It is intuitive that distance is significant for a rural sample because urban areas usually have at least one health center, while rural individuals have to

[49] Estimation of this model only with a linear term for age showed that one more year of age increases the probability of having disability by 0.6% and 0.8% for urban males and females respectively, and by 1.1% and 1.3% for rural males and females respectively. These regressions are not reported.
[50] Only 8% of the rural labor force is covered by social insurance, compared to 25% of the urban labor force.
[51] Usually the houses are built in places close to potable water sources (rivers, creeks or irrigation systems).
[52] Since electricity allows households to have a refrigerator and keep food in safer conditions and also helps to make public health programs more widely known through television, it maybe a more powerful explanatory variable than potable water in rural areas.
[53] When the model is estimated with temperature instead of altitude the results are very similar. The reader has to take into account that Colombia's proximity to the Equator implies a strong correlation between temperature and altitude.
[54] They find that altitude and altitude squared are significant in the determination of child mortality and that child mortality is lower in regions with higher altitudes.
[55] It would have been more useful to have the commuting time to the closest hospital or medical center, but unfortunately this information was not available.

commute to find one. However, it is hard to find an economic explanation for the gender difference in this result.

In addition to the other factors taken into account in Table 7, living on the Pacific Coast contributes positively to disability and to the number of days disabled for all females (rural and urban) and for rural males. People living in that region have on average between 0.25 and 0.87 more days disabled. The dummy variable for the Atlantic Coast was significant on reducing the number of days disabled for the rural male sample, but it does not contribute in a special way to individual health in the other samples. When the models were estimated without the regional dummies, the other coefficients were very similar.[56]

The estimations for height by gender are shown in column (9) and (10) of Table 7. Height increases with age until around 23 years old, but then begins to decrease. The shape of a graph with height in the Y-axis and age in the X-axis with the coefficients from Table 7, is that of an inverse U indicating that height is subject to diminishing returns to age, i.e. that for older individuals an additional year implies a larger decrease in height than for younger individuals. This behavior was expected from the analysis of the descriptive statistics included in Section 3. The height patterns are further explored in Table A-3 included in the Appendix. Disaggregating by sex, a regression is first reported on age as a linear and then quadratic function to quantify the trend of improvement in height and nutrition, holding nothing else constant. The trend indicates that one year older cohorts have 0.06 cm. less of stature, more or less the same for males and females. A woman with one more year of schooling is expected to be 0.3 cm taller and a man 0.4 cm. holding only age constant. When other individual variables e.g. non-labor income, owner-occupied housing, and community characteristics are taken into account, the partial association between schooling and height decreases.

"Owner-occupied housing" is a significant determinant of height and has the expected positive sign. The wealthier an individual is, the better his health status indicator is. The "percentage of houses in the community with basic services" is significant to explain height of individuals and it has positive sign. To live in a community with a high level of basic services contributes to more height for the individual, though only the male coefficient is significant. Similarly, the supply of adequate housing, measured by the "percentage of houses in the community with adequate number of rooms per person," is associated with better health outcomes for individuals, measured by height.

When wealth is interacted with public policies[57] to analyze the personal distribution of health benefits, the product of non-labor income and the "percentage of houses with adequate number of rooms per person" is significant and positive, indicating that non-labor income and the adequacy of houses in the community are "complements."[58] In parallel regressions run with the same explanatory variables but excluding the interaction term, non-labor income was significant and positive, and the effect was greater for females than for males.[59]

Tests of joint significance of the identifying variables[60] imply that they are jointly significant. The hypothesis that the coefficients of the identifying variables in each model are jointly equal to zero can be rejected at the 5% level. Only in columns (3) and (5) can the null hypothesis be rejected at the 10% level.

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[56] These regressions are not reported.

[57] The interaction is similar to the one between mother's education and program treatment mentioned in Rosenzweig and Schultz (1982a).

[58] Schultz (1984). The fact that they are complements means that having adequate housing in the community does not reduce the lower health caused by a lack of non-labor income.

[59] The regressions are not included in the paper. The estimated coefficient of "non-labor income/10^6" in the height female regression was 6.60 (t-statistic = 2.68). For males, the coefficient was 1.72 (t-statistic = 2.24).

[60] All except age and age squared.

4.4 Hourly earnings Equations with Instrumental Health Variables

In this section, the earnings function (1) is re-estimated because the human capital health stocks (***H***) may be correlated with the earnings error or be itself measured with error, imparting bias to single equation estimates of the earnings equation. These problems are solved by estimating equation (1) using instrumental variable [IV] methods. The estimated equation is:

$$log\ (w_i) = a + S\ b_j X_{ji} + S\ c_k\ C_{ki} + S\ d_h\ H_{hi}^{*} + f_i \qquad (6)$$

where w_i is the hourly earnings, X_{ji} contains only exogenous endowments, C_{ki} are forms of human capital, and H_{hi}^{*} are the endogenous health status indicators. The health status variables are assumed to be endogenous because they result from a process that involves individual resource opportunities, local prices (***O***), and community prices and policies (***P***). H_i^{*} are computed using the estimated parameters from Section 4.3:

$$H_i^{*} = g^{\wedge} + S\ c_l^{\wedge} X_{li} + S\ h_j^{\wedge} O_{ji} + S\ r_k^{\wedge} P_k \qquad (7)$$

The identifying instruments used to predict H^{*} are included in the environmental variables ***P*** and ***O*** [61].

Table 8 reports the estimation results for the model using instrumental variables for health variables. This was done for rural and urban areas and by gender[62] separately. The pattern of effects of the health indicator changes significantly with the IV method, and health variables are now more significant and affect wages in the expected directions.

For the dummy variable "disability," the effects become negative and significant for all the samples, although they are more significant for males than for females.[63] This is the expected sign for this variable and it was not observed in the estimations without IV methods shown in Table 5. The effect of number of days disabled on earnings is negative and significant for rural samples, and the size of the coefficients indicate that one more day of disability reduces more significantly male earnings than female earnings. In the urban samples, the pattern for ***ln(w)*** depicted by the coefficients of the quadratic specification for number of days disabled is U-shaped. The returns to the number of days disabled are decreasing in the first nine[64] (for males) or eleven (for females) days of disability. For more days of disability the returns reverse and become increasing. In fact, the bulk of the sample has fewer than ten days of disability as shown in Figure 1. In the rural samples, the shape of ***ln(w)*** depicted by the quadratic specification for number of days disabled is decreasing and concave in all the relevant range,[65] indicating that the effects on earnings of the number of days disabled are negative and are worse for a higher numbers of days. The education returns are approximately the same as those shown in Table 5.

When the endogeneity of health is taken into account, the estimated effects of being salaried for all the samples are equal to the ones shown in Table 5. Similarly, domestic servants continue to be paid less, but according to the IV methodology the coefficient's absolute value increases.

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[61] The squared endogenous variables are computed running first stage regressions on the quadratic term and using that auxiliary regression to predict the squared endogenous variable. The auxiliary regressions are included in the Appendix, Table A-4.

[62] Given that the percentage of domestic servants is only 4.6%, the model with disability and number of days disabled was estimated excluding domestic servants.

[63] The endogenous probability of disability for urban and rural females is significant at the 10% level.

[64] The critical values reported in the tables are calculated by differentiating totally the fitted equation of the model with respect to the variable of interest, equating the derivative to zero and solving for the optimal value.

[65] Although in rural samples both terms are not individually significant, they are jointly significant as indicated by the test reported in the table.

The IV models in the last four columns of Table 8 show that height is significant in the determination of wages, in the linear and quadratic specifications, for both males and females.[66] The size of the coefficients in the linear specifications of columns (13) and (15) is much larger than the corresponding OLS estimates from Table 5 (the male coefficient is eleven times larger, and the female coefficient is fifteen times larger). This indicates that when the endogenous determinants of height are taken into account, the effect of endogenous variation in height on productivity is increased substantially. The quadratic effects of height on hourly earnings estimated by instrumental variables are not defined precisely by our data for females or plausibly for males (Table 8). Therefore, the discussion here (and subsequent simulations) rely on the uniformly significant estimates of the linear specification by instrumental variables, which can be interpreted as the expected wage effects of height for the average person in our sample.[67]

4.5 Simulations with Health Production Functions and Hourly earnings IV Equations

The last step of the research combined the estimates from the earnings function and the health outcome equations to simulate how changes in policy variables are likely to affect lifetime earnings. In order to apply this procedure, the simplifying assumption that the effects of health on wages are uniform over the life cycle is introduced. The effects of policy changes on the probability of having a disability,[68] on height, and on productivity are presented. This section is based in the estimates from Tables 7 and 8.

From Table 7 it was seen that most of the policy variables, were not significant for the explanation of disability, which makes it difficult to draw many policy inferences from the model. Therefore, the only variable considered for simulations with disability was the coverage of affiliation to social security. Table 9 shows the results in the probability of being disabled for the different models when the percentage of individuals affiliated to social security in the “departamento” and area (urban or rural) is increased by 10%, 20% and 30%. The second part of Table 9 shows the consequent changes in log earnings implied by such a policy.

As expected from the sign of the coefficients shown in Table 7, more affiliation to social security in rural areas would decrease the probability of being disabled and increase productivity while the opposite would hold in urban areas. According to the model described by equation (5), and controlling for the other variables included in column (1) to (4) of Table 7, an increase of 20% in the social security coverage in rural areas could reduce the probability of being disabled by 5.3% for rural women and by 2.1% for rural males. This particular change would reflect increases in the productivity for rural women of 0.7% and for rural males of 0.5%, controlling for the other variables included in column (9) to (12) of Table 8. All these conclusions hold, assuming that all other variables are held constant. In addition, the link between social security and better health may not be causal. In urban areas, social security is associated with a higher tendency to report illness, and our indicator may only be revealing the formality of the labor markets in the sub-regions.

The effect on height and the consequent changes in earnings of performing diverse simulations are shown in Table 10. The first line shows the estimated model without variations. Subsequent lines show diverse simulations with “percentage of houses in the community with basic services” and “percentage of houses in

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[66] Although for females both terms are not individually significant, they are jointly significant as indicated by the joint test reported in the table.

[67] The estimated values for height and height squared imply that earnings increase with height, as it was expected, for 99.9% of the female sample (those with height lower then 182 cm.). However, the quadratic specification did not provide reasonable predictions for 33% of the male sample (those with height lower than 167 cm.). The estimated model exhibits negative income effects of height for that group, because the U-shaped curve of *ln(w)* against height reaches a minimum at 167 cm.. This problem persisted when the sample was restricted to men older than 25, because younger men may not have yet reached their adult height and may receive low incomes.

[68] The results of the simulations with number of days disabled are very similar and are not included.

the community with adequate number of rooms per person." Simulations confirm that both policies would be positively associated with stature and earnings, as expected from Tables 7 and 8. Almost all the simulations produced a higher percentage effect on female height than on male height, but the related increases in earnings to each policy are higher for males than for females. This is consistent with the fact that the productivity effects of height for males are higher than for females. The effect on earnings of increasing the provision of adequate housing would be greater than of increasing the provision of public services. Holding constant all the other variables included in the models, and assuming that it was possible to increase by one third the "percentage of houses with adequate number of rooms per person," it would increase by 2.2% females' height and by 1.9% males' height, which in turn could imply increases in hourly earnings of 27% and 29% respectively.

5. Conclusions

The purpose of this study was to understand how public and private investments in health in Colombia might be related to future earnings of individuals. In Colombia there are no previous studies that considered health as a determinant of an individual's income. Human capital had always been viewed from an educational perspective, although health is obviously an important component of individual human capital in increasing work productivity and enhancing the functioning of the economy as a whole. As with education, the health status of individuals can be improved through public policies. The study identified the magnitude of the returns to having good health status through the direct effect of health variables on earnings of individuals. It was found that one more day of disability decreased male rural earnings by 32% and female earnings by 13%, that having a disability in a given month decreased the earnings of an urban male by 28% and by 14% for an urban female, and having one more centimeter of stature increased urban female earnings by 7% and males by 8%.

At the descriptive level, illness is more frequent for women than for men, for less educated than for more educated, for rural than urban residents, and for older individuals. Corresponding patterns were found with height, although this sample was only urban. The well educated are almost 9 cm. taller than those with no years of education and mean height is lower for older age groups. Investments in health have an impact on an individual's productivity and the impact is larger than found in one African study. A Mincerian log-earnings equation that included health indicators as a parallel form of human capital was estimated. The initial OLS regressions with number of days disabled and disability, exhibited a weak correlation between health status variables and earnings. When health status variables are treated as endogenous and estimated by instrumental variables, both variables become significant and have the expected signs. The regressions with height showed the correct sign and high significance even without the IV correction for health, but the coefficients increased significantly with IV methods. The linear returns to height are increasing. Correcting for the selection bias introduced when only individuals who are earning positive wages are analyzed, made little difference in the hourly earnings equation estimates.

Significant and positive effects of height have been estimated. They were found greater than in other countries. A taller man receives hourly earnings 8% higher per centimeter and a woman receives hourly earnings that are 7% higher per centimeter. Contrary to results observed in other studies, the returns to education are almost invariant to the introduction of health in the earnings equations. They change from 9.8% without height to 9.1% with height for urban men and from 9.6% without height to 9.0% with height for urban women. They are identical when the dummy for disability or the number of days disabled is included in the IV estimates of the earnings function.

The coverage of social security and altitude in the community were among the most important determinants of incidence of disability and number of days disabled in rural areas. In those areas where the coverage of social security is low, more social security implies fewer disabilities and also fewer days disabled. On the contrary, in urban areas, higher levels of social security are associated with reporting disabilities more frequently. This led to the conclusion that increasing social security in rural areas could be associated with a lower incidence or duration of illness in these regions. However, social security may not necessarily improve the health of individuals and may be associated with the tendency of respondents to report illnesses more often, as is the case in urban areas.

A general result that does not depend on the measure of health status used is that wealthier individuals (those who have higher non-labor incomes, or own the house where they live, or live in a house or apartment), controlling for age, community characteristics and geographic location, tend to have better health. Also a complementarity between the non-labor income (wealth) of the individual and the number of rooms per person in the houses of the community where the person lives, was found in the production of health. The interaction of these two variables positively affects the health status of individuals.

Individual wealth and favorable environmental conditions such as the provision of public services and adequate housing in the community, were the most important determinants of health in urban areas. Under the assumptions specified in the models, policies oriented to increase the coverage of basic services in the households (electricity, potable water or sewage) were found to have a negligible effect on height and, through height, on productivity. An increase in the supply of adequate housing would translate into better health conditions and productivity for individuals. These changes, in general, would benefit male earnings more than female.

Finally, it should be noted that the quality of available information on public health interventions is a limitation of the study. The answers to the questions "Were you disabled in the last month?" and "How many days were you disabled in the last month?" are subjective and may exhibit recall errors. Although height may also be subject to measurement errors, the study showed that it offers a better measure of health status, revealing the value of using anthropometric measures as adult health indicators. Despite a large effort of collecting data at the "departamento" and municipality levels to describe the individuals' environment and merging it with the household surveys data for the analysis, most of these indicators could not account for the variation in individual health indicators. Although several patterns are suggestive, variables that were expected to be correlated with health outcomes such as the coverage of vaccination programs for different diseases, the supply of hospitals in the region, the number of hospital beds in each region, and the number of primary and secondary schools, were not significant in explaining the available health indicators. This fact may reveal the poor quality of the information collected from sources other than the surveys, and the need for better indicators of the quality and prices of the health services. It may reveal also that the health services offered may be of poor quality, or that they are not relevant in improving the adult health indicators used in the study.

Future research should extend this analysis of height in combination with household survey measures of acute and chronic illnesses and weight to height (BMI), which could be jointly explained by local policy and environmental factors. With these data, a firmer case may be made for investments in particular health programs and policies, that would be expected to raise labor productivity by improving the Colombian population's current health status.

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Figure 1. Histogram of number of days disabled

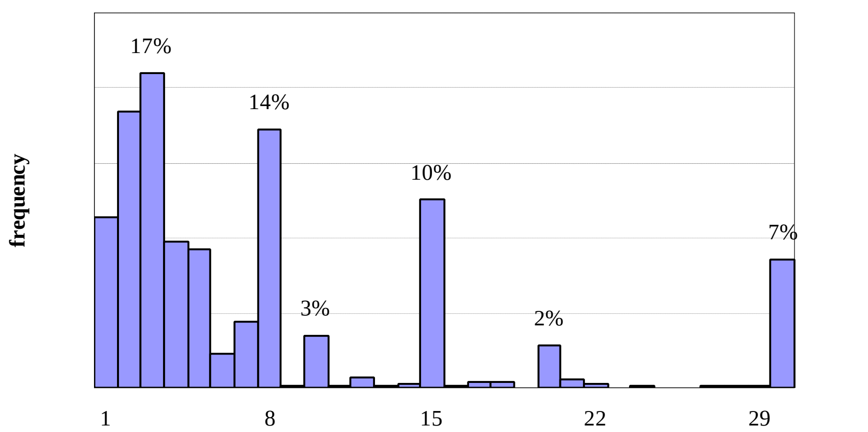

Figure 3: Mean height by year of birth - Labor force ages 25-55

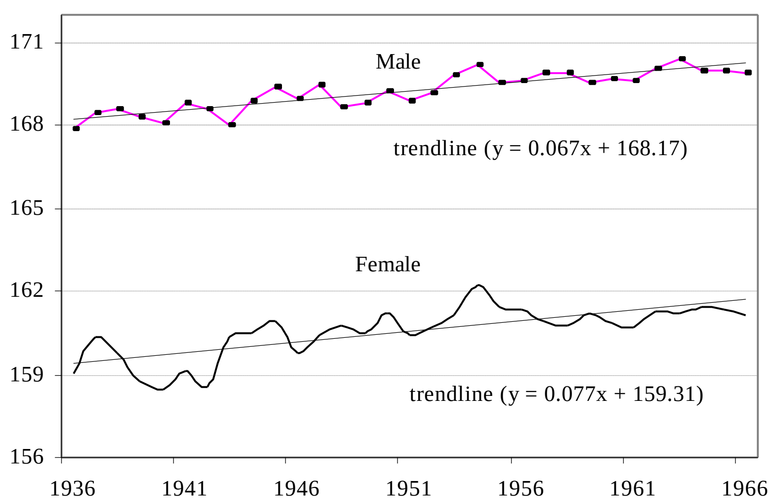

Figure 2: Mean height by year of birth - All sample ages 25-55

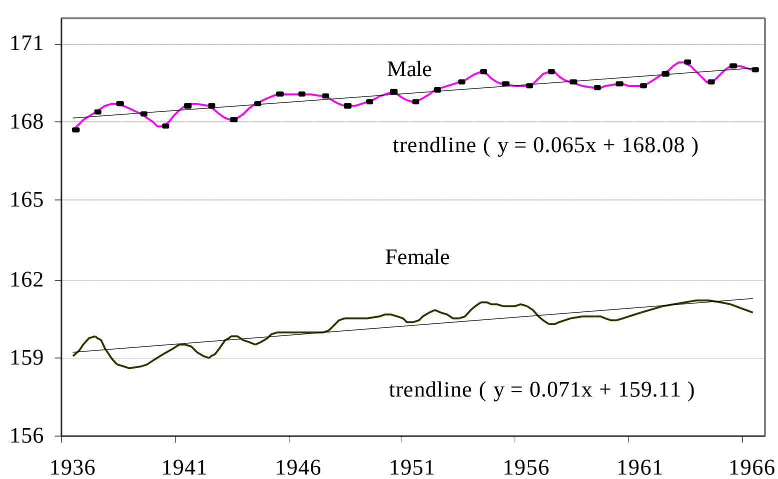

TABLE 1. WEIGHTED SHARE WITH DISABILITY BY SEX, AGE, EDUCATION AND AREA

	AREA				SEX		
EDUCATION	RURAL	URBAN	TOTAL	EDUCATION	MALE	FEMALE	TOTAL
0 years	52,184	24,606	76,790	0 years	53,164	23,626	76,790
% POP.	9.60%	6.46%	8.31%	% POP.	7.99%	9.13%	8.31%
1-6 Years	139,580	222,164	361,744	1-6 Years	237,664	124,080	361,744
% POP.	6.78%	6.80%	6.79%	% POP.	6.46%	7.55%	6.79%
7-12 Years	18,315	237,096	255,411	7-12 Years	150,262	105,149	255,411
% POP.	4.83%	6.29%	6.16%	% POP.	6.11%	6.23%	6.16%
+13 Years	1,298	42,179	43,477	+13 Years	13,723	29,754	43,477
% POP.	3.61%	4.31%	4.28%	% POP.	2.44%	6.57%	4.28%
TOTAL	211,377	526,045	737,422	TOTAL	454,813	282,609	737,422
% POP.	7.01%	6.27%	6.46%	% POP.	6.17%	6.99%	6.46%

	EDUCATION						SEX		
AGE	0 years	1-6 Yrs.	7-12 Yrs.	>13 Yrs	TOTAL	AGE	MALE	FEMALE	TOTAL
18-24	2,466	49,186	64,010	3,139	118,801	18-24	70,496	48,305	118,801
% POP.	3.84%	5.44%	5.77%	3.15%	5.45%	% POP.	5.03%	6.23%	5.45%
25-34	7,597	85,494	87,591	18,020	198,702	25-34	118,245	80,457	198,702
% POP.	5.88%	6.19%	5.33%	4.10%	5.53%	% POP.	5.22%	6.05%	5.53%
35-44	12,764	81,775	68,222	15,559	178,320	35-44	98,094	80,226	178,320
% POP.	6.29%	6.36%	7.44%	4.78%	6.53%	% POP.	5.85%	7.61%	6.53%
45-59	26,716	98,301	28,814	6,544	160,375	45-59	104,983	55,392	160,375
% POP.	8.23%	7.33%	7.21%	4.88%	7.29%	% POP.	6.99%	7.93%	7.29%
60-70	27,247	46,988	6,774	215	81,224	60-70	62,995	18,229	81,224
% POP.	13.40%	11.48%	8.75%	1.26%	11.49%	% POP.	12.11%	9.76%	11.49%
TOTAL	76,790	361,744	255,411	43,477	737,422	TOTAL	454,813	282,609	737,422
% POP.	8.31%	6.79%	6.16%	4.28%	6.46%	% POP.	6.17%	6.99%	6.46%

Source: CASEN

% of total population below numbers
Sample including all persons between 18 and 70 in the labor force

TABLE 2. MEAN NUMBER OF DAYS DISABLED BY SEX, AGE, EDUCATION AND AREA

AGE	SEX: MALE	FEMALE	TOTAL
18-24	6.87 (6.25)	4.28 (4.23)	5.82 (5.66)
25-34	6.38 (6.44)	6.36 (6.26)	6.37 (6.37)
35-44	7.53 (8.35)	7.05 (8.37)	7.31 (8.36)
45-59	10.17 (9.47)	7.12 (6.8)	9.12 (8.76)
60-70	10.30 (8.57)	10.95 (9.61)	10.44 (8.82)
TOTAL	8.12 (8.09)	6.65 (7.17)	7.56 (7.78)

EDUCATION	AREA: RURAL	URBAN	TOTAL
0 years	8.54 (8.24)	10.55 (9.52)	9.18 (8.72)
1-6 Years	8.77 (8.34)	7.37 (7.49)	7.91 (7.86)
7-12 Years	6.62 (5.15)	6.22 (6.7)	6.24 (6.6)
+13 Years	3.67 (0.95)	9.66 (10.29)	9.48 (10.19)
TOTAL	8.49 (8.09)	7.18 (7.62)	7.56 (7.78)

AGE	EDUCATION: 0 years	1-6 Yrs.	7-12 Yrs.	>13 Yrs	TOTAL
18-24	6.153 (4.66)	5.862 (5.9)	5.51 (5.02)	11.244 (10.25)	5.82 (5.66)
25-34	7.821 (6.5)	6.943 (6.54)	5.866 (6.14)	5.521 (6.24)	6.37 (6.37)
35-44	8.026 (8.81)	6.936 (6.77)	6.213 (8.03)	13.551 (12.99)	7.314 (8.36)
45-59	8.922 (8.83)	9.549 (9.35)	7.672 (6.66)	9.737 (6.41)	9.115 (8.76)
60-70	10.627 (9.14)	10.057 (8.97)	12.304 (5.26)	13.046 (13.08)	10.443 (8.82)
TOTAL	9.18 (8.72)	7.907 (7.86)	6.244 (6.6)	9.479 (10.19)	7.556 (7.78)

EDUCATION	SEX: MALE	FEMALE	TOTAL
0 years	9.38 (8.93)	8.74 (8.21)	9.18 (8.72)
1-6 Yrs	8.45 (8.32)	6.87 (6.77)	7.91 (7.86)
7-12 Yrs	7.07 (7.07)	5.06 (5.66)	6.24 (6.60)
+13 Yrs	9.15 (9.67)	9.63 (10.41)	9.48 (10.19)
TOTAL	8.12 (8.09)	6.65 (7.17)	7.56 (7.78)

Source: CASEN

Standard deviation in brackets
Sample including all persons between 18 and 70 in the labor force

TABLE 3. MEAN HEIGHT IN CENTIMETERS BY SEX, AGE AND EDUCATION

	SEX		
AGE	MALE	FEMALE	TOTAL
18-24	169.32	160.40	164.23
SD	(11.43)	(9.98)	(11.49)
25-34	169.50	160.38	164.55
SD	(10.10)	(9.93)	(10.96)
35-44	169.13	160.21	164.30
SD	(9.57)	(9.75)	(10.57)
45-59	168.05	158.63	162.94
SD	(8.51)	(10.86)	(10.91)
60-70	166.41	157.52	161.32
SD	(10.67)	(10.62)	(11.47)
TOTAL	168.89	159.81	163.89
SD	(10.14)	(10.17)	(11.08)

	SEX		
EDUCATION	MALE	FEMALE	TOTAL
0 years	164.66	155.25	158.58
SD	(9.52)	(12.79)	(12.46)
1-6 Years	167.01	158.30	162.04
SD	(9.10)	(10.28)	(10.68)
7-12 Years	169.44	160.72	164.63
SD	(10.63)	(9.80)	(11.05)
>13 Yrs	171.64	162.01	166.94
SD	(10.25)	(9.05)	(10.74)
TOTAL	168.89	159.81	163.89
SD	(10.14)	(10.17)	(11.08)

	EDUCATION				
AGE	0 years	1-6 Yrs.	7-12 Yrs.	>13 Yrs	TOTAL
18-24	160.37	162.11	164.72	165.76	164.23
SD	(14.81)	(11.06)	(10.97)	(14.03)	(11.49)
25-34	158.27	162.69	164.75	166.84	164.55
SD	(15.98)	(10.82)	(10.97)	(9.97)	(10.96)
35-44	160.28	162.50	164.73	167.61	164.30
SD	(8.27)	(10.53)	(11.20)	(8.15)	(10.57)
45-59	158.28	161.62	164.47	168.08	162.94
SD	(13.19)	(10.53)	(10.86)	(8.56)	(10.91)
60-70	157.59	160.92	162.85	166.10	161.32
SD	(10.74)	(10.41)	(12.44)	(19.11)	(11.47)
TOTAL	158.58	162.04	164.63	166.94	163.89
SD	(12.46)	(10.68)	(11.05)	(10.74)	(11.08)

Source: ENH-91

Standard deviation in brackets
Sample including all persons between 18 and 70 in and out of the labor force

TABLE 4. LN(HOURLY EARNINGS) BY EDUCATION AND HEALTH INDICATORS

HEALTH INDICATORS		MALES Years of Schooling 0	1-6	7-12	>13	Total	FEMALES Years of Schooling 0	1-6	7-12	>13	Total
DISABILITY	**NO**	5.64	5.95	6.37	7.20	6.16	5.41	5.68	6.22	6.99	6.05
		(0.88)	(0.85)	(0.82)	(0.78)	(0.92)	(1.14)	(1.02)	(0.86)	(0.73)	(1.03)
	YES	5.55	5.99	6.42	7.10	6.11	5.37	5.65	6.24	7.13	5.99
		(1.12)	(0.90)	(0.74)	(0.81)	(0.96)	(1.08)	(1.01)	(0.78)	(0.64)	(1.03)
	Total	5.63	5.96	6.37	7.20	6.16	5.41	5.68	6.22	7.00	6.05
		(0.90)	(0.85)	(0.81)	(0.78)	(0.92)	(1.14)	(1.02)	(0.86)	(0.72)	(1.03)
DAYS DISABLED	**0**	5.64	5.95	6.37	7.20	6.16	5.41	5.68	6.22	6.99	6.05
		(0.88)	(0.85)	(0.82)	(0.78)	(0.92)	(1.14)	(1.02)	(0.86)	(0.73)	(1.03)
	1-7	5.41	5.97	6.41	6.96	6.11	5.36	5.57	6.24	7.12	5.99
		(1.21)	(0.86)	(0.71)	(0.80)	(0.94)	(1.27)	(1.04)	(0.79)	(0.65)	(1.06)
	8-14	5.77	6.04	6.49	7.42	6.16	5.49	5.80	6.26	6.97	6.01
		(0.90)	(0.96)	(0.72)	(0.46)	(0.93)	(0.77)	(0.95)	(0.68)	(0.60)	(0.89)
	15-29	5.72	5.95	6.38	7.78	6.09	5.30	5.62	6.11	7.44	5.83
		(1.05)	(0.91)	(0.90)	(1.01)	(1.00)	(0.96)	(1.01)	(0.74)	(0.77)	(1.04)
	30	5.58	6.04	6.56	7.02	6.10	5.28	6.18	6.35	7.18	6.33
		(1.15)	(1.04)	(0.80)	(0.55)	(1.06)	(1.13)	(0.73)	(1.00)	(0.56)	(0.92)
	Total	5.63	5.96	6.37	7.20	6.16	5.41	5.68	6.22	7.00	6.05
		(0.90)	(0.85)	(0.81)	(0.78)	(0.92)	(1.14)	(1.02)	(0.86)	(0.72)	(1.03)
HEIGHT IN CM.	**135-154**	6.90	7.14	7.43	7.94	7.24	6.59	6.73	7.15	7.93	7.02
		(0.61)	(0.71)	(0.78)	(0.47)	(0.74)	(0.72)	(0.72)	(0.72)	(0.60)	(0.81)
	155-159	6.78	7.14	7.41	8.20	7.29	6.58	6.83	7.27	8.02	7.19
		(1.00)	(0.65)	(0.66)	(0.73)	(0.72)	(0.63)	(0.73)	(0.72)	(0.66)	(0.82)
	160-164	6.94	7.16	7.38	8.19	7.33	6.65	6.88	7.31	8.01	7.28
		(0.65)	(0.63)	(0.70)	(0.67)	(0.72)	(0.59)	(0.65)	(0.65)	(0.69)	(0.77)
	165-169	6.96	7.16	7.47	8.26	7.43	6.90	6.86	7.34	8.03	7.36
		(0.60)	(0.66)	(0.62)	(0.75)	(0.74)	(0.69)	(0.73)	(0.64)	(0.68)	(0.79)
	>169	6.98	7.21	7.51	8.34	7.58	6.56	6.84	7.34	8.07	7.39
		(0.62)	(0.59)	(0.63)	(0.78)	(0.77)	(0.94)	(0.70)	(0.63)	(0.65)	(0.79)
	Total	6.95	7.18	7.48	8.31	7.50	6.65	6.83	7.29	8.02	7.26
		(0.64)	(0.62)	(0.64)	(0.76)	(0.76)	(0.68)	(0.71)	(0.67)	(0.67)	(0.80)

Sources: CASEN (excluding domestic servants) for disability and number of days disabled. ENH-91 for height

Standard deviation in brackets

TABLE 5

HOURLY EARNINGS EQUATIONS: DEPENDENT VARIABLE LOG (HOURLY EARNINGS) [1]

	MALE										
	URBAN							RURAL			
Individual Variables [2]	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
1 - Age	0.069 *	0.069 *	0.069 *	0.069 *	0.057 *	0.056 *	0.057 *	0.036 *	0.036 *	0.036 *	0.036 *
	(25)	(25)	(25)	(25)	(16)	(16)	(16)	(6.9)	(7)	(7)	(6.9)
2 - Age squared / 1000	-0.674 *	-0.675 *	-0.675 *	-0.675 *	-0.507 *	-0.502 *	-0.504 *	-0.349 *	-0.352 *	-0.352 *	-0.350 *
	(20)	(20)	(20)	(20)	(11)	(11)	(11)	(5.6)	(5.7)	(5.7)	(5.6)
3 - Years of schooling	0.087 *	0.087 *	0.087 *	0.087 *	0.098 *	0.095 *	0.095 *	0.078 *	0.078 *	0.078 *	0.078 *
	(61)	(61)	(61)	(61)	(76)	(71)	(71)	(19)	(19)	(19)	(19)
4 - Dummy salaried worker (person earns a wage = 1)	0.003	0.003	0.003	0.003	-0.070 *	-0.068 *	-0.067 *	0.210 *	0.210 *	0.210 *	0.210 *
	(0.23)	(0.24)	(0.24)	(0.23)	(6)	(6)	(6)	(8)	(8)	(8)	(8)
5 - Dummy domestic servant=1					-0.326 *	-0.311 *	-0.312 *				
					(3)	(2.9)	(2.9)				
Health Variables											
6 - Number of days disabled/100		0.200	0.865						0.400	-0.221	
		(0.89)	(1.38)						(0.99)	(0.21)	
7 - Number of days disabled squared / 1000			-0.292							0.278	
			(1.14)							(0.63)	
8 - Dummy disabled =1				0.028							0.021
				(1.07)							(0.45)
9- Height /100						0.72 *	-9.02 *				
						(8.7)	(3.7)				
10- Height squared /10^4							2.88 *				
							(4)				
11 - Intercept	4.160	4.159	4.158	4.159	5.397	4.201	12.430	4.496	4.492	4.493	4.495
Test joint significance (1)-(2)	607 *	607 *	607 *	607 *	698 *	715 *	712 *	49 *	49 *	49 *	49 *
Test joint significance (6)-(7)			1.88							0.05	
Test joint significance (9)-(10)							46 *				
Max ln(w) attained at age	51.09	50.95	50.95	51.06	55.79	56.21	56.07	52.19	51.52	51.52	52.13
Critical ln(w) attained at days disabled			14.83							3.97	
Critical ln(w) attained at height							156.75				
Adjusted R- squared	0.20	0.20	0.20	0.20	0.33	0.33	0.33	0.08	0.08	0.08	0.08
Number of observations	18,666	18,666	18,666	18,666	13,721	13,721	13,721	4,966	4,966	4,966	4,966

Sources: ENH -91 for columns (5), (6), (7), (16), (17) and (18). CASEN (excluding domestic servants) for all others.

[1] Hourly labor income measured in pesos of the year of the survey. A 1991 peso is equivalent to 1.53 pesos of 1993.

[2] t - statistics in brackets

* Statistically Significant

… table continues in next page

TABLE 5 … **continuation**

HOURLY EARNINGS EQUATIONS: DEPENDENT VARIABLE LOG (HOURLY EARNINGS) [1]

	FEMALE										
	URBAN							RURAL			
Individual Variables	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**	**(21)**	**(22)**
1 - Age	0.074 *	0.074 *	0.074 *	0.074 *	0.047 *	0.047 *	0.047 *	0.047 *	0.047 *	0.047 *	0.047 *
	(16)	(16)	(16)	(16)	(10)	(10)	(10)	(3)	(3)	(3)	(3)
2 - Age squared / 1000	-0.705 *	-0.705 *	-0.704 *	-0.705 *	-0.429 *	-0.424 *	-0.420 *	-0.421 *	-0.421 *	-0.420 *	-0.417 *
	(13)	(13)	(13)	(13)	(6.8)	(7)	(7)	(2.5)	(3)	(2.5)	(2.5)
3 - Years of schooling	0.106 *	0.106 *	0.106 *	0.106 *	0.096 *	0.095 *	0.095 *	0.102 *	0.102 *	0.102 *	0.102 *
	(47)	(47)	(47)	(47)	(55)	(53)	(53)	(11)	(11)	(11)	(11)
4 - Dummy salaried worker	0.211 *	0.211 *	0.211 *	0.211 *	0.141 *	0.139 *	0.139 *	0.276 *	0.276 *	0.274 *	0.274 *
(person earns a wage = 1)	(11)	(11)	(11)	(11)	(8)	(8)	(8)	(4)	(4)	(4)	(4)
5 - Dummy domestic					-0.322 *	-0.317 *	-0.303 *				
servant=1					(14)	(13)	(13)				
Health Variables											
6 - Number of days disabled/100		0.297	-0.601						0.004	-1.532	
		(0.92)	(0.73)						(0.0)	(0.63)	
7 - Number of days			0.411							0.738	
disabled squared / 1000			(1.18)							(0.69)	
8 - Dummy disabled =1				0.010							-0.055
				(0.30)							(0.5)
9- Height /100						0.48 *	10.08 *				
						(4.7)	(3.1)				
10- Height squared $/10^4$							-2.99 *				
							(2.9)				
11 - Intercept	3.488	3.487	3.490	3.487	5.294	4.542	-3.143	3.890	3.889	3.896	3.899
Test joint significance (1)-(2)	607 *	607 *	607 *	328 *	262 *	265 *	267 *	17 *	17 *	17 *	17 *
Test joint significance (6)-(7)			1.88							0.50	
Test joint significance (9)-(10)							15 *				
Max ln(w) attained at age	52.21	52.39	52.28	52.36	54.82	55.17	55.43	56.44	56.43	56.41	56.66
Critical ln(w) attained at days disabled			7.32							10.39	
Critical ln(w) attained at height							168.43				
Adjusted R- squared	0.25	0.25	0.25	0.25	0.35	0.35	0.35	0.12	0.12	0.12	0.13
Number of observations	10,464	10,464	10,464	10,464	9,332	9,332	9,332	1,299	1,299	1,299	1,299

Sources: ENH -91 for columns (5), (6), (7), (16), (17) and (18). CASEN (excluding domestic servants) for all others.

[1] Hourly labor income measured in pesos of the year of the survey. A 1991 peso is equivalent to 1.53 pesos of 1993.

[2] t - statistics in brackets

* Statistically Significant

TABLE 6 **HECKMAN SELECTION MODEL FEMALE**

	URBAN					RURAL		
	Probit [1]	Earnings [2]	Earnings	Probit	Earnings	Probit	Earnings	Earnings
Individual Variables [3]	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1 - Age	0.127 *	0.083 *	0.083 *	0.286 *	0.099 *	0.066 *	-0.016	-0.016
	(35.63)	(12.80)	(12.82)	(41.37)	(24.97)	(8.20)	(1.04)	(1.05)
2 - Age squared /1000	-1.558 *	-0.826 *	-0.826 *	-3.551 *	-1.040 *	-0.693 *	0.244	0.248
	(35.26)	(10.17)	(10.18)	(38.60)	(20.10)	(7.22)	(1.35)	(1.37)
3 - Years of education	0.051 *	0.106 *	0.106 *	-0.014 *	0.090 *	0.062 *	0.032 *	0.032 *
	(22.64)	(37.90)	(37.93)	(4.24)	(66.64)	(9.43)	(2.78)	(2.79)
4 - Dummy salaried worker		0.224 *	0.224 *		-0.032 *		0.155 *	0.155 *
(person earns a wage = 1)		(11.72)	(11.70)		(2.79)		(2.25)	(2.25)
5 - Dummy domestic servant =1		-0.700 *	-0.700 *		-0.029		-0.580 *	-0.579 *
		(25.49)	(25.46)		(0.26)		(6.33)	(6.31)
6 - Non labor income/10^6	-0.946 *			-1.160 *		0.161		
	(6.69)			(11.37)		(0.28)		
7 - Dummy lives in house or apartment = 1 **(a)**	-0.135 *					-0.366 *		
	(3.63)					(4.11)		
8 - Dummy adequate floors **(b)**	-0.009					0.103 *		
	(0.49)					(2.02)		
9 - Dummy owner occupied house **(c)**	0.021							
	(1.24)							
Health Variables								
10 - Number of days disabled /100		-0.480					-1.543	
		(0.61)					(0.71)	
11 - Number of days disabled squared / 1000		0.302					0.821	
		(0.92)					(0.87)	
12 - Dummy (disabled =1)			0.004					-0.032
			(0.14)					(0.33)
13 - Height/100					-0.986 *			
					(5.89)			
14- Height squared /10^4					0.515 *			
					(7.98)			
15 - Intercept	-2.653	3.225	3.222	-3.970	4.764	-1.865	7.099	7.102
16 - Lambda **(d)**		0.113	0.114		0.404		-1.291	-1.292
		(0.06)	(0.06)		(0.02)		(0.08)	(0.08)
Critical Values								
Max Dep. Var. attained at Age	40.87	50.46	50.45	40.26	47.64	47.74	32.85	32.75
Min ln(w) attained at height					95.68			
Rho		0.131	0.132		0.628		-0.851	-0.851
Sigma		0.865	0.865		0.643		1.518	1.519
Log. Likelihood		-32807	-32807		-19395		-5200	-5200
Number of observations	27,292	11,956	11,956	16,974	9,824	5,390	1,472	1,472

Sources: ENH-91 for columns (4) & (5). CASEN for all others.

[1] Dependent variable: participation in labor force
[2] Dependent variable: log (hourly earnings)
[3] Z- statistic in brackets
[*] Statistically significant

(a) Type of Housing :rents or owns house or apartment = 1; rents room or other = 0
(b) Floors made of tile, brick, carpet, marble or hard wood =1, otherwise =0
(c) Owner occupied housing: house or apartment where lives is own = 1; rented or other =0
(d) Figure in brackets for lambda is standard error

TABLE 7 **INDIVIDUAL HEALTH PRODUCTION FUNCTIONS (a)**

Dependent Health Variable:	DUMMY DISABLED (b)				NUMBER OF DAYS DISABLED				HEIGHT	
Region:	URBAN		RURAL		URBAN		RURAL		URBAN	
Gender:	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Individual variables										
1 - Age	-0.004	0.013	0.005	-0.004	-0.013	0.013	-0.029	-0.070	0.088 *	0.119 *
	(0.62)	(1.32)	(0.42)	(0.16)	(1.46)	(0.97)	(1.59)	(1.74)	(2.31)	(2.47)
2 - Age squared / 1000	0.136	-0.058	0.075	0.204	0.311 *	-0.009	0.608 *	1.205 *	-1.989 *	-2.514 *
	(1.58)	(0.49)	(0.55)	(0.74)	(2.84)	(0.05)	(2.80)	(2.56)	(4.04)	(3.90)
3 - Dummy type of housing (rents or owns house or apartment = 1; rents room or rooms or other, e.g. squatter = 0)	-0.215 *	-0.280 *	-0.182	-0.166	-0.131	-0.355 *	-0.270	-0.060		
	(3.58)	(3.54)	(1.14)	(0.58)	(1.62)	(2.89)	(1.04)	(0.13)		
4 - Dummy owner occupied housing (house or apartment where lives is own = 1; rented or other =0)									0.29 *	0.32 *
									(2.41)	(2.11)
5 - Non labor income/10^6 **(c)**	0.012	0.308	0.447	1.049	0.167	0.809	-1.256	-0.893	-7.21	-66.1
	(0.09)	(1.19)	(0.59)	(0.69)	(0.97)	(1.90)	(0.93)	(0.30)	(0.40)	(1.85)
Municipality Variables										
6 - Hospitals/clinics per capita *1000	0.592	0.045	0.270	0.014	1.425 *	-1.167	-0.030	0.704		
	(1.53)	(0.08)	(0.86)	(0.02)	(2.78)	(1.57)	(0.06)	(0.63)		
7 - Community % of people directly enrolled or beneficiaries of social security	0.497 *	0.79 *	-0.731	-2.05 *	0.482	-0.109	-2.115 *	-3.101		
	(1.96)	(2.56)	(1.24)	(1.98)	(1.57)	(0.26)	(2.30)	(1.87)		
8 - Community % of households with electricity	0.151	0.011	0.130	-0.086	-0.034	0.243	0.239	-0.306		
	(0.51)	(0.03)	(0.90)	(0.36)	(0.11)	(0.44)	(1.04)	(0.71)		
9 - Altitude (in meters above sea level) / 100.000	-0.57	-2.08	-6.67	-10.56	-2.201	-3.95	-11.98 *	-27.04 *		
	(0.25)	(0.79)	(1.65)	(1.54)	(0.79)	(1.10)	(1.91)	(2.42)		

(a) Econometric Models Used: Probit for Dummy Disabled. OLS for Number of Days Disabled and for Height.
(b) z - statistics in brackets columns (1) to (4) and t - statistics in brackets for other columns.
(c) Monetary variables (5, 13 and 14) are in pesos of 1993 for columns (1) to (8) and in pesos of 1991 for columns (9) and (10). A 1991 peso is equivalent to 1.53 pesos of 199
(e) Reference interior

… table continues in next page

TABLE 7 … continuation **INDIVIDUAL HEALTH PRODUCTION FUNCTIONS (a)**

Dependent Health Variable:	DUMMY DISABLED (b)				NUMBER OF DAYS DISABLED				HEIGHT	
Region:	URBAN		RURAL		URBAN		RURAL		URBAN	
Gender:	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Municipality Variables										
10 - Distance to "capital" of "departamento" in kilometers / 1.000	0.206	0.272	0.441	-0.052	0.004	0.262	1.251 *	-1.098		
	(1.14)	(1.32)	(1.17)	(0.07)	(0.02)	(0.87)	(2.16)	(0.94)		
11 - Community % of houses with basic services: electricity, water, sewage									7.002 *	0.495
									(4.40)	(0.32)
12 - Community % of houses with adequate number of rooms per person									10.84 *	11.70 *
									(14.14)	(12.51)
13 - (Non Labor Income/1.000.000) * (Community % of houses with adequate number of rooms per person)									9.60	76.50 *
									(0.49)	(2.04)
Departamental Variable										
14 - Transfers per capita from central government to "departamento" for health	-2.474	-4.803	16.368	-28.591	-6.678	-2.524	14.257	23.118		
	(0.82)	(1.25)	(0.70)	(0.61)	(1.88)	(0.55)	(0.40)	(0.32)		
Individual Regional variables (d)										
15 - Dummy (Lives in Atlantic Coast = 1)	0.052	0.079	-0.084	-0.001	-0.019	-0.083	-0.257 *	-0.432		
	(1.19)	(1.45)	(1.02)	(0.01)	(0.36)	(1.13)	(2.07)	(1.65)		
16 - Dummy (Lives in Pacific Coast = 1)	0.047	0.147 *	0.211 *	0.574 *	0.019	0.249 *	0.314 *	0.872 *		
	(1.02)	(2.89)	(2.79)	(4.34)	(0.33)	(3.42)	(2.59)	(4.03)		
Intercept	-1.780	-1.826	-1.816	-1.107	0.527	0.188	0.827	1.940	159.37	149.31
Test of joint significance Var. 3 to Var. 16	22.67 *	34.07 *	15.95	28.19 *	1.68	3.41 *	2.22 *	2.99 *	68.06 *	43.05 *
Prob > F or Prob > chi ^{2}	0.01	0.00	0.10	0.00	0.08	0.00	0.01	0.00	0.00	0.00
Log Likelihood	-3695	-2613	-1224	-356						
Adjusted R-Squared	0.007	0.011	0.021	0.056	0.004	0.005	0.014	0.038	0.033	0.032
Number of Observations	18,666	10,464	4,966	1,299	18,666	10,464	4,966	1,299	13,721	9,332

Sources: ENH-91 for columns (9) and (10). CASEN for all others.

(a) Econometric Models Used: Probit for Dummy Disabled. OLS for Number of Days Disabled and for Height.
(b) z - statistics in brackets columns (1) to (4) and t - statistics in brackets for other columns.
(c) Monetary variables (5, 13 and 14) are in pesos of 1993 for columns (1) to (8) and in pesos of 1991 for columns (9) and (10). A 1991 peso is equivalent to 1.53 pesos of 199
(d) Reference interior

TABLE 8 **HOURLY EARNINGS EQUATIONS - HEALTH INSTRUMENTAL VARIABLES**

DEPENDENT VARIABLE: LOG (HOURLY EARNINGS)

	URBAN				**RURAL**			
	MALE		FEMALE		MALE		FEMALE	
Individual Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1 - Age	0.070 *	0.070 *	0.075 *	0.068 *	0.026 *	0.026 *	0.036 *	0.034 *
	(21.3)	(21.3)	(15.5)	(13.2)	(4.49)	(4.50)	(2.29)	(2.09)
2 - Age squared/1000	-0.702 *	-0.714 *	-0.704 *	-0.601 *	-0.143 *	-0.150 *	-0.238	-0.201
	(14.8)	(15.1)	(11.4)	(9.0)	(1.85)	(1.93)	(1.22)	(1.00)
3 - Years of education	0.087 *	0.087 *	0.106 *	0.105 *	0.075 *	0.074 *	0.100 *	0.101 *
	(62.1)	(61.6)	(47.9)	(47.2)	(18.1)	(17.97)	(11.8)	(11.73)
4 - Dummy salaried worker (person earns a wage = 1; owns a business = 0)	0.003	0.002	0.211 *	0.209 *	0.191 *	0.190 *	0.262 *	0.259 *
	(0.2)	(0.11)	(9.6)	(9.53)	(7.32)	(7.19)	(3.77)	(3.67)
I.V. Health Variables (a)								
6 - Fitted number of days disabled /100	8.756	-96.027 *	-6.780	-90.633 *	-32.930 *	-3.555	-13.475 *	0.545
	(0.98)	(3.98)	(1.14)	(4.36)	(5.04)	(0.09)	(2.04)	(0.03)
7 - Fitted number of days disabled squared /1000 **		51.104 *		42.780 *		-12.968		-7.965
		(4.45)		(4.22)		(0.79)		(0.74)
Intercept	4.1	4.2	3.5	3.7	4.8	4.7	4.1	4.1
Critical Values								
Max ln(w) attained at age:	49.81	48.81	53.05	56.18	89.90	85.59	75.70	83.67
Critical ln(w) attained at days:		9.40		10.59		-1.37		0.34
Adjusted R -squared	0.20	0.20	0.25	0.25	0.09	0.09	0.12	0.13
Joint test Var. 1 & Var. 2	450 *	416 *	232 *	226 *	59 *	48 *	16 *	16 *
Joint test Var. 6 & Var. 7		13 *		11 *		15 *		2 *
Number of observations	18,666	18,666	10,464	10,464	4,966	4,966	1,299	1,299

Sources: ENH-91 for columns (13) to (16). CASEN for all others.

* t - statistics for robust standard errors in brackets

(a) Instrumental variables for health indicators based on models from Table 7.

** squared fitted variables are computed running first stage regressions on the quadratic term and using that auxiliary equation to predict squared fitted. Auxiliary regressions included in Table A-4.

Table continues in next page …

TABLE 8 … continuation **HOURLY EARNINGS EQUATIONS - HEALTH INSTRUMENTAL VARIABLES**

DEPENDENT VARIABLE: LOG (HOURLY EARNINGS)

	URBAN		RURAL		URBAN			
	MALE	FEMALE	MALE	FEMALE	MALE		FEMALE	
Individual Variables	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**
1 - Age	0.067 *	0.076 *	0.038 *	0.045 *	0.049 *	0.056 *	0.038 *	0.037 *
	(22)	(16)	(6.9)	(3.1)	(13)	(13)	(7.2)	(6.7)
2 - Age squared/1000	-0.634 *	-0.713 *	-0.313 *	-0.366 *	-0.357 *	-0.497 *	-0.260 *	-0.240 *
	(16)	(11)	(4.7)	(2.1)	(7.1)	(8)	(3.5)	(3.0)
3 - Years of education	0.087 *	0.106 *	0.076 *	0.101 *	0.091 *	0.091 *	0.090 *	0.090 *
	(62)	(48)	(19)	(11.9)	(62)	(62)	(47)	(46)
4 - Dummy salaried worker	0.003	0.212 *	0.201 *	0.268 *	-0.069 *	-0.072 *	0.141 *	0.140 *
(person earns a wage = 1;	(0.21)	(10)	(8)	(3.88)	(5.51)	(5.74)	(7)	(7)
owns a business = 0)								
5 - Dummy domestic servant =1					-0.381 *	-0.372 *	-0.370 *	-0.370 *
					(3.97)	(3.92)	(14)	(14)
I.V. Health Variables (a)								
8 - Fitted dummy (disabled=1)	-0.281 *	-0.144	-0.410 *	-0.188				
	(3.17)	(1.73)	(3.35)	(1.75)				
9 - Fitted height /100					7.973 *	-477.4 *	6.888 *	56.10
					(14.2)	(3.63)	(9.28)	(0.65)
10 - Fitted height sqrd. /10^4 **						142.92 *		-15.36
						(3.69)		(0.57)
Intercept	3.7	3.2	3.8	3.6	-8.0	403.4	-5.6	-45.0
Critical Values								
Max ln(w) attained at age:	53.03	53.11	60	61.37	68.76	56.71	73.03	76.8
Critical point of ln(w) attained at height:						167.02		182.64
Adjusted R -squared	0.20	0.25	0.08	0.13	0.34	0.34	0.35	0.35
Joint test Var. 1 & Var. 2	526 *	237 *	44 *	15 *	736 *	404 *	288 *	262 *
Joint test Var. 9 & Var. 10						119 *		48 *
Number of observations	18,666	10,464	4,966	1,299	13,721	13,721	9,332	9,332

Sources: ENH-91 for columns (13) to (16). CASEN for all others.

* t - statistics for robust standard errors in brackets

(a) Instrumental variables for health indicators based on models from Table 7.

** squared fitted variables are computed running first stage regressions on the quadratic term and using that auxiliary equation to predict squared fitted. Auxiliary regressions included in Table A-4.

TABLE 9 **SIMULATIONS OF POLICIES BY AREA AND SEX**

Incidence of Disability

	Urban Male	Urban Female	Rural Male	Rural Female
Model	0.050	0.069	0.068	0.077
Coverage of social security (1+10%)	0.051	0.071	0.067	0.075
% Change 1	2.40%	3.36%	-1.03%	-2.71%
Coverage of social security (1+20%)	0.052	0.073	0.067	0.073
% Change 2	5.01%	7.01%	-2.06%	-5.30%
Coverage of social security (1+30%)	0.054	0.076	0.066	0.071
% Change 3	7.41%	10.66%	-2.94%	-7.88%

Mean Hourly Labor Earnings

	Urban Male	Urban Female	Rural Male	Rural Female
Model	535.500	448.855	293.536	262.146
Coverage of social security (1+10%)	533.415	447.332	294.241	263.038
% Change 1	-0.39%	-0.34%	0.24%	0.34%
Coverage of social security (1+20%)	531.339	445.813	294.919	263.934
% Change 2	-0.78%	-0.68%	0.47%	0.68%
Coverage of social security (1+30%)	529.271	444.300	295.627	264.860
% Change 3	-1.16%	-1.01%	0.71%	1.04%

Sources: Model of Tables 7 and 8 and CASEN

TABLE 10 **SIMULATIONS OF POLICIES BY SEX**

	Height						ln(hourly earnings)			
	Female			Male			Female		Male	
Simulations	Mean	Change in Cm.	% Change	Mean	Change in Cm.	% Change	Mean	% change in real earnings	Mean	% change in real earnings
1 - Mean values at original model **(a)**	160.90 (1.21)			169.40 (1.22)			7.2784 (0.476)		7.4982 (0.440)	
2 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-33%) and (Community % of houses with adequate number of rooms per person)*(1+33%)	164.42 (1.70)	3.53	2.19%	172.63 (1.45)	3.22	1.90%	7.5216 (0.491)	27.54%	7.7553 (0.451)	29.32%
3 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-50%) and (Community % of houses with adequate number of rooms per person)*(1+50%)	166.24 (2.02)	5.34	3.32%	174.28 (1.59)	4.88	2.88%	7.6469 (0.500)	44.56%	7.8876 (0.458)	47.60%
4 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-33%)	160.90 (1.21)	0.00	0.00%	169.45 (1.17)	0.05	0.03%	7.2786 (0.476)	0.03%	7.5025 (0.438)	0.43%
5 - (Community % of houses with adequate number of rooms per person)*(1+33%)	164.42 (1.70)	3.52	2.19%	172.57 (1.49)	3.17	1.87%	7.5214 (0.491)	27.51%	7.7511 (0.454)	28.77%
6 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-50%)	160.90 (1.20)	0.01	0.00%	169.48 (1.16)	0.08	0.05%	7.2787 (0.476)	0.04%	7.5045 (0.437)	0.63%
7 - (Community % of houses with adequate number of rooms per person)*(1+50%)	166.23 (2.03)	5.34	3.32%	174.21 (1.65)	4.80	2.84%	7.6465 (0.501)	44.51%	7.8813 (0.462)	46.68%

Sources: Models from Tables 7 and 8 and ENH-91

(a) Standard deviations in brackets

TABLE 10 **SIMULATIONS OF POLICIES BY SEX**

Simulations	Height						ln(hourly earnings)			
	Female			Male			Female		Male	
	Mean	Change in Cm.	% Change	Mean	Change in Cm.	% Change	Mean	% change in real earnings	Mean	% change in real earnings
1 - Mean values at original model **(a)**	160.90 (1.21)			169.40 (1.22)			7.2784 (0.476)		7.4982 (0.440)	
2 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-33%) and (Community % of houses with adequate number of rooms per person)*(1+33%)	164.42 (1.70)	3.53	2.19%	172.63 (1.45)	3.22	1.90%	7.5216 (0.491)	27.54%	7.7553 (0.451)	29.32%
3 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-50%) and (Community % of houses with adequate number of rooms per person)*(1+50%)	166.24 (2.02)	5.34	3.32%	174.28 (1.59)	4.88	2.88%	7.6469 (0.500)	44.56%	7.8876 (0.458)	47.60%
4 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-33%)	160.90 (1.21)	0.00	0.00%	169.45 (1.17)	0.05	0.03%	7.2786 (0.476)	0.03%	7.5025 (0.438)	0.43%
5 - (Community % of houses with adequate number of rooms per person)*(1+33%)	164.42 (1.70)	3.52	2.19%	172.57 (1.49)	3.17	1.87%	7.5214 (0.491)	27.51%	7.7511 (0.454)	28.77%
6 - (Community % of houses with lack of one basic service: electricity, water, sewage)*(1-50%)	160.90 (1.20)	0.01	0.00%	169.48 (1.16)	0.08	0.05%	7.2787 (0.476)	0.04%	7.5045 (0.437)	0.63%
7 - (Community % of houses with adequate number of rooms per person)*(1+50%)	166.23 (2.03)	5.34	3.32%	174.21 (1.65)	4.80	2.84%	7.6465 (0.501)	44.51%	7.8813 (0.462)	46.68%

Sources: Models from Tables 7 and 8 and ENH-91

(a) Standard deviations in brackets

TABLE A-1 **DESCRIPTIVE STATISTICS ENH-91 SURVEY**

	all	women	men
Individual variables			
1 - Age	33.9	32.8	34.7
	(10.38)	(9.93)	(10.61)
2 - Age squared	1260	1175	1319
	(777)	(726)	(805)
3- Height (in cm.)	165.91	160.87	169.41
	(7.91)	(6.77)	(6.65)
4-Height Squared	27590	25924	28743
	(2618)	(2173)	(2253)
5- Ln(hourly wages)	7.380	7.236	7.480
	(0.79)	(0.80)	(0.76)
6 - Non labor income (in pesos 1991)	3997	3503	4497
	(58062)	(27682)	(73014)
7 - Education	8.57	8.75	8.51
	(4.23)	(4.30)	(4.18)
8 - Dummy wage earner =1	0.711	0.759	0.677
9 - Dummy domestic service	0.053	0.127	0.002
10 - Owner occupied housing **(a)**	0.687	0.697	0.680
Municipality Variables			
11 - % of houses in community with basic services (Electricity, water and sewage)	0.977	0.978	0.977
12 - % of houses in community with favorable number of persons per room	0.885	0.890	0.882
8 - Var. 6 * Var. 12	3655	3230	3950
	(54171)	(26363)	(66978)

Source: ENH-91 (labor force participants, with height>135 cm., ages 18 - 60)
Standard deviations in brackets
(a) Dummy: House or apartment where lives is own = 1; rented or other =0

TABLE A-2 DESCRIPTIVE STATISTICS CASEN SURVEY (a)

	URBAN		RURAL	
	MALE	FEMALE	MALE	FEMALE
Individual Variables				
1- ln(hourly labor earnings)	6.28	6.11	5.68	5.57
	(0.89)	(1.00)	(0.88)	(1.15)
2 - Age	36.63	35.75	38.07	38.96
	(12.55)	(11.33)	(13.92)	(13.26)
3 - Age squared	1499	1406	1643	1694
	(1033)	(910)	(1169)	(1126)
4 - Years of education	7.04	7.94	3.45	4.27
	(4.26)	(4.40)	(3.00)	(3.71)
5 - Dummy wage earner =1	0.63	0.59	0.55	0.38
6 - Non labor income (in pesos of 1993)	9823	10329	3874	4941
	(109298)	(61026)	(31092)	(28131)
7 - Type of housing **(b)**	0.94	0.95	0.97	0.96
Health Variables				
8 - Dummy disabled =1	0.0503	0.0696	0.0693	0.0847
9 - Number of days disabled	0.42	0.49	0.58	0.67
	(2.58)	(2.65)	(2.96)	(3.06)
10 - Number of days disabled squared	6.80	7.25	9.12	9.79
	(62.9)	(62.8)	(71.4)	(69.4)
Municipality Variables				
11 - Hospitals per capita*10^5	1.36	1.26	3.69	3.06
	(3.93)	(3.75)	(9.60)	(8.63)
12 - % enrolled in seguro social	0.248	0.254	0.066	0.066
13 - % of houses with electricity	0.983	0.985	0.718	0.745
14 - Altitude (meters)	776.74	823.79	104.09	1154.18
	(835)	(865)	(928)	(999)
15 - Kilometers to capital	57.71	54.79	104.73	96.15
	(90.6)	(93.1)	(87.1)	(85.0)
Departamental Variables				
16 - Transfers for health per capita*10^3	8.56	8.78	7.42	7.37
	(5.65)	(6.06)	(1.25)	(1.29)
Regional variables (c)				
17 - Dummy Atlantic Coast	0.34	0.30	0.32	0.28
18 - Dummy Pacific Coast	0.15	0.18	0.20	0.28

Sources: CASEN- Instituto Geografico Agustin Codazzi - Ministerio de Salud - Authors Calculations
Standard deviations in brackets
(a) Samples exclude domestic service
(b) Type of Housing: lives in house or apartment = 1; lives in room or other = 0
(c) Reference Interior.

TABLE A - 3 **HEIGHT REGRESSIONS - LABOR FORCE AGES 25-55**

DEPENDENT VARIABLE	**HEIGHT**							
	FEMALE				MALE			
Individual variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1 - Age	-0.061 *	0.208 *	0.187 *	0.169	-0.064 *	0.012	-0.053	-0.055
	(6.05)	(2.23)	(2.05)	(1.87)	(8.44)	(0.17)	(0.76)	(0.78)
2 - Age squared/1000		-3.544 *	-2.702 *	-2.63 *		-0.986	0.340	0.277
		(2.91)	(2.26)	(2.21)		(1.05)	(0.38)	(0.31)
3 - Education			0.304 *	0.251 *			0.391 *	0.350 *
			(16.95)	(13.20)			(27.24)	(22.51)
4 - Non Labor Income/10^6 (in pesos of 1991)				-47.62				-11.28
				(1.22)				(0.62)
5 - Dummy owner occupied housing (house or apartment where lives is own = 1; rented or other =0)				0.287				0.043
				(1.69)				(0.33)
Municipality Variables								
6 - % of houses in community with basic services (Electricity - Water - Sewage)				-2.989				0.754
				(1.77)				(0.42)
7 - % of houses in community with favorable number of persons per room				9.66 *				5.76 *
				(8.96)				(6.60)
8 - Var. 4* Var. 7				52.51				12.87
				(1.26)				(0.66)
Intercept	163.1	158.2	155.2	150.2	171.8	170.4	167.6	162.2
Adjusted R-Squared	0.005	0.006	0.044	0.055	0.006	0.006	0.069	0.074
Number of Observations	7260	7260	7260	7260	10940	10940	10940	10940

Source: ENH-91

t - statistics in brackets

TABLE A-4 QUADRATIC HEALTH PRODUCTION FUNCTIONS

Dependent Health Variable:	QUADRATIC OF NUMBER OF DAYS DISABLED				QUADRATIC OF HEIGHT	
Region:	URBAN		RURAL		URBAN	
Gender:	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
	(1)	(2)	(3)	(4)	(5)	(6)
Individual variables						
1 - Age	-0.270	0.418	-0.645	-1.584	29.43 *	37.59 *
	(1.22)	(1.30)	(1.47)	(1.73)	(2.28)	(2.42)
2 - Age squared/1000	6.604 *	-2.571	13.16 *	26.42 *	-666 *	-793 *
	(2.47)	(0.64)	(2.51)	(2.46)	(4.00)	(3.83)
3 - Dummy Type of Housing (rents or owns house or apartment = 1; rents room or rooms or other, e.g. squatter = 0)	-1.167	-4.130	-6.319	-0.686		
	(0.59)	(1.41)	(1.01)	(0.07)		
4 - Dummy Owner Ocuupied Housing (house or apartment where lives is own = 1; rented or other =0)					99.65 *	99.59 *
					(2.44)	(2.05)
5 - Non Labor Income /10^4 **(a)**	50760	187534	-330618	-350236	7.980	34.669 *
	(1.20)	(1.86)	(1.01)	(0.52)	(1.50)	(3.50)
Municipality Variables						
6 - Hospitals/clinics per capita *1000	33.30 *	-30.93	-3.76	26.72		
	(2.66)	(1.75)	(0.31)	(1.05)		
7 - Community % of people directly enrolled or beneficiaries of seguro social	8.57	-6.69	-50.38 *	-65.09		
	(1.14)	(0.67)	(2.27)	(1.72)		
8 - Community % of households with electricity	-2.17	12.01	4.16	0.001		
	(0.28)	(0.92)	(0.75)	(0.00)		
9 - Altitude (in meters above sea level) / 100.000	-36.78	-91.40	-272	-581 *		
	(0.54)	(1.07)	(1.79)	(2.27)		
10 - Distance to "capital" of "departamento" in kilometers / 1.000	-3.23	4.766	30.65 *	-35.16		
	(0.59)	(0.67)	(2.20)	(1.31)		
11 - Community % of houses with basic services: electricity, water, sewage					2422 *	120
					(4.49)	(0.24)
12 - Community % of houses with adequate number of rooms per person					3668 *	3745 *
					(14.13)	(12.48)
13 - (Non Labor Income/10^4) * (Community % of houses with adequate number of rooms per person)					29.63	258 *
					(0.45)	(2.14)
Departamental Variable						
14 - Transfers per capita from central government to "departamento" for health	-161.4	-9.75	82.21	1914		
	(1.86)	(0.09)	(0.10)	(1.15)		
Individual Regional variables (b)						
15 - Dummy (Lives in Atlantic Coast = 1)	-0.89	-2.74	-6.82 *	-8.35		
	(0.70)	(1.57)	(2.27)	(1.40)		
16 - Dummy (Lives in Pacific Coast = 1)	0.024	5.109 *	5.533 *	14.68 *		
	(0.02)	(2.95)	(1.89)	(2.97)		
Intercept	9.55	-9.59	18.87	25.27	29020	25980
Adjusted R-Squared	0.0033	0.003	0.0106	0.0264	0.0329	0.0305
Number of Observations	18,666	10,464	4,966	1,299	13,721	9,332

Sources: ENH 91 for columns (5) and (6). CASEN for all others. Different sources for variables 6, 9, 10 and 14.
t - statistics in brackets.
(a) Monetary variables (5, 13 and 14) are in pesos of 1993 for columns (1) to (4) and in pesos of 1991 for columns (5) and (6). A 1991 peso is equivalent to 1.53 pesos of 1993.
(b) Reference interior