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HEALTH STATUS IMPACTS ON INDIVIDUAL EARNINGS IN BRAZIL

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SUMÁRIO

ABSTRACT

The aim of this paper is to estimate the impact of health conditions on the earnings of Brazilians. We have identified three ways through which health conditions affect workers' earnings: labor force participation, hourly wages and weekly hours worked. A measure of the welfare reduction due to poor health conditions was created by aggregating individual losses. Individuals are classified as sick or healthy according to two criteria. Firstly, the clinical criterion which is based on the presence of chronic diseases or problems with physical mobility. Secondly, the subjective criterion which is based on the health self-assessment. Each Brazilian individual loses from R$6.30 to R$16.89 per week depending on individual characteristics. In relative terms these aggregated losses represent from 1.5% to 4.7% of the Brazilian GDP. The data base used in this work were PNAD/1998 (the Brazilian national household survey). In 1998, PNAD had an additional survey about health.

1. INTRODUCTION

Health is important for economic agents as it directly contributes to the well-being of individuals, besides constituting part of the human capital stock which determines the productivity and income levels reached. In this sense, individual or public policy decisions affecting health have significant effects on economic development and constitute an important mechanism of income redistribution and combat to poverty.

Empirical evidence in Brazil on the relation of health and income suggest that in general the poor show the worst health conditions[1]. Despite this fact, only a few studies discuss the role of health as a determinant of individual earnings. THOMAS & STRAUSS (1997) used data from ENDEF (the national study of family expense), accomplished between August, 1974 and August, 1975, in order to analyze the relation between health and labor productivity in Brazil. By estimating a determination equation for wages, the authors showed that higher levels of health are associated with higher levels of productivity.

KASSOUF (1997), using data from PNSN (the national health and nutrition survey), attempts to estimate the relation between health and earnings in Brazil. The health indicator used is an anthropometric measure for each individual. The estimation model used are the Three Stages Least Squares method, allowing simultaneity in determining health status, wages, and hours worked. The model hypothesis is that the individual utility depends on the vector of consumption goods and the individual health conditions[2]. The health, in turn, depends on the vector of consumption goods, health inputs (drugs, access to providers, among others) and on a set of exogenous variables (as for example, on conditions of household, region, age, sex, race among others). The individual's health affects labor productivity directly and indirectly. The indirect effect comes from the restriction on the number of hours available for work and leisure. The direct effect comes from the reduction of wage-hour and the impossibility of entering the labor force. The major results encountered show that health conditions positively impact the level of earnings and show a negative sign in the female spouses' decisions to participate in the labor supply. For female family heads and men, health status is not significant.

Using the same database, CASTRO & KASSOUF (1999) estimate the earning losses for sick individuals in Brazil. The earning losses were estimated by means of a counterfactual analysis by which the impact of health status on earnings stem from the probability of reduction in participating in the labor force and the change in the hour wage rate for adult men. In this study, the authors also use an anthropometric measure for rating individuals between healthy and sick which constitutes an body mass index (BMI). The individuals presenting BMI<20, characterized as malnutrition status, were rated as being sick. The advantage of such indicator is that it is an objective measure of health conditions. On the other hand, as the authors have chosen to classify as sick only those individuals in malnutrition status, this criterion does not include a series of diseases that may affect productivity and the insertion in the labor market. Thus, this criterion may strongly underestimate earnings losses. The results found point out to earnings losses of approximately US$187.00 per year per sick adult worker.

[1] BAER, CAMPINO & CAVALCANTI (2000) and NUNES *et al.* (2001) study health conditions in Brazil and give some examples related to their distribution throughout the country.

[2] The estimated model is based on BECKER (1981), GROSSMAN (1972), and PITT & ROZENZWEIG (1986).

This paper aims at furthering the analysis of the relation between health and earnings in Brazil by using data from PNAD (the Brazilian national household sample survey) as of 1998, whose supplement is concerned with health issues. PNAD is a unique database in Brazil which allows an original analysis of the relation between health and earnings in the country. We are particularly interested in measuring the earnings losses stemming from poor health conditions in Brazil. The PNAD health indicators allows a broader evaluation of health status, by providing more reliable measures of earnings losses.

Health is assumed as a component of the individuals' human capital stock formation thus being one of the factors affecting their earnings. We identified three ways through which health status affects the workers' earnings: the participation in the labor force; the wage rate; and the number of hours worked.

This paper proposes to develop the works of LUFT (1975), for the American economy, and CASTRO & KASSOUF (2000), for Brazil. The first part of the paper is concerned with the analysis of health conditions aiming at rating the individuals as sick and healthy. In the second part, in order to calculate the earnings losses due to health conditions, we compared the earnings sick workers are effectively gaining in the labor market to those they could earn if they were paid according to the return structure of healthy individuals. The losses of earnings were calculated for males and females separately, taking into account different criteria for rating individuals between healthy and sick. The use of several health criteria allows us to analyze the magnitude of loss stemming from different health problems. Disaggregation by sex is relevant, viewing the difference of insertion of both groups in the labor market and their participation in the family income.

The paper is divided into five sections besides the introduction. In the next section, we briefly discuss on the international and Brazilian literature, by highlighting the empirical works in Brazil. In section 3, we describe the data used and present a descriptive analysis of the individuals' health status. Section 4 deals with the methodology used for measuring the impact of health on the earnings. Section 5 presents the major results and section 6, the final remarks.

2. REVIEW OF LITERATURE

2.1. Health and Earnings

The economic theory basically establishes two ways for explaining the issue of how health status affects the economic agents' earnings[3]. Firstly, health status affects the wage-hour rate. Secondly, poor health affects labor supply by affecting the decision to work and/or how much time should be allocated to work.

[3] The earnings include the individual's remuneration for his/her activities performed in the labor market. Obtaining some pay firstly depends on the individual's participation in the labor force. Additionally, earnings will be higher, the higher the hourly wage rate and the number of hours allocated to work. An individual's weekly earnings are given by as a result of the hourly wage and the number of workhours.

Health conditions affect wages mainly through their effects on the worker's productivity as it is assumed that healthier individuals have a greater human capital stock and hence tend to be more productive than those with poor health. Furthermore, hourly wages may be reduced when employers have to pay for accommodating an employee with a precarious health status or when discrimination against sick people can be found in the labor market (CURRIE & MADRIAN, 1999; KIDD *et al.*, 2000). Generally speaking, the wage rate is positively correlated with health. However, it is worth noting that this may not be true when workers are paid some extra earnings for health hazardous activities.

As for labor supply, health status impacts on sectorial choice, decision to work, and the number of workhours to be supplied (STRAUSS & THOMAS, 1998). Considering these last two issues mentioned[4], the outcome of poor health on labor supply is ambiguous and depends on the combination of endowment, substitution, and income effects.

The labor endowment effect occurs because the sick individual has less time to accomplish his normal activities including work. Secondly, if poor health corresponds to a lower wage rate, the worker decides to reduce his/her labor supply, since labor generates disutility to the individual, i.e., there is a substitution effect between work and leisure. Thirdly, there is an income effect which makes the sick individual to work more in order to offset lower hourly earnings. If the income effect is large enough to offset the endowment effect plus the substitution effect, then poor health will end in a greater labor supply. Conversely, the sick individual tends to work less time as compared to the healthy.

2.2. Empirical works

Several empirical efforts have been done in order to understand the effects of poor health conditions on earnings. Some empirical efforts treat health as an exogenous variable, i. e., as being determined independently of the contemporary income level: LUFT (1975); CASTRO & KASSOUF (2000); and KIDD *et al.* (2000). Others attempt to control the endogenous relation between health and earnings: GROSSMAN & BENHAM (1974); SAHN & ALDERMAN (1988); THOMAS & STRAUSS (1997); SCHULTZ & TANSEL (1997); KASSOUF (1997); GLICK & SAHN (1998). The major difficulty these works deal with is related to the adequate tools which would allow to assess the individual's health status. Considering health status as an exogenous or predetermined variable is directly associated with the temporal dimension of the analysis. However, it is reasonable to assume health as an exogenous variable in cross-section analyses.

Assuming health as an exogenous variable, LUFT (1975) attempts to measure the losses provoked by the effects of a poor health status[5] of the American workers' earnings aged 18-64, by discriminating the sample by sex and race (whites and blacks), based on data from the Survey of Economic Opportunity (SEO), as of 1967. The author points out that the major earnings loss channels

[4] The sectorial choice issue is not treated in this paper.

[5] Based on five health status data, individuals are ranked as sick or healthy. Health information used here indicates whether the individual had been prevented from working; restricted to some kind or amount of work; restricted to some amount of work; and restricted to some amount of household task.

differ according to sex/race groups. The blacks - while sick – are more likely to be excluded from labor force or work less time than the whites. For the latter, a disease tends to provoke greater losses through the reduction of the wage rate as compared to the blacks.

CASTRO & KASSOUF (2000) use the same procedure employed by LUFT (1975) to evaluate the impact of inadequate health conditions on the adult (male) workers' (aged 18-65) earnings in Brazil, by discriminating sectors (urban/rural) by great regions. In this study, poor health provokes losses through the reduction of the probability of an individual to participate in the labor force and a lower wage rate. The health status is measured based on the nutritional status of a person as indicated by the Body Mass Index (BMI). The sick are those people with BMI<20, since a BMI<20 denotes a malnutrition status. As stated in the introduction of this paper, the health criterion used by these authors is very restricted and probably unable to capture the differences in health status which could affect the insertion of workers in the labor market.

3. DESCRIPTION OF DATA AND ANALYSIS OF HEALTH STATUS

3.1. Sample Description

The data used in this paper are from PNAD/1998 with a supplement concerning health issues[6]. A cross-section analysis was chosen due to the lack of other information sources compatible with the variables used here. The sample for Brazil[7] comprises 189,635 individuals from 15 - 65 years of age, out of whom 92,694 were males and 96,941, females[8]. The age section is in accordance with the usual limits used for defining the population at working age.

3.2. Health status analysis

Health status is a multidimensional variable and its many aspects are imperfectly captured by a sole measure. Furthermore, health effects on earnings vary in magnitude, depending on how health status is measured. The empirical literature basically uses three kinds of indicators of an individual's health status: the subjective indicators; the clinical status indicators; and the functional limitation indicators. Each of such indicators presents problems and specific difficulties[9].

In this paper, health status means the standing of individuals as healthy or sick. PNAD/1998 provides information on chronic diseases, physical mobility problems, and self-assessed health conditions which allows us to establish different criteria for ranking individuals in these respects. Two criteria were used for ranking individuals as healthy and sick: the clinical/functional criterion and the

6 PNAD is the national household sample survey annually accomplished by IBGE (the Brazilian census bureau).

7 Data for the North region were not taken into account, since PNAD does not cover this region's rural area.

8 It is worth mentioning that 13,189 observations with work earnings equal to zero and positive workhours were excluded. Most excluded individuals worked in agriculture (about 60% of males and more than 80% of females), comprising non-wage activities. That is, these workers would not effectively be within the labor market.

9 BEHRMAN & DEOLALIKAR (1988) and STRAUSS & THOMAS (1998) discuss some of these indicators and the difficulties related to their use.

subjective criterion. The clinical/functional criterion is constructed by using the incidence of chronic disease and/or the presence of physical mobility problems as the indicator of health status. The subjective criterion is based on health self-assessment as the indicator of general health status.

Clinical indicators show an important aspect in the assessment of an individual health status, since the clinical dimension provides objective information for measuring an individual's health conditions. In this paper, we used the symptoms of diseases reported as clinical indicators of health status. However, a remark should be made: if he/she is not used to see the doctor and have periodical medical examinations, an individual may ignore the existence of some health problem. This fact may cause systematic errors, as for example, correlated with the use of the healthcare services. It is hard to know whether there are significant systematic errors in measuring health status as well as their proportion if they exist. The use of such an indicator is elucidating, though it requires caution.

Indicators of functional limitations constitute another method of measuring health status. These indicators are also self-reported, but they are less vulnerable to subjective limitations as they focus on specific questions related to the individual's ability to accomplish common activities, such as walk a certain distance or carry a heavy thing, among others. These indicators also tend to be less correlated with socioeconomic endowment, conditioning factors, and perceptions. One of the problems they present, however, is the low-incidence frequency of such limitations in younger population groups, which makes it an inadequate indicator for capturing the health status of such a population.

The clinical/functional criterion used in this paper combines clinical and functional limitation indicators. PNAD has a list of twelve questions concerning chronic health problems to which individuals answer 'yes' in case he/she has the disease in question (see Chart 2, in the Annex). As for mobility, there are seven questions related to the individual's ability to accomplish tasks, each of them with four answer categories to which he/she responds 'unable', 'has great difficulty', 'has little difficulty', or 'no difficulty at all' (see Chart 3, in the Annex). An individual is classified as sick if he/she answers 'yes' to any of the twelve questions related to a chronic disease or if he/she reported 'unable' or 'has great difficulty' to any of the questions related to physical mobility problems.

The subjective criterion uses the self-assessed health information of PNAD. For obtaining such information, the respondent is asked how he/she assess his/her own health conditions by using the following categories: 'very good', 'good', 'regular', 'poor', 'very poor'. The self-assessed health status is a commonly used subjective indicator as it shows the advantage of using information on the general health conditions which basically depends on the individual's own perception for measuring his/her health status. This perception is conditioned by a set of data available to the individual on his/her own health conditions, such as medical diagnoses and knowledge about diseases (MARTIKAINEN *et al.*, 1999). The disadvantage of such a criterion is that this perception may be systematically related to the individual's socioeconomic and cultural characteristics.

It is argued that socioeconomic and cultural conditions change the probability of individuals reporting themselves as sick or having poor health *vis-à-vis* their real health status. For example, better educated people are more sensitive to their real health status as compared to less educated people and are more aware of the consequent limitations imposed to them. Thus, error between data of reported and real health status is less significant for these people than those related to people at lower

socioeconomic level. In another example, STRAUSS & THOMAS (1998) argue that lower-income individuals search for healthcare with less frequency and hence tend to report a better health status than they would if they were submitted to clinical examinations.

Furthermore, the point of reference for what is considered good health varies systematically within a society and the respondent may make comparisons with other people belonging to his/her own socioeconomic level instead of considering a broader health pattern related to the society. In other words, health status expressions, such as 'good' or 'poor', may not have the same meaning for everyone and there is no way to precisely assert whether the individual reports his/her health status in relation to the national average or to his/her neighbor's status (STRAUSS & THOMAS, 1998). As in the case of the indicators of reported symptoms, it is difficult to know whether there are significant systematic errors (and their proportion) in measuring health status based on the subjective indicator. However, it is worth noting that the use of this indicator is clarifying, though caution must be taken when analyzing the results.

Two sections are made for classifying individuals based on self-assessed health conditions. In the first, healthy individuals were exclusively defined as people reporting their health as being 'very good'. This is called restricted subjective criterion. In the second section, healthy individuals are those people with 'very good' or 'good' health status, which is called unrestricted subjective criterion[10].

Table 1 allows to compare the number of observations corresponding to the subsamples of healthy and sick people according to the two ranking criteria adopted for Brazil. The proportion of healthy individuals in relation to the sick is quite different considering both criteria. The clinical/functional criterion indicates 65% of males and 56% of females as being healthy. The restricted subjective criterion significantly broadens the proportion of the sick in relation to the clinical/function criterion with only 27% of males and 23% of females being classified as healthy. The unrestricted subjective criterion is the section with lower proportion of the sick – 20% for males and 26% for females.

Table 1
Number of observations in the subsamples of sick and healthy individuals by Sex in Brazil

Criteria	Males			Females		
	Healthy	Sick	Total	Healthy	Sick	Total
Clinical/Functional	60,225	32,339	92,564	54,121	42,689	96,810
Restricted Subjective	24,997	67,671	92,668	22,315	74,598	96,913
Unrestricted Subjective	74,386	18,282	92,668	71,921	24,992	96,913

Source: PNAD/1998.

[10] The terms restricted and unrestricted are used here meaning that the first criterion is restricted to the healthy population in relation to the unrestricted criterion which encompasses more people among the healthy ones. It should be reminded that these are arbitrary sections in this paper .

It is worth noting that, among males, 13,716 are sick and 21,150 are healthy by any criterion used, meaning that 37% out of whom are healthy by any of the alternative criteria. The sick group has 4.2 years of schooling and 45 years of age on the average, 35% out of whom live in the Northeast and 36% in the Southeast. The 21,150 healthy individuals show different characteristics, such as higher average schooling (7.3 years) and lower average age (29), most of whom (45%) live in the Southeast region. The average earnings are also different between these two groups. Approximately 77% of the healthy individuals work against only 70% of the sick; the healthy people offer 36 weekly workhours on the average and the sick 34; finally, the average hourly wage is higher for the healthy people – R$4.20 as compared to R$2.66 for the sick.

Among females, 20,296 are sick and 17,934 healthy by all criteria, i.e., 39% of the total female sample was classified with no ambiguity by the different criteria. This sick female group has – on the average – a lower education degree with 4.5 years of schooling, as compared to 8 years for the healthy individuals, and older – 44 years of age – compared to 28 for the healthy. Approximately 45% of the healthy females live in the Southeast, whereas 35% and 36% of the sick are in the Southeast and the Northeast, respectively. The healthy females' earnings are higher than those for the sick. About 47% of the healthy ones work 19 weekly hours on the average and earn an average of R$3.70 per workhour. Among the sick, they work an average of 14 weekly hours and earn R$2.00 per workhour on the average.

By comparing the clinical/functional and the unrestricted subjective criteria, it can be verified that 55,656 males and 54,106 females are healthy and, similarly, 13,176 males and 20,296 females are sick by both criteria, i.e., about 75% of the males and 72% of the females have the same rank, by using criteria based both on data on chronic disease and physical mobility and the individual's health self-assessment.

4. METHODOLOGY: ECONOMETRIC MODEL

The approach used in this paper consists in a counterfactual analysis where health is a predetermined variable. Based on health data, the individuals are ranked as sick or healthy, but the individual health status is not intrinsically determined in the model equation system.

The hypothesis that health is predetermined may be justified in a first approach by two reasons: firstly, assuming that the current health status is not affected by the individuals' earnings is reasonable in the short run, if we admit that a rise in economic resources may increase the use of healthcare services or change the individuals' behavior, although they may have immediate impact only on investment in health and not on health capital stock. Furthermore, considering health as predetermined naturally precedes a more accurate examination in which this hypothesis is more flexible. Such a hypothesis is relevant by the simplicity it offers in the analysis, given the difficulty for controlling the simultaneity that may exist in the relation between health and earnings, mainly because we can count on only one data cross-section (a PNAD/1998).

We argue that precarious health conditions may affect earnings through three channels: the decision to enter the labor force; the labor supply in terms of workhours; and the worker's

productivity. In order to investigate the relation between health and earnings, we used a model with three equations, estimated separately for males and females. In the first equation, we estimated the probability of participation in labor force. The second is the wage rate equation, with a view to evaluate the effects of health on productivity. And the third is the equation of the number of weekly workhours[11]. That is:

$$\text{Prob}\left(Y_i^j = 1\right) = \text{Prob}\left(Z_{1i}^j \gamma^j > \mu_{1i}^j\right) = \Phi\left(Z_{1i}^j \gamma^j\right), \quad j = d, s \qquad (1)$$

$$W_i^j = X_{1i}^j \beta_1^j + \varepsilon_1^j \quad \text{dado} \quad Y_i^j = 1, \qquad j = d, s \qquad (2)$$

$$S_i^j = W_i^j \alpha^j + X_{2i}^j \beta_2^j + \varepsilon_2^j \quad \text{dado } Y = 1, \qquad j = d, s \qquad (3)$$

where

the underscript i denotes the individual and the superscript j indicates the individuals' health status – sick (d) and healthy (s), respectively;

Y is a binary variable, equal to 1 if the individual, participates in the labor force;

W is the labor productivity, measured by the hourly wage rate;

S is the labor supply, given by the number of weekly workhours;

Z_1, X_1, X_2 are vectors of exogenous individual characteristics;

γ, β_1, β_2, α are parametric vectors;

μ_1, ε_1, ε_2 are random shocks.

The equation (1) corresponds to the probability of participation in the labor force, estimated through a Probit model, where Φ represents an accumulated normal distribution[12]. The expression (2) for wages is specified as a Mincer equation in which the natural logarithm of hourly wage is a function of productive endowment of individuals and other observable characteristics. Labor supply[13] is given by the equation (3), with the workhours logarithm in function of the wage rate, non-wage earnings, and other observable characteristics. The variables included in the vectors Z_1, X_1 e X_2 are specified in Chart 3, in the Annex.

The model is estimated only taking the sample for healthy people into account. Then, the estimated coefficients are applied to the vector of the sick individuals' characteristics, in order to obtain their adjusted average earnings. This procedure provides estimates of the sick people's

[11] The wage rate and the number of hours the individual wishes to supply are observed only for those participating in the labor force in such a way that the sample used in estimating equations (2) and (3) is not a random one. HECKMAN (1979) proposed a solution for this problem of sample selectivity. Heckman's procedure will be used in this paper for estimating equations (2) and (3). The Heckman's method is discussed in section 4.3.2.

[12] We determined that an individual participates in the labor force if he/she has earnings from work higher than zero or equally if he/she works a number of hours per week higher than zero. The individual with positive workhours and null wage is not considered in the sample.

[13] Labor supply is given by the number of weekly workhours, corresponding to the sum of weekly hours allocated to the major, secondary, and other work activities.

earnings, as if they presented the same return rates to personal characteristics as those of the healthy individuals. The differences in the average earnings of the sick and these values adjusted constitute the losses due to the individuals' health conditions. Thus, there are three kinds of earning differentials among the average results of the sick which they would obtain if they presented the same return structure of personal characteristics as those for the healthy people. Such differentials are:

$$\text{Diferencial } 1 = E[\Phi(Z_1^d \gamma^d)] - E[\Phi(Z_1^d \gamma^s)] \qquad (4)$$

$$\text{Diferencial } 2 = E[X_{1i}^d \beta_1^d] - E[X_{1i}^d \beta_1^s] \quad \text{dado } Y_i^d = 1 \qquad (5)$$

$$\text{Diferencial } 3 = E[W_i^d \alpha^d + X_{2i}^d \beta_2^d] - E[W_i^d \alpha^s + X_{2i}^d \beta_2^s] \quad \text{dado } Y_i^d = 1 \qquad (6)$$

The effects of poor health on labor force participation correspond to differential 1 in equation (4). Differential 1 represents a difference in the probability to participate in the labor force between healthy and sick individuals. Differential 2, in equation (5), indicates the impact of poor health on the worker's productivity through changes in the hourly wage rate. Finally, equation (6) represents the earnings differentials by the impact of poor health on the number of workhours which define differential 3. In the three cases presented in equations 4 – 6, a negative differential is characterized as earnings losses.

5. Results

5.1. Equations of the econometric model

The probability of labor force participation is estimated by the maximum likelihood method. The wage rate and labor supply equations are jointly estimated by the three stages- least square method. The inverse Mills ratio is included in the wage rate and labor supply equations in order to correct the sample selection bias through Heckman's procedure. The estimates are accomplished by using the Stata 7.0 software for Windows 98/95/NT and in all regressions the expanding factor of the PNAD/1998 sample is used as a weighting factor.

The equations are estimated by breaking down the samples by sex. The estimates are accomplished separately for the healthy and the sick individuals, which is made for each of the three criteria established for measuring health status. As it is an intermediate phase, a detailed analysis of each equation is not presented in this paper[14].

The encountered results of the impact of health conditions on the earnings are discussed in two sections. In the next section, losses are analyzed at the individual level for all three channels of earnings considered in this paper. In section 5.3, individual earnings losses are aggregated in terms of weekly losses, which permit to jointly evaluate the three kinds of losses.

[14] The coefficients obtained for each equation and the relevant test statistics may be directly obtained with the authors or from the Master's dissertation by ALVES (2002).

5.2. Individual earnings losses

Health conditions have caused losses for individuals through the three earnings channels, i.e., poor health means presenting lower probability of participating in the labor force, obtaining lower hourly wages, and working fewer weekly hours. Table 2 shows the earnings losses for the sick in Brazil[15].

Table 2
Reduction in the probability of working, hourly wages, and number of weekly workhours, resulting from adverse health conditions in Brazil - percentage (%) – 1998

Criteria	Males			Females		
	PFT	wages	hours	PFT	wages	hours
Clinical/ Functional	5.68	0.58	0.26	2.57	5.29	2.54
Restricted Subjective	3.96	10.90	0.78	2.06	9.61	3.05
Unrestricted Subjective	12.58	13.00	1.17	9.60	10.05	3.41

Source: PNAD/1998.

The reduction in probability of participation in the labor force due to poor health is in the interval between 3.96% and 12.58% for males and 2.06% and 9.60% for females. Thus, the reduction is relatively higher for males. This suggests that sick females are more likely to adapt to labor conditions as compared to males due to worsening health status. On the other hand, males are more likely not to participate in the labor force due to worsened health. This result reinforces the difference between males and females as for the kind of insertion in the labor market. Males are mostly in charge for the household expenses.

If the clinical/functional criterion is considered, the probability of participation in the labor force is very responsive to the males' health status and little responsive as for females. One of the explanations for such a result is that men generally work in activities and occupations demanding more physical strength as compared to women. Thus, a chronic disease or limitation to their physical mobility is more likely to exclude them from the labor force. A clinical and/or functional problem would be a minor hindrance for females' participation in the labor force[16]. It is also worth noting that the proportion of the sick as compared to the healthy individuals is higher for the groups with lower education degree. The latter would be given heavier tasks than those with higher education, performing activities which are easier to adapt even with some clinical/functional problem.

[15] The tables with the estimated average earnings can be found in the Annex where the statistical significance of the earnings differentials are also presented. Table 2 synthesizes the individual losses in relation to the estimated values for the sick corrected by the estimated return rates for the healthy individuals. In this table, positive values mean losses.

[16] Most working females are in the service sector (36%), public administration (22%), and commerce (15%). Conversely, the proportions of women in agricultural activities (3%) and in the manufacturing industry or civil construction (11%) are low. As for males, a quite different situation can be found, i.e., most of them work in agricultural activities (18%), manufacturing or civil construction (28%), commerce (14%) , and services (14%).

Poor health also reduces the hourly wage rate for workers in Brazil. The reduction of hourly wages varies in an interval ranging from 0.6% to 13% for males, whereas for females such a result is in a narrower interval, ranging from 5.3% to 10%. By the subjective criterion, the hourly wages are very responsive to the individual health status both for males and females. However, the hourly wages for males are not significantly reduced by the clinical/functional criterion.

The clinical and functional status would not imply restrictions able enough to reduce productivity in some activities, which would be illustrated by minor wage losses for the sick, if seen by such a criterion. In other words, when submitted to a chronic disease, an individual would be able to adapt to the work environment and normally perform his/her tasks, unless such a disease is serious enough to force him/her to abandon the labor force. As an indicator of the total perception of an individual about his/her health status, the subjective criterion does not only focus on a specific disease, but also takes into consideration other information only available for the individual being interviewed. The subjective criterion possibly measures more adequately the individual's health status than the clinical/functional criterion and would be widely capturing the restrictions imposed by the health status to the sick people's performance, mainly on productivity.

Health status has relatively minor effects on the number of weekly workhours than the probability of participation in the labor force and on hourly wages. The weekly workhours show a reduction ranging from 0.26% to 1.17% for sick males, indicating that for the latter the time allocated to work is slightly responsive to the health status. As for females, labor supply is more responsive to the health status, whose reduction of the time devoted to work by the sick ranges from 2.54% to 3.41%. The nature of housekeeping allows a greater flexibility of labor supply in terms of workhours mainly for females. The workday is more severe for males, specially in formal sector jobs in industry. The variance in the number of workhours for females is generally greater insofar as part-time work is more usual among females. When a woman gets sick, an adjustment of labor supply with reduced weekly workhours is easier to be settled with the individual's maintenance in the labor force. However, such an adjustment for males is more difficult and health status tends to have stronger impact with the worker's withdrawal from the labor force[17].

5.3. Losses of aggregate earnings

5.3.1. *Aggregation of individual losses*

Individual losses are aggregated so as to obtain total earnings losses of working age population by sex in Brazil[18]. This aggregation provides an indication of welfare losses provoked by poor health for the society. Furthermore, it allows to determine: (a) which are the components with greater weight

[17] Data on position of workers' occupation aid in the interpretation of the low-sensibility results from the number of workhours to health status, mainly for males. Most of working females are formal sector employees (31%, except for household servants), but a considerable number can be found in household positions (21%), legally registered or not. Most males are also formal employees (37%) and a large proportion are own-account workers (28%), but only 1% are works at household jobs (legally registered or not).

[18] The tables containing data on aggregation of losses can be found in the Annex. In the aggregation of losses, the earnings compensations (negative values for individual losses) are not computed nor nonsignificant values of individual losses.

in total earnings losses; (b) which are the differences of health impacts on earnings among males and females.

Chart 1 describes the procedure used for the aggregation based on the individual results presented in the previous section. Three kinds of aggregate losses are calculated, one for each earnings channel affected by health conditions. The final values are measured in terms of weekly earnings losses, by using averages of the hourly wage rate and the number of weekly workhours.

In order to obtain the total value of weekly earnings losses in the society, due to poor health effects on the probability of participating in the labor force (line 9), we multiplied the difference in the probability of participating in the labor force - the adjusted difference 1 (line 6) – by the sick population so as to obtain the expected number of workers out of the labor force due to health status (line 7). Then, we multiplied the outcome of line 7 by the hourly wage average and the number of weekly workhours.

Chart 1
Procedure for aggregating earnings losses stemming from adverse health status

Description	Source
1. Total population	Obtained from the expansion factor of PNAD/1998 sample
2. Sick population	
3. Working sick population	
4. Average hour wage rate	PNAD/1998
5. Average weekly labor supply	PNAD/1998
Losses 1 – Participation in the Labor Force	
6. Adjusted difference (1)	Result of equation 4
7. Loss in the labor force (people)	6 X 1
8. Hourly earnings loss	7 X 4
9. Weekly earnings loss	8 X 5
Losses 2 – Productivity	
10. Adjusted difference (2)	Result of equation 5
11. Hourly earnings loss	10 X 3
12. Weekly earnings loss	11 X 5
Losses 3 – Labor Supply	
13. Adjusted difference (3)	Result of equation 6
14. Weekly workhours loss	13 X 3
15. Weekly earnings loss	14 X 4
16. Total of earnings losses	9 + 12 + 15
17. Losses by individual	16 / 1
18. Total earnings	PNAD/1998
19. Losses (%)	16 / 18
20. Losses (% of GDP)	16/ GDP

In order to obtain the total value of the weekly earnings losses of the society by means of poor health effects on the wage rate (line 12), we multiplied the adjusted difference 2 by the number of the sick who remained in the labor force so as to obtain the total value of the hourly earnings losses, and multiplied this value by the average number of weekly workhours.

We multiplied the adjusted difference 3, in line 13, by the number of people working in order to obtain the total number of workhours lost per week (line 14). Then, we multiplied this value by the hourly wage average in order to find the total value of the weekly earnings losses due to the effects of poor health status on the number of weekly workhours (line 15).

The sum of lines 9, 12, and 15 provides the total earnings losses (in line 16). Based on this value, we can analyze the social welfare losses, by calculating the losses as a proportion of the total labor earnings[19], in line 19, or to consider the losses as a proportion of the Gross Domestic Product (GDP)[20], in line 20. The value of losses by sick individual, in line 17, is useful for comparisons between alternative criteria for evaluating health status[21]. The aggregation results of earnings losses are presented in two phases below. Firstly, we discuss the composition of earnings losses, by showing which earnings channels are more affected by health status. In section 5.3.3, we analyze the relative losses and the individual losses.

5.3.2. *Composition of Earnings Losses*

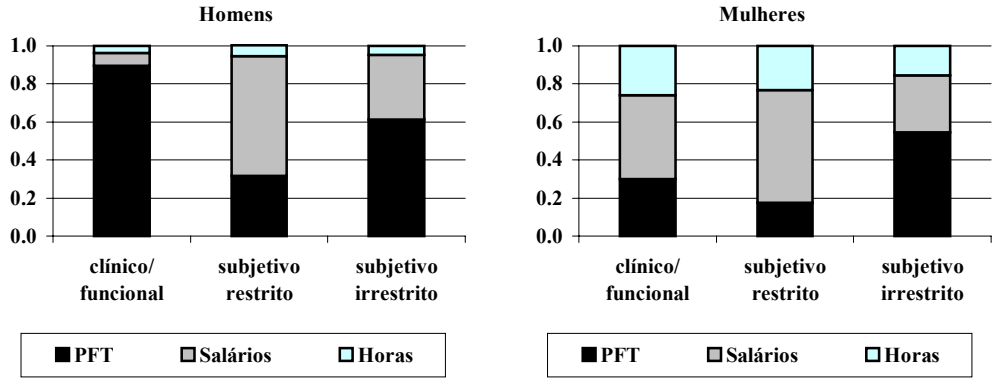
The composition of earnings losses presents particularities, according to sex or the criterion used for assessing health status. Figure 1 shows that the earnings losses occurring through the reduced probability of participating in the labor force have a greater weight in the total male losses as compared to those of females. This is valid for all criteria used, but the relative weight of this kind of loss is significantly stressed by the clinical/functional.

[19] Total earnings are obtained by the sum of the work earnings of the individuals in the PNAD/1998 sample, weighed by the sample expanding factor, which is the same as multiplying the population of working individuals by the workers' weekly average earnings (the result from the hourly wage average and the workhours average).

[20] In this case, the weekly earnings losses should be multiplied by 52 weeks so as to be converted into yearly earnings losses. IBGE is the source of GDP.

[21] The population size of the sick varies significantly among such criteria. In this case, if the criterion amplifies the sick population, it also amplifies the losses related to total earnings or GDP. This problem is avoided, by comparing losses among the criteria by means of the losses of sick individuals.

Figure 1
Composition of earnings losses, resulting from adverse health conditions in Brazil, by sex - 1998



Source: PNAD/1998.

By the clinical/functional criterion, a reduced probability of participating in the labor force is responsible for almost 90% of the total earnings losses for males. In other words, the stronger impact in terms of welfare losses provoked by adverse health conditions is due to sick male workers excluded from the labor force. As for sick females, the major loss channel is the reduced hourly wage rate (44% of total losses). The losses stemming from reduction in the allocated work time are also significant (26%). In other words, health status provokes substantial losses for sick females remaining in the labor force which are liable for 70% of total female earnings losses.

By the subjective criterion, we verified that the weight of losses stemming from reduced probability of participating in the labor force is smaller and, conversely, the weight of losses stemming from the effect of health status on hourly wages is higher than that by the clinical/functional criterion for both males and females. By the unrestricted subjective criterion, the major loss channel for males is still the reduced probability of participating in the labor force (63% of total losses), whereas 33% of the losses stem from the reduced hourly wage rate. We also verified that losses stemming from the smaller probability of remaining in the labor force for females (55% of total losses)is strongly significant, which does not occur in the analysis using the other criteria.

By the restricted subjective criterion, males losses through the reduced wage rate are relatively more relevant (63% of total losses), while only 31% are due to the health status effects on the probability of participating in the labor force. This is a quite different result from that encountered by the clinical/functional criterion. For females, the weight of losses via wage rate reduction is also higher than those found by the other criteria, reaching 59% of the total female losses.

5.3.4. *Welfare losses*

Losses of aggregate earnings provide an indication of welfare losses which adverse health conditions bring about to society. We were able to verify that health is important from the viewpoint of income generation for males and females in the labor market with a significant volume of earnings

loss for the sick. Table 3 shows a picture of such an aggregate impact of health status in Brazil, measured through the relation between total weekly losses and earnings as well as through the relation between annual losses and the GDP.

We verified that, by the clinical/functional criterion, relative losses for females (4.12% of total earnings) are slightly higher than those for males (2.53%). By the subjective criterion, there is not a significant difference. By the unrestricted subjective criterion, losses correspond to 4.5% of total earnings and, by the restricted subjective criterion, this percentage increases to 10%. As for the GDP, the earnings losses in this paper vary from 1.47% (by the clinical/functional criterion) to 4.63% (by the restricted subjective criterion).

Table 3
Relative earnings losses resulting from adverse health conditions in Brazil – percentage (%) – 1998

Criteria	Losses/ Total Earnings			Losses/ GDP
	Males	Females	Total	
Clinical/ Functional	2.53	4.12	2.98	1.47
Restricted Subjective	10.12	10.01	10.09	4.73
Unrestricted Subjective	4.53	4.69	4.58	2.11

Source: PNAD/1998.

The relation between earnings losses due to poor health and total earnings, surveyed by LUFT (1975) for the United States of America in the 1960's, are also significant, reaching a percentage of 6.2% for the total sample of adults (aged 18-64). In this study, the relative losses corresponded to 5.4% of white males, 7.7% of black males, 8.4% of white females, and 9.9% of black females. Thus, compared to the values obtained for the present paper, the losses as a proportion of total earnings found by Luft are between the losses pointed out by the unrestricted subjective criterion and those pointed out by the restricted subjective criterion.

When dividing the total losses by the sick population, an average of welfare loss resulting from poor health status appears, which would not be affected by the number of the sick as is the case with relative losses. The results of such a calculus are found in Table 4 and allow a comparison between losses found by different criteria.

Table 4
Earnings losses by individual, resulting from adverse health status in Brazil - Reais (R$) by week – 1998

Criteria	Males	Females	Total
Clinical/ Functional	8.75	4.40	6.30
Restricted Subjective	16.97	6.11	11.31
Unrestricted Subjective	27.93	8.60	16.89

Source: PNAD/1998.

The weekly earnings losses by person reach the value of R$ 8.75 for males in Brazil, when the clinical/functional criterion is taken into account. This value is higher by the subjective criterion, reaching about R$17.00 by the restricted subjective criterion, and R$28.00 by the unrestricted subjective criterion. As for females, the differences in values by person are smaller, corresponding to R$4.40 per week by the clinical/functional criterion, R$6.11 by the restricted subjective criterion, and R$8.60 by the unrestricted subjective criterion. The weekly losses by a sick individual in Brazil are on the average found in an interval between R$6.30 (clinical/functional criterion) and R$16.89 (unrestricted subjective criterion) with no discrimination by sex.

CASTRO & KASSOUF (2000) had already surveyed very significant figures for earnings losses by adult males (18 to 64 years of age) in the amount of US$187,00 per year, in values of 1989. However, these values should not be directly compared, but one should have in mind that the two surveys show the relevance of health status as a determinant of individual earnings[22]. Anyway, Table 5 shows that the amount of annual losses[23] by person in Brazil, in dollars of 1989, is higher than US$187,00. both by the clinical/functional criterion and the subjective criterion for males, which probably reflects the difference in the dimension of health conditions captured by the indicators used in this paper. By the three criteria used, the losses by a sick individual are substantial. If we consider that the Brazilian GDP per capita is approximately US$4,000, these losses may range from 10% to 30% for males.

Table 5
Earnings losses by sick individual, resulting from adverse health conditions in Brazil – in dollars[24] by year- 1998

Criteria	Males	Females
Clinical/Functional	425.36	213.90
Restricted Subjective	824.95	297.02
Unrestricted Subjective	1,357.75	418.07

Source: PNAD/1998.

[22] Comparing the numbers would not be valid, since the values are expressed by different currencies and time and also because there are some methodological differences in both papers, mainly as far as the information available in the databases is concerned.

[23] The weekly losses were multiplied by 52 ao as to find the yearly losses.

[24] Values in dollars as of 1989.

6. FINAL REMARKS

This paper discusses the relevance of health conditions in determining the Brazilian worker earnings, by showing that poor health provokes losses through the three earnings sources analyzed. A worsened health status is associated with a smaller probability to participate in the labor force with effects on productivity, measured by the wage rate, and on labor supply, measured by the number of weekly workhours.

For males, exclusion from the labor force is the major effect of worsened health status, whereas for females a reduction in the wage rate has a greater weight amongst the components of losses, although some of such comparisons present variations depending on the way health status is analyzed. Health conditions in Brazil should be given close attention, as poor health provokes significant losses for the society both in relative or per capita terms.

The earnings losses by person in Brazil range from R$ 6.30 to R$ 16.89 by week. In relative terms, the losses represent 1,5% to 4.7% of the Brazilian GDP. Such numbers are significant so as to reiterate the need of guaranteeing better health conditions for the population. In addition to the welfare gains not directly measurable, as better living conditions, there is the possibility of reduction of earnings loss values, if the individuals' health status is improved.

We emphasize that the clinical/functional criterion - which ranks as sick the person having a chronic disease or physical mobility problems – may not be sufficient to capture all relevant dimensions of health status for this paper, although this criterion provides clear indications of welfare losses resulting from poor health conditions. The subjective criterion (measured from self-assessed health conditions) points out to a greater volume of welfare losses, besides confirming such results, possibly because such criterion reflects the perception of the individual's thorough health status, adding a health dimension greater than that by the clinical/functional criterion. A qualification to the two criteria is that information on health is given by the individuals themselves who have been interviewed by the PNAD and - as its is usually shown in the empirical literature – such information may be conditioned by the respondent's socioeconomic characteristics. However, it is difficult to know to what extent this might jeopardize the results.

The relevance in comparing the results obtained from the three criteria resides in the fact that the clinical/functional criterion – as it involves a narrower dimension of health status – may underestimate the effects of health on earnings. However, one may consider the results obtained by the clinical/functional and subjective criteria as limits defining an interval where earnings losses by sick people could be found. Between the restricted and unrestricted subjective criteria, a second section would be a more plausible reference for losses by the sick by the subjective criterion. For females, the loss interval by individual is smaller than that for males.

A progress in the analyses of health impacts on earnings in Brazil involves health treatment as a variable simultaneously determined with earnings, which is a proposal for a subsequent study. As the health supplement of PNAD, used in this paper, counts on only one cross-section for 1998, the use of instrumental variables methods seems to be a more adequate alternative for estimating the relation between health status and earnings when the health status is endogenous. An effort to combine the clinical/functional and subjective criteria in a unique measure seems to be interesting in an attempt to capture a broader dimension of health status.

7. REFERENCES

ALVES, L. F. **Impactos do estado de saúde sobre os rendimentos individuais no Brasil**. Belo Horizonte: CEDEPLAR/ UFMG. Dissertação de mestrado. 2002.

BAER, W.; CAMPINO, A. C.; CAVALCANTI; T. Condições e política de saúde no Brasil: Uma avaliação das últimas décadas. **Economia Aplicada**, v. 4, n. 4, p. 763-785, 2000.

BECKER, G. A theory of the allocation of time. **The Economic Journal**, v. 75, p.493-517, 1965.

BEHRMAN, J. H.; DEOLALIKAR, A. B. Health and Nutrition. In: CHENERY, H.; SRINIVASAN, T. N. **Handbook of Development Economics**. Amsterdam: Elsevier, v. 1, cap. 14, 1988. p. 631-711.

CASTRO, E. T. P. de; KASSOUF, A. L. Rendimentos perdidos por trabalhadores em condições inadequadas de saúde (errata). **Economia Aplicada**. São Paulo, v. 4, n. 1, p. 115-119, 2000.

CASTRO, E. T. P. de; KASSOUF, A. L. Rendimentos perdidos por trabalhadores em condições inadequadas de saúde. **Economia Aplicada**. São Paulo, v. 3, n. 2, p. 239-262, abr./jun. 1999.

CURRIE, J.; MADRIAN, B. C.; Health, health insurance and the labor market. In: ASHENFELTER, O.; CARD, D. (eds.). **Handbook of Labor Economics**, v. 3, cap. 50, p. 3309-3416. 1999.

GLICK, P.; SAHN, D. E. Health and productivity in a heterogeneous urban labour market. **Applied Economics**. v. 30, p. 203-216. 1998.

GROSSMAN, M. On the concept of health capital and the demand for health. **Journal of Political Economy**. Chicago, v. 80, n.2, p. 223-255, Mar./ Apr. 1972.

GROSSMAN, M., BENHAM, L. Health, hours and wages. In.: PERLMAN, M. **The economics of health and medical care**. London: Macmillan Press 1974. p. 205-233.

HECKMAN, J. J. Sample selection bias as a specification error. **Econometrica.** v. 47, n. 1, p. 153-161, 1979.

KASSOUF, A. L. Rendimentos perdidos por trabalhadores em condições inadequadas de saúde. **Economia Aplicada**. São Paulo, v. 3, n. 2, p. 239-262, 1999.

KASSOUF, A. L. Saúde e mercado de trabalho. **Pesquisa e Planejamento Econômico**. Rio de Janeiro, v. 27, n. 3, p. 587-610, 1997.

KIDD, M. P.; SLOANE, P. J.; FERKO, I.; Disability and the labour market: An analysis of British males. **Journal of Health Economics**, v. 19, p. 961-981, 2000.

LUFT, H. S. The impact of poor health on earnings. **The Review of Economics and Statistics**, v. 57, n. 1, p. 43-57, 1975.

MARTIKAINEN, P.; AROMAA, M. H.; TIMO, K.; KNEKT, P.; MAATELA, E. L.. Reliability of perceived health by sex and age. **Social Science, Medicine**, v. 48, 1999. p. 1117 - 1122.

NUNES, A.; SANTOS, J. R. S.; BARATA, R. B.; VIANA, S. M.. **Medindo as desigualdades em saúde no Brasil: Uma proposta de monitoramento**. Brasília: Organização Pan-Americana da Saúde, Instituto de Pesquisa Econômica e Aplicada, 2001. 224p.

PITT, M. , ROSENZWEIG, M. Agricultural prices, food, consumption na the health and productivity of Indonesian farmers. In: SINGH, I ; SQUIRE, L., STRAUSS, J. (eds) **Agricultural Household Models**, 1986.

SAHN, D. E.; ALDERMAN, H. The effects of human capital on wages, and the determinants of labor supply in a developing country. **Journal of Development Economics**, v. 29, p. 157-183, 1988.

SCHULTZ, T. P.; TANSEL, A. Wage and labor supply effects of illness in Côte d'Ivoire and Ghana: Instrumental variable estimates for days disabled. **Journal of Development Economics**. v. 53, n. 2, p. 251-286, 1997.

STRAUSS, J.; THOMAS, D.. Health, nutrition, and economic development. **Journal of Economic Literature**, v. 36, p. 766-817, junho de 1998.

THOMAS, D.; STRAUSS, J. Health and wages: Evidence on men and women in urban Brazil. **Journal of Econometrics**, v. 77, n. 1, p. 159-185, 1997.

ANNEX

Chart 2
List of Chronic Diseases according to PNAD/1998

1) spinal column or back disease	7) heart disease
2) arthritis and rheumatism	8) chronic renal disease
3) cancer	9) depression
4) diabetes	10) tuberculosis
5) bronchitis and asthma	11) tendinitis tenonitis
6) hypertension	12) cirrhosis

Chart 3
List of Tasks of the Physical Mobility Topic of PNAD/1998

1) difficulty in feeding, bathing, and using the toilet by him/herself;
2) difficulty in running, lifting heavy things, practicing sports, or accomplishing heavy tasks;
3) difficulty in pushing a table or accomplishing domestic repairs;
4) difficulty in walking up a slope or staircase;
5) difficulty in crouching. kneeling, or bending;
6) difficulty in walking more than one kilometer;
7) difficulty in walking about 100 meters;

Chart 4
Explaining variables included in the econometric model equations

Explaining Variables	Description	Z1	X1	X2
ln (non-work income)	non-wage income logarithm	x		x
education	Numbers of years of complete schooling	x	x	
education^2	Square number of years of complete schooling	x	x	
experience	Potential experience = Age - Education - 5	x	x	x
experience^2	Square potential experience	x	x	x
Race	= 1 for white individuals; 0 otherwise	x	x	x
Labor union	= 1 if the individual is a union member; 0 otherwise		x	x
Urban Sector	= 1 if resident in an urban area; 0 otherwise	x	x	x
Region in the country	Binary variable with values equal to 0 or 1			
Northeast	= 1 for the Northeast region;	x	x	x
Southeast	Southeast region: reference category;			
South	= 1 for the South region;	x	x	x
Center-West	= 1 for the Center-West region (except for Federal District);	x	x	x
Federal District	= 1 for the Federal District ;	x	x	x
Marital Status	Binary variable with values equal to 0 or 1			
Married 1	= 1 if the individual is married and the spouse does not work;	x		x
Married 2	= 1 if the individual is married and the spouse works;	x		x
Single	Single individuals: reference category			
Presence of children in the family	Number of children in the family by age group			
Children aged 0 - 2	Number of children aged 0 to 2;	x		x
Children aged 3 - 6	Number of children aged 3 to 6;	x		x
Children aged 7 - 9	Number of children aged 7 to 9;	x		x
Children aged 10 - 14	Number of children aged 10 to 14;	x		x
Branches of Activity	Binary variable with values equal to 0 or 1			
Agricultural	Agricultural activity: reference category;			
Manufacturing	= 1 for workers in the manufacturing industry;		x	x
Construction	= 1 for workers in the civil construction industry;		x	x
Other industries	= 1 for workers in other industries;		x	x
Commerce	= 1 for workers in commerce;		x	x
Services	= 1 for workers in service activities;		x	x
Aid services	= 1 for workers in aid service activities;		x	x
Transport and Communications	= 1 for workers in transport and communications activities;		x	x
Social	= 1 for workers in social activities;		x	x
Public administration	= 1 for workers in public administration;		x	x
Others	= 1 for workers in other activities;		x	x
Position in the Occupation	Binary variabel with values equal to 0 or 1			
formal sector	Formal sector employees: reference category;			
military or public servant	= 1 for military or public servant;		x	x
informal sector	= 1 for informal sector workers;		x	x
household	= 1 for household servants;		x	x
own-account	= 1 for own-account workers;		x	x
employer	= 1 for employers.		x	x
Lambda	Mills inverse ratio		x	x

Table 6
Average of estimated earnings for the sick in Brazil by sex

Ranking Criterion	Males			Females		
	Participation in the Labor Force	Wage Rate	Number of Workhours	Participation in the Labor Force	Wage Rate	Number of Workhours
Clinical/Functional	0.7850	2.6724	45.8990	0.4398	2.0454	35.4094
Restricted Subjective	0.7800	2.3720	45.4005	0.4467	1.9568	36.2295
Unrestricted Subjective	0.7207	1.8759	45.5381	0.3907	1.5220	34.7542

Source: PNAD/1998.

Table 7
Average of received earnings with estimated coefficients of the healthy and the characteristics of the sick in Brazil by sex

Ranking Criterion	Males			Females		
	Participation in the Labor Force	Wage Rate	Number of Workhours	Participation in the Labor Force	Wage Rate	Number of Workhours
Clinical/Functional	0.8323	2.6880	46.0190	0.4515	2.1597	36.3339
Restricted Subjective	0.8122	2.6623	45.7582	0.4561	2.1649	37.3674
Unrestricted Subjective	0.8211	2.1563	46.0772	0.4332	1.6920	35.9804

Source: PNAD/1998.

Table 8
Average differentials of earnings, resulting from adverse health conditions in Brazil by sex

Ranking Criterion	Males			Females		
	Participation in the Labor Force	Wage Rate	Number of Workhours	Participation in the Labor Force	Wage Rate	Number of Workhours
Clinical/Functional	0.0473	0.0155	0.1200	0.0116	0.1142	0.9245
Restricted Subjective	0.0322	0.2903	0.3577	0.0094	0.2081	1.1379
Unrestricted Subjective	0.1033	0.2804	0.5392	0.0416	0.1700	1.2262

Source: PNAD/1998.
Test t under the null hypothesis of average equal to zero:
the values of this table are significant at 1% (higher than zero).

Table 9
Losses of aggregate earnings, resulting from adverse health conditions in Brazil by sex – 1998

Description	Males			Females		
	Clinical/ Functional	Restricted Subjective	Unrestricted Subjective	Clinical/ Functional	Restricted Subjective	Unrestricted Subjective
1. Total population	43,641,668	43,693,162	43,693,162	44,962,816	45,012,148	45,012,148
2. Sick population	15,261,827	31,448,286	85,613,85	19,566,867	34,220,754	11,401,762
3. Working sick population	11,893,106	24,473,705	6,117,015	8,425,323	15,047,959	4,343,692
4. Wage rate per average hour	3.5196	3.5198	3.5198	2.8541	2.8545	2.8545
5. Weekly average labor supply	47.1406	47.1395	47.1395	39.5926	39.5924	39.5924
Losses 1 – Participation in the Labor Force						
6. Adjusted difference (1)	0.0473	0.0322	0.1033	0.0116	0.0094	0.0416
7. Loss of Labor Force (individuals)	722,287	1,013,091	884,114	227,261	321,548	474,483
8. Loss of earnings per hour	2,542,135	3,565,877	3,111,903	648,630	917,845	1,354,390
9. Loss of earnings per week	119,837,779	168,093,482	146,693,412	25,680,981	36,339,700	53,623,569
Losses 2 – Productivity						
10. Adjusted difference (2)	0.0155	0.2903	0.2804	0.1142	0.2081	0.1700
11. Loss of earnings per hour	184,426	7,104,017	1,715,166	962,558	3,131,912	738,303
12. Loss of earnings per week	8,693,972	334,879,436	80,851,970	38,110,195	123,999,956	29,231,196
Losses 3 – Labor Supply						
13. Adjusted Difference (3)	0.1200	0.3577	0.5392	0.9245	1.1379	1.2262
14. Loss of weekly workhours	1,426,852	8,754,440	3,298,114	7,789,134	17,123,193	5,326,192
15. Loss of weekly earnings	5,021,892	30,813,878	11,608,702	22,231,096	48,877,353	15,203,365
16. Total earnings losses	133,553,644	533,786,796	239,154,083	86,022,273	209,217,009	98,058,129
17. Losses by sick individual	8.75	16.97	27.93	4.40	6.11	8.60
18. Total Earnings	5,273,556,866	5,273,556,866	5,273,556,866	2,090,431,734	2,090,431,734	2,090,431,734
19Losses (%)	2.53%	10.12%	4.53%	4.12%	10.01%	4.69%

Source: PNAD/ 1998.