

ORDERED PROBIT MODEL ANALYSIS OF HEALTH STATUS OF UNORGANISED INDUSTRIAL WORKERS IN TAMILNADU

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Abstract

Enhancing the quality of growth is an important objective of the development paradigm in many developing countries. Better health, education, equal and wider job opportunities to all, trustworthy and transparent people's institutions, sustainable and cleaner environment, dignity, self-esteem and life security, among others, are key manifestations of the quality of growth (World Bank, 2000). If the quality of human capital is not good, physical capital and natural resources can't be properly utilised and growth neither be sustained nor be qualitative. Health is major segment of human capital.

Keywords: *World Bank, human capital, WHO, social infrastructure, health and medical care, commodities*

According to World Health Organisation (WHO), health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The health status is usually measured in terms of life expectancy at birth, infant mortality rate, fertility rate, crude birth rate and crude death rate. These indicators of health are determined by numerous factors such as per capita income, nutrition, housing, sanitation, safe drinking water, social infrastructure, health and medical care services provided by government, geographical climate, employment status, incidence of poverty and the like (Reddy and Selvaraju, 1994; Dadibhavi and Bagalkoti, 1994). It is, de facto, the quality of human health upon which the realization of life goals and objectives of a person, the community or nation as a whole depends. Health is multi-dimensional phenomenon. It is both an end and means of development strategy. The relationship between health and development is mutually reinforcing- while health contributes to economic development, economic development, in turn, tends to improve the health status of the population in a country. Health is also an important entitlement that enhances "capabilities" of the poor people leading to increase in "commodities" and further improvement in health status (Dadibhavi and Bagalkoti, 1994; Bloom *et al.*, 2004). Growth can be qualitative and sustainable only when there is high quantity of human capital invested along with the optimum utilization of natural resources (Reddy and Selvaraju 1994). With rapid improvement in health, particularly of the poor "vicious circle" of poverty can be converted into "virtuous circle" of prosperity (Mayer 1999; Mayer 2000; Bloom *et al.*, 2004). Although there has been a two-way relationship, a strong causal link from adult health to

economic growth is observed by many studies (Mayer 1999; Knowles and Owen 1997; Jamison and Wang 1998). Further, Knowles and Owen (1997) and Jamison and Wang (1998) find that life expectancy contributes to economic growth more than education. In addition to its direct impact on productivity, health has other effects on economic development and demographic transition. Good infant health and nutrition directly increase the benefits of education (WB 1993; WHO 1999). Further, Barro (1996) points out that by increasing longevity, health reduces the depreciation rate of human capital, making investment in education more attractive.

Health Insecurity in India

The health sector in India is at the crossroads. India is experiencing a “double burden of disease”. Many preventable communicable diseases are growing unchecked, nutrition-linked health problems continue to plague the country. Along with it, chronic health conditions are rising menacingly. While public healthcare infrastructure has been allowed to decay, private healthcare sector is wooed with a plethora of incentives, in keeping with the pro-market agenda of the ruling regime. Due to these developments, access and affordability of healthcare has suffered enormously, leading to our failure to achieve good health and provide financial risk protection to the population in general and the poor in particular. A nation aspiring to attain and sustain a double-digit economic growth cannot remain a mute spectator without a concomitant focus on its health of the workforce. A productive workforce and a healthy population are necessary components of any development strategy, which could be ensured only by providing adequate health security to its society. The causal link between health and economic development is well known (Thomas and Frankenberg 2002). Unfortunately, the “exclusive” growth strategy of the neoliberal variety followed since the early 1990s has exposed the population to extreme vulnerability in general, and health insecurity in particular.

Sampling Frame and Size

In the first stage, data relating to textile industrial units have been collected from the Office of the Textile Commissioner, Coimbatore, South Indian Mills Association (SIMA) Coimbatore, South Indian Small Spinners Association (SISSPA), Coimbatore and South Indian Textile Research Association, (SITRA), Coimbatore. Of the 869 units functioning, 550 units belong to Small Scale Industrial category, while the remaining 319 units come under the Non-Small Scale Industrial category. Among the Non -Small Scale Industrial units, 308 units are spinning mills while the remaining 11 units are Composite Mills. In the Textile Industrial category, 550 units under the Small Scale Industrial category have been taken up for study.

The records available with various entities like District Industries Centre (DIC), South Indian Engineering Manufacturers’ Association (SIEMA), Indian Institute of Foundry Men (IIFM), and Coimbatore District Small Scale Industries Association (CODISSIA) showed

that there were nine major engineering industries encompassing foundry industry (755 units), Pump industry (497 units), textile machinery manufacturing industry (524 units), auto component manufacturing industry (484 units), furniture manufacturing industry (170 units), gear industry (140 units), jewellery manufacturing industry (1200 units), sheet metal and fabrication industry (235 units), and engineering outsourcing industry (7000 units).

In the Second stage, using the number of units functioning and the size of workforce as the criteria, Textile Industry and Engineering Industry (Foundry, Pump and Textile Machinery) have been chosen for the study. To make the study reliable, the study is restricted to 30 per cent units in both Textile Industrial units (165 units) and Engineering units (307 units) and 30 percent of the workers were taken on random basis of the textile industrial workers (total workers: 3656) and engineering industrial workers (total workers: 3660). The number of workers who constitute the sample is 1097 in Textile industrial units and while it is 1098 in Engineering Industrial units. Data was collected through personal interviews with the help of the interview schedule. The statistical work was carried out using SPSS and Gretl. Gretl is an econometrics package, including a shared library, a command-line client program and a graphical user interface. It is said to be developed by Prof. Ramu Ramanathan Health Status was assessed using Self Assessed Health Status (SAHS) of the respondent with the help of Ordered Probit model.

Health Status by Ordered Probit Model

Grossman, who made a distinction between the demand for health and demand for healthcare, proposed the first formal economic model of the determinants of health. Grossman constructed a model where individuals use medical care and their own time to produce health. Individuals were assumed to invest in health production until the marginal cost of health production equalled the marginal benefits of improved health status. Health status was assumed to affect utility directly by the value that individual place on good health per se and indirectly through increasing healthy time and, hence, labour income. The researcher used health status as a self-reported categorical measure of health status. The advantage of using such a measure is that it is based on a very simple survey question that has a high reliability. First the demand for health was estimated with an ordered probit model.

a) A latent variable model

The ordinal regression model is commonly preseed as a latent variable model. Defining y^* as a latent variable ranging from $-\infty$ to ∞ , the structural model is

$$y_i^* = X_i S + V_i$$

Or, for the case of a single independent variable,

$$y_i^* = \Gamma + Sx_i + V_i$$

where i is the observation and V is a random error discussed further below.

The measurement model for binary outcomes is expanded to divide y^* into J ordinal categories:

$$y_i = m \quad \text{if } T_{m-1} \leq y_i^* < T_m \quad \text{for } m = 1 \text{ to } J$$

where the cut points T_1 through T_{J-1} are estimated. (Some authors refer to these as thresholds). We assume $T_0 = -\infty$ and $T_J = \infty$ for reasons that will be clear shortly.

Described by the respondent about their health is; possible responses are: 1=Very Poor (VP), 2=Poor (P), 3=Average (A), 4=Good (G) and 5= Very Good (VG). The continuous latent variable can be thought of as the propensity to good and very good health of the respondent. The observed response categories are tied to the latent variable by the measurement model:

$$y_i = \begin{cases} 1 \Rightarrow \text{Very Poor} & \text{if } T_0 = -\infty \leq y_i^* < T_1 \\ 2 \Rightarrow \text{Poor} & \text{if } T_1 \leq y_i^* < T_2 \\ 3 \Rightarrow \text{Average} & \text{if } T_2 \leq y_i^* < T_3 \\ 4 \Rightarrow \text{Good} & \text{if } T_3 \leq y_i^* < T_4 \\ 5 \Rightarrow \text{Excellent} & \text{if } T_4 \leq y_i^* < T_5 = \infty \end{cases}$$

Thus, when the latent y^* crosses a cut point, the observed category changes.

b) Dependent variable

i) Determinants of Health Status - (H_t)

The researcher used an indicator of Self-Assessed Health (SAH) as a measure of health status, which is widely used in health economics. SAH is a subjective measure of health that provides an ordinal ranking of perceived health status. The advantage of using such a measure is that it is based on a very simple survey question that has a high reliability. However, SAH measure is not perfect, when compared with continuous measurement like objective health measure. One advantage of categorical measurement is that in some degree it can mitigate measurement error problem. After reviewing relevant studies, Idler and Benyamini (1997) concluded 'self-rating represent a source of very valuable data on health status'. Helmer *et al.* (1999), Kaplan and Camacho (1983), find this categorical health variable contains important information on individual's health. Self-reported specific morbidities are more likely to be identified by the respondent in a survey if these morbidities have already been diagnosed by the medical care system. However, in most societies access to the medical system varies by region and across socioeconomic classes, introducing systematic reporting bias (Strauss *et al.* 1995).

Model for Ordered Categorical Data: Ordered Probit

In the last few years researchers have evolved new techniques to analyse social science data problem, such as the study of multiple choice variables (Greene, 2003; Jones, 2000).

In particular, we focus our analysis on individual's Self-Assessed Health Status (SAH). This variable takes four values that vary from "excellent health" to "poor health". The logit or probit models take into account of binary form variables having two choices and they cannot take into account of an ordered variable. In our case the dependent variable takes an order of four, which can not be accommodated by logit or probit model. An appropriate tool for analyzing such ordered categorical data is the ordered probit model (Gerdtham and Johannesson, 1999; Greene, 1993, 2002 and Jones, 2000).

Table 1: Ordered Probit Model: Maximum Likelihood Estimation Results

Dependent variable: Health Status (SAHS Categorical: Very Poor (1) to Excellent (5))

SAHS	Coefficient	Std. Error	Z	p-value	
Maritalstatus	-0.108286	0.0512412	-2.1133	0.03458	**
Religion	0.121153	0.0558392	2.1697	0.03003	**
MBC	0.137061	0.0599482	2.2863	0.02223	**
SCST	0.119264	0.0606274	1.9672	0.04916	**
Illiterate	-0.51608	0.14242	-3.6236	0.00029	***
Primary	-0.412489	0.138427	-2.9798	0.00288	***
Middleschool	-0.504149	0.136324	-3.6982	0.00022	***
Secondarieschool	-0.456957	0.140068	-3.2624	0.00110	***
Migration	-0.0311636	0.0514265	-0.6060	0.54453	
cut1	-2.34122	0.160432	-14.5932	<0.00001	***
cut2	-1.86124	0.155462	-11.9723	<0.00001	***
cut3	-0.954186	0.152071	-6.2746	<0.00001	***
cut4	0.94929	0.152168	6.2384	<0.00001	***
Mean dependent var	3.704784;		S.D. dependent var	0.802429	
Log-likelihood	-2366.986;		Akaike criterion	4759.972	
Schwarz criterion	4833.993;		Hannan-Quinn	4787.024	

Significant level (*P < 0.01 for 10% level; ** 0.01<p<0.05 for 5% level; *** 0.05 <0.10 for 1% level)

Number of cases 'correctly predicted' = 1358 (61.9%);

Likelihood ratio test: Chi-square (9) = 34.2414 [0.0001]

Test statistic: Chi-square (1) = 0.367256 with p-value = 0.544504

The Ordered Probit Model can be used to model a discrete dependent variable that takes ordered multinomial outcomes, e.g. $Y = 1, 2, \dots, m$. A common example is self-assessed health, with categorical outcomes such as Very Poor, Poor, Average, Good and excellent. Examples of Ordered Probit Models include Kenkel (1995) who has categorical measures of

self-reported health status and of activity limitation from the health promotion/disease prevention module of the 1985 U.S. National Health Interview Survey. Gredtham and Johannesson (1999) used this model to analyse three-scale self rated health status and four-point scale method used by Balasubramanian from his unpublished thesis.

The results explain the changes in probabilities within category pairs have the same pairs. Therefore, the interpretation of the coefficients presented in (Coef.) is straight forward. Negative sign shows that increase in the respective variables rises the probability of very good rather than good health status and lowers the probability of a very poor health and rather poor health. The negative sign of the coefficients indicates that increase in the respective variable improves the probability of very good health status and lowers the probability of very good health. The married workers have poor health status than the unmarried industrial workers and significant at five percent level. Hindu religion has good health status than the worker belongs to other religions such as Christian and Muslim religion. Most backward and SC and ST categories have better health status as compared to Forward and Backward community workers. In the case of Education, illiterate workers and secondary level educated have poor health status. The Non-migrant workers have better health status than the migrant workers.

Concluding Observations

Coimbatore has occupied a prominent place in the industrial map of India. Generally, Textile and Engineering industrial units attracted the migrant workers and made them to be mainstay. But the migrant workers had very less opportunities for going for alternative jobs, which did not provide room for the vertical mobility of their professional ladder. Similarly, the mobility of the workers of engineering industry was confined with certain jobs alone. Some workers articulated that they had a very remote chance of promotion and some others opined that there would be a possibility to have promotion only when the workers had better education and very good relationship with the superiors concerned. Coimbatore will become global industrial centre. Among the industrial workers, the results of the Ordered Probit Model explains that the married workers have poor health status than the unmarried industrial workers and significant at five percent level. Hindu religion has good health status than the worker belongs to other religions such as Christian and Muslim religion. Most backward and SC and ST categories have better health status as compared to Forward and Backward community workers. In the case of Education, illiterate workers and secondary level educated have poor health status. The Non-migrant workers have better health status than the migrant workers. Even common benefits like ESI and PF were not extended to all the workers. Due to unhealthy and unhygienic nature of production process, around two-fifths of workers were affected by occupational health hazards. No specific health care protection was made available to these workers either by the government or by the employers. So the workers of the foundry industry faced a high degree of insecurity of health.

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