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Height, weight and earnings among coalminers in India

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Abstract

This paper analyses earning/wage differentials by height among coalmine workers in India. Our findings suggest that workers of above average height earn 9–17% more than their shorter counterparts and 6–13% more than average *reference* height. The results suggest that long-term investments in health human capital might ensure increase of labour productivity and thereby earnings, particularly in underdeveloped economies.

JEL classification: I12; J24

Keywords: Height; BMI; Human health capital; India; Malnutrition; Labour productivity; Wage differentials; Coalmine workers; Weight; Physical stature; Anthropometrics

1. Introduction

The empirical labour economics literature addresses wage differentials in labour market outcomes by sex, education, health status and many other aspects. Among these factors, physical appearance has also attracted researchers. Several studies in economics and social psychology address the relationship between physical appearance and labour market outcomes. The findings of those studies suggest that labour earnings depend on physical attributes of the workers, *ceteris paribus*.

Three physical attributes – attractiveness, weight and height – have been examined as indicators of wage differentiation. Hamermesh and Biddle (1994), Biddle and Hamermesh

(1998) and Hamermesh and Parker (2003) studied the effects of beauty on wage earnings. According to these investigators, workers of above average looks earned more than those of average attractiveness, possibly because of certain communication skills and higher self-confidence. Averett and Korenmann (1996), Cawley (2004) and Mitra (2001) examined the effects of weight on socioeconomic outcomes. Earlier studies of the relationship between weight and wage have found mixed results but Cawley (2004) found that weight lowers wages for overweight white females. Some of these studies on the relationship between weight and labour market outcomes include height as a further control variable. In addition, Komlos (1998), Schultz (2002), Judge and Cable (2003), Komlos and Kriwy (2003), Persico et al. (2004), Jacobs and Tassenaar (2004) and Heineck (2004) examined the effects of height on wage earnings and socioeconomic status.[1]

Physical growth indicators of health status include a variety of anthropometric measurements, the most common being adult height, which is thought to be particularly sensitive to childhood nutrition and health status that may be a proxy for the living standard of the family (Thomas and Strauss, 1997; Steckel, 1995; Schultz, 2001). Habits, preferences and choices of parents might affect health status and, consequently, adult height of their children. Height is the result of complex biological and nutritional processes. Adult height is determined by genetic and biochemical factors; however, it is realised in part through nutrition and health-related care and conditions. In addition to genetic endowments, nutrition and health status contribute to adult height (Cole, 2003; Schultz, 2001). Nutritional intake in childhood, thus, may be considered as a latent indicator of adult height and lifetime health status (Schultz, 2002).

Individuals with low socioeconomic status are shorter than individuals with higher socioeconomic status.[2] However, family and community behaviours (or customs) may influence overall development of children. These influences are most important during early stages of human development (i.e., physical and psychological growth during the first 4 years of childhood and physical growth during adolescence) and formation of health human capital.[3] Nutritional intake during childhood is crucially important for formation of the stock of health human capital that is likely to impact lifetime productivity. Adult height, thus, may be considered as the result of long-term investments in health human capital (Schultz, 2003a, b; Zellner et al., 2004), and may, in turn, bring about differences in labour productivity.[4] Along with height, it is also necessary to examine the effect of weight and body mass index (BMI) on earnings (McGee, 2004; Zellner et al., 2004).

This paper re-examines for the first time whether the prior results found exist for a developing country such as India. In other words, to what extent are adult height and weight differentials

[1] There are substantial differences between studies that explored the effects of the relationship between height and wage earnings (Judge and Cable, 2003, 2004; Persico et al., 2004; Heineck, 2004) and studies that addressed the association between individual's height and their socioeconomic status (Steckel, 1995; Komlos, 1998; Komlos and Kriwy, 2003; Komlos and Baur, 2003).

[2] The positive association between individual's income and height is well documented in the anthropometric literature. Moreover, a large number of studies have shown average height to be responsive to economic activities (Komlos, 1998; Komlos and Baten, 1998).

[3] Here, we mean the creation of human health capital on the basis of proper food intake before entrance into the job market. The availability of adequate calories, minerals, proteins and other micronutrients allow a child to grow, fight infections and properly perform various energy-demanding tasks. It is true that labour productivity in terms of the physical efficiency of workers may provide a better insight for investment in human health capital formation, because health, nutrition and productivity are closely interrelated (Schultz, 2001, 2002, 2003a, b).

[4] Tallness, particularly among men, is associated with authority, capability and success. According to Judge and Cable (2003, 2004), the relationship between height and wage earnings is particularly strong in sales and management positions.

associated with labour productivity among coalmine workers in India. Earlier studies have mainly explored data from the United States, Germany (Cawley, 2004; Heineck, 2004), Ghana, Brazil and the United States (Schultz, 2002) and, recently, the USA and UK (Persico et al., 2004), the Netherlands (Jacobs and Tassenaar, 2004) and China (Morgan, 2004).

2. Data

The data set used in this analysis was collected by Regional Occupational Health Centre in the collaborative study of Indian Council of Medical Research (ICMR) and International Development Research Centre, Canada (IDRC), on pneumoconiosis in underground coalminers, in the Eastern Region of India[5] (June 1986–March 1993). The original study was done on a sample of 5777 underground and 1236 surface coalminers and included a wide range of labour-related indicators and socioeconomic variables (NIOH Web site, i.e., http://www.nioh.org/niohachiveprocoalminer.htm). Gangopadhyay (1995) discussed the data in detail. There is major focus on health-related variables and anthropometric indicators, i.e., height and weight are part of it.[6] We use data pertaining to 3567 adult coalminers (age 21–50) who have complete (physical, medical, pathological and socioeconomic) information (Table 1).

3. Methodology

The dependent variable used in all regressions is the logarithm of monthly wage earnings.[7] Individual height is the prime regressor of interest and is treated as an exogenous variable, in so far as wage earnings are concerned. This study uses a wide range of additional control variables that commonly appear in Mincer-type[8] earnings functions. Duration of work (in years[9]) and environmental conditions at the workplace (e.g., dust exposure, temperature, relative humidity and noise level) are relevant control variables. Work efficiency essentially depends on work experience, environmental conditions and risk, which is nonlinearly associated with work efficiency. To account for this nonlinear relationship, we introduce the term ‘‘duration of work squared,’’ which is expected to be negative, to reflect the inverse relationship between work efficiency and work duration. The wage distribution of coalminers is positively skewed

[5] Such as Asansol, Barakar, Raniganj and Jharia, i.e., the Barakar/Damodor-Raniganj belt. The reports included some surface/opencast mines also. The site of present study is spread over an area of 1367 km^2. Six coal mining areas were chosen for the study. The selection of these areas was based on geographical location, easy accessibility and willingness of the local mining authorities to participate in the study (ICMR–IDRC Report, 1993; Gangopadhyay, 1995).

[6] Gender effect could not be calculated with these data since women are not allowed inside coalmines in India.

[7] To be exact, the logarithm of wage earnings is a dependent variable. A minimum wage is paid to all workers for regular-time work, and an extra amount is paid for overtime work. Monthly earnings are calculated on the basis of these wages. Mining activity continues throughout the year. It should be noted that coalmines were nationalised in 1972–1973. Since then, the Government of India has owned all mines and has managed and regulated the mining-related labour force. Therefore, insofar as payment is concerned, there is no discrimination in India, particularly in organised sectors such as coal mining.

[8] Mincer (1974) first introduced an earnings function in which control variables included age, age squared, job duration, hours of work per week, marital status, race, public employment, part time jobs, overtime duration, occupation and branch dummy variables and family size.

[9] The implicit assumption is that a coalminer works approximately the same number of hours each year. There is virtually no variation in work hours per day among the miners. However, no data are available for the duration of illness and/or other occupations.

Table 1
Summary statistics of adult Indian coalmine workers

	Number of workers	Mean	Standard deviation
Age (year)	3567	45.22	9.03
Height (cm)	3567	161.76	6.61
Weight (kg)	3567	50.45	8.19
BMI	3567	19.24	2.62
Income (Rs./monthly)	3567	2244.40	543.14
Duration of work (year)	3567	21.93	8.61
BSA (m^2)	3567	1.52	0.13

Note: Monthly income is in Indian rupees. In 1989–1990, 1 US dollar was equal to 17 Indian rupees. Adult is defined as men between the ages of 21 and 50.

Table 2
Gross monthly earnings of Indian coalminer (Rs.) by height

Class-height	Number of workers	Earnings (Rs.)	Standard deviations
Height 175.0 cm and above	105	2445.7	534.3
165–174.99 cm	1100	2363.3	610.5
155–164.99 cm (*reference height*)	1878	2199.0	513.0
Height below 155 cm	484	2106.5	421.5
Total	3567		

with a long tail on the right side but the logarithm of wage earnings ($\ln y$) follows normal distribution:

$$\ln y_i = \alpha + x_i'\beta + \gamma_1 z_i + \gamma_2 z_i^2 + w_i'\theta + \varepsilon_i, \quad (1)$$

where y_i is the wage earnings from coal mining activities of individual i, x the vector of height category,[10] z the duration of work, w_i the vector of other exogenous variables and ε_i is an error term that has a normal distribution (as confirmed by the Jarque–Bera normality test). With regard to other exogenous variables, duration of work and its square term are used in model I. Model II is the Mincer-type earnings function, which includes age, age squared, duration of work and other exogenous variables. Since duration of work is taken into account in the age variable, collinearity should be investigated. For purposes of comparison, we also present the results of models that include height and other possible indicators, such as weight and BMI.

4. Results

Monthly income increases with height (Table 2),[11] and t-tests indicate that the differences are statistically significant (Table 3). Table 4 presents estimated results of the relationship between heights (and other demographic and work-related characteristics) and wage earnings, obtained by

[10] The rule for taking reference class-height is $\approx\mu \pm \sigma$ and $\approx\mu \pm 10, \pm 20$, etc.

[11] We used other classifications and obtained similar results.

Table 3
Results of *t*-test for equality of mean earnings for different height-groups

Class-height	ht ≥ 175	165 ≤ ht < 175	155 ≤ ht<165	ht < 155
ht ≥ 175		3.35	10.88	16.14
165 ≤ ht < 175			7.01	10.92
155 ≤ ht < 165				4.16
ht < 155				

Note: ht denotes 'Height'.

Table 4
Results of height-dummy on log earnings of coalminers in India

Variables	Age control (21–50 years)	
	Model I	Model II
The tallest (height 175.0 cm and above)	0.085***	0.086***
Taller (165–174.99 cm) (above average height)	0.057***	0.057***
Average height (155–164.99 cm)	*Reference height*	*Reference height*
Shorter (height below 155.0 cm)	−0.036***	−0.034***
Age	–	0.005
Age^2	–	0
Duration of work	0.008***	0.006***
Duration of work^2	0	–
Smoking	−0.019**	−0.019**
Dust exposure	0	0
Alcohol drinking	0.017*	0.017*
Family size	−0.003*	−0.003*
Marital status	0.05*	0.046
Job1	−0.139***	−0.142***
Job2	−0.027***	−0.028***
Job3	−0.083***	−0.086***
R^2	0.367	0.373
Log-Likelihood Function	399.54	405.41

Note: (i) Dummy variables are used for height-class; (ii) (***) (**) and (*) denote statistically significant at 1, 5 and 10% level, respectively; (iii) Job1: Coal cutter, coal cutter assistant and coal dresser, Job2: underground loader, Job3: Line Mistri, Line Mozdur and Trammer, Job4: Driller.

means of Eq. (1), with a dummy variable denoting height category.[12] Analysis of height categories in 10-cm increments supports the hypothesis that the tall-miners earn more.[13] Workers who are taller earn 6–13% more and the shorter 3–4.5% less compared with workers in the reference range. These results support earlier studies such as Heineck (2004) who observes that taller German men workers gain 1–1.3% compared to the average height, while shorter men

[12] The results of this cross-sectional analysis might not capture unobservable heterogeneous data that might be captured as paneled data (Heineck, 2004).

[13] Our basic model is semilogarithmic. Therefore, the coefficients of dummy variables for height categories should be treated carefully. We calculated the antilog of estimated coefficient of dummy variables related to height category, subtracted 1, and multiplied the result by 100. The formula is $(e^b - 1) \times 100$, where b represents the value of the coefficient. Thus, the mean wage earning of mine workers was higher or lower, compared with wage earning of workers whose height was within the reference range (Gujarati, 1995; Greene, 2003).

Table 5
Results of interaction (height × dummy) on earnings of coalminers in India

Variables	Model I	Model II
The tallest (height 175.0 cm and above)	0.0005***	0.0005***
Taller (165 cm–174.99 cm) (above average height)	0.0004***	0.0004***
Average height (155–164.99 cm)	*Reference height*	*Reference height*
Shorter (height below 155.0 cm)	−0.0003***	−0.0002***
Age	–	0.014***
Age^2	–	−0.0001***
Duration of work	0.015***	0.0045***
Duration of $work^2$	−0.0002***	–
Smoking	−0.018**	−0.018**
Family size	−0.004***	−0.004***
Job1	−0.12***	−0.12***
Job2	−0.044***	−0.047***
Job3	−0.092***	−0.096***
R^2	0.3877	0.3952
Log-Likelihood Function	588.89	601.21

Note: (i) Height is continuous within the group and interaction results are easy to interpret the effect of incremental height on earning for each group; (***) and (**) denote statistically significant at 1% (P-value < 0.01) and 5% (P-value < 0.05) level, respectively.

workers loose earnings around 3–6%. Persico et al. (2004) observe 2.1% increase in adult wages for each additional inch of adult height in Britain and 2.6% in the USA.

We next considered height as a segmented or group-wise continuous variable[14] (Greene, 2003; Gujarati, 1995). The results (Table 5) indicate that for every centimetre increment in height, the mean wage earnings of coalminers in the tallest (above 175.0 cm) and taller (165–174.99 cm) height categories are 0.05% and 0.04% more than the reference height (155.0–164.99 cm), respectively.

The correlation coefficient between age and duration of work is very high, which indicates the possibility of multicollinearity.[15] Surprisingly, the estimated coefficients of age or/and duration of work are not affected too much comparing the exclusion of other one. Other exogenous variables include job category (such as coal cutting and coal loading, etc.), family size, smoking, alcohol drinking, marital status and dust exposure. Family size is usually inversely related to wage earnings. It provides the basic features of less developed economy that low earners have large family size while high earners have small. Naturally low earning workers have less food per head and fail to maintain their health condition. Smoking has a negative impact on labour productivity[16] (Table 4) whereas alcohol drinking, may act as a stimulating factor, has positive effect on it.

For further investigation on the effect of physical attributes on wage earnings, we examine body weight that refers to short-term health status. Height reflects only long-term net nutritional status. So, the relationship between wage and weight is a short-term measurement of current health status and physical work capacity (Komlos, 1994). Thus, BMI could be associated with

[14] Separate regression implies that all of the coefficients can vary. But here, the coefficients of control variables are kept fixed over different height intervals.
[15] Conditional indexing suggests that multicollinearity is due to inclusion of both age and job duration.
[16] In the absence of any other data, it is natural to assume that labour productivity is directly related to wage earnings.

Table 6
Earnings and BMI of coalmine workers in India

Variables	Dummy		Segment wise continuous (interaction)	
	Model I	Model II	Model I	Model II
Obese (BMI above 30)	−0.047	−0.045	−0.002	−0.002
Overweight (24.5–29.9)	0.09***	0.088***	0.004***	0.003***
Normal (18.5–24.49)	*Reference group*	*Reference group*	Reference group	Reference group
Underweight (BMI below 18.49)	0.019***	−0.02***	−0.001***	−0.001***
R^2	0.3603	0.3695	0.6302	0.3693
Log-Likelihood Function	546.419	560.196	546.161	559.836

Note: (***) and (**) denote statistically significant at 1 and 5% level, respectively.

health and productivity. We find that weight of coalminers is positively correlated with wage earnings. This suggests either that labour productivity[17] increases as worker's nutritional intake increases or that people with higher nutritional status have a higher productivity, earn more and therefore can afford a greater nutritional intake.

The distribution of BMI is positively skewed and most of the coalminers are within or less than normal range (i.e., BMI is 18.5–24.5 kg/m^2). Workers with a low BMI are considered to be undernourished or underweight (McGee, 2004; Schultz, 2002). A low BMI is associated with an elevated risk of chronic morbidity and mortality, and a high BMI (obesity) is associated with an increased risk of morbidity and mortality (Fogel, 1994; Schultz, 2001). As BMI increases (from underweight to normal level), health improves and thereby productivity also increases (Schultz, 1995; Thomas and Strauss, 1997).

As a continuous variable, BMI is directly related to wage earnings. This suggests that, in the short-term, as the nutritional status of coalminers changes from malnutrition to normal, productivity and wage earnings increase. Furthermore, overweight workers earn 9% more and underweight workers earn 2% less than the reference standard wage (Table 6).[18] It is clear that malnutrition might be the cause of low productivity and, in turn, decreased wage earnings and low productivity, in turn, can influence nutritional status (Brennan et al., 2004). It is true that huge amount of energy is required to perform the coal mining activities. Underweight coalminers may lack the required energy to perform their tasks, whereas overweight coalminers may have the required energy. This might explain why overweight coalminers earn more than workers with lower body weights.

5. Conclusion

This paper presents evidence for the first time on the relationship between height, BMI and earnings of Indian coalmine workers. The results support prior research (Heineck, 2004; Persico

[17] Labour productivity has been assumed to be a close substitute for earnings, and the correlation between earnings and weights is significantly positive ($r = 0.21$ [$n = 3567$]). Weight might be endogenous with respect to wage earnings of adults (cf. the nutrition motivated efficiency wage model Bliss and Stern (1978)). Current food intake should be treated as endogenous, and should be treated with caution in models accounting for labour productivity (Strauss and Thomas, 1995; Thomas and Strauss, 1997; Schultz and Tansel, 1997). Thus, there is a possibility of simultaneous equation bias. To obtain proper estimates, instrumental variables are needed (Schultz, 2002). It is true that nutritional deficiency might be the cause of decreased productivity and/or wage earnings.

[18] The basic results remain the same even if 18.5–24.9 kg/m^2 is used as the BMI reference range.

et al., 2004, etc.) in so far as there is evidence for an earnings differential by height among Indian coalminers. The findings suggest that workers of above average height earn 9–17% more compared to their shorter counterparts and 6–13% more than *reference height*. Whereas, workers of below average height have lower earnings by 3–4.5% compared to workers of the reference height. These are similar to the findings of Heineck (2004). The wage differences of Indian coalmine workers might be due in part to better health status and/or increased productivity among tall workers.

This study suggests that (public or private) investment for improvement of child health care is important for creation of health human capital, which is essential for ensuring future returns in terms of earnings. This study has some limitations. First, it might be worthwhile to examine the relationship between caste and productivity in a given work environment. Second, coalminers come from a particular region (or social class). Certainly, they do not represent the Indian population as a whole. Thirdly, one can study wage differentiation in other economic activities that are linked to height.

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References

Averett, S., Korenmann, S., 1996. The economic reality of the Beauty Myth. J. Hum. Resources 31, 304–330.

Biddle, J.E., Hamermesh, D.S., 1998. Beauty, productivity and discrimination: lawyers' look and lucre. J. Labor Econ. 16, 172–201.

Bliss, C., Stern, N., 1978. Productivity, wages and nutrition. J. Dev. Econ. 5, 331–398.

Brennan, L., McDonald, J., Shlomowitz, R., 2004. Infant feeding practices and chronic child malnutrition in Indian States of Karnataka and Uttar Pradesh. Econ. Hum. Biol. 2, 139–158.

Cawley, J., 2004. The impact of obesity on wages. J. Hum. Resources 39 (2), 451–474.

Cole, T.J., 2003. The secular trend in human physical growth: a biological view. Econ. Hum. Biol. 1, 161–168.

Fogel, R.W., 1994. Economic growth, population theory and physiology. Am. Econ. Rev. 84, 369–395.

Gangopadhyay, P.K., 1995. A study of coal miners' pneumoconiosis in Eastern coal fields, Gujarat University, Ahmedabad, Ph.D. thesis, National Institute of Occupational Health.

Greene, W.H., 2003. Econometric Analysis. Prentice Hall, New Jersey.

Gujarati, D.N., 1995. Basic Econometrics. McGraw-Hill Inc., Singapore.

Hamermesh, D.S., Biddle, J.E., 1994. Beauty and the labor market. Am. Econ. Rev. 84, 1174–1194.

Hamermesh, D.S., Parker, A.M., 2003. Beauty in the classroom: professors' pulchritude and putative pedagogical productivity, NBER Working Paper No. 9853.

Heineck, G., 2004. Up in the skies? The relationship between body height and earnings in Germany, Department of Economics, University of Munich, unpublished working paper.

ICMR–IDRC Report, 1993. Study of pneumoconiosis in underground coalminer in India http://www.nioh.org/niohachi-veprocoalminer.htm.

Jacobs, J., Tassenaar, V., 2004. Height, income and nutrition in the Netherlands: the second half of the 19th century. Econ. Hum. Biol. 2, 181–195.

Judge, T., Cable, D., 2003. Workplace rewards tall people with money, respect, UF study shows, http://www.napa.ufl.edu/2003news/heightsalary.html, November 2004.

Judge, T., Cable, D., 2004. The effect of physical height on workplace success and income: preliminary test of a theoretical model. J. Appl. Psychol. 89, 428–441.

Komlos, J., Kriwy, P., 2003. The biological standard of living in the two Germanies. German Econ. Rev. 4, 459–473.

Komlos, J., Baur, M., 2003. From the tallest to (one of) the fattest: the enigmatic fate of the American population in the 20th century. Econ. Hum. Biol. 2, 57–74.

Komlos, J., Baten, J. (Eds.), 1998. The Biological Standard of Living in Comparative Perspective. Franz Steiner Verlag, Stuttgart.

Komlos, J., 1998. Shrinking in a growing economy? The mystery of physical height during the industrial revolution. J. Econ. Hist. 58, 779–803.

Komlos, J., 1994. Height living standards and economic development: essays in anthropomrtric history. University of Chicago press, Chicago.

McGee, D.L., 2004. Weight–height relationships and body mass index. Some observations from the Diverse Population Collaboration, Department of Statistics, Florida State University, unpublished working paper.

Mincer, J., 1974. Schooling Experience and Earnings. Columbia University Press for NBER, New York.

Mitra, A., 2001. Effects of physical attributes on the wages of males and females. Appl. Econ. Lett. 8, 731–735.

Morgan, S.L., 2004. Economic growth and biological standard of living in China, 1880–1930. Econ. Hum. Biol. 2, 197–218.

Persico, N.G., Postlewaite, A., Silveman, D., 2004. The effect of adolescent experience on labour market outcomes: the case of height. J. Political Economy 112 (5), 1019–1053.

Schultz, T.P., 1995. Human capita and development. In: Peters, G.H., Hedley, D.D. (Eds.), Agricultural Competitiveness. Paper presented to the 22nd International Conference of Agricultural Economists, Dartmouth Publishing Company, Aldershot, England.

Schultz, P.T., 2003a. Human capital, schooling and health. Econ. Hum. Biol. 1, 207–221.

Schultz, P.T., 2003b. Wage rentals for reproducible human capital: evidence from Ghana and the Ivory Coast. Econ. Hum. Biol. 1, 331–336.

Schultz, P.T., 2002. Wage gains associated with height as a form of health human capital, Economic Growth Center, Discussion Paper No. 841.

Schultz, P.T., 2001. Productive benefits of improving health: evidence from low-income countries. In: Presented at the Meeting of Population Association of America, Washington DC, March 29–31, Yale University.

Schultz, P.T., Tansel, A., 1997. Wage and labor supply effects of illness in Cote d'Ivoire and Ghana: instrumental variable estimates for days disabled. J. Dev. Econ. 53, 251–286.

Steckel, R.H., 1995. Height and the standard of living. J. Econ. Lit. 33, 1903–1940.

Strauss, J., Thomas, D., 1995. Human resources: empirical modeling of household and family discussions. In: Behrman, J.R., Srinivasan, T.N. (Eds.), Handbook of Development Economics. North-Holland, Amsterdam (Chapter 34).

Thomas, D., Strauss, J., 1997. Health and wages: evidence on men and women in urban Brazil. J. Econometrics 77, 159–185.

Zellner, K., Jaeger, U., Hauschild, K.K., 2004. Height, weight and BMI of schoolchildren in Jena, Germany—are the secular changes levelling off? Econ. Hum. Biol. 2, 281–294.