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Does physical capacity explain the height premium?

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Abstract

The paper examines the role of physical capacity in the determination of the height premium by using the "Health 2000 in Finland" data that contain both self-reported information on the physical strenuousness of work, and information on muscle mass from medical examinations. Our results show that the height premium does not vary according to the physical strenuousness of work. We also find that muscle mass is not related to wages. Furthermore, we observe that the shortest men do physically very demanding work and the tallest do sedentary work, even after controlling for the effects of age and education.

JEL classification: I10, J23, J31

Keywords: Height; Height premium; Body composition; Wages

1. Introduction

Non-economic attributes are widely rewarded (e.g. Komlos, 1990; Hamermesh and Biddle, 1994; Mocan and Tekin, 2010). Several empirical studies document the fact that height has a statistically and economically significant positive influence on labour market outcomes such as earnings (e.g. Judge and Cable, 2004; Heineck, 2005; Hübler, 2009).[1] There are many potential explanations for this observation. Some authors argue that the pattern arises because height is associated with non-cognitive skills (e.g. Persico et al., 2004). Non-cognitive skills refer mainly to social skills. On the other hand, other authors maintain that cognitive skills are more important contributors to the height premium (e.g. Case and Paxson, 2008a, 2008b). In particular, Case and Paxson (2008a) show that 30-50% of the height premium can be attributed to cognitive ability that is measured in childhood and youth. The effect of height on labour market outcomes remains a puzzle because of this conflicting evidence.

In a recent contribution, Lundborg et al. (2009) argue that the positive effect of height on earnings can largely be explained by the fact that there is a positive association between height and physical capacity. Lundborg et al. (2009) demonstrate that physical capacity explains 80% of the observed height premium in Sweden. Lundborg et al. (2009) propose multiple explanations for this finding. They include physical capacity being a health marker, being perceived as attractive, and being a signal of demanded personality traits.

The importance of physical capacity in the determination of the height premium is a rather provocative claim, because work has become much more sedentary and less dependent on physical capacity in all developed countries. The effect of height on earnings through physical capacity would also be a rather surprising pattern in the sense that one of the best known stylized facts of labour market development is that the relative labour market position of low-skilled workers has declined sharply in industrialized countries during the past few decades (e.g. Autor et al., 2008). Most of those low-skilled workers hold jobs that are physically strenuous, at least to some degree. However, besides the explanations proposed by Lundborg et al. (2009), there is also evidence that individuals who are engaged in leisure sport activities receive higher wages (e.g. Ewing, 1998; Cornelissen and Pfeifer, 2007; Lechner, 2009). This premium is not related to specific, physically demanding job tasks, but it could, for instance, reflect the fact that individuals with better fitness can endure more effective working hours or have fewer sick absence days. Hence, the premium is not exclusive to certain occupations. Instead, it is rather general in character.

We contribute to the debate by examining the effect of height on wages at the different levels of the physical strenuousness of work. In particular, we study whether height yields the largest positive rewards in terms of higher wages at work that is physically strenuous. In this paper, we use the "Health 2000 in Finland" data that incorporate self-reported information on the physical strenuousness of work. Furthermore, our data contain information on individuals' muscle mass from medical examinations that can be used to study whether the effect of height on wages is systematically larger for individuals that have a lot of muscle mass. Muscle mass is one of the direct measures of individuals' physical capacity. Lundborg et al. (2009) also used information on objectively measured muscle strength.

2. Data

This study is based on the Health 2000 population survey data set.[2] (Aromaa and Koskinen, 2004, provide a description of the data set.) This data set has been constructed in order to give a comprehensive picture of the health and functional ability of the working-age and old-age Finnish population. The basic data set comes from a random sample of 10,000 individuals from the entire country, and the information was collected between September 2000 and June 2001 by means of personal interviews, telephone interviews, and professional health examinations. Supplementary information was obtained from various government registers.

88% of the sample persons were interviewed, 80% attended a comprehensive health examination and 5% attended a condensed examination at home. The most essential information on health and functional capacity was obtained from 93% of the subjects. The sample size that we use is ~2500. To obtain a relatively homogeneous sample, we have limited the focus to wage and salary earners aged between 30 and 64 who have weekly working hours of at least 29 hours.[3] Thus, we exclude those who are students, and retired,[4] unemployed and laid-off individuals, those who are doing work only at home, part-time workers and those who do not have positive earnings. Because we focus on full-time wage and salary earners, we also exclude self-employed persons from the sample. (The share of the self-employed in the labour force in Finland is ~7%.) Furthermore, it is useful to note that people aged 80 or over in the data were over-sampled with a double inclusion probability relative to the younger age groups.

Annual individual wage data originating from the Finnish tax authorities have been linked to the Health 2000 data set, using the personal identification number that every person residing in Finland has.[5] Many of the earlier studies on height premium have used survey-based information on earnings that is prone to non-response and reporting bias.[6] The stratified sampling framework is accounted for in our empirical analyses, as we use survey data methods and appropriate weights in estimations.

The data set contains self-reported information on the physical strenuousness of the respondents' work in which they are currently employed. Four alternative answers with examples of typical occupations in each of them were given to the respondents. The first alternative was chosen if the person had *sedentary work:* a job involving little walking during a typical working day. (Examples of occupations belonging to this particular category include watchmaking and office work.) Sedentary work is used as a reference group in the estimations. The second alternative involved jobs that entailed quite a lot of walking, but no lifting or carrying of heavy objects. (The examples include supervising and *light manufacturing work.*) The third alternative was for jobs involving a lot of walking and lifting. (The examples include carpentry and *heavy manufacturing work.*) The fourth alternative included *physically very demanding work* involving lifting and carrying heavy objects. (The examples include logging and heavy farm work.)

The most important limitation of our study is that information on physical workloads is self-reported. In particular, it is possible that systematic measurement error emerges, because what is reported as a strenuous job may depend on the person's height, if height is related to physical capacity. Taller persons would then, due to their greater physical capacity, report a lower amount of physical strenuousness in a given job than shorter persons. That being said, it is important to note that the question that we use is not in the general form "Is your current job physically strenuous?" with answers, for example, from 1 to 4. On the other hand, the question involves detailed examples of occupations that come under each of those four categories. These examples of occupations were mentioned to the respondents at the time of the interview. For example, sedentary work was described to the respondents as work that includes occupations such as watchmaking and office work. This should reduce the bias in our self-reported measure of the physical strenuousness of work.

The very same question on physical strenuousness of work is also incorporated in the National FINRISK Study, which is Finnish individual micro data at five-year intervals over the period 1972-2002 (e.g. Böckerman et al., 2008). The change in the shares of individuals that come under the different categories has been dramatic over the period 1972-2002, especially for men. The share of sedentary work has increased for men from 26% in 1972 to 43% in 2002 (Fig. 1). In contrast, the share of physically very demanding work has declined from 32% to 11% over the same period.[7] The changes in the shares of jobs that belong to different categories are reasonable and they largely replicate the changes in occupational structure that involves a substantial increase in the share of office work in Finland, as documented by Statistics Finland. Hence, the objective changes in the shares of occupations have been reflected in the self-reported measure. In particular, it would be very difficult to explain the trends in the self-reported measure over time if the respondents did not anchor their answers to the examples of occupations that were mentioned to them at the time of the interview. Thus, in some sense the question that we use is similar to anchoring vignettes, which can be used to evaluate answers to subjective questions when the response scales differ, for instance, between countries or over time (King et al., 2004). In other words, it is possible that individuals' views of what constitutes a physically strenuous job has changed over time, but it is less likely that individual opinions whether, for instance, office work constitutes sedentary work has changed over time. These points support the validity of our self-reported measure of the physical strenuousness of work. It is also useful to note that sedentary work is identified by using self-reported information in other studies (e.g. Mummery et al., 2005; Bernaards et al., 2006).

Fig. 1 here

The Health 2000 data set also contains information on individual body composition measurements from professional health examinations that have been conducted at local health centres. The measures of body composition are obtained from an eight-polar bioelectrical impedance analysis, which is performed by running a small constant current through the body (Scharfetter et al., 2001). Resistance, or impedance, is higher in fat than in other types of tissue, which makes it possible to calculate the proportion of fat mass and muscle mass in the body. Measures of body composition have rarely been used in the literature that has analysed the effects of non-economic attributes on labour market outcomes (e.g. Burkhauser and Cawley, 2008; Burkhauser et al., 2009; Wada and Tekin, 2007).[8] We use muscle mass as a direct measure of physical capacity. In the data muscle mass is measured at the same time as wages.

3. Empirical strategy and results

To explore the occupational sorting in terms of height, we begin by running OLS regressions of the following form:

$$(1) \quad Height_i = \beta_0 + \beta_1 D(Strenuousness_i) + \beta_2 \boldsymbol{X}_i + \varepsilon_i$$

In equation (1) the variables of our interest are the three indicators for the physical strenuousness of work. *D*(.) denotes indicator variables. ***X*** is a vector of individual-level control variables including age and education.

To examine the potential contribution of physical capacity and physical strenuousness of work to the height premium we estimate models of the form:

$$(2) \quad \log wage_i = \beta_0 + \beta_1 Height_i + \beta_2 D(Strenuousness_i)$$

$$+ \beta_3 Height_i \times D(Strenuousness_i) + \beta_4 \boldsymbol{X}_i + \varepsilon_i$$

In equation (2) the variables of our main interest are the interactions between height and the three indicators of the physical strenuousness of work instead of the direct effects of height and the indicators of the physical strenuousness of work on wages. In an alternative specification of the model, we use the measure of muscle mass, based on bioelectrical impedance analysis, instead of the different levels of the physical strenuousness of work.

The models are reported both without and with educational levels, because education is not always determined before the labour market entry (Lundborg et al., 2009; Neal and Johnson, 1996).[9] We report all estimates separately for men and women, because of the social norm and occupational structure differences between men and women. Our expectation is that physical capacity should be a more important determinant of men's wages. However, it is also interesting to study the effects on women's wages, because Lundborg et al. (2009) do not consider women's wages, owing to the fact that they use data from the military enlistment register.

Table 1 documents descriptive statistics. The occupational structure differences are striking between women and men. The share of wage and salary earners in physically very demanding work is 3% and 12% for women and men, respectively. Regarding the control variables we observe that women are, on average, better educated than men, with 19% of women and 16% of men having an academic degree. Table 2 reveals that there is a negative association between the physical strenuousness of work and wages. Thus, wages are substantially higher at sedentary work compared with physically very demanding work.[10]

Tables 1-2 here

Table 3 shows the correlations between the key variables of interest. There is a statistically significant positive correlation between wages and height that is consistent with the existence of a height premium. In contrast, there is no statistically significant correlation between wages and muscle mass, by a wide margin. However, there is a significant positive correlation between height and muscle mass. These patterns are similar for women (Panel A) and men (Panel B).

Table 3 here

Table 4 reveals an interesting pattern according to which the shortest Finnish workers perceive to do physically very demanding work and the tallest perceive to do sedentary work. In particular, the regression results in Column 4 of Table 4 show that those men doing physically very strenuous work are, on average, roughly 2 cm shorter than those doing sedentary work, even after controlling for the effects of age and education. It is important to note that this pattern is not inconsistent with the findings by Lundborg et al. (2009), because they find some evidence that taller men do sort themselves into higher paying occupations. For women the picture is different (Table 4, Columns 1 and 3), i.e. the physical strenuousness of work is not related to height, after taking into account the effects of the control variables.

Table 4 here

The existence of the height premium is documented in Table 5. The coefficients imply that 10 cm extra height for a man is associated with a higher hourly wage of 7-9%, depending on the set of controls (Table 5, Columns 2 and 4).[11] However, for women the corresponding point estimate is somewhat lower at 5% (Table 5, Column 1). For women the height premium is also not statistically significant, after controlling for both age and education (Table 5, Column 3).[12] Table 5 also uses self-reported information on the physical strenuousness of work as a determinant of wages. The results reveal that the only statistically significant coefficients prevail for men in light manufacturing work. For women not even this effect prevails. All in all, there is no systematic evidence that the height premium is larger for those doing physically more strenuous work. It is important to note that the findings of Lundborg et al. (2009) do not necessarily predict that the height premium is largest in work that is physically strenuous. Instead, physical capacity may constitute a signal for good health. This implies that it should be rewarded to a greater extent in higher paid white-collar occupations. Our results point out that the height premium does not vary according to the physical strenuousness of work. To check the robustness, we have estimated the models in Table 5 by adding weight to the set of controls. The results remain the same. In addition, we have aggregated the four categories of the physical strenuousness of work to three alternatives by merging light and heavy manufacturing work. We have also used only one single indicator that captures sedentary work. Furthermore, we have estimated separate regressions for each level of the physical strenuousness of work. The conclusions do not change.

Table 5 here

Table 6 takes advantage of muscle mass as a direct measure of physical capacity. The results show that muscle mass is not related to wages. (Weight is not included among the explanatory variables, because there is a strong positive correlation between weight and muscle mass, as documented in Table 3.) The pattern is similar for both women and men. Lundborg et al. (2009) argue that maximum oxygen uptake is a better measure for physical capacity than muscle strength. They find statistically weaker results for objectively measured muscle strength than for maximum oxygen uptake. Our results for muscle mass do not even approach statistical significance at any conventional levels.[13]

Table 6 here

4. Conclusions

Height premium is widely reported. This paper contributes to the literature by studying the role of physical capacity and the physical strenuousness of work as a determinant of the height premium. Lundborg et al. (2009) argue that the positive effect of height on earnings can largely be explained by the fact that there is a positive association between height and physical capacity. We evaluate the role of physical capacity in the determination of the height premium by using the "Health 2000 in Finland" data that contain both self-reported information on the physical strenuousness of work, and information on muscle mass from medical examinations.

Our results show that the height premium does not vary according to the physical strenuousness of work. We also find that muscle mass is not related to wages. Furthermore, we observe that the shortest men do physically very demanding work and the tallest do sedentary work, even after controlling for the effects of age and education. Our data have some shortcomings. First, we used self-reported information on the physical strenuousness of work that may be prone to measurement error. Second, we used cross-sectional data. Thus, we were unable to estimate fixed effects models that would account for unobservable heterogeneity at the individual level. Third, we did not estimate causal effects and address the possibility that the physical strenuousness of work may be endogenous. Fourth, our analyses lack some useful control variables such as parental education and parental height.

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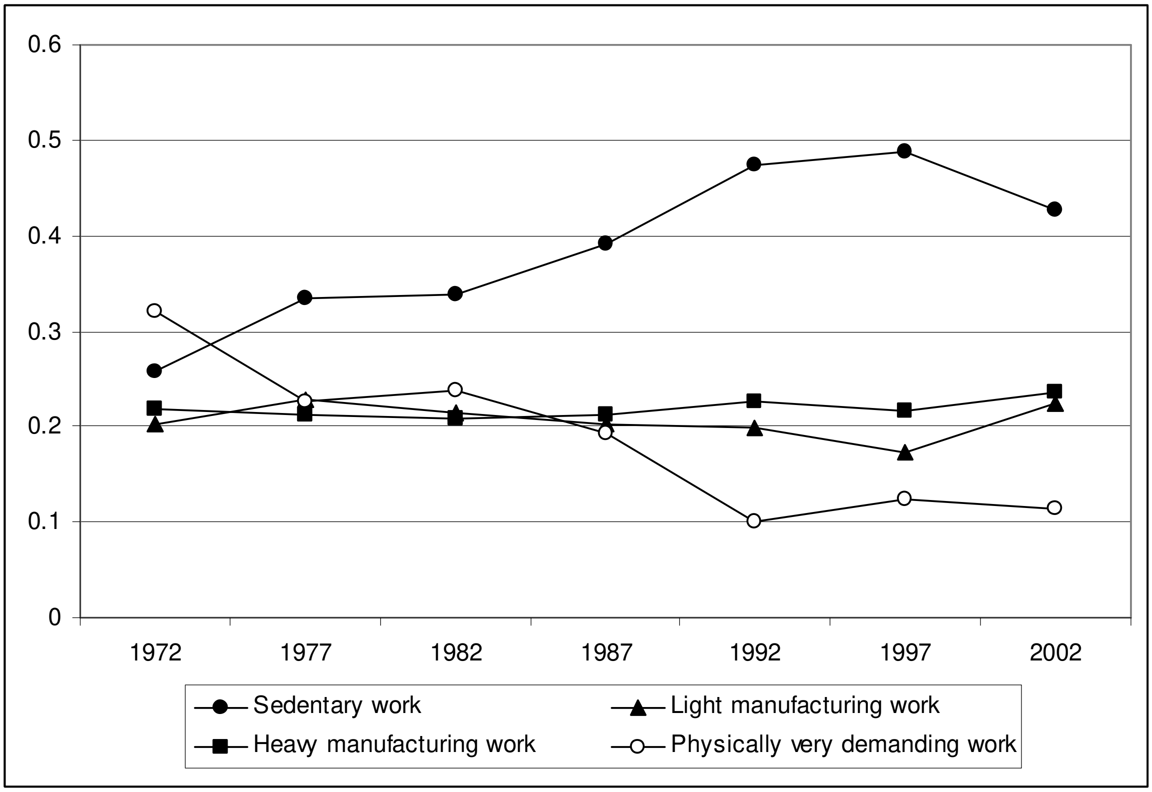
Fig. 1. Self-reported information on the physical strenuousness of work for men, proportions, over the period 1972-2002.



Note: The figure is drawn for men who are wage and salary earners and aged 30-64 covering the data from two provinces in Eastern Finland.

Source: the National FINRISK Study.

Table 1

Descriptive statistics.

	Women		Men	
	Mean	St. Dev.	Mean	St. Dev.
Hourly wages (€)	7.70	2.96	9.38	7.37
Logarithm of hourly wages	1.99	0.31	2.14	0.42
Height (cm)	164.37	6.22	177.89	6.61
Weight (kg)	69.60	13.26	84.48	13.89
Muscle mass (kg)	45.15	5.43	63.09	8.00
Sedentary work	0.43	0.49	0.41	0.49
Light manufacturing work	0.29	0.45	0.24	0.43
Heavy manufacturing work	0.24	0.43	0.22	0.42
Physically very demanding work	0.03	0.17	0.12	0.33
Age (years)	44.04	8.08	43.44	8.14
High education	0.19	0.39	0.16	0.36
Middle education	0.57	0.50	0.45	0.50
Low education	0.24	0.43	0.39	0.49
N	1259		1247	

Note: The hourly wages are calculated as an individual's annual wage divided first by 52, and then by the individual's self-reported number of weekly working hours. The classification for the physical strenuousness of work is explained in the text. These are reported as proportions. High education refers to tertiary education, according to the ISCED 1997 classification. Middle education refers to at least upper secondary education, but not tertiary education. Low education refers to less schooling than upper secondary education. Educational levels are also reported as proportions.

Table 2

The mean level of hourly wages (€) at the different levels of the physical strenuousness of work.

	Women	Men
Sedentary work	8.35	11.16
Light manufacturing work	7.80	9.31
Heavy manufacturing work	6.94	7.69
Physically very demanding work	6.71	7.01
N	1259	1247

Table 3

Correlations.

	Logarithm of hourly wages	Height	Weight	Muscle mass
Panel A: Women				
Logarithm of hourly wages	1			
Height	0.0947*	1		
Weight	0.0119	0.2581*	1	
Muscle mass	0.0482	0.6268*	0.8312*	1
Panel B: Men				
Logarithm of hourly wages	1			
Height	0.118*	1		
Weight	0.0790	0.4407*	1	
Muscle mass	0.0762	0.7037*	0.8701*	1

Note: * indicates significance at the 1% level.

Table 4

The relationship between height and the physical strenuousness of work. Estimation method: OLS, dependent variable is height.

	(1)	(2)	(3)	(4)
Sample	Women	Men	Women	Men
Constant	180.9***	165.8***	178.8***	165.2***
	(5.238)	(5.193)	(5.283)	(5.217)
Light manufacturing work	-0.188	-1.318***	-0.0913	-1.115**
	(0.417)	(0.448)	(0.416)	(0.456)
Heavy manufacturing work	-0.634	-2.003***	-0.209	-1.658***
	(0.414)	(0.487)	(0.435)	(0.523)
Physically very demanding work	-1.170	-2.440***	-0.719	-2.086***
	(0.973)	(0.615)	(0.984)	(0.648)
Controls				
Age	-0.581**	0.771***	-0.530**	0.777***
	(0.238)	(0.241)	(0.238)	(0.241)
Age	0.00471*	-0.0104***	0.00419	-0.0104***
	(0.00264)	(0.00274)	(0.00264)	(0.00274)
High education	..	..	1.871***	1.084*
			(0.554)	(0.576)
Middle education	..	..	0.659	0.189
			(0.422)	(0.416)
R^2	0.051	0.059	0.060	0.061
N	1259	1247	1259	1247

Note: The reference category is sedentary work.
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 5

The relationship between height, the physical strenuousness of work and wages. Estimation method: OLS, dependent variable is logarithm of hourly wages.

	(1)	(2)	(3)	(4)
Sample	Women	Men	Women	Men
Constant	0.769*	0.650	0.777*	0.787
	(0.432)	(0.513)	(0.402)	(0.489)
Height	0.00461**	0.00878***	0.00260	0.00707***
	(0.00200)	(0.00247)	(0.00179)	(0.00232)
Light manufacturing work	-0.489	1.343*	-0.518	1.159
	(0.526)	(0.744)	(0.476)	(0.726)
Heavy manufacturing work	-0.0790	0.208	-0.149	-0.000926
	(0.443)	(0.739)	(0.413)	(0.732)
Physically very demanding work	-1.260	0.529	-1.516	0.183
	(1.020)	(0.975)	(1.041)	(0.964)
Height × Light manufacturing work	0.00242	-0.00850**	0.00269	-0.00719*
	(0.00321)	(0.00421)	(0.00289)	(0.00412)
Height × Heavy manufacturing work	-0.000600	-0.00291	0.000273	-0.00127
	(0.00270)	(0.00413)	(0.00251)	(0.00409)
Height × Physically very demanding work	0.00645	-0.00529	0.00850	-0.00286
	(0.00628)	(0.00548)	(0.00641)	(0.00542)
Controls				
Age	Yes	Yes	Yes	Yes
Education	No	No	Yes	Yes
R^2	0.093	0.166	0.219	0.209

N	1259	1247	1259	1247

Note: The reference category is sedentary work.
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 6

The relationship between height, muscle mass and wages. Estimation method: OLS, dependent variable is logarithm of hourly wages.

	(1)	(2)	(3)	(4)
Sample	Women	Men	Women	Men
Constant	0.449	1.161	0.502	2.037
	(1.388)	(1.914)	(1.203)	(1.822)
Height	0.00689	0.00405	0.00397	-0.00214
	(0.00844)	(0.0106)	(0.00726)	(0.0101)
Muscle mass	-0.00553	-0.0207	-0.00125	-0.0234
	(0.0305)	(0.0297)	(0.0265)	(0.0285)
Height × Muscle mass	1.65e-05	0.000105	4.71e-06	0.000134
	(0.000186)	(0.000164)	(0.000161)	(0.000157)
Controls				
Age	Yes	Yes	Yes	Yes
Education	No	No	Yes	Yes
R^2	0.033	0.035	0.196	0.145
N	1259	1247	1259	1247

Note: Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

[1] Cohen (2009) has popularized this research. Deaton and Arora (2009) show that taller persons are also happier.

[2] The data set is available from the National Public Health Institute in Finland (see http://www.terveys2000.fi/indexe.html).

[3] The effective sample size before the restrictions is 7998. 3515 of these persons are wage and salary earners aged between 30 and 64.

[4] The official retirement age in Finland is 64. However, the actual retirement age is approximately 60 years.

[5] The data set originates from the Finnish tax administration (see http://www.vero.fi/).

[6] Lundborg et al. (2009) use register data on wages.

[7] The increase in the share of manufacturing work over the period 1997-2002 can be explained by the fact that the recovery from the great depression of the early 1990s in Finland was largely based on the expansion of manufacturing exports.

[8] Wada and Tekin (2007) estimate models for wages that include fat-free mass as an explanatory variable. They observe that fat-free mass is associated with an increase in the wages of white men and white women.

[9] It is important to note that we use data for individuals aged 30-64. The level of education is determined for most of the individuals in Finland before the age of 30.

[10] This indicates that there are no compensating wage differentials for physically very demanding work.

[11] Johansson et al. (2009) have earlier reported the existence of height premium by using the Health 2000 data set.

[12] We have estimated the models also by using quantile regression methods. Estimating several quantiles makes it possible to explore the shape of the conditional distribution, not just its mean. We have estimated the models for the 10th, 25th, 50th and 75th quantiles. The point estimates suggest that the effect of height on wages for both women and men is larger in the highest wage quantiles than at the lower tail of the distribution. However, owing to the relatively small sample size the differences are generally not statistically significant. Lundborg et al. (2009) observe that the return to an additional centimetre in height is larger further away from the median earnings.

[13] To explore the nonlinear effects, we divided muscle mass into four discrete categories that each have equal number of observations. Muscle mass does not have positive influence on wages by using discrete categories.