Does height bias exist in the labour market to cause wage inequality?

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1 Introduction

The knowledge of unconscious attitudes in making immediate responses is important for an understanding of the way people make certain choices. Simple decisions such as whether or not to trust a stranger can be tainted by bias that people are mostly not consciously aware of, resulting in relatively unobjective decision-making (Gladwell, 2006).

However, these unconscious attitudes are unavoidable and certainly play a significant role in daily life, for instance, when determining one's income. In particular, previous research has shown that the physical height of an individual does indeed impact the impression he or she gives. For example, taller individuals are perceived to be more socially desirable (Roberts & Herman, 1986), persuasive (Young & French, 1996), capable (Hensley, 1993) and in possession of other positive traits. In addition, research has also revealed that height and leadership are positively correlated (Lindqvist, 2012), suggesting that height is an important factor that leads to career success. In fact, Judge and Cable (2004) found that taller individuals earn significantly more than shorter individuals of the same age, sex and weight.

Despite prior evidence suggesting that taller people receive higher income, the possibility of an unaccounted-for variable explaining the relationship between height and income remains. Therefore, to eliminate the chances of finding a spurious relationship, the present study aims to investigate the effect of height on one's income, while controlling for six additional elements. Accordingly, our research question was formulated as: "To what extent does height affect one's hourly income, given that gender, highest education level, experience, intelligence, ethnicity and years of schooling of parents are controlled?". Additionally, we are also interested in a possible interaction effect of gender, whereby the effect of height on income is different for male and female.

To test our model, data from a sample of 3000 observations from the United States were examined and analyzed using the R programme. The data sets used were obtained from the National Longitudinal Survey of Youth 1979 (NLSY79).

This paper is divided into five sections. Following the introduction are the theoretical framework, methods, results and discussion sections consecutively. Finally, at the end of this report is the reference list.

2 Theoretical framework

The present study aims to test a model with height as the treatment variable and income as the dependent variable; while ethnicity, highest education level obtained, intelligence, experience and number of schooling years of parents are the control variables. Additionally, the possible interaction effect of gender would be examined.

One's adolescent years are arguably the most important period of physical, physiological and psychological development. Not only do the body and internal organs experience growth spurts during adolescence, but it is also the period where one's self-concept, self-esteem, personal beliefs and values mature ("Adolescence", 2020). According to Persico, Postlewaite and Silverman (2004), adolescence is also the time where one acquires useful skills that will aid career success. In fact, they concluded that taller, white male adults are more advantaged in terms of receiving income benefit because they were more likely to acquire "productive skills and attributes" through participation in extracurricular activities during their teenage years (2.7% increase in income for every centimetre of height when young). The development of human capital seems to be more prominent among

taller adolescents, perhaps because they are more confident about themselves due to their height; and therefore, able to enjoy extracurricular activities better without feeling insecure that their height would affect performance in sports activities, for example.

Likewise, Judge and Cable (2004) concluded that height, combined with positive social and self-esteem, boost objective performance (e.g. actual performance at work) and subjective performance (e.g. evaluation given by supervisor) at work ($\hat{\beta}$ = .26). The findings from both studies are consistent with the idea that taller individuals are blessed with an extra advantage in social situations, which encourages high self and social esteem, building confidence in participating in extracurricular activities such as sports. Furthermore, given that this social advantage is effective from adolescence throughout adulthood, it is implied that one's social image gathered from observations of physical appearances plays a significant role in determining the success of an individual, whether it is academically or career-wise.

In contrast, while some researchers focused on the benefits of being tall to explain the relationship between height and income, others focused on the discrimination experienced by short individuals. For example, it was suggested that having below-average height negatively affects one's interpersonal relationships, as they are received less positively by others in social situations or negotiations (Martel & Biller, 1987; Frieze et al., 1990). In fact, Loh (1993) provided evidence that individuals with below-average height earn 4 to 6% less than individuals with above-average height. Not surprisingly, these findings continue to show that the physical height of an individual contributes to the social impression one produces, which in turn, predicts income.

In terms of ethnicity, it has been documented that for both genders, White people have been and are still consistently taller than Black people over the past two decades (Komlos, 2009). Besides that, skin colour is an easily observable physical trait and could therefore be subjected to bias in social settings such as the workplace. Indeed, recent research has revealed that white individuals in wage employment earn significantly more than other ethnic groups, while this difference was not found among self-employed individuals (Ñopo et al., 2007). This suggests that racial discrimination or selection bias may explain the income gap between different ethnic groups.

On the other hand, the remaining control variables namely highest education level obtained, intelligence, experience and number of schooling years of parents, are not easily observable traits

of an individual. However, once made known (to the employer), it is highly possible that these characteristics will have important effects on one's income. To illustrate, Berndt (1991) viewed formal education and practical on-the-job training as "investments", as they are considered as a means to accumulate human capital, which would then lead to higher income. However, while education background and practical experience determine one's performance at work, it may also be possible for an individual to receive a higher income than less intelligent peers, after controlling for other factors (Taki et al., 2012). The effect of parents' education background on their children's income is however unclear, as it has not been well-documented in previous literature. Therefore, the present study will provide an indication of the strength of this effect to address the gap of knowledge.

Thus, the main hypothesis of this study is that physical height will affect income positively. Interestingly, previous research has not found height to be a significant predictor of income for working females (Judge & Cable, 2004; Persico et al., 2004; Kedir et al., 2013). Thus, we do not expect to find a possible interaction effect of gender in our model, whereby the effect of height is different for male and female. Nevertheless, gender will still be included in the model to check for the presence of an interaction effect.

3 Methods

3.1 Data

Data used in this study were collected from a sample of teenagers from the United States, aged 14 to 21, consisting of both genders and who participated in the National Longitudinal Survey of Youth 1979 (NLSY79). Extensive information of a person's demographic details was gathered and updated frequently for just over two decades; data were revised annually until 1994, when the revision was decreased to every two years, the last data being recorded in 2002. As it is longitudinal data, it gives a strong representation of the population and thus increasing the general validity.

3.2 Measures

The variables that are of interest to our research question are of course the treatment variable height, as well as other control variables that are related to work and personal information. Personal variables include sex, ethnicity, highest educational qualification, height measured in 1985, years of schooling of parents and a composite intelligent score of arithmetic reasoning, word knowledge and

paragraph comprehension. Lastly, work-related variables include our dependent variable earnings and out-of-school work experience in years both as of 2002.

Earnings. Earnings recorded were hourly earnings as of the last interview of the survey in 2002.

Height. Height reported in inches as reported in 1985.

Male. A dummy variable of the participant's sex, with 1 being male and 0 being female.

Ethnicity. Three dummy variables were included, namely black people (ETHBLACK = 1, otherwise = 0), Hispanics (ETHHISP = 1, otherwise = 0) and non-Blacks and non-Hispanics (ETHWHITE = 1, otherwise = 0).

Highest educational qualification. Seven dummy variables of a participant's highest obtained qualification. Variables of this include Professional degree (EDUCPROF = 1, otherwise = 0), Doctorate (EDUCPHD = 1, otherwise = 0), Master's degree (EDUCMAST = 1, otherwise = 0), Bachelor's degree (EDUCBA = 1, otherwise = 0), Associate's (two-year college) degree (EDUCAA = 1, otherwise = 0), High school diploma or equivalent (EDUCHSD = 1, otherwise = 0) and High school drop-out (EDUCDO = 1, otherwise = 0).

Intelligence. All the NLSY79 participants took part in a series of test called "The Armed Services Vocational Aptitude Battery", an entry exam given to provisionally admitted military personnel. ASVABC, the variable name that was used in the model, is a composite score constructed using the following formula: 0.5*(arithmetic reasoning) + 0.25*(word knowledge + paragraph comprehension).

Parents educational background. Years of schooling of the respondent's parents, this variable is not directly obtained from NLSY79, but it is the sum of the years of schooling of the respondent's mother and father. The variable name used in the model is SP.

Experience The total work experience in years reported as of the last interview (2002), excluding any work experience acquired during schooling years (i.e. work experience acquired after graduation).

Table 1 shows a descriptive statistic table consisting of the number of observations for both male and females of mean earnings, mean experience, mean years of schooling of parents, mean score of ASVABC, the percentage of respective education qualification as well as the percentage of respective ethnicity in three groups of height. The first group (Group 1) represents height within the range between minimum height and the first quartile (25%), the second group (Group 2) represents height within the interquartile range and the third group (Group 3) represents height between the

third quartile (75%) and maximum height.

3.3 Data Analysis

The empirical specification is:

$$ln(Earnings)_i = \alpha + \beta_1(Height)_i + \beta_2(Male)_i + \beta_3(Experience)_i + \beta_4(EDUCPROF)_i + \beta_5(EDUCMAST)_i + \beta_6(EDUCBA)_i + \beta_7(EDUCHSD)_i + \beta_8(EDUCDO)_i + \beta_9(ASVABC)_i + \beta_{10}(ETHWHITE)_i + \beta_{11}(ETHHISP)_i + \beta_{12}(SP)_i + \beta_{13}(Male * Height)_i + Error_i$$

A multiple variable ordinary least square regression analysis was carried out on the model above in R (R Core Team, 2019). A male*height variable was added into the model to check for any interaction effect of genders for the relationship between height and ln earnings, which is the natural logarithm of earnings. The reference group for gender, ethnicity and highest qualification obtained are female, black people and Associate degree respectively.

4 Results

In total, data obtained from 3000 individuals (1495 male, 1505 female) were analyzed. 359 men were included in Group 1, 550 men in Group 2 and 586 men in Group 3; similarly, 328 women were included in Group 1, 606 women in Group 2 and 571 women in Group 3.

On average, taller men acquired more experience and received higher earnings than shorter men (Table 1). Furthermore, the mean years of schooling of parents and ASVABC scores were also higher for men with average height and taller men. In terms of highest education qualification, shorter men had the highest percentages of Associate's degree graduates, Professional degree graduates, high school diploma or equivalent graduates and high school dropouts; whereas men with average height had the highest percentages of Master's degree graduates and Doctorate graduates. Taller men had the highest percentage of Bachelor's degree graduates. The majority of the men were White.

The patterns of earnings, experience, mean years of schooling of parents and ASVABC scores observed for men of the three different intervals are similar to those observed for women. Comparable

Table 1

Descriptive Statistics

	Group 1	Group 2	Group 3
		MALE	
Mean earnings	19.40	23.87	24.25
Mean experience	17.68	17.80	18.05
Mean years of schooling	21.57	24.45	24.62
Mean score of ASVABC	47.56	52.77	53.22
Education			
Percentage with EDUCAA	7.24	7.09	6.48
Percentage with EDUCBA	11.70	20.36	25.43
Percentage with EDUCPROF	1.67	1.09	1.54
Percentage with EDUCPHD	0.56	1.09	1.54
Percentage with EDUCMAST	3.06	7.09	6.48
Percentage with EDUCDO	19.50	8.36	6.83
Percentage with EDUCHSD	54.32	52.91	50.00
Ethnicity			
Percentage with ETHWHITE	70.75	86.00	91.13
Percentage with ETHBLACK	12.53	9.09	7.51
Percentage with ETHHISP	16.71	4.91	1.37
Total number of observations	359	550	586
		FEMALE	
Mean earnings	14.26	16.65	17.03
Mean experience	15.66	15.94	16.38
Mean years of schooling	21.62	23.28	23.51
Mean score of ASVABC	47.74	51.00	51.31
Education			
Percentage with EDUCAA	5.79	12.21	8.79
Percentage with EDUCBA	14.33	19.14	21.97
Percentage with EDUCPROF	0.61	0.33	0.18
Percentage with EDUCPHD	0.00	0.00	0.35
Percentage with EDUCMAST	4.27	7.92	7.38
Percentage with EDUCDO	12.80	7.59	7.38
Percentage with EDUCHSD	60.06	49.01	51.85
Ethnicity			
Percentage with ETHWHITE	71.34	85.48	86.64
Percentage with ETHBLACK	13.41	9.09	11.25
Percentage with ETHHISP	15.24	4.95	2.11
Total number of observations	328	606	571

Note. Mean values as well as proportions of different education levels and ethnicity are reported in the table for different intervals of height. Group 1 represents height within the range between minimum height and the first quartile, while group 2 represents height in the interquartile range and lastly group 3 represents height between the third quartile and maximum height.

Table 2

The Impact of Height on Hourly Earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: ln(Earnings)						
Coefficient on Height	0.027**	0.025**	0.009**	0.005	0.006	0.005	0.002
(Standard Error)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
R-Squared	0.083	0.102	0.336	0.355	0.356	0.361	0.361
Controls Included:							
Gender	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Experience	No	Yes	Yes	Yes	Yes	Yes	Yes
Education Level	No	No	Yes	Yes	Yes	Yes	Yes
ASVABC	No	No	No	Yes	Yes	Yes	Yes
Ethnicity	No	No	No	No	Yes	Yes	Yes
Schooling of Parents	No	No	No	No	No	Yes	Yes
Male X Height	No	No	No	No	No	No	Yes

Note. Regression coefficients are reported in the table, along with standard errors in parenthesis. The dependent variable in the top panel of the table is the natural log of the hourly earnings. Each coefficient reported in the table is from a separate regression. The other variables included in each model are noted in the table, but the coefficients on there other variables are reported in table 3.
$^{**}p < .05$

to shorter men, shorter women also had the highest percentages of Professional degree graduates, high school diploma or equivalent graduates and high school dropouts; whereas women with average height had the highest percentage of Master's degree graduates, just like men with average height. However, women with average height also had the highest percentage of Associate's degree graduates. Taller women, like taller men, had the highest percentage of Bachelor's degree graduates as well. Additionally, only taller women were Doctorate graduates, although the percentage of the taller women who obtained a Doctorate's degree was minimal. The majority of the women were White as well.

Table 2 and 3 present a series of results from the regression models. In the first model, height was the only treatment variable, with gender as the control variable and ln earnings as the dependent variable. The model showed that for every inch of height, earnings increased significantly by 2.7% (z = 7.07); men earned 20.5% more than women. For the second model, we added another control variable: Experience. This resulted in a drop of the estimated coefficient of height but it was still a significant predictor of income (z = 6.77).

Table 3

Sample of Coefficient Estimates on Control Variables

	ln(Earnings)			
Dependent Variable:	Coeff.	s.e.	Coeff	s.e.
Explanatory Variable:				
Male	0.205**	0.026	-0.192	0.427
Experience	0.028**	0.002	0.028**	0.002
Education Level (EDUCAA omitted):				
EDUCPROF	0.947**	0.100	0.947**	0.100
EDUCPHD	0.314**	0.144	0.320**	0.144
EDUCMAST	0.426**	0.046	0.426**	0.046
EDUCBA	0.262**	0.034	0.261**	0.034
EDUCHSD	-0.158**	0.030	-0.158**	0.030
EDUCDO	-0.268**	0.043	-0.267**	0.043
ASVABC	0.009**	0.001	0.009**	0.001
Ethnicity (ETHBLACK omitted):				
ETHWHITE	0.018	0.032	0.018	0.032
ETHHISP	0.131**	0.047	0.131**	0.047
SP	0.010**	0.002	0.010**	0.002
Height x Male Interaction			0.006	0.006

Note. This table reports a subset of the coefficients on the control variables in the model shown in column 6 and column 7 of table 2. See the notes of table 2 for further details.

For the third model, the highest education qualification obtained was added. The estimated coefficient of height decreased but it was still a significant predictor of earnings (z = 2.82). For the fourth model, the composite score of ASVABC that measures intelligence was added. The model showed that for every inch of height, earnings increased by 0.5%; although height was no longer a significant predictor of earnings (z = 1.68). Interestingly, the model showed that intelligence was a significant predictor of income instead (z = 9.41). Compared to the first model with only one controlling variable, as more controlling variables were added to the model, every inch of height contributed to a smaller percentage of increase in earnings.

For the fifth model, ethnicity was added into the model. The model revealed that similar to the results from the fourth model, height was not a significant predictor of earnings (z = 1.96). Next, years of schooling of parents was added into the sixth model, revealing that height was not a significant predictor of income as well (z = 1.67). However, the model showed that the education background of parents was a significant predictor of income (z = 5.11). In the seventh model, we added the variable Male*Height to study the interaction effect of gender. The model revealed that the interaction effect of gender was not significant (z = 0.93).

5 Discussion

The main goal of this study was to investigate the effect of height on one's earnings. After running our analyses, two important findings were obtained. First, the height bias on earnings is statistically insignificant. Second, there is no interaction effect of gender on the relationship between height and earnings.

5.1 Comparing to previous literature

Contrary to our expectation, we did not find support for the hypothesis of height positively affecting one's income; thus the findings of this research did not concur with existing literature (Judge & Cable, 2004; Persico et al., 2004; Loh, 1993). A possible reason for this is because different variables were included in the regression. Specifically, Loh (1993) did not include a variable representing intelligence, a crucial factor affecting earnings, as demonstrated in this study.

Nevertheless, the findings of this study found some support for the theory of taller people being more productive at work (Judge & Cable, 2004; Persico et al., 2004). It was found through regression analysis that intelligence significantly predicts income, supporting Judge and Cable's (2004) theory that objective performance at work (as an implication of utilizing intelligence effectively) contributes to higher income. Additionally, the theory of taller people being more likely to "acquire productive skills and attributes" (Persico et al., 2004), resulting in higher intelligence, is supported as well. The results of this study also provided support for Berndt's (1991) theory that human capital obtained through education and working experience contributes to higher income.

5.2 Implications for practice

The results of this study revealed a possible indirect relationship between height and earnings through intelligence. Thus, more extensive research should be carried out to confirm if the intelligence-income relationship is significant.

Additionally, education institutions or corporate companies can make use of the findings of this study to encourage students or employees to be confident and proactive despite their height. Most importantly, readers should acknowledge the power of acquiring high education qualifications and

work-related experience, as these "investments" (Berndt, 1991) are very likely to produce a return in the form of higher income.

5.3 Limitations of research and suggestions for further research

Although data used in this study were obtained from a survey and not an experiment, the internal validity of this study is substantial as multiple control variables were used in the regression models to reduce the possibility of finding spurious relationships. However, some issues are raised with regards to the construct validity of this study. For example, the ASVABC score provided by the dataset (NLSY1979) consisting of "arithmetic reasoning, word knowledge, and paragraph comprehension" may not be a good measure representing overall intelligence. A solution to this problem would be to use a measure of intelligence that is more exhaustive in terms of measuring different forms of intelligence. Furthermore, although highest education qualification was chosen over total years of schooling to represent one's education background, the quality of tertiary education may vary across different institutions in the United States, such that the same level of education qualification cannot represent the same productivity or intelligence.

The external validity of the study is considerably high as a large sample that was randomly selected was used. Therefore, the findings of this study are generalizable to the population of Americans living in the United States. Of course, the findings of this study may not apply to other countries, such as countries with minimal wage gap between individuals of different demographics.

Thus, a suggestion for further research is to collect data from a culturally different country, perhaps a non-western country, to investigate how the height-income relationship is different from that found in the United States. Besides cultural differences, personality and individual difference could also be taken into account when studying the relationship between height and income. Last but not least, it would also be interesting to conduct a longitudinal study to provide insight into the height-income relationship over a longer span of time.

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