The Effect of Adolescent Experience on Labor Market Outcomes: The Case of Height*

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Abstract

Taller workers receive a wage premium, and the disparity in wages is similar in magnitude to the race and gender gaps. We exploit the variation in an individual's height over time to explore the way in which height affects wages. Specifically, we show that for white males, the effect of adult height is essentially eliminated when adolescent height is taken into account. We take this as evidence that adolescent height has important economic implications long after the time that it is observable to others, and we explore the channels through which the effects might be manifested.

1 Introduction

Labor market outcomes are likely to differ depending on a person's outward characteristics. These differences have motivated a large body of research focussed on the disparities across racial and gender groups. Beyond establishing the magnitude of the disparities, a goal of this research is to identify the channels through which these gaps develop. In this paper we take up the same research agenda with respect to height. We start by estimating the magnitude of the height premium, and find it comparable to

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those associated with race and gender.[1] We then take advantage of a special feature of height relative to race and gender: height varies over time, so that a relatively tall 16-year old may turn out to be a relatively short adult, and vice versa. This time-variation allows us to investigate the stage of development at which having the characteristic (in our case, being short) most strongly determines the wage disparity. We find that being relatively short through the teen years (as opposed to adulthood or early childhood) essentially determines the returns to height. We suggest that social effects might be an important channel for the emergence of the height premium.

Height is widely believed to be an important ingredient of professional and personal success. Popular books discuss the advantages of being tall.[2] In the past 13 US presidential elections, the taller candidate has won 10 times (the most recent exception being George W. Bush) and, as shown in Figure 1, presidents tend to be distinctly taller than the average population.[3]

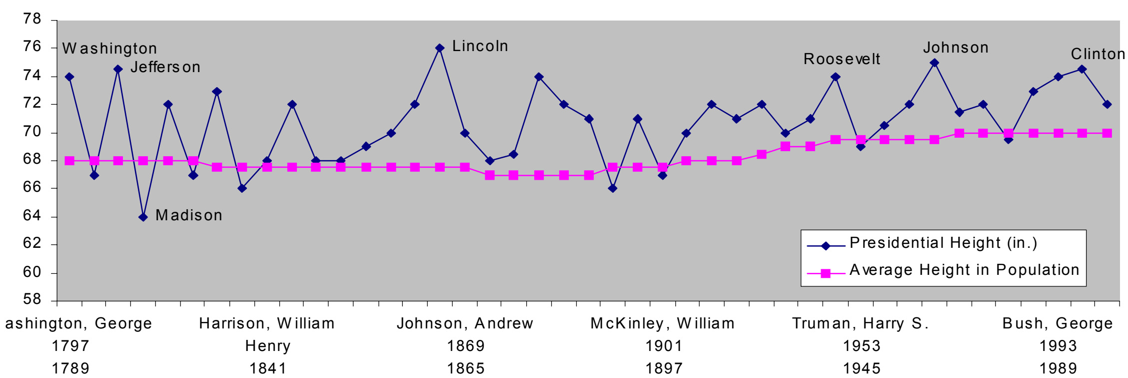

Figure 1: Height of US Presidents

There is an academic literature that investigates the possibility that labor markets

[1]While for methodological purposes we will compare our analysis with the literature on racial and gender discrimination, we do not imply that height discrimination, if the term were well-defined, is morally equivalent to racial or gender bias.

[2]See, for example, *The Height of Your Life* by Ralph Keyes: Little, Brown and Co. 1980.

[3]The height of Presidents is taken from http://www.uvm.edu/~tshepard/tall.html. The average height in the population is taken from Steckel (1995) and is the adult height of white males *born* in the US around the year in which the president was in office. Because average height is trending up, in any given year this measure most likely overestimates the average height of *adults* in the US population. The period 1850-1900 over which the height trend flattens is a possible exception.

reward height separate from ability.[4] Following a standard approach that accounts for differences in productive characteristics and interprets the residual wage differential as a height premium, prior research has estimated that an additional inch of height is associated with a 0.025-5.5 percent increase in predicted wages. Taking into account the potential biases allowed by most of the previous literature,[5] and using data from Britain's National Child Development Survey (NCDS) we find that among white British men, every additional inch of height is associated with a 1.7 percent increase in wages. In a complementary analysis, drawing on data from the National Longitudinal Survey of Youth (NLSY) we find that among adult white males in the US, every additional inch of height is associated with a 1.8 percent increase in wages. As the interquartile range of adult heights spans 4 to 5 inches in our data (in Britain and the US, respectively), the shorter quarter of the population earns on average around 10 percent less than the tallest quarter. The impact of this height wage disparity is comparable to those associated with characteristics such as race or gender.[6]

Beyond estimating the magnitude of the height premium, our primary focus is to investigate its roots. Several plausible theories have been proposed for why markets might treat shorter people differently. A leading theory in social psychology describes the **interpersonal dominance** derived from height. According to this theory, short people are stigmatized by others, perceived less positively, and thus placed at a disadvantage in negotiating interpersonal dealings.[7] **Evolutionary selection** may also explain disadvantages of being shorter than competitors. As the human species evolved, to the extent that size provided a direct advantage in the competition for resources, a preference for associating with tall people might have been naturally selected. In addition, greater height may have signaled good health throughout the development process, and therefore a genetic makeup robust to illness and deprivation. To the degree that this signal translated into a preference for taller mates, this may provide an

[4]This research is found mainly in the sociology and psychology literatures. For a review of the evidence from sociology and psychology see Martel and Biller (1987). A more recent example from this literature is Frieze *et al.* (1992). Importantly, this evidence is not only drawn from less developed economies where physical size may be an important determinant of productivity (see Steckel (1995) for a review of the connection between height and standard of living). In economics and related literatures see, e.g., Behrman and Rosenzweig (2001), Loh (1993), and Sargent and Blanchflower (1994).

[5]Berhman and Rosenzweig (2001) is an important exception.

[6]Correcting for differences in family background and region of residence, we estimate the black-white wage gap to be approximately 15% among full time male workers in the NLSY. Similar analysis indicates that the male-female wage gap is approximately 20% among white full-time workers in both the NCDS and NLSY.

[7]See, Martel and Biller (1987) and Frieze, et al. (1990), (1978).

explanation for why, other things equal, shorter people may be viewed as less valuable. These theories are designed to explain a 'taste' for height among employers. A final theory emphasizes **self-image** by placing the roots of the height premium in a superior conception of self that is achieved through a comparison with a culturally- and socially-determined notion of ideal height. A greater self-image leads to higher achievement through a variety of channels, including perseverance and interpersonal skills.

The theories presented above may account for the adverse consequences of a *current* lack of height. Of course, the fact that we observe a height wage premium does not imply that shorter workers are penalized for their current stature. There may be another characteristic, correlated with current height and valuable to employers that is in fact acquired at some pre-market stage. We can think of this characteristic as a form of human capital, a set of skills both cognitive and non-cognitive, that is accumulated at earlier stages of development. If this characteristic were unobservable to the researcher, the lower wages of shorter people would be incorrectly ascribed to their lack of height, instead of to their lack of human capital. For example, short children, if stigmatized because of their stature, might find it more difficult to develop interpersonal skills, positive self-conception, or might simply be excluded from participation in groups that foster the development of cognitive and non-cognitive skills. The mechanisms that generate the disadvantage of short people in acquiring human capital could include any of the channels presented above (interpersonal dominance, self-image, etc.) which may have an impact at any **early stage of development**. An alternative theory, **statistical discrimination**, might predict that children who forecast being short adults invest less in human capital because the returns to human capital are smaller for short adults; a rational individual will invest less in assets that provide lower personal return.

Finally, we might entertain a theory that pushes back the source of the height premium to birth: taller people might be endowed to a greater degree with some favorable characteristics. These characteristics could be **family resources** which raise a person's productivity, or other characteristics such as intellectual stamina or work energy, that are **directly productive characteristics** independent of external factors.

Distinguishing among these theories is important for understanding the channel through which outward characteristics affect market outcomes. The magnitude of the height premium alone makes it important to investigate these theories. In addition, understanding the ways in which height affects income may shed light on other labor market disparities such as the race and gender gaps. In the case of the height premium it is possible to make progress on tests of the relative importance of these theories. Alone among common bases of labor market disparities, height is impermanent. Relative stature, as defined below, often and randomly changes as an individual grows to his or her full adult height. Participants in the NCDS were measured by physicians at ages 7, 11 and 16, and self-reported height at age 23. Respondents to the NLSY provided self-reported measures of height in 1981, 1982 and 1985. Of particular interest for the present study is that in each of these samples, among those who were relatively short when young, many grew to become average height or even tall adults. These changes in relative stature provide an opportunity to understand better the sources of the height premium.

We show that the preponderance of the disadvantage experienced by shorter adults on the labor market can be explained by the fact that, on average, these adults were also shorter at age 16. More specifically, we show that two adults of the same age and height who were different heights at age 16 are treated differently on the labor market: the person who was taller as a teen earns more. This finding suggests that a large fraction of the disparity is not due to a taste for tall adult workers, or to any employer's preference for height when young (which the employer presumably cannot observe); rather, the disparity must reflect a characteristic correlated with height when young. This observation leads our investigation away from a theory of the labor market's taste for height, and toward an analysis of the nature of the unobservable characteristic.

Using the fact that NCDS measures height at ages 7 and 11 in addition to 16 and 23 we are able to parse the contribution to the height premium of being tall at different ages. When we regress wages on height measured at ages 7, 11, 16, and 23 we find that only age-16 height has a significant coefficient. Among the different heights, that is, height at age 16 uniquely influences future wages. The negligible role played by height prior to age 16 (together with other supporting evidence) suggests that the height premium is not simply a premium to early development, and, in fact, our findings place a lower bound on the time at which height appears to play its role.

The wealth of data provided by the NLSY allows an analysis of the channels through which teen height influences later wages. In the US data, those who were relatively short when young were less likely to participate in social activities associated with the accumulation of productive skills and attributes,[8] and report lower self-esteem. Much

[8] Examples of human capital that might be acquired through such activities include skills of interpersonal negotiation, social adaptablity, and motivation. Productive attributes that are often ascribed to participation in extra-curricular activities include self-esteem and self-discipline. See Heckman (2000) for a complete discussion of the importance of these 'non-cognitive' skills, and their development by

of the wage differential can be accounted for by measures of participation in school-sponsored non-academic activities (such as athletics and clubs), and by measures of self-image. We interpret these findings as suggestive of the effects of social and cultural (non-market) factors on the development of human capital and the distribution of economic outcomes. If, in fact, height is among the selection criteria for access to social activities, this aspect of the social arrangements of young people would appear to have important effects on economic outcomes in adulthood. Viewed in this light, our findings suggest that social and cultural stigma during adolescence, rather than contemporaneous market discrimination or the advantage of accelerated pre-teen development, may be at the root of the disparity in wages across heights.

Our finding that early factors are important determinants of between-group wage disparities parallels the evidence presented in Neal and Johnson (1996) regarding racial discrimination. Controlling only for 'premarket factors' proxied by a youth test score, Neal and Johnson find that the adult black-white wage gap is significantly reduced for men, and disappears (statistically) for women. Neal and Johnson go on to account for much of the disparity in the test scores with the differences in family and school resources between black and white children. In this dimension, the situation of men who were short when young diverges from Neal and Johnson's analysis of the black-white gap in an important way. Differences in family and school resources explain little of the disparity between tall and short adults. Indeed, conditional on adult height, these pre-market characteristics appear little correlated with height when young. Thus, from a policy perspective, our message with respect to short adolescents is quite different from that of Neal and Johnson. While they place the roots of the racial wage gap early in the development of a child (and possibly even before birth, through the contribution of family circumstances) and make it essentially a problem of resources, we emphasize the teen years and the role of social and cultural factors as critical for the emergence of the height premium.

1.1 Related literature

Our analysis relates most directly to previous studies of the effects of height on market outcomes. Frieze, et al. (1990) considers the relationship between height and salary for a sample of M.B.A.'s who graduated during the decade following 1972. Controlling for several demographic and anthropometric characteristics, as well as detailed measures of human capital, Frieze, et al. find that every additional inch of height is associated

social institutions.

with an increase in salary of \$570. The black-white salary gap in the same sample is estimated to be \$1,000. As business school graduates, the sample studied in Frieze, et al. (1990) represents an elite subset of the working population. These findings therefore suggest that the premium received by taller workers should not be attributed solely to their greater physical capacity. Above a low threshold, it is implausible that greater physical capability *per se* contributes to the marginal product of a professional business worker.

As with most studies of the effect of discrimination on labor market outcomes, Frieze, et al. (1990) make efforts to control for productive characteristics that may be correlated with the characteristic of interest – in this case height. As must always be the case, such efforts can only partially control for these productive characteristics. Using the variation in height *between* monozygotic female twins, Behrman and Rosenzweig (2001) are able to control thoroughly for both productive genetic and family background characteristics that may be correlated with height.[9] Based on these unique data, Behrman and Rosenzweig estimate that every additional inch of height is associated with a 3.5-5.5 percent increase in women's wages. While the twins data allow Behrman and Rosenzweig to control for genetic and family background characteristics, there is no information on the twins' paths to their adult height, and thus no opportunity to perform our investigation into the sources of height wage differentials.

Sargent and Blanchflower (1994) provide evidence that the US is not unique among industrialized economies in the premia it pays taller workers. Using Britain's NCDS, Sargent and Blanchflower estimate the effect on age-23 wages of height and body-mass index measured at age x, for the cohort born in 1958. A separate regression is run for $x = 11, 16$, and 23. Controlling for a number of other characteristics including the respondent's educational qualifications and industry, Sargent and Blanchflower estimate that every additional 10 centimeters in height at age 16 (23) is associated with 2.7 (3.3) percent increase in wages at age 23. As an estimate of the cumulative effect of height on wages, however, Sargent and Blanchflower's study is limited by the fact that their oldest worker is just 23 years old.

Using an early release of the NLSY data, Loh (1993) regresses wages on adult height. He estimates that workers who are shorter (below-average) as adults earn 4%-6% less than above-average workers. These estimates account for differences in adult human capital, occupation, local labor markets, and other demographic characteristics. As in Sargent and Blanchflower (1994), however, Loh's study is limited by the fact that his

[9] There is considerable variation in adult height within a pair of monozygotic twins. See, e.g., Behrman and Rosenzweig (2001).

oldest worker is only 24 years old.

Taken together, the evidence accumulated in this literature suggests an economically important, positive association between height and wages. Loh (1993) provides evidence that this relationship holds across broad sections of the US. population, while Sargent and Blanchflower (1994) demonstrates that the apparent advantage to taller workers is not unique to the US. Behrman and Rosenzweig (2001) shows that the relationship between height and wages cannot be ascribed to different family circumstances or even to differences in genetic endowments. Frieze, et al. (1990) suggest that the estimated height-wage differential is not merely capturing height's directly productive aspects.

2 Data

Our two main data sources are the NCDS, and the 1979 youth cohort of the NLSY. The findings from the NLSY closely parallel those in the NCDS. We draw attention to the aspects in which the results from the US and Britain are substantially different, and where some distinctive features of the each data set provide additional insight.

The NCDS began as a perinatal mortality study of *all* the children born in England, Scotland and Wales during the week beginning March 3, 1958. Seven years later, an attempt (sweep) was made to recontact all of the children who survived infancy. Similar sweeps were made again when the children were ages 11, 16, 23 and 33. At age 33, 11,407 (66%) of the original 17,414 children were recontacted and at least partially surveyed.[10] The NLSY began in 1979 with 12,686 men and women ages 14-21, and has interviewed this cohort every year until 1994, and every other year since then. Respondents to the NLSY were first asked to report their height in 1981, when they were ages 16-23, and most recently in 1985 when they were ages 22-29. We will refer to height measured in 1985 as adult height.

To avoid confounding the effects of race, gender and height discrimination we will carry out our analysis separately by race and gender. We focus our attention primarily on white males. In Britain this implies excluding the small number of native-born non-whites; we also exclude those participants in the NCDS who immigrated to Britain

[10] Selection analysis indicates that those from Scotland and the Northwest of England, and those with lower reading test scores at age 7 were less likely to respond to the fifth sweep. Elias and Blanchflower (1988) find similar results with respect to the fourth sweep. In the years following the first, perinatal sweep, the study grew to include all people born during relevant week who subsequently emigrated to Britain. We exclude these immigrants from our analysis.

after 1958. In the US we focus on the 2,063 white, non-Hispanic males for whom there exists both adequate height data, and other information.[11]

Table 1 presents summary statistics of the height measures from our primary data sets, along with statistics from an unrelated survey of measured height in the US. We note a few important features of the data. First, even when attention is restricted to white men, there is substantial cross-sectional variation in adult height. The data include respondents as short as 60 inches and as tall as 83 inches. The interquartile range spans 4 inches (NCDS) and 5 inches (NLSY). Second, while in the NLSY the cross-sectional variation in height is considerable, the variation in height over time is limited by the fact that respondents were 16 or older when first measured, with more than half being older than 18.[12] On average, the NLSY sample grew just 0.28 inches between 1981 and 1985, compared with almost 3 inches for the NCDS. Of the NLSY respondents, 618 (30%) reported growth of at least one inch over the period; among those who grew, the average change was 1.68 inches. Nevertheless, as our later analysis shows, this variation in height over time is adequate to provide reasonably precise estimates of the relationship between youth height and adult outcomes, conditional on adult height.

A potentially important limitation of the NLSY data is that height is self-reported to the nearest inch, which raises the issue of measurement error. To illustrate, we note that among our white male subsample, 315 (15.2%) respondents report a height in 1985 that is strictly less than what they reported in 1981, and 75 (3.6%) report a decline in height of more than one inch.[13] By itself, the presence of measurement error may strengthen our results, as the error would be expected to bias estimated coefficients towards zero.[14] Nevertheless, we would like a gauge for the accuracy of self reporting. By one measure the height data recorded in the NLSY appear reasonably accurate. The distribution of the NLSY's self-reported heights is quite similar to that of a national survey of carefully *measured* heights completed in 1980; with the distribution in the NLSY shifted slightly to the right, and having a fatter right tail.[15] A distinction of

[11] Our interest in adult wages also leads us to exclude the entire NLSY oversample of poor whites who were dropped from the survey after 1990.

[12] It is estimated that in the US adult height is reached at a median age of 21.2 years for males, with a median growth after age 16 of slightly less than 1 inch (Roche 1992, pp. 104-5).

[13] Not all those who report a decrease in height need be in error. Damon, Stoudt, and McFarland (1966) p. 50 reports that adults shrink by an average of 0.95 inches over the course of a day.

[14] Indeed when we omit the extreme tails of the 1981-1985 growth distribution, the magnitude of the estimated effect of height when young increases.

[15] The National Health and Nutrition Examination Survey conducted by the National Center for

the NCDS is that as part of the first three sweeps, members of the birth cohort were examined by a school physician. Thus for a large sample we have access to measured standing height at ages 7, 11 and 16.[16] As in the NLSY, the NCDS provides only self-reported height at age 23. The advantages of the earlier and more accurate height measures in the NCDS are clear. Among the 2,132 white men for whom there exists sufficient data, the average growth between ages 16 and 23 is 2.76 inches, and just 61 (2.9%) report negative growth over this period.[17]

3 Evidence of the Height Premium

Our first task is to examine whether in our data sets, consistent with the literature, there are sizable effects of height on wages. There are some important aspects in which our investigation differs from previous studies. Unlike much of the prior research, we estimate the regression equations separately by race and gender, and focus on the results for white, non-Hispanic males. As noted above, estimating the equations separately avoids confounding the effects of race, gender and height discrimination; moreover this approach allows all of the coefficients to differ by race and gender. In addition, unlike most prior studies, we are able to measure wages at a relatively advanced age (31–38) and thus capture the cumulative effects of differences in height. Finally, our approach to estimating the effect of height takes care to avoid controlling for variables such as education, work experience, and occupation that are endogenous, i.e. choice variables that may be influenced by height. This approach is consistent with the strategy taken by Neal and Johnson (1996) who, along with Heckman (1998), provide detailed arguments against accounting for differences in decision variables when estimating the effect of labor market discrimination.

To begin our assessment of the relationship between height and wages, Table 2 compares summary statistics of the white male subsample by above- and below-median

Health Statistics between 1976 and 1980 measured standing height against a calibrated bar and used a camera to standardize recording. In this survey, the average measured height for white males ages 18-24 was 69.8 inches, with a standard deviation of 2.8 inches. See National Center for Health Statistics (1987), Table 13. The comparable figures in our subsample of the NLSY are 70.41, and 2.85.

[16] At age 7 most of the examining physicians reported height to the nearest inch, while some were equipped with stadiometers and reported height to the nearest centimeter. At ages 11 and 16 measured height was recorded either to the nearest centimeter or to the nearest quarter inch.

[17] Just two respondents report shrinking by an inch or more during this period. The NCDS has disadvantages as well. Importantly, for large fractions of those successfully contacted in the later sweeps, data from their earlier sweeps (including height measures) is incomplete.

adult height. For the adult outcomes in the NCDS we consider wages at age 33; in the NLSY we consider the data from 1996 when respondents were 31 to 38 years old. The statistics on adult wages summarize only the data for full time workers.[18] Comparing mean log of wages, we find that the average wage of shorter males is 13 percent lower than that of the taller group in the NCDS and 10 percent lower in the NLSY.

Importantly, these shorter and taller males come from family backgrounds that are also quite different. In particular, Table 2 shows that compared with their taller counterparts, shorter males, on average, come from larger families with less educated parents who were less likely to have worked in skilled or professional occupations.[19] Thus, an immediate concern is that the disparities in the average adult outcomes of taller and shorter males reflect these differences in family background rather than any form of height premium. Growing up in families with less human and financial capital, shorter than average men may be placed at a disadvantage in the labor market for reasons that have nothing to do with their lack of height.

To account for the influence of these systematic differences in family background, Table 3 presents OLS estimates of the effect of height on wages holding constant a number of family characteristics.[20] Results from the NLSY are presented along side those from the NCDS. In Columns 1 and 5, the first, simple regression of log wages on height, age, and region of residence[21] indicates that every additional inch of adult height is associated with an increase in wages of 2.2% percent (or approximately £408 ($722) in 1991 full-time equivalent annual earnings) in the NCDS, and 2.5 percent (or $820 in full-time equivalent annual earnings) in the NLSY. In Columns 2 and 6,

[18] In the NCDS, wages are defined as gross pay per reporting period divided by usual hours worked during reporting period. (The reporting period varies depending on how often the respondent is paid.) In the NLSY wages are defined as annual income from wages, salaries and tips, divided by annual hours worked. Full time workers are identified as those who worked more than 1,000 hours in the previous year. The results discussed here and elsewhere in the paper are qualitatively unchanged when other definitions of work are used.

[19] The mothers of shorter men in the NCDS are an exception.

[20] Here, as in our subsequent regression analyses, we implicitly assume that, conditional on other observables, an individual's heights at various ages are exogenously given. This assumption precludes, for example, a model in which, conditional on other observables, height at various ages is determined in part by parents' unobservable investment decisions that also contribute directly to adult productivity and thus to adult wages.

[21] There are small, but statistically significant differences in the distribution of heights across regions. We find, for example, that males from Scotland are on average 0.5 inches shorter than those from the East or the North Midlands of England. In the US, white males in the Northeast are, on average, 0.45 inches shorter than their counterparts in Northcentral states, and 0.59 inches shorter than in the Southern states.

after controlling for family characteristics including parents' education and occupation status, and number of siblings, the coefficient on adult height is reduced to 1.7 percent in the NCDS and 1.9 percent in the NLSY.[22]

Neal and Johnson (1996) provides evidence of an important association between the resources of a child's school and the accumulation of valuable pre-market skills. With this evidence in mind, we move on consider whether differences in measures of school quality such as student-teacher ratio, disadvantaged student ratio, dropout rate and teacher turnover rate may explain more of the height wage premium. Because many schools did not respond to the NCDS and NLSY surveys, a substantial portion of our white male subsample (29% and 40%, respectively) is lost when we condition on these variables. Restricting attention to the remaining sample with sufficient data, Columns 3-4, and 7-8, present the effects of adding controls for measures school quality in the NCDS and NLSY, respectively. We find that while some of these measures of school quality are significantly associated with adult wages in the expected way, they are not responsible for the height wage premium. Introducing controls for school quality in the NCDS leaves the estimated effect of adult height on adult wages unchanged. In the NLSY, the estimated effect of height on wages increases very slightly when differences in school quality are taken into account.

In summary, although the estimated coefficients on height are somewhat reduced after accounting for differences in some external resources, the reduction is minor especially when compared with the analysis of Neal and Johnson (1996), who find that family and school variables may account for a large fraction of the racial wage gap. In our analysis, the fact that taller people tend to come from somewhat more advantaged families does not explain a large part of the height premium.

4 It's All in Teen Height

As noted in the introduction, the fact that shorter people are penalized on the labor market does not imply they are penalized for being short. We now argue that much of the wage disadvantage experienced by shorter people can be explained by a characteristic other than adult height, namely height in adolescence. This finding casts substantial doubt on the relevance of a taste for height as an explanation for the observed wage premium.

[22] If endogenous variables such as years of completed education and occupation are controlled for, the coefficient remains statistically significant although, as anticipated, it is further reduced.

4.1 Irrelevance of Adult Height

We now show that adult height predicts wages only insofar as it is correlated with youth height. The evidence for this claim comes both from the NCDS and the NLSY. (For height when old and young, in the NCDS we use age-23 and age-16 height, in the NLSY height reported in 1985 and 1981.)

To fix the idea of our estimation, consider a random sample of 33 year-old males all of the same height. Among this group, individuals will have been more or less tall at age 16. More specifically, some will not have grown at all in the intervening years, while others may have grown several inches to achieve this adult height. Conditional on adult height, we find a sizable (and statistically significant) difference between the wages of late and early maturers— a 'teen-height premium.' In fact, of the total effect that might be ascribed to adult height discrimination, nearly all can be attributed to the fact that adults who are relatively tall at age 33 tend to be relatively tall at age 16.

A simple comparison of means already suggests that most of the adult-height wage gap is in fact a teen-height wage gap. Table 4 considers only those white male adults of above-average height (70 inches or taller in Britain and 71 inches or taller in the US). Among this taller adult group we exclude approximately the tallest 15 percent, and classify the remainder according to their height when young.[23] Approximately 34 (13) percent of these remaining 'tall adults' in Britain (US) were of median height or below when young (67.3 inches or smaller in the British data, 70 in the US data). Note that as adults, 'tall youth-tall adults' are on average less than an inch taller than 'short youth-tall adults'; and yet their adult wages differ considerably. The wages of these 'short youth-tall adults' in Britain are 13 percent lower (10 percent in the US) than those of 'tall youth-tall adults,' a wage gap that mirrors that between short and tall adults (Table 2).

A full regression analysis is reported in Table 5. Each specification in Table 5 takes the following form:

$$y_i = \alpha_0 + \alpha_1 H_{i,adult} + \alpha_2 H_{i,youth} + \boldsymbol{\alpha}\mathbf{X}_i + u_i \qquad (1)$$

[23] Ommitting the tallest of the category of "tall adults" addresses the concern that the results of a simple comparison of above- and below-average may be driven by the fact that those tall adults who were short when young are also likely to be among the shorter 'tall adults,' and for this reason less well paid. Ignoring this fact could lead to an overestimate of the power of youth height to explain adult wage disparities.

where:

$$
\begin{aligned}
y_i &= i\text{'s adult wage} \\
H_{i,adult} &= \text{adult height} \\
H_{i,youth} &= \text{youth height} \\
\mathbf{X}_i &= \text{a vector of other covariates} \\
u_i &= \text{an error term, } u_i | \left(H_{i,adult}, H_{i,youth}, \mathbf{X}_i\right) \sim N\left(0, \sigma^2\right)
\end{aligned}
$$

As above, the results from the NCDS and NLSY are presented side-by-side. In the first, basic specification of Table 5 (Columns 1 and 5) we regress adult wages on adult height, youth height, age, and region. In this basic specification we find that, conditional on adult height, every additional inch of height when young, is associated with a 2.6% increase in adult wages in Britain, and a 2.7% increase in the US. Importantly, when we control for youth height, the estimated effect of adult height on wages is essentially zero. The point estimate suggests that conditional on youth height, any additional adult height has no effect on adult wages in the British data. In the US. data the estimated coefficient of adult height is a statistically insignificant 0.2%.

As in Section 3 concerning the analysis of adult height alone, we move on to account for a possible relationship between height and aspects of family and school background.[24] Adding controls for family characteristics (Columns 2 and 6) changes the estimates slightly. Accounting for differences in family background we find that, conditional on adult height, every additional inch of age-16 height is associated with a somewhat diminished, but still highly significant 2.2% increase in adult wages in Britain,

[24] It may be argued that, to capture the gross effect of teen height on adult wages, it is appropriate to condition on the teen's stock of human capital. One argument for such a specification is that, conditional on adult height and family resources, investments in human capital that are positively correlated with later wages are also positively correlated with teen height. Observe, however, that to the extent that these investments are the *result* of greater stature, conditioning on teen human capital would lead to an underestimate of the gross effect of teen height on adult wages. Consistent with this story, our analysis indicates that while pre-teen investments in human capital are unrelated to the teen height premium, post-teen investments may be. Table 7, below, indicates that conditioning on age-7 measures of academic achievement does not affect estimates of the teen height premium. Similarly, in analysis of the NLSY (results not shown) adding additional controls for years of completed schooling in 1981 has no impact on the estimated effect of 1981 height on 1996 wages for those who were in fact teenagers in 1981. Among those who were at least 20 years old in 1981, however, conditioning on years of completed schooling reduces the estimated coefficient on teen height by approximately 20 percent. Based on this evidence, we omit controls for the stock of human capital at the time of height measurement to avoid understating the degree to which teen height influences adult wages.

and a 2.6% increase in the US. Controlling for the effect of youth height, we again estimate that adult height has essentially no effect on adult wages in Britain, and in the US. the estimated effect of adult height on wages is -0.4% but not statistically different from zero. Columns 3-4, and 7-8 add controls for measures of school quality from the NCDS and NLSY respectively. As in the analysis of adult height alone (Table 3), we find that adding controls for differences in school quality leaves the estimated effects of youth height and adult height little changed. In the relevant samples, introducing controls for school quality reduces the estimated effect of an additional inch of youth height from 2.1% to 1.9% in the NCDS, and from 2.7% to 2.5% in the NLSY. Thus, the finding that pre-adult height, rather than adult height itself, determines the wage premium is robust to the introduction of controls for region, family background, and school quality.

Since in both the NCDS and the NLSY the effect of adult height on wages, conditional on youth height, is essentially zero, the adult height-wage disparity is not due to a taste for tall workers. Rather, the different outcomes for taller and shorter workers appear to reflect a characteristic correlated with height when young.

4.2 Irrelevance of Pre-Teen Height

This section is based solely on data from the NCDS, which afford a unique opportunity to further parse the height premium according to the age at which high stature is attained. Respondents to the NCDS were also measured at ages 7 and 11, allowing us to consider the extent to which height at these ages contributes to the height premium. It is clear that each of these heights, if considered on its own (without conditioning on other heights), will appear to carry a wage premium simply because of the positive correlation between heights at all ages. To determine the extent to which teen height proxies for pre-teen heights, we examine how the estimated contribution of teen height is changed when we introduce earlier heights.

Table 6, Columns 1 and 2, considers only those respondents for whom there exists data on age 23, 16, 11 and 7 heights. The basic estimation (Column 1) regresses log of age-33 wages on age-23 height, age-16 height, family background, region. Column 2 adds controls for both pre-teen heights. Comparing the results in Columns 1 and 2 we find first that age-11 and 7 heights have no appreciable effect on adult wages. Conditional on all other heights, the estimated effect of an increase in either age-11 or age-7 height is essentially zero. In addition, introducing these controls for earlier height leaves the estimated effects of both age-23 and age-16 height basically unchanged. Among all recorded heights, only age-16 height is estimated to have a large and statistically significant effect on adult wages; no other height contributes to the height premium.[25]

5 Explaining the Teen-Height Premium

5.1 Not Due to Employers' 'Taste' for Height

In the previous section we have pushed back the source of the height premium to the pre-adult stages of development. We have shown, in particular, that the wages of two men with the same adult height may reflect the full amount of a 'height gap' depending only on the difference in their heights as teens. We conclude that the height penalty cannot be caused by *current* lack of height. This casts doubt on the existence of an employers' taste for current height or, since employers likely cannot differentiate based on height when young, for early height in the choice of employees. Similarly, these results suggest a limited role of adult height in determining the productive aspects of one's self-image.

5.2 Not an Effect of External Resources

As shown in Section 3, differences in family and school resources explain little of the disparity between tall and short adults. The coefficient on height (adult and/or youth) was little changed in both the US. and the British data when we controlled for family and school background characteristics, and our finding of a 1.7-2.7% per-inch height premium is net of family background characteristics. The conclusion that the height premium is not driven by family background characteristics draws additional support from the analysis of Behrman and Rosenzweig (2001), who find evidence of a sizable wage premium between female twins of varying heights. Finally, to the extent that external resources are correlated with height at all ages, if resources were driving the height premium then we should observe heights at all ages being positively associated with wages, not just age-16 height.

[25] Previous studies (Hamermesh and Biddle, 1994; Averett and Korenman 1996) have found that being physically attractive as an adult, and in particular being tall and thin, has a positive association with wages. Our analysis (results not shown) indicates that adding a control for teen weight, measured as body mass index, does not appreciably alter the coefficients on height at different ages.

5.3 Not a Premium to Native Intelligence

Suppose height were proxying for native intelligence; given the pattern we observe whereby age-16 height alone among heights at all ages explains wages, the productive components of native intelligence must be most strongly correlated with age-16 height. Although this hypothesis seems peculiar, we can use the NCDS to investigate it by conditioning on the score of a test of academic achievement taken at age 7. Insofar as academic achievement at age 7 measures native intelligence, conditioning on the test score ought to reduce the coefficient on age-16 height. Table 7 presents the effect of introducing age-7 test scores on the coefficient for age-16 height. Note that all of these estimates account for differences in family backgrounds, so the test scores do not proxy for these characteristics.

Columns 1 and 2 of Table 7 restrict attention to those respondents to the NCDS with information on height ages 16 and 23, and test scores at age 7. Consistent with the notion that they capture native intelligence, the test scores contribute importantly on their own to explaining adult wages. Each test score is associated with a statistically significant, positive coefficient (1.4% increase in wages per point on the reading test, and 2.4% per point on the math test). However, introducing the scores does not reduce appreciably the estimated teen-height premium. Without controlling for the test scores, the teen-height premium is estimated at 2.2% per inch in this sample. Adding the controls merely reduces the estimated teen-height premium to 2.1% per inch.

5.4 Not a Reward to Early Cognitive Development

Later physical maturers might also be later cognitive or emotional maturers. If this were the case, we would expect those maturing later to, for example, get less from the same amount of schooling than their early maturing adult peers and, therefore, complete less school or do worse in the adult labor market. The notion is that at any age, being taller allows one to get more out of education. In this were the case, greater height would be beneficial at all ages and we would expect the coefficient of height at all ages to be significantly different from zero in Tables 6 and 7. The fact that we do not see this pattern suggest that there is no advantage to earlier development *per se*.

Alternatively, it might be argued that puberty has a special quality among stages of development. One might hypothesize that achieving puberty enables one to start accumulating a special kind of human capital, and those who achieve puberty early (and so are taller at age 16) get a head start in the accumulation process. This could be the reason for the pre-eminence of age-16 among all heights in explaining adult wages. In this story, age 16 is not special because of the social environment associated with adolescence; rather, being tall at age 16 is merely a symptom of early puberty and thus the precocious achievement of a large fraction of one's ultimate height. This argument can be explored by estimating the extent to which the fraction of one's ultimate height achieved at age 16, rather than height level, matters for adult wages. Table 8 introduces the fraction of final height achieved at 16 along with age-16 height level. This allows us to distinguish the effect on adult wages of being fully developed at 16 from just being tall on the way to greater heights. If early puberty was the key to larger wages, then its estimated coefficient should be large. However, we observe that percentage height has a small coefficient and introducing this new variable does not appreciably reduce the coefficient on age-16 height.

Columns 1 and 2 of Table 8 present results from the NCDS. In these specifications we estimate of the effect on wages of teen height alone, and of the effect of teen height conditional on percentage of adult height achieved, respectively. In Column 1 we regress the log of age-33 wages on age-16 height, family background and region, and estimate a 2.1% per inch teen height premium. Column 2 adds a control for the percentage of age-23 height achieved by age 16. In these British data we find no relationship between adult wages and the fraction of adult height achieved by age-16; and adding this control leaves the estimated effect of teen height unchanged. In the US data (Columns 3 and 4) we observe an identical pattern. In Column 3 we estimate a 2.2 percent teen height premium, absent a control for fraction of adult height achieved. As in the British data adding the control for teen development (Column 4) leaves the estimated effect of teen height level unchanged. Here, as in the NCDS, this percent of maturity measure does not explain the teen height wage premium.

5.5 The Importance of Social and Cultural Effects During Adolescence

Having ruled out several possible channels through which age-16 height influences adult wages, we now provide evidence suggesting that social and cultural factors at age 16 contribute importantly to the teen-height premium. To this end we restrict attention to the NLSY data set, which contains especially detailed information concerning self-assessments and participation in social activities. Those who were relatively short when young are less likely to participate in social activities that facilitate the accumulation of productive human capital like self-esteem and social adaptability. We think of athletics, school clubs, and dating as examples of these types of activities. We show that participation in extracurricular activities and self esteem together have a role in the teen-height premium.

Table 9 presents estimates of the effects of height on adult wages, conditional on the youth's level of self-esteem, and participation in high school social activities. Recall that in the NLSY youth height is reported in 1981 when respondents were ages 16-23. Self esteem is evaluated in 1980, when respondents were asked the extent to which they agreed with seven statements about themselves. Both positive and negative statements are included in the survey.[26] The extent of agreement was chosen from four possible responses ranging from strong agreement to strong disagreement. Our measure of self esteem is an index, ranging from 0-7, representing the number of 'positive' statements with which the respondent at least agreed plus the number of 'negative' statements with which the respondent at least disagreed.[27] Retrospective questions about participation in high school activities were asked in 1984, only to those who had finished or were expected to finish high school. Our measure of social activity is the number of non-vocational, non-academic high school clubs in which the respondent participated.[28] Because height is often a criterion for participation in athletics, we separate athletics from these other high school activities.[29] Last, we note that for the younger members of the sample, height in 1981 represents (at least in part) high school height. For those 19 and older in 1981, however, height in 1981 will be a noisier signal of high school height. The analysis is performed both for all white males for whom we have adequate data (Table 9, Columns 1-2), and for those younger than 19 in 1981 alone (Columns 3-4).

Restricting attention to those white males for whom we have measures of both self-esteem in 1980 and participation in high school activities, in Column 1 we find that controlling for adult height, age, region and family background, every inch of youth height is associated with a 2.3% increase in adult wages. As before, this effect is sig-

[26] For example, respondents were asked the extent to which they agreed with the statements "I am a person of worth" and "I have very little to be proud of."

[27] The average self-esteem score among the white male subsample is 6.80, standard deviation 0.58. Alternative indices which take into acount the extent of agreement with the self-evaluation statements have more variation. We choose the one described here based on its superior ability to explain the variation wages. Results concerning the the ability of self-esteem to explain the youth height preimum are robust to the choice of self-esteem index.

[28] These clubs include youth groups, hobby clubs, student government, newspaper/yearbook, performing arts, and 'other' clubs. This list does not include, in particular, honor societies or vocational clubs. On average, the white male subsample participated in 0.68 clubs, standard deviation 0.99.

[29] Among the white males in our subsample, 52% participated in high school athletics.

nificant at least at the 5% level, and the estimated effect of adult height is statistically zero. Column 2 includes measures of self-esteem and activity participation; their coefficients are positive and both economically and statistically significant. Controlling for age, height, region and family background, and other club membership, participation in high school athletics is associated with an 11.4% increase in adult wages. Participation in every additional club other than athletics is associated with a 5.1% increase in wages. When we add controls for the levels of self-esteem and participation in high school activities the coefficient on youth height declines by a relatively modest 22% and becomes only borderline significant at the 10% level. The estimated effect of adult height is essentially unchanged.

The effects of accounting for youth self-esteem and high school activities are more dramatic, however, when attention is restricted to those who were actually in high school in 1981 when their height was recorded. Column 3 presents the basic regression for this younger group. Here we estimate that every inch of youth height is associated with a 2.6% increase in adult wages. Again the effect of adult height, while estimated at -1.4% per inch, is statistically indistinguishable from zero. When, in Column 4, we add controls for the levels of self-esteem and participation in high school activities the coefficient on youth height declines by more than 42% and is no longer statistically significant at the 10% level.[30] Again the coefficients on self-esteem and participation in activities are economically meaningful and statistically significant.

Before going on, we should emphasize that one must be cautious in interpreting these regressions since the variables of interest - participation in athletics and clubs - are choice variables, and we have not modelled that choice. This point is sufficiently important that we discuss in some detail.

There are several plausible ways that one might model teens' choice of whether to participate in extracurricular activities; for some of those models, the interpretation of regression coefficients as the predicted change in wage if one exogenously manipulated a variable is appropriate, while for others it is not. Consider first the following model of that choice.

Model A. Each individual is characterized by two attributes, one of which is height. Suppose the following are true:

a. The second characteristic is athletic ability, which is independent of height and unobservable to the analyst;

b. Individuals know their athletic ability;

[30] We note that the coefficient on father's education exhibits a decline that is similar both in magnitude and in the change of statistical significance.

c. There is a cost to participating in athletics (for example, the effort expended or the opportunity cost of time) that is identical across individuals;
d. Success in athletics depends (stochastically) on height and athletic ability;
e. Teens receive a contemporaneous benefit from participating in athletics if they are successful;
f. Participation in athletics leads to higher wages.

Given these assumptions, for any given athletic ability, shorter teens expect lower probability of success than a taller teen with the same ability, hence, they are less likely to participate in athletics. If however, we made athletics mandatory, the predicted wage increase for a shorter teen who now participates in athletics would be as predicted from the regression, since it is participation per se that leads to higher wages (by assumption).

While for this model, regression coefficients can be interpreted as the predicted wage change, for other models that seem equally plausible, such interpretation is not appropriate. For example consider the following model that is a slight variant of model A.

Model B.
a. - e. As in Model A;
f. Success in athletics leads to higher wages.

This change doesn't alter teens' decisions, since the probability of that any individual is successful in athletics - the benefit to the teen - is the same for both models. Consequently, we would expect for both models qualitative results similar to those in our regression: teen height affects adult wage. But if model B is correct, the interpretation of the regression coefficients as predicted wage changes would be incorrect; mandatory athletic participation would ensure that shorter teens participated in athletics, but it would have no effect on their adult wage, since by assumption it is *success* in athletics, not participation that leads to increased wages.

There are obviously many other plausible models consistent with our finding a relationship between teen participation in athletics and adult wages. Understanding that relationship is important, and we refer to Barron, Ewing, and Waddell (2000) for an analysis of the link between participation in high school athletics and labor market outcomes. Baron, Ewing, and Waddell find that the link can be attributed to lower cost of effort of those who participate in athletics, or to a directly productive role of athletic in training youth for the labor market. In this paper we will not further investigate the link between athletics and labor market outcomes. We will, however, investigate the extent to which participation in social activities and self-esteem independently affect wages. It could be the case, for instance, that self-esteem is a by-product of success in athletics and participation to extra-curricular activities. In that case, the important estimated effect of self-esteem would reflect another independent channel through which participation in these social activities affects wages. Symmetrically, one might hypothesize that participation in social activities is a by-product of self-esteem, as high self-esteem generates a gregarious attitude which is conducive to participation in social activities. To address this question we introduce controls for participation and self-esteem separately, and assess the extent to which introducing the controls together affects the coefficient on each control estimated separately.

The results reported in Table 10 suggest that self esteem and participation in athletics and clubs have independent relationships with later wages. For example, controlling for self-esteem alone (Table 10, Column 1) we estimate an associated coefficient of 0.12 – essentially the same estimate as when all three controls are included. Similarly, we estimate that participation in athletics is associated 19.3% increase in adult wages when controlled for alone, and a 16.7% increase when differences in both self-esteem and club participation are also accounted for. The same basic results holds for club participation as well. We interpret these results to suggest that self-esteem and participation in social activities affect wages through largely independent channels. It appears as though the rewarded aspects of self-esteem are neither a by-product of success in athletics and clubs, nor an important predictor of participation in these social activities.

5.6 Not Statistical Discrimination

Access to the kind of social activities we focussed on depends on the costs and benefits individuals attach to participation in the activities. The analysis above does not address the reasons shorter teens have a lower participation rate of shorter teens in social activities. The lower rate may be due to obstacles created by the social environment, stigma, etc., that raise the cost for shorter teens, or it may be that shorter teens have the same cost of participation and yet choose to invest less. Shorter teens might invest less in these social activities, for example, if short *adults* have a lower return on investments in social activities. If this were the case, since shorter teens forecast themselves as short adults, it is rational of them to invest less relative to taller teens.

To a certain extent, the same argument may be made concerning self-esteem. One view in the literatures on psychology and education holds that self-esteem can be enhanced.[31] There is certainly a large self-help industry devoted to the conscious adjust-

[31] See Pope *et al.* 1988.

ment of self-image that is premised on this possibility. To the extent that self-esteem is an outcome of behavior on the part of an individual, it can be thought of as another form of human capital. If this form of human capital were rewarded less in shorter adults then, *ceteris paribus*, it would be rational for short youths to curtail their investment in self-esteem.

In this section we suggest that, to the extent that short adolescents participate less in these social activities and choose to acquire less self-esteem it is not because they anticipate a lower return to these factors when adult. Again restricting attention to the NLSY data, and those who were 19 or younger in 1981, Table 11 presents estimates of the return to self-esteem, and participation in social activities. Column 1 considers only those white male workers who were less than median height as adults; Column 2 performs the parallel analysis for those who were at least median height as adults. Conditioning only on age, family background and region, we find that the coefficients on self-esteem and social activities do not differ significantly, or systematically between the two regressions. Among those who grew to less than median adult height the estimated coefficient on self esteem is 0.108. Among those who grew to median height or above, the same coefficient is estimated to be 0.126 – a statistically insignificant difference. Among those who grew to less than median adult height the estimated coefficient on participation in athletics is 0.129, while for those who grew to at least median adult height the estimated coefficient is considerably larger (0.203), though we can not reject the null hypothesis that the two coefficients are the same. Last, the estimated coefficient on participation in clubs among the shorter adult group is actually larger (0.131) than that for the taller group (0.068), though again we cannot reject the null hypothesis that the coefficients are the same.[32] Thus we find little evidence that the returns to investing in self-esteem and social activities when young are significantly or systematically different depending on whether one forecasts becoming a tall or short adult.

6 Discussion

Our findings are consistent with Heckman (2000), which suggests a class of plausible mechanisms for the accumulation of non-cognitive skills including social adaptability, motivation and self-esteem. The mechanisms focus on the cumulative effects of early skill development and the informal, non-institutional, social sources of learning that

[32] Similar results hold when we analyze the entire sample of white male workers rather than only this younger subsample.

contribute to human capital and productivity. We interpret the results in Table 9 as indirect evidence for the importance of non-cognitive factors for the youth-height premium. Those who were relatively short when young were less likely to participate in social activities associated with the accumulation of productive skills and attributes, and developed less self-esteem. If these activities facilitate the acquisition of skills such as social adaptability and self-discipline, then this aspect of the social arrangements of young people would appear to have important effects on economic outcomes in adulthood.

While the question requires further investigation, we interpret our results in this context to suggest that early social discrimination rather than contemporaneous market discrimination, may be at the root of the disparity in wages across heights. We are not suggesting, of course, that it is discrimination within athletics and other extracurricular activities that accounts for shorter teens' lower participation. It may be, for example, that earlier treatment has made these youths more sensitive to slights, and that as a result they withdraw from such interactions. We do know, however, that *something* causes lower participation, and that this is associated with persistent lower labor market success in later years. Given the plausibility that these extracurricular activities are associated with the acquisition of non-cognitive skills, it is important to examine the question in more detail.

The first question is whether the lower participation is due to obstacles placed on shorter teens by others or whether the shorter teens choose to withdraw. Distinguishing the two is not at all obvious: for example, a short teen may not go out for basketball because he expects not to be able to make the team, or because he is made fun of. In both cases, the distinction between self-imposed and external obstacles is not clear-cut. Even in a world in which short teens are treated identically as others are, it may be that earlier experiences have conditioned shorter teens so that they are less willing than others to interact. Investigating this possibility would require establishing the earliest age at which observable behavior arises that is associated with lower participation.

Assuming that there are valuable non-cognitive skills that are acquired through participation in clubs and athletics, what precisely is acquired? Our results suggest that self esteem accounts for some of the difference in job market success, but not all. Other likely candidates are the interpersonal skills acquired through social interactions, social adaptability from working in groups, and discipline and motivation that result from participation. More detailed data on the activities that youths engage in, and the job market consequences would permit a better understanding of the production process of generating social skills. In addition to the question of *what* is acquired, it is important to understand *how* it is acquired. For example, an individual may become aware that he is competent as he engages in different activities, or instead learn it from others. To the extent that the latter alternative is prevalent, the learning path might depend on the level of non-cognitive skill of those with which an individual associates.

We emphasized in the introduction that we do not imply that height discrimination is morally equivalent to racial discrimination. Despite the differences in the history and psychology, what is learned from height discrimination may shed light on racial discrimination. First, the magnitude of wage differences associated with height is similar to that associated with racial differences. Without correcting for education or occupation choice, we estimate the black-white wage gap to be approximately 15% among males in the NLSY. Depending on our specification, this estimated gap is approximated by the difference in wages for two men whose heights differ by six to eight inches.

There are, however, very significant differences between black-white wage differences and the wage advantage associated with being taller as an adolescent. For the case of racial differences, Neal and Johnson (1996) provide evidence that some of the disparity in typically unobservable skills can be predicted by differences in the family and school resources of the children. There are sharp differences between the background characteristics of blacks and whites. The quality of the schools whites go to, as measured by the teacher/student ratio, dropout rate and disadvantaged student ratio, is clearly superior to that of the schools blacks go to. The probability that one's father is a professional is much higher in white households and the number of siblings is lower. All of these can presumably be affected by public policy.

The differences between the background characteristics of blacks and whites is in stark contrast to the differences - or lack thereof - in the background characteristics of youths who were tall or short. When compared to the black-white case, the schools and families of tall and short teens are essentially indistinguishable. As a consequence, it is far more difficult to attribute the effect of short stature as an adolescent on subsequent labor market outcomes to a deficiency in available resources. But if social exclusion and a feeling of 'not fitting in' has long-term, economically important consequences for shorter teens, one must consider the possibility that minority youths might suffer similarly. Obviously, a serious investigation of this is beyond the scope of this paper.

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Table 1: Distribution of Height and Change in Height, White Males of the NCDS and NLSY					
Britain -- NCDS[1]	Height age 16	Height age 23	Δ age 16-23	Height age 11	Height age 7
Mean	67.33	70.08	2.76	56.94	48.56
Median	67.32	70.00	2.48	57.01	49.02
Standard deviation	3.01	2.65	1.95	2.62	2.14
25th percentile	65.35	67.99	1.46	55.24	47.01
75th percentile	69.29	72.01	3.66	58.74	50.00
N	2132	2132	2132	2031	1949
US -- NLSY[2]	Height 1981	Height 1985	Δ 1981-85		
Entire subsample					
Mean	70.41	70.69	0.28		
Median	70	70	0		
Standard deviation	2.85	2.77	1.44		
25th percentile	68	68	0		
75th percentile	73	73	1		
N	2603	2603	2603		
Those with Δ height >0					
Mean	69.54	71.22	1.68		
Median	69	70	1		
Standard deviation	3.09	2.73	1.51		
25th percentile	68	69	1		
75th percentile	72	74	3		
N	618	618	618		
***US Measured* heights for white males, ages 18-24, from the National Health and Nutrition Examination Survey 1976-1980**[3]					
Mean	69.8				
Median	69.7				
Standard deviation	2.8				
25th percentile	67.9				
75th percentile	71.6				
N	846				

[1] The subsample consists only of the white male respondents to the NCDS for whom there is a measure of height at age 23 and 16, and information on family background. The sample is further restricted when we consider those with data on age-11 and age-7 height.
[2] The subsample consists only of the white male respondents to the NLSY for whom there is a measure of height at in 1985 and 1981, and information on family background. The NLSY's oversample of poor whites is also excluded.
[3] Source: National Center for Health Statistics (1987), Table 13.

Table 2: Summary Statistics, White Males by Adult Height				
	Britain -- NCDS		**US -- NLSY**	
	Adult Height Median or Below	Adult Height Above Median	Adult Height Median or Below	Adult Height Above Median
Adult Characteristics:	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Teen height (inches)	65.70* (0.06)	69.49 (0.08)	68.19* (0.07)	72.23 (0.06)
Adult height (inches)	68.26* (0.05)	72.54 (0.05)	68.25* (0.06)	72.70 (0.05)
Age	33.0 (…)	33.0 (…)	35.34 (0.07)	35.31 (0.07)
Ln(wage per hour)	1.99* (0.02)	2.12 (0.02)	2.58* (0.03)	2.68 (0.02)
Years of completed schooling	10.95* (0.02)	11.15* (0.03)	13.38* (0.09)	13.79 (0.08)
Ever married (%)	78.74 (1.13)	79.45 (1.32)	78.84* (1.42)	83.15 (1.17)
Divorced or separated (%)[1]	18.35 (1.21)	15.73 (1.33)	20.71* (1.59)	15.90 (1.26)
Family Background:				
Mother's years of schooling	10.38* (0.04)	10.63 (0.06)	11.83* (0.08)	12.29 (0.07)
Mother skilled/ professional (%)	55.09 (1.36)	52.87 (1.60)	7.20* (0.85)	9.98 (0.89)
Father's years of schooling	11.30* (0.04)	11.48 (0.06)	12.14* (0.10)	12.66 (0.10)
Father skilled/ professional (%)	78.10* (1.13)	82.55 (1.22)	12.78 (1.09)	14.92 (1.06)
Number of siblings	3.20* (0.04)	2.90 (0.05)	2.99 (0.06)	2.91 (0.06)
N	974	1347	931	1132

* Indicates means are statistically different at the 5% confidence level.
[1] Conditional on having been married.

Notes: Teen height is height recorded at age 16 (NCDS), or in 1981 (NLSY), adult height is height recorded at age 23 (NCDS), or 1985 (NLSY). Log wages are in measured in 1991 pounds (NCDS) and 1996 dollars (NLSY), and are for full-time workers only. In the NCDS the sample of full time workers with wage, height and all family background data is 1615. In the NLSY this number is 1577. For the NCDS years of schooling equal the age at which the respondent (or parent) left school minus five. Parents are identified as skilled (professional) if they work in a professional and or skilled, non-manual (NCDS) or professional/managerial (NLSY) occupation.

Table 3: OLS Estimates Ln(wage) Equation for Adult, White Male Workers, NCDS and NLSY

	Britain -- NCDS				US -- NLSY			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covariates								
Adult height (inches)	0.022 (3.96)	0.017 (3.14)	0.023 (3.33)	0.023 (3.27)	0.025 (4.53)	0.018 (3.34)	0.018 (2.57)	0.019 (2.68)
Age	…	…	…	…	0.028 (4.02)	0.027 (3.98)	0.023 (2.52)	0.022 (2.35)
Mother's years of schooling		0.015 (1.45)	0.018 (1.38)	0.008 (0.61)		0.025 (2.77)	0.030 (2.67)	0.030 (2.62)
Mother skilled/ professional (%)		-0.059 (-1.73)	-0.020 (-0.48)	-0.008 (-0.19)		0.019 (0.32)	0.092 (1.15)	0.087 (1.09)
Father's years of schooling		0.008 (0.79)	0.010 (0.86)	0.003 (0.28)		0.030 (4.70)	0.026 (3.23)	0.025 (3.03)
Father skilled/ professional (%)		0.124 (2.80)	0.088 (1.63)	0.066 (1.21)		0.050 (1.00)	0.100 (1.55)	0.101 (1.57)
Number of siblings		-0.033 (-3.40)	-0.022 (-1.82)	-0.017 (-1.41)		-0.023 (-2.70)	-0.023 (-2.18)	-0.023 (-2.21)
Student/teacher eatio				-0.002 (-0.24)				-0.002 (-0.30)
Disadvantaged student ratio				-0.002 (-2.12)				-0.001 (-0.81)
Dropout rate				-0.002 (-2.18)				-0.001 (-1.25)
Teacher turnover rate				0.001 (0.33)				-0.006 (-2.24)
N	1615	1615	1139	1139	1577	1577	943	943
Adjusted R^2	0.031	0.045	0.040	0.051	0.031	0.092	0.104	0.108
F-Statistic (K,N-K-1)	6.09	6.04	4.13	4.22	10.97	16.92	11.95	9.13

T-statistics are in parentheses.

Notes: See notes for Table 2. Sample consists only of white male, full-time workers. Each specification includes controls for region and a constant term, results omitted. In the NCDS the disadvantaged student ratio is defined as the percentage of the school's population with a father in a non-skilled, manual occupation. Starting in the academic year beginning in the fall of 1972, the age of mandatory schooling was raised to 16 years in Britain. The dropout rate used here is the percentage of students who, in the 1971-72 academic year, left the respondent's school at or before their earliest legal opportunity.

Table 4: Summary Statistics, Somewhat Taller White Males, By Relative Teen Height				
	Britain -- NCDS		**US -- NLSY**	
	Adult Height 70-73 inches		Adult Height 71-74 inches	
	Teen Height Median or Below	Teen Height Above Median	Teen Height Median or Below	Teen Height Above Median
Adult Characteristics:	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Teen height (inches)	65.89** (0.08)	69.43 (0.04)	69.13** (0.17)	72.24 (0.04)
Adult height (inches)	70.61** (0.04)	71.44 (0.04)	71.50** (0.07)	72.37 (0.03)
Age	33.0 (…)	33.0 (…)	34.05** (0.18)	35.48 (0.07)
Ln(wage per hour)	2.01** (0.03)	2.14 (0.03)	2.57* (0.06)	2.67 (0.02)
Years of completed schooling	10.99** (0.04)	11.17 (0.03)	11.79 (0.50)	12.02 (0.20)
Ever married (%)	80.75 (2.04)	79.76 (1.48)	71.67** (4.11)	84.66 (1.29)
Divorced or separated (%)[2]	16.23 (2.12)	16.07 (1.51)	23.26** (4.56)	14.76 (1.38)
Family Background:				
Mother's years of schooling	10.61 (0.09)	10.51 (0.06)	12.38 (0.22)	12.26 (0.07)
Mother skilled/ professional (%)	54.10 (2.52)	53.14 (1.81)	12.21 (2.86)	9.23 (0.99)
Father's years of schooling	11.41 (0.04)	11.45 (0.06)	12.40 (0.32)	12.63 (0.11)
Father skilled/ professional (%)	75.13** (2.19)	82.72 (1.37)	10.69 (2.70)	15.77 (1.25)
Number of siblings	3.23** (0.04)	2.91 (0.05)	2.76 (0.17)	2.94 (0.06)
N	390	764	131	856

** Indicates means are statistically different at the 5% confidence level.
* Indicates means are statistically different at the 10% confidence level.
[1]Conditional on having been married. **Notes:** See Table 2.

Table 5: OLS Estimates Ln(wage) Equation for Adult, White Male Workers, NCDS and NLSY

	Britain -- NCDS				US -- NLSY			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covariates								
Adult height (inches)	0.000 (-0.06)	-0.001 (-0.10)	0.006 (0.55)	0.007 (0.65)	0.002 (0.18)	-0.004 (-0.39)	-0.006 (-0.40)	-0.003 (-0.25)
Youth height (inches)	0.026 (3.51)	0.022 (2.90)	0.021 (2.29)	0.019 (2.09)	0.027 (2.36)	0.026 (2.36)	0.027 (1.96)	0.025 (1.86)
Age	…	…	…	…	0.024 (3.38)	0.023 (3.34)	0.020 (2.07)	0.018 (1.94)
Mother's years of schooling		0.016 (1.47)	0.018 (1.39)	0.008 (0.63)		0.023 (2.64)	0.028 (2.51)	0.028 (2.49)
Mother skilled/ professional (%)		-0.053 (-1.54)	-0.012 (-0.27)	0.000 (-0.01)		0.024 (0.41)	0.101 (1.27)	0.095 (1.20)
Father's years of schooling		0.007 (0.70)	0.009 (0.81)	0.003 (0.25)		0.030 (4.75)	0.026 (3.28)	0.025 (3.10)
Father skilled/ professional (%)		0.118 (2.67)	0.082 (1.50)	0.060 (1.11)		0.052 (1.05)	0.103 (1.60)	0.103 (1.61)
Number of siblings		-0.030 (-3.05)	-0.019 (-1.54)	-0.014 (-1.16)		-0.023 (-2.70)	-0.023 (-2.12)	-0.023 (-2.15)
Student/teacher ratio				-0.003 (-0.31)				-0.001 (-0.24)
Disadvantaged student ratio				-0.002 (-2.13)				-0.001 (-0.66)
Dropout rate				-0.002 (-2.05)				-0.001 (-1.24)
Teacher turnover rate				0.001 (0.34)				-0.006 (-2.23)
N	1615	1615	1139	1139	1577	1577	943	943
Adjusted R^2	0.037	0.049	0.043	0.054	0.034	0.094	0.107	0.110
F-Statistic (K,N-K-1)	6.69	6.22	4.22	4.24	10.10	15.93	11.25	8.77

T-statistics are in parentheses. Equations include controls for region and a constant term, results omitted
Notes: See notes for Tables 2 and 3.

Table 6: OLS Estimates Ln(wage) Equation for White Male Workers of Britain's NCDS, at Age 33, Controlling for Prior Physical Development

	(1)	(2)
Covariates[2]		
Height age 23 (inches)	-0.002 (-0.21)	-0.002 (-0.22)
Height age 16 (inches)	0.022 (2.98)	0.021 (2.32)
Height age 11 (inches)		0.001 (0.08)
Height age 7 (inches)		0.000 (-0.02)
Mother's years of schooling	0.016 (1.47)	0.016 (1.47)
Mother skilled worker	-0.068 (-2.01)	-0.069 (-2.01)
Father's years of schooling	0.008 (0.79)	0.008 (0.79)
Father skilled worker	0.120 (2.75)	0.120 (2.75)
Number of siblings	-0.030 (-3.05)	-0.030 (-3.03)
N	1477	1477
Adjusted R^2	0.054	0.052
F-Statistic (K,N-K-1)	6.21	5.51

T-statistics are in parentheses.

Sample consists only of full time workers. Equations include controls for region and a constant term, results omitted

Notes: See notes for Tables 2 and 3.

Table 7: OLS Estimates Ln(wage) Equation for White Male Workers of Britain's NCDS, at Age 33, Controlling for Prior Physical Development, and Age-7 Academic Test Scores

	(1)	(2)
Covariates		
Height age 23 (inches)	-0.002 (-0.19)	-0.006 (-0.74)
Height age 16 (inches)	0.022 (2.91)	0.021 (2.81)
Age 7 reading test score (0-30)		0.014 (5.42)
Age 7 math test score (0-10)		0.024 (3.46)
Mother's years of schooling	0.015 (1.39)	0.002 (0.14)
Mother skilled worker	-0.056 (-1.60)	-0.046 (-1.34)
Father's years of schooling	0.005 (0.53)	0.004 (0.37)
Father skilled worker	0.122 (2.71)	0.082 (1.86)
Number of siblings	-0.029 (-2.96)	-0.020 (-1.98)
N	1570	1570
Adjusted R^2	0.049	0.093
F-Statistic (K,N-K-1)	6.05	9.89

T-statistics are in parentheses.
Sample consists only of full time workers. Equations include controls for region and a constant term, results omitted
Notes: See notes for Tables 2 and 3.

Table 8: OLS Estimates Ln(wage) Equation for White Male Workers of both the NLSY and Britain's NCDS, Youth Height Level vs. Percentage of Adult Height

	Britain -- NCDS		**US -- NLSY**	
	(1)	(2)	(3)	(4)
Covariates[2]				
Youth height (inches)	0.021 (4.28)	0.021 (3.65)	0.022 (4.07)	0.022 (3.82)
100*(Youth height)/ (adult height)		0.000 (-0.02)		0.002 (0.28)
Mother's years of schooling	0.016 (1.47)	0.016 (1.47)	0.024 (2.65)	0.023 (2.64)
Mother skilled worker	-0.053 (-1.55)	-0.053 (-1.55)	0.023 (0.39)	0.024 (0.40)
Father's years of schooling	0.007 (0.70)	0.007 (0.70)	0.030 (4.73)	0.030 (4.74)
Father skilled worker	0.118 (2.67)	0.118 (2.67)	0.052 (1.05)	0.052 (1.05)
Number of siblings	-0.030 (-3.05)	-0.030 (-3.05)	-0.023 (-2.70)	-0.023 (-2.70)
N	1615	1615	1577	1577
Adjusted R^2	0.050	0.049	0.095	0.094
F-Statistic (K,N-K-1)	6.63	9.22	17.52	15.92

T-statistics are in parentheses.
Sample consists only of full time workers. Equations include controls for region and a constant term, results omitted
Notes: See notes for Tables 2 and 3.

Table 9: OLS Estimates Ln(wage) Equation for White Male Workers of the NLSY, Controlling for Self-esteem and Participation in Social Activities, by Age

	All Ages		Less than 19 years old in 1981	
	(1)	(2)	(3)	(4)
Covariates				
Height in 1985 (inches)	-0.003 (-0.25)	0.000 (-0.01)	-0.014 (-1.03)	-0.006 (-0.46)
Height in 1981 (inches)	0.023 (2.10)	0.018 (1.67)	0.026 (1.95)	0.015 (1.13)
Age 1996	0.022 (3.02)	0.020 (2.90)	0.007 (0.27)	0.002 (0.08)
Self-esteem measure 1980 (0-7 scale)[4]		0.084 (2.99)		0.110 (3.01)
Participated in HS athletics		0.114 (3.53)		0.167 (3.59)
Participated in other HS clubs (number)[3]		0.051 (3.09)		0.095 (3.83)
Mother's years of schooling	0.023 (2.49)	0.016 (1.76)	0.040 (2.93)	0.031 (2.32)
Mother professional worker	0.037 (0.60)	0.020 (0.33)	-0.046 (-0.53)	-0.077 (-0.90)
Father's years of schooling	0.032 (4.81)	0.026 (3.91)	0.021 (2.15)	0.010 (1.04)
Father professional worker	0.068 (1.34)	0.065 (1.29)	0.050 (0.67)	0.042 (0.57)
Number of siblings	-0.022 (-2.59)	-0.020 (-2.35)	-0.054 (-4.11)	-0.045 (-3.52)
N	1527	1527	636	636
Adjusted R^2	0.095	0.115	0.112	0.170
F-Statistic (K,N-K-1)	15.55	15.09	8.28	9.13

T-statistics are in parentheses.
Sample consists only of full time workers. Equation includes controls for region and a constant term, results omitted. For the self-esteem measure, respondents were asked the extent to which they agreed with seven statements concerning self-assessment. The extent of agreement was chosen from four possible responses ranging from strong agreement to strong disagreement. The measure used in this specification is an index, ranging from 0-7, representing the number of 'positive' statements with which the respondent at at least agreed plus the number of 'negative' statements with which the respondent at least disagreed. Clubs include youth groups, hobby clubs, student government, newspaper/yearbook, performing arts, and "other" clubs.

Table 10: OLS Estimates Ln(wage) Equation for White Male Workers of the NLSY, Controlling for Self-esteem and Participation in Social Activities, Younger Sample Only[1]

	Less than 19 years old in 1981			
	(1)	(2)	(3)	(4)
Covariates[2]				
Height in 1985 (inches)	-0.013 (-0.94)	-0.010 (-0.75)	-0.011 (-0.77)	-0.006 (-0.46)
Height in 1981 (inches)	0.024 (1.82)	0.018 (1.38)	0.023 (1.74)	0.015 (1.13)
Age 1996	0.002 (0.06)	0.004 (0.14)	0.011 (0.39)	0.002 (0.08)
Self-esteem measure 1980 (0-7 scale)[4]	0.120 (3.19)			0.110 (3.01)
Participated in HS athletics		0.193 (4.13)		0.167 (3.59)
Participated in other HS clubs (number)[3]			0.107 (4.29)	0.095 (3.83)
Mother's years of schooling	0.036 (2.68)	0.038 (2.83)	0.035 (2.61)	0.031 (2.32)
Mother professional worker	-0.030 (-0.34)	-0.060 (-0.69)	-0.085 (-0.97)	-0.077 (-0.90)
Father's years of schooling	0.019 (1.98)	0.014 (1.37)	0.018 (1.85)	0.010 (1.04)
Father professional worker	0.055 (0.73)	0.054 (0.72)	0.033 (0.44)	0.042 (0.57)
Number of siblings	-0.052 (-3.97)	0.054 (-3.94)	-0.049 (-3.77)	-0.045 (-3.52)
N	636	636	636	636
Adjusted R^2	0.125	0.134	0.136	0.170
F-Statistic (K,N-K-1)	8.54	9.20	9.33	9.13

T-statistics are in parentheses.
Sample consists only of full time workers. Equation includes controls for region and a constant term, results omitted.
See also notes Table 9.

Table 11: OLS Estimates of the Returns to Self-Esteem and Social Activities, by Adult Height, for White Male Workers of the NLSY, Younger Sample Only

Covariates	Adult Height Below Median	Adult Height Median or Above
Age	0.008 (0.20)	-0.001 (-0.04)
Self-esteem measure 1980 (0-7 scale)	0.108 (1.98)	0.126 (2.42)
Participated in HS athletics	0.129 (1.69)	0.203 (3.43)
Participated in other HS clubs (number)	0.131 (3.29)	0.068 (2.07)
Mother's years of schooling	0.028 (1.43)	0.040 (2.19)
Mother skilled worker	-0.073 (-0.48)	-0.092 (-0.88)
Father's years of schooling	0.018 (1.10)	0.002 (0.17)
Father skilled worker	0.075 (0.61)	0.025 (0.27)
Number of siblings	-0.036 (-1.82)	-0.048 (-2.81)
N	288	348
Adjusted R^2	0.173	0.134
F-Statistic (K,N-K-1)	6.01	5.45

T-statistics are in parentheses.
Sample consists only of full time workers. Equation includes controls for region and a constant term, results omitted.
See also notes Table 9.