



Height and cognition at work: Labor market productivity in a low income setting



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ABSTRACT

Taller workers earn more, particularly in lower income settings. It has been argued that adult height is a marker of strength which is rewarded in the labor market; a proxy for cognitive performance or other dimensions of human capital such as school quality; a proxy for health status; and a proxy for family background and genetic characteristics. As a result, the argument goes, height is rewarded in the labor market because it is an informative signal of worker quality to an employer. It has also been argued that the height premium is driven by occupational and sectoral choice. This paper evaluates the relative importance of these potential mechanisms underlying the link between adult stature and labor market productivity in a specific low income setting, rural Central Java, Indonesia. Drawing on twelve waves of longitudinal survey data, we establish that height predicts hourly earnings after controlling education, multiple indicators of cognitive performance and physical health status, measures of family background, sectoral and occupational choice, as well as local area market characteristics. The height premium is large and significant in both the wage and self-employed sectors indicating height is not only a signal of worker quality to employers. Since adult stature is largely determined in the first few years of life, we conclude that exposures during this critical period have an enduring impact on labor market productivity.

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1. Human capital and labor market performance

There is abundant evidence that taller people live longer, are healthier, better educated and have higher standards of living (Deaton and Arora, 2009; Fogel, 2012; Strauss and Thomas, 1988). While the precise mechanisms underlying variation in the aggregate relationships across populations and over time is not clear (Deaton, 2007), within populations the fact that taller workers earn more has been widely documented, particularly in lower income settings.¹ This paper uses rich longitudinal survey data to investigate mechanisms that potentially underlie the association between height and productivity in the labor market in rural Indonesia, a rapidly-growing low income setting.

Adult stature is largely determined in early childhood and reflects the combined influence of the early childhood environment including nutrition, disease insults, and investments in health during pregnancy and the first few years of life (Martorell and Habicht, 1986), as well as the possibility of selective early life mortality in some contexts. In an important paper, Case and Paxson (2008a) point out height is but one dimension of human capital that captures very early investments and is likely to be correlated with other early childhood experiences as well as later life human capital investments, many of which are difficult to measure. Specifically, height is likely to be correlated with schooling attainment (Case et al., 2009), cognition (Case and Paxson, 2008a, 2008b), non-cognitive traits such as ambition and confidence (Persico et al., 2004), as well as an array of other markers of both the quantity and quality of health and human capital (Strauss and Thomas, 2008). Moreover, a portion of height is genetic and thus almost surely captures the role of family background and investments made across multiple generations. In low income settings, height may be a marker of strength that translates into greater productivity in physically demanding work. Disentangling that effect is complicated since workers likely self-select into occupations that reward their skills (Case et al., 2009)

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¹ See, among others: Behrman et al. (2013), Case and Paxson (2008a, 2008b), Gao and Smyth (2010), Hoddinott et al. (2008), Lundborg et al. (2014), Persico et al. (2004), Sohn (2015), Thomas and Frankenberg (2002), Thomas and Strauss (1997), Yamamura, Smuth and Zhand (2015) and Vogl (2014).

and taller, stronger workers are also likely to have better cognitive skills (Vogl, 2014). It is possible that height is a signal of worker quality or used as a screening device by employers or customers (Sohn 2015; Yamamura et al., 2015).

This research investigates each of these potential explanations for the association between height and productivity in the labor market as indicated by hourly earnings. Rather than attempt to identify a single mechanism, height is treated as one measure of human capital investments that is likely to be correlated with many others and we explore the relative contributions of the different explanations using data from a single study setting, Central Java, Indonesia. The Work and Iron Status Evaluation (WISE) was designed to provide the evidence necessary to address this question, and analyze the role of human capital in predicting success in both the formal and informal sectors. In addition to measuring height and education, WISE assesses several different domains of cognition, a battery of additional health markers, measures of family background, and multiple labor market outcomes including earnings, wages, and sectoral and occupational choice.

2. Conceptual framework

Height, cognition, health, family background and labor market behavior are examined within a framework that recognizes the multidimensionality and dynamics of human capital accumulation over the life course (Strauss and Thomas, 1988, 2008; Heckman, 2006). Given early childhood production functions for multiple types of human capital, parental choices concerning nutrition and other investments interact with environmental factors and child-specific endowments to establish early levels of human capital. These parental choices reflect not only the prices and opportunity costs of differing investments, but also family background characteristics such as available resources and attitudes towards health and human capital. If different markers of human capital share common inputs, correlations between cognitive and physical development naturally arise at a young age due to parental choices geared toward maximizing their own expected future utility, that of the child and possibly the entire family.

As the individual transitions through adolescence, human capital development and skill acquisition continues through choices regarding investments in schooling and skill development along with early labor market experiences. Facing a labor market with multiple sectors and occupations with varying uncertain returns, the decision to remain in school, for example, will be a reflection of liquidity constraints, expectations and the opportunity cost of forgone work, all of which depend on both the individual's choices and parental investments over the life course.

Similarly, earnings in differing occupations and sectors may offer specific returns to different dimensions of human capital which may vary over the short and longer term. As individuals choose to sort across formal wage work and informal self-employment, for example, their comparative advantage is a reflection not only of human capital at that point in time, but of the human capital accumulation process throughout the life course. Individuals may continue to make health and cognitive investments as they age, with opportunities for further development dependent in part on their chosen sectors and occupations.

Thinking in this framework of a life-course production process for multiple dimensions of human capital illuminates several key relationships explored in this research. The well established correlation between height and labor market productivity could be due to a number of simultaneously determined factors. Attained height as an adult reflects one's early life health, disease and nutrition environments, and likely also captures other early life investments as well as family background characteristics including tastes for human capital of the next generation and both financial

and non-financial resources. Similarly, shared inputs into the height, cognitive, and other human capital production functions may drive a relationship between physical and intellectual capacity. Finally, as the value of different traits may vary over time and differ depending on the sector and nature of work chosen by an individual, so too may the links between height, earnings, and additional human capital markers.

To empirically examine these relationships in the labor market, we exploit rich, longitudinal data on sectoral and occupational choice, and formal and informal earnings of males and their siblings in combination with high quality measures of a wide array of human capital markers.

3. The Work and Iron Status Evaluation

WISE, a large-scale longitudinal study conducted in Central Java, Indonesia designed to collect detailed information on human capital and labor market outcomes, is ideally suited to investigate the relationship between height, cognition, education, health, and labor market outcomes within a population. After a listing survey in late 2001, a population-representative sample of households living in Purworejo *kabupaten* was interviewed every four months beginning in 2002 and continuing through 2005. Longer-term follow-ups were conducted five and seven years after the start of the survey in 2007 and 2009. All twelve waves of the survey are included in this study.

The study area covers over 1800 km² in Central Java and almost 80% of the population of one million lives in rural areas, the vast majority of whom rely on agriculture for their living. Rice is the dominant crop. It is a relatively low income area. According to the 2006 SUSENAS, median household per capita expenditure in Indonesia was Rp 900,000 per month and Rp 580,000 in the study area. Part, but only part of this gap can be attributed to the fact that the study area is largely rural; focusing only on rural areas, median PCE is Rp 550,000 in the study area and Rp 770,000 in all rural areas of Indonesia.

As the analysis relies on following individuals over time, it is imperative that selective attrition does not contaminate inferences. Attrition is extremely low in WISE: 94% of households from the 2002 baseline were re-interviewed seven years later in the 2009 wave (see Thomas et al., 2015; for a more extensive discussion of tracking and attrition). We focus on 5304 men between the ages of 25 and 65 who reported any earnings during the survey period; there are over 38,000 person-wave observations in our panel sample.²

3.1. Hourly earnings

Labor market outcomes are measured with great care in WISE. Each household member age 15 and older is individually interviewed to obtain detailed information on work status, employer and occupation, tenure, nature of work (tasks), and earnings in each job. Hourly earnings from wage work are

² 7% of 25–65 year old men report they did not earn income during the study period and are not included in these analyses. As shown in column 1 of the Appendix A, these men are more likely to have difficulty running a kilometer, perform worse on two cognitive assessments and are lower weight than those who do report earnings in the survey. Conditional on all of these characteristics, the excluded men are very slightly better educated than those included in the analyses. There are no differences in the heights of those who do and do not report earnings in WISE. The analytical sample includes all person-wave observations in which a respondent earned any income. Restricting analyses to the balanced panel of males whose earnings are positive in every wave reduces the sample by 6% and does not affect the substance of our results or our inferences. Because this restriction raises the possibility of selectivity of the sample, we report results for all males who have earnings in any survey wave.

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