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Estimating male and female height inequality

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ABSTRACT

This study investigates the coefficient of variation (CV) of height of males and females as a measure of inequality. We have collected a data set on corresponding male and female height CVs from 124 populations, spanning the period between the 1840s and 1980s. The results suggest that the R^2 between the two CVs is 0.39, with the male CV being greater, indicating higher plasticity.

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1. Introduction

In recent years, an increasing body of anthropometric literature has emerged using the coefficient of variation (henceforth 'CV') as an indicator of socioeconomic inequality in cases where conventional inequality measures are unavailable (Blum and Baten, 2011; Osmani and Sen, 2003). In this study, the author aims investigates the relationship between male and female height CVs and tests for systematic influences on this relationship.

To accomplish this task, corresponding male and female height CVs from 124 populations, spanning the period between the 1840s and the 1980s, are analyzed. A set of regression models is used to test for world region-specific influences, the impact of changes in nutritional standards, and the relative status of males and females on this relationship. The empirical evidence indicates that the relationship between male and female height inequality is statistically significant with a R^2 of 0.39.

2. Methodology and advantages of height inequality measures

Distribution of height is used as an approximate determinant of inequality in the case where monetary measurements do not exist; it is also used to obtain an alternative, biological view of income inequality. Anthropometricians use stature as an alternative measure of inequality, as this measure complements conventional inequality indicators nicely and, in some respects, constitutes perhaps an even better indicator (Bassino, 2006; Blum and Baten, 2011; Komlos, 2007; Komlos and Meermann, 2007; Steckel, 1995).[1]

Final (adult) average height and height inequality reflect a birth cohort's net nutritional intake during childhood and youth; hence, it is a primary indicator of the nutritional and health statuses of a population. Average values give a clear illustration of well-being, while inequality measures highlight differences in living standards. Anthropometric indicators reflect not only

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[1] In a recent study, Etile (2013) uses an alternative anthropometric concept to assess socioeconomic inequality: BMI inequality is used as a target variable to evaluate the effectiveness of education policies in reducing overall health inequalities in France between 1981 and 2003.

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monetary income, but also unofficial income, e.g. from subsistence farming and black markets. Conventional income data from earlier time periods and from developing countries are often weak in quality and low in availability – two reasons for the popularity of anthropometric data among economic historians and development economists (Baten and Blum, 2013; Blum and Baten, 2011; Komlos, 1985; Komlos and Baten, 2004; Steckel, 1995).

How does socioeconomic inequality affect height inequality? If the distribution of resources that shape height distributions, such as food and medical goods, becomes unequal, heights are expected to follow suit. While a correlation between income inequality and height inequality does exist, this correlation is not perfect, since some important inputs to biological living standards are not traded on markets. Public health measures, for example, are often financed by public funds or statutory insurance (Sen, 2000, 2002). Food supplements for schoolchildren may improve nutrition without burdening family budgets (Blum and Baten, 2011; Moradi and Baten, 2005). In addition, height inequality reflects transfers within households. If the sole income earner of a family transfers money to relatives, only his income is included in official statistics – any utility benefitting family members is not taken into account.[2]

Deaton (2001) and Pradhan et al. (2003) have argued convincingly that measures of health inequality are important in their own right, not only in relation to income. Height inequality captures important biological aspects of inequality and may lead to new insights while serving as a countercheck for conventional indicators.

Scholars using height inequality tend to prefer the coefficient of variation (CV) over standard deviation (SD) values, since anthropologists argue that the biological variance increases with average height. The CV takes this effect into account and is therefore a more consistent and robust estimate of inequality (Blum and Baten, 2011; Schmitt and Harrison, 1988). The standard deviation σ is expressed as a percentage of the mean μ.[3] For a country i and a birth decade t, the CV is defined as:

$$CV_{it} = \frac{\sigma_{it}}{\mu_{it}} \times 100$$

3. A selective literature review of studies using height inequality

There are several ways to utilize height inequality in research on socioeconomic inequality. This section reviews the body of literature which uses CV as a measure of inequality in stature as a measure of socioeconomic inequality.[4] Two pioneer studies on anthropometric inequality use an almost complete compilation of height data from Bavarian conscripts during the 18th and 19th centuries (Baten, 1999, 2000). Baten demonstrates that height is distributed normally around an arithmetic mean and can therefore be used in empirical analyses, often without any transformation. Similarly, Quiroga and Coll (2000) investigate Spanish height inequality and conclude that changes in the differences of heights could indicate, among other factors, shifts in income inequality. Moradi and Baten (2005) study the relationship between conventional and anthropometric measures of inequality. They show empirically that both inequality measures are related, taking into account the fact that inequality in height is influenced by factors other than monetary income inequality. Access to public goods, existence and extent of subsistence economy, and shadow markets all contribute to the determination of the final height distribution. In a similar vein, Blum and Baten (2011) find a correlation between height inequality and the corresponding wage premia of skilled construction workers compared to their unskilled peers. This indicates that inequality in monetary wealth has an impact on anthropometric inequality. Stolz and Baten (2012) adopt this methodology and use height inequality as a basis to explain the human capital selectivity of migrants in a sample of 52 source and five destination countries. Van Zanden et al. (in press) use height inequality observations to estimate inequality on a global scale during the 19th and 20th centuries relying upon historical data on average height and the corresponding height distribution. Similarly, Guntupalli and Baten (2006) use the coefficient of variation of height to trace inequality developments in India between 1915 and 1944. Meisel and Vega (2007) investigate average height and height inequality in Colombia using information on individual height taken from identification cards. Their findings suggest that Colombian stature increased continuously between the 1900s and 1980s and height inequality, measured by the coefficient of height variation, declined. Moreover, these authors also find decreasing height gaps between men and women between the 1900s and 1950s, but the opposite between the 1960s and 1980s, indicating that until the 1950s female height had grown over proportionally while in the post-1950s male average height benefitted over proportionally from increases in biological living standards. Bassino (2006) finds that in Japan, inequality in income and access to health services can explain differences in stature across the 47 Japanese prefectures during 1892–1941. The variation in income contributed to changes in height during the 1930s. Japan experienced a regional convergence in terms of stature before 1914, and a divergence during the interwar period. For the US case, Godoy et al. (2005) use survey data from

[2] Genetics and biology are considered the most important influencing factors shaping final height distribution. Therefore, even small differences between height distributions may express significant inequality tendencies. In practice, since the biological variance continues to contribute a large share to the total variance, most height distributions are normally distributed or very close to normal, but with a much higher standard deviation than the rather theoretical situation of perfect income equality.

[3] In contrast to conventional applications of the coefficient of variations, CV in the field of anthropometric history is usually multiplied by 100.

[4] See Blum and Baten (2011) who provide a manual on how to distinguish several forms of within-country inequality as well as a guide on how to take into account several forms of bias. They conclude that the estimation of height inequality is a complex process since, in reality, several of the aforementioned issues occur at the same time.

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