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The influence of inequality on the standard of living: Worldwide anthropometric evidence from the 19th and 20th centuries

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ABSTRACT

We provide empirical evidence on the existence of the Pigou–Dalton principle. The latter indicates that aggregate welfare is – ceteris paribus – maximized when incomes of all individuals are equalized (and therefore marginal utility from income is as well). Using anthropometric panel data on 101 countries during the 19th and 20th centuries, we determine that there is a systematic negative and concave relationship between height inequality and average height. The robustness of this relationship is tested by means of several robustness checks, including two instrument variable regressions. These findings help to elucidate the impact of economic inequality on welfare.

1. Introduction

In 1920, Hugh Dalton, a British Labor-party politician and economist, argued that in a given population the marginal product of income is lower among the rich than among the poor for the simple reason that the rich have already reached a higher standard of living than the poor (Dalton, 1920).[1] It follows that in a static and theoretical world, aggregate welfare is – ceteris paribus – maximized when incomes of all individuals are equalized (and therefore marginal utility from income is as well) – a mechanism known as the *Pigou–Dalton principle*.[2,3] The latter implies that redistribution from rich to poor strata can increase aggregate welfare because the gain among the poor outweighs the loss among the rich.[4] In the current era of global economic inequality, the

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[1] The terms "rich" and "poor" are relative to the mean and do not refer to those at the extreme ends of the income/height distribution.

[2] This idea is based on the assumption that all consumers are characterized by the same preferences/utility. However, it differs significantly from conventional utility approaches in one important respect. Using height as a measure of utility means that 'utility' is associated with the physiological needs of the human body, rather than with classic consumption preferences. With human physiology/biology as a reference, needs/requirements (for growth) are probably quite similar among individuals, whereas general consumption patterns are not; it follows that biological requirements are as well: not the case when it comes to many utility-based approaches. Thus, while the use of height as a measure of utility means a simplification of reality, the simplification is not inappropriate.

[3] For the sake of completeness: Dalton (1920) uses the term "marginal utility", not "marginal returns to income". In addition, this theoretical mechanism holds only on the assumption that the order of ranking is not changed on account of redistribution.

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Pigou–Dalton principle offers valuable insights into the determinants of a nation's welfare.

There is a long tradition of research into this relationship between inequality and welfare. Preston (2007), for instance, found that among poor countries increases in purchasing power are positively correlated with significant improvements in health, whereas among wealthy countries this effect is found to be weak, if it exists at all, because – on account of diminishing returns to income – they require a larger income increase than do poor countries in order to achieve the equivalent health increase. Preston hypothesizes that if this mechanism operates within a single country, redistribution from rich to poor social strata can increase average health.

Sawyer and Wasserman (1976) offer a similar argument, having found among OECD countries a strong negative correlation between life expectancy and the Gini values of income there. Wilkinson (1992) shows a positive relation among several developed countries between the income received by the poorest 50% of the population and life expectancy and concludes that the lower half of the income distribution is the most sensitive to income inequality. Similarly, Leigh and Jencks (2007) find a weak positive impact of the top 10% income share on infant mortality and negative one on life expectancy.

In defiance of the evidence that has been gleaned from decades of research in this field, (Deaton, 2003, 151) concludes that income inequality itself is not a major determinant of population health, contending that nobody has yet provided a robust correlation. The aim of the present study is to fill this need, by providing evidence that income inequality is in fact negatively correlated with average welfare. In this paper, unlike the studies mentioned above, anthropometric measures, namely adult male height and the coefficient of height variation (henceforth 'CV'), are used as indicators of well-being and economic inequality, respectively. This methodology offers several advantages, in that, thanks chiefly to its outcome-oriented character, it combines several sources of income and does not only rely on inequality of purchasing power.[5] In similar analyses, Steckel (1995) and Carson (2009) take advantage of this feature by using height as the dependent variable. Unfortunately, their main explanatory variable is not measured in the same way, but as a Gini coefficient of income. In contrast, our data set provides corresponding values for average height and height inequality of males over the course of the 19th and 20th centuries. This correspondence enables us to use those two yardsticks in a complementary manner.

We argue that inequality has a significant influence on the standard of living: more specifically, that the negative influence of inequality has existed throughout the past two centuries; that in the late 19th century this influence diminished for a short period; and that it not only recovered but in fact increased over the course of the second half of the 20th century.

The paper is structured as follows: In Section 2 the applied methods and the data are introduced. In Section 3 the empirical analysis is described, and in Section 4 the results are presented and discussed. In Section 5 we address potential biases by applying two instrument variable regressions and perform a number of robustness checks, in Section 5 we offer our conclusions.

2. Methodology and data

2.1. Methodology

The measure applied in this study is the *biological standard of living* (respectively its distribution as a measure of inequality), which combines several sources of income on account of its output-oriented character and allows countering problems related to conventional (monetary) income measures. The usual source of conventional monetary welfare measures such as real wages and GDP per capita are normally based on official statistics, whereas sectors of the economy not reflected in such returns are required as well if one is to paint a comprehensive picture of the society. Measures based upon purchasing power only capture one important source of income. In contrast, anthropometric ones include public goods such as public health care or education, income from moonlighting, subsistence farming, and intra-family transfers as well.

Existing income inequality data sets combine a scattering of information rather than comparable estimations and measurements. Therefore, a number of studies in the fields of development economics and economic history rely on height measures (Van Zanden et al., 2012).[6] If data are available, the issues of selection bias and measurement error often arise since reliable conventional data tend to be limited to urban areas, taxpayers (often urbanites), and regions equipped with a well-developed regulatory structure. Income statistics are problematic in socialist and ex-socialist countries, since there the income distribution is distorted by the central planning system (Komlos and Kriwy, 2003; Pak, 2004; Schwekendiek and Pak, 2009).

Average height and height inequality are useful measures in that genetic height potentials are partly determined by environmental conditions. Silventoinen (2003) estimates that approximately 20% of stature changes can be attributed to environmental changes, and estimates that nutrition and diseases – factors correlated with the family's socio-economic status – are the most important (non-genetic) determinants. Because at the national level the remaining 80% of each individual's genetically determined height potential is canceled out, it is safe to consider the remaining 20% a reflection of socio-economic factors. In theory, if all factors influencing height inequality, such as nutrition and health care, were

[4] Aggregate welfare is defined as the sum of individual welfare.

[5] On this account, when the term "income" is applied, the authors refer to several sources – monetary and non-monetary – of income.

[6] Van Zanden et al. (2012) report that in the face of insufficient data some scholars apply post-1914 or even post-1945 inequality data to draw conclusions regarding inequality developments during the 19th century. For the entire continent of Asia, the aforementioned authors use only four observations: two for Indonesia, one for Japan, and one for China.