Title: Measuring the “American Dream”

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**Abstract**/**One Sentence Summary:** Canonical measures of economic intergenerational mobility are mutually inconsistent and may be misleading.

**Main Text:** The “growing public perception that intergenerational income mobility […] is declining in the United States” *(1)* has led scholars to seek quantifiable measures of it. Typically such measures are divided into two categories, relative and absolute: relative measures gauge children’s propensity to occupy a higher position in the income distribution than their parents; absolute measures gauge their propensity to have a higher income than their parents in money terms. A hypothetical economy in which all children have exactly twice the real incomes of their parents would exhibit minimal relative mobility and maximal absolute mobility. Therefore, the precise definitions of quoted mobility measures are important. The canonical measures in each category yield different and contradictory interpretations of ostensibly the same concept. This may mislead the unaware.

While relative intergenerational mobility has been studied for decades, investigations of absolute intergenerational mobility remain “scarce, mainly because of the lack of large, high-quality panel data sets linking children to their parents” *(2)*. Recently in *Science*, Chetty *et al*. *(2)* considered trends in absolute mobility in income in the United States since 1940. They define the rate of absolute mobility as the fraction of children earning more than their parents, denoted by *A*. Their analysis uses census and survey data of inflation-adjusted pre-tax income at age 30. Figure 1A illustrates the historical trend of the rate of absolute mobility, showing it falling from around 90% for children born in 1940 to 50% for children born in 1980.

The canonical measure of relative intergenerational mobility is the elasticity of child income with respect to parent income, known as the intergenerational earnings elasticity (IGE) and denoted by *β* *(3,4)*. IGE is a measure of immobility rather than of mobility: the larger it is, the stronger the relationship between parent and child income. Therefore, *1-β* is often used as a measure of mobility. Unlike the trend in absolute mobility, empirical studies of IGE and other relative mobility measures in the United States show them holding stable over the past several decades *(1,2,4,5)*.

The seemingly contradictory co-observations of declining absolute mobility and stable relative mobility require careful interpretation. We point out a simple theoretical relationship between the two, often overlooked, which is consistent with the empirical data.

Income distributions are known to be well approximated by the log-normal distribution *(6)*. Therefore, a simple plausible model for the joint distribution of parent and child log-incomes is the bivariate normal distribution, in which both marginal income distributions for parents and children are log-normal. The correlation between parent and child incomes is characterized by a single parameter. Fig. 1A shows that approximating the joint distribution of log-incomes as bivariate normal, with constant correlation, reproduces faithfully the evolution of absolute mobility reported by Chetty *et al*. *(2)*, without the detailed data analysis.

Having established its empirical soundness, this simple model’s properties can be studied theoretically. Both measures of mobility, *A* and *1-β*, can be derived from the model and, notably, expressed analytically as functions of the other. Fig. 1B shows *A* as a function of *1-β* for different birth cohorts in the United States. It shows that, *ceteris paribus*, relative mobility increases as absolute mobility decreases.

This seemingly counter-intuitive finding results from a fundamental conceptual difference between the definitions of relative and absolute mobility measures. It exposes the problems that can arise if both are treated as measuring similarly the same phenomenon. In particular, trends in absolute mobility can be confounded by across-the-board economic growth. For example, during the middle ages – when relative mobility rates were low because social class and profession were largely inherited *(7,8)* – even the slightest positive or negative income growth would result in very high or low absolute mobility. Thus, mobility measures may paint a misleading picture of intergenerational mobility if not understood and interpreted correctly.

Empirically addressing concepts like the “American Dream”, inclusive growth, and equality of opportunity requires a deep understanding of the subtleties noted above to prevent misinterpretation.

**References and Notes:**

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**Fig. 1**. Absolute mobility declines as relative mobility increases. **A**) A bivariate normal distribution reproduces the historical trend of the rate of absolute mobility (calculations are based on the pretax income per capita and pretax income inequality reported in *(9,10)*); **B**) The theoretical relationship between the rate of absolute mobility and the complement of the intergenerational earnings elasticity, assuming the bivariate normal approximation for the log-incomes. This produces a seemingly counter-intuitive result – the two types of mobility are inversely related, considering different birth cohorts in the United States.