

Commentary on Clark, Gregory, *A Farewell to Alms: A Brief Economic History of the World* (Princeton, 2007)

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This memo provides some background to my “Genetically Capitalist?” (in *Science*, **318**, 19 October, 2007) which is a review of Clark (2007). Clark's thesis is that the industrial revolution occurred when and where it did (England, late 18th century) because from 1250 on wealthy Englishmen passed their distinctive values of diligence, patience, and prudence on to their children who were more numerous and became wealthier than the children of other families (who lacked these values), the result being a gradual spread of these values in the population, eventually accounting for England's take off. The following data and reasoning amplify points made in the review and suggest some empirical shortcomings of the thesis.

1. *The fitness advantage of rich commoners in early modern England was far from unique.* Indeed the rich tend to parent more surviving children than the rest in most pre-industrial societies for which we have data. Clark notes (p. 132) that this was true for villages in Austria and Southern Germany. Further sources, in addition to a personal communication from Maristella Botticini on 15th century Tuscany, are the following:

Low, Bobbi. 1991. "Reproductive Life in Nineteenth Century Sweden: An Evolutionary Perspective on Demographic Phenomena." *Ethology and Sociobiology*, **12**, pp. 411-48.

Klindworth, Heike and Eckart Voland. 1995. "How did the Krumhorn Elite Males Achieve Above Average Reproductive Success." *Human Nature*, **6**:3, pp. 221-40.

Hadeishi, Hajimi. 2003. "Economic Well-Being and Fertility in France: Nuits 1744-1792." *The Journal of Economic History*, **62**:2, pp. 489-505.

Borgerhoff Mulder, Monique. 1986. "On cultural and reproductive success: Kipsigis evidence." *American Anthropologist*, **89**, pp. 617-34.

2. *Nor was the transmission of wealth across generations uniquely English.* Evidence for this is from the as yet unpublished work of an ongoing Santa Fe Institute research group on the intergenerational transmission of wealth in pre-modern societies (which I jointly direct

with Monique Borgerhof Mulder). The transmission of wealth across the generations documented by Clark is matched or exceeded by the intergenerational transmission of cattle among the Kipsigis (a contemporary pastoral population in Kenya) or of land in 18th century Sweden or 19th century Germany.

3. *Some personality traits contribute to economic success, but the effects are modest.* A number of recent studies of the determinants of earnings have stressed the importance of “behavioral” or personality traits relative to cognitive performance or measures of skill (see below). Groves' careful research found correlations between a measure of fatalism (the Rotter Score) and the natural logarithm of earnings of about 0.2, implying that this personality measure statistically explains about four percent of the variance of ln earnings. Other studies (e.g. Jencks 1979) suggest that personality measures (even in combination) are unlikely to explain more than 4 percent of the variance of earnings. These correlations overstate the causal effects of variations in personality because personality traits that contribute to high earnings are correlated with other individual characteristics that contribute to high earnings. Recent research (mostly using U.S. data) has done little to revise a conclusion based on Jencks (1979). In that study (p.129), the average of the seven statistically significant normalized regression coefficients for personality measures (each estimated singly) predicting occupational status achievement when family background is controlled was 0.09, meaning that a standard deviation difference in these personality measures was associated on average with a 9 per cent difference in occupational status. The coefficient of “impulsiveness” – the measure closest to the values Clark identifies – was a third of this average and not statistically significantly different from zero. When predicting hourly earnings (p.347) the mean is 0.12 (with impulsiveness again not significant). Of course, what it took to get ahead in thirteenth century England must have differed from contemporary conditions and none of the personality measures really capture the values that Clark stresses, but there is no reason to think that such values as prudence, patience, and diligence would have been radically more important than the traits studied.

Bowles, Samuel, Herbert Gintis, and Melissa Osborne. 2001. "The Determinants of Earnings: A Behavioral Approach." *Journal of Economic Literature*, XXXIX(December), pp. 1137-76.

Groves, Melissa Osborne. 2005. "Personality and the Intergenerational Transmission of Economic Status," in *Unequal Chances: Family Background and Economic Success*. Samuel Bowles, Herbert Gintis and Melissa Osborne Groves eds. Princeton: Princeton University Press, pp. 208-31.

Heckman, James, J. Stixrud, and S Urzua. 2006. "The effects of cognitive and non cognitive abilities on labor market outcomes and social behavior." *Journal of Labor*

Economics, **24**:3, pp. 411-82.

Jencks, Christopher. 1979. *Who Gets Ahead?* New York: Basic Books.

4. *Genetic similarity of parents and offspring accounts for some inter-generational transmission of behavior or personality.* Evidence is based on correlations between birth parent's and adopted-away offspring's personality measures, correlations between measures for the children of one monozygotic twin and the other twin's offspring, and comparisons of the correlation of traits in monozygotic and dizygotic twins (Loehlin, 2005). There are drawbacks to each method, but all indicate at least a modest degree of genetic heritability of at least some traits. However the widely cited studies of twins may overstate heritability. Heritability estimates based on the fact that monozygotic twins (MZ) are more similar than dizygotic twins (DZ) rely on the assumption that the environments experienced by DZ twins are as similar as the environments of MZ twins (See Bowles and Gintis, 2002, technical appendix). Moreover, the aspects of personality under consideration are unlikely to be the expression of a single gene, but rather of configurations of genes among which effects are likely to be non-additive due to dominance and epistasis. As a result, heritability estimates based on MZ twins (whose similarity will reflect these non-additive effects) will overstate the genetic resemblance across generations (because the contribution of genes from both parents tends to break up the gene configurations that plausibly heighten MZ twin similarity.) These may be among the reasons why studies using MZ twins give considerably higher estimates of heritability (h^2) than other methods. For example, three twin-based estimates of h^2 for the "big five" personality trait called "conscientiousness" are more than twice the upper bound estimates based on parent offspring similarity (that is, assuming that genetic effects alone account for the parent offspring similarity (Loehlin, 2005, p.205).)

Bowles, Samuel and Herbert Gintis. 2002. "The Inheritance of Inequality." *Journal of Economic Perspectives*, **16**:3, pp. 3-30.

Feldman, Marcus W., Sarah P. Otto, and Freddy B. Christiansen. 2000. "Genes, Culture, and Inequality," in *Meritocracy and Economic Inequality*. Kenneth Arrow and Samuel Bowles and Steven Durlauf ed: Princeton University Press, pp. 61-85.

Loehlin, John. 2005. "Resemblance in Personality and Attitudes Between Parents and their Children: Genetic and Environmental Contributions," in *Unequal Chances: Family Background and Economic Success*. Samuel Bowles, Herbert Gintis and Melissa Osborne Groves eds. Princeton: Princeton University Press, pp. 192-207.

Wallace, Bjorn, David Cesarini, Paul Lichtenstein, and Magnus Johannsson. 2007.

"Heritability of Ultimatum Game Responder Behavior." *Proc. Natl. Acad. Sci. USA*, **104**.

Jang, Kerry, John Livesley, and Philip Vernon. 1996. "Heritability of the Big Five Personality Dimensions and their Facets: A Twin Study." *The Journal of Personality*, **64**:3, pp. 577-91.

5. *If parent-child personality similarity is due entirely to parent child transmission – whether genetic or cultural – it will dissipate rapidly, accounting for a very modest correlation of traits over 4 or more generations.* Clark's argument concerns fathers and sons. We assume that mating assortment can be ignored, given the evidence Clark offers for "great social mobility and fluidity... in medieval England" (p. 161). Let the intergenerational correlation of a trait be r . Then if genes are not involved and the only direct influence of vertical cultural transmission on sons is by fathers (not grandfathers, etc.), the correlation across n generations is r^{n-1} . So a personality trait with a parent-offspring (i.e. two generations) correlation of 0.13 (the mean in Loehlin's 2005 study mentioned above) implies a grandfather-grandson correlation of $(0.13)^2 = 0.017$. If a genetically transmitted trait has additive heritability of h^2 then the father son correlation is $h^2/2$. Thus if Loehlin's mean intergenerational personality correlation were explained entirely by genetic transmission, the implied $h^2 = 0.26$. The correlation across n generations is $h^2/2^{n-1}$. So if $h^2 = 0.26$ the correlation across 4 generations (great grandfather-great grandson) is 0.032. If we estimate h^2 from the observed intergenerational correlation of traits (r) as above, then the correlation of a genetically transmitted trait across n generations is just $r/2^{n-2}$. Thus the statistical association across generations becomes vanishingly small over the course of a single century, whether the trait is culturally or genetically transmitted. Extending this analysis to take account of plausible levels of mating assortment would somewhat increase persistence across generations, but not alter the conclusion. See the technical appendix to Bowles and Gintis (2002) above.

6. *Acknowledgments.* This commentary, and the review of Clark (2007) mentioned above has benefitted from the comments of Robert Allen, Robert Brenner, David Cesarini, Gregory Clark, Oded Galor, Herbert Gintis, Kenneth Pomeranz, Paul Seabright and Elisabeth Wood. Thanks to the Behavioral Sciences Program at the Santa Fe Institute and the University of Siena and the Italian Ministry of Education for support