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Intergenerational Wealth Transmission and Inequality in Premodern Societies

Intergenerational Wealth Transmission among Agriculturalists

Foundations of Agrarian Inequality

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CA+ Online-Only Supplement: Estimating the Inheritance of Wealth in Premodern Societies

This paper uses data from eight past and present societies practicing intensive agriculture to measure the transmission of wealth across generations in preindustrial agricultural societies. Focusing on embodied, material, and relational forms of wealth, we compare levels of wealth between parents and children to estimate how effectively wealth is transmitted from one generation to the next and how inequality in one generation impacts inequality in the next generation. We find that material wealth is by far the most important, unequally distributed, and highly transmitted form of wealth in these societies, while embodied and relational forms of wealth show much weaker importance and transmission. We conclude that the unique characteristics of material wealth, and especially wealth in land, are key to the high and persistent levels of inequality seen in societies practicing intensive agriculture. We explore the implications of our findings for the evolution of inequality in the course of human history and suggest that it is the intensification of agriculture and the accompanying transformation of land into a form of heritable wealth that may allow for the social complexity long associated with agricultural societies.

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Intergenerational Wealth Transmission among Agriculturalists

This article uses data from several past and present populations from Africa, Asia, and Europe to explore wealth transmission in societies practicing intensive agriculture. We begin by defining the production system of intensive agriculture, the forms of wealth most important in such societies, and the important components of agricultural societies as they relate to social inequality and the transmission of wealth between generations. We follow with a discussion of the ethnographic background of the eight societies in our sample and the different types of wealth analyzed for each. After presenting quantitative results on the extent and form of intergenerational transmission for each society and type of wealth, we conclude with a summary of our results and discussion of their importance for understanding key themes of social structure and inheritance in agricultural societies.

Agricultural Production Systems

We classify agricultural production systems as those that cultivate crops using technologies such as plows and traction animals and that are characterized by land-limited cultivation systems, and in some cases by markets for land and agricultural labor. Intensive agriculture is characterized by the cultivation of plants using technologies that supplement human labor; these technologies allow for more yield per acre as well as larger fields of crops (e.g., Boserup 1965; Scarborough 2003; Wittfogel 1957). In the literature on Eurasia, the most well-known and widely discussed technologies include various forms of irrigation and the use of plows pulled by large domesticated animals (Barker 2006; Scarborough 2003; Wittfogel 1957). However, many other forms of intensive agriculture have been in widespread use including raised fields, terracing, reservoirs, chinampas (stationary floating islands of arable land constructed on shallow lake beds), and various types of organic fertilizers including manure, charcoal, bone, and shell (e.g., Erickson 2008; Rostain 2008; Scarborough 2003; Wenke 1984).

Although the domestication of crops began around 12,000 years ago, the first farmers used only human labor and hand tools in a subsistence pattern that many anthropologists refer to as horticulture (Barker 2006; Bellwood 2005; see Gurven et al. 2010, in this issue). It would take thousands more years before there was evidence for the practice of intensive agriculture in highly populated river valleys in Mesopotamia (4100 BCE), Egypt (4000 BCE), China (2400 BCE), and South Asia (2400 BCE), contemporaneous with the rise of early complex societies in those regions (Barker 2006; Bellwood 2005; Feinman and Price 2001; Scarborough 2003). Intensive agriculture also developed independently in Mesoamerica beginning around 2000 BCE and in Andean South America around 1300 BCE (Billman 2002; Denevan 2001; Moseley 2001; Scarborough 2003).

The initial development of agriculture gave rise to farming societies characterized by sedentary people, villages with permanent structures, and food storage (e.g., Barker 2006; Bellwood 2005; Wenke 1984). Despite higher rates of communicable diseases, agricultural populations typically had higher fertility and faster population growth rates, a trend sometimes referred to as the Neolithic demographic transition (e.g., Bocquet-Appel and Bar-Yosef 2008; Caldwell et al. 2006; McKeown 1988; McMichael 2001). The very early farming societies are often thought to have been relatively egalitarian or to have only limited hierarchies and primarily local forms of political integration; evidence for this has come primarily from the archaeological literature (e.g., Barker 2006; Hayden 2001) or has emphasized ethnographic data from traditional societies (e.g., Johnson and Earle 2000; Service 1962).

The development of intensive agriculture is historically associated with the rise of complex societies, including complex chiefdoms and states (Boserup 1965; Fried 1967; Hayden 2001; Johnson and Earle 2000; Service 1975; Stein 2001; Wenke 1984). Complex societies are characterized by social stratification (economic and social differentiation among people) as well as political integration of communities resulting in multiple levels of sociopolitical hierarchy (Johnson and Earle 2000). They are also characterized by complex divisions of labor, including a rise in full-time occupational specializations such as artisans, merchants, religious specialists, bureaucrats, tax collectors, and soldiers, often concentrated in urban areas (e.g., Fried 1967; Johnson and Earle 2000; Service 1975; Stein 2001) and with greater concentrations of people, including the formation of the first towns and cities (Boserup 1965; Carneiro 1970; Johnson and Earle 2000; Stein 2001; Wenke 1984). Despite these developments, however, the majority of people in such cultures may continue to live in rural areas and/or work in agriculture (Boserup 1965; Johnson and Earle 2000; Scarborough 2003; Wolf 1966). All populations studied in this paper are a part of modern or historical state societies, though some exist on the rural margins of the state while others exist closer to urban centers.

Wealth and Inequality in Agricultural Societies

Material, embodied, and relational wealth. As discussed in the introductory paper in this special section, in order to capture important aspects of wealth in very different types of societies our project defines wealth in a very general sense as any attribute of individuals that contributes to their long-term well-being. We distinguish three categories of wealth. *Material wealth* refers to animals, objects, or spaces in the physical world over which individuals have ownership or use rights. *Embodied wealth* refers to attributes contained in the bodies of individuals, including somatic attributes such as strength and immune function as well as mental attributes such as knowledge and skills (see Kaplan 1996 for a more general treatment of the concept of "embodied capital"). *Relational wealth* resides in the social connections and relationships be-

tween individuals through which they are able to gain access to information or flows of resources.

In most traditional agricultural societies, land is a—if not the—primary form of material wealth. Agricultural societies usually recognize property rights in land held by a kin group or an individual (Boserup 1965; Goody 1976; Harrell 1997). Land has two peculiar characteristics that influence its importance: arable land is finite, and if divided into small enough parcels it may no longer be enough to support a family. In contrast to horticulturalists, agricultural societies are characterized as being land limited rather than labor limited (e.g., Goody 1976; Harrell 1997; Johnson and Earle 2000). Population growth can result in all of the arable land in an area being owned and under cultivation (Beise and Voland 2008; Boserup 1965; Johnson and Earle 2000; Low 1990; Voland and Dunbar 1995). Truly land-unlimited agricultural populations may occur only during the expansion of agriculturalists into a frontier area (e.g., American pioneers) and are thus temporary situations. Intensive agriculturalists also possess other important material wealth currencies. Farmers may have significant wealth in livestock, a more movable form of subsistence-related wealth than land that is often subject to less complex inheritance dynamics (Goody 1976; Goody, Thirsk, and Thompson 1976). Stored grain can serve both as a subsistence staple and as a form of currency for paying rent on land or other kinds of debts (Feinman and Price 2001). Durable goods such as plows, carts, tools, furniture, cooking vessels, jewelry, and clothing can be important forms of wealth that often can be divided among multiple heirs (Goody 1976). Finally, it is in intensive agricultural societies that money first becomes a common form of wealth, often associated with commerce in urban areas but also penetrating into rural areas where trade may sometimes take place in cash rather than in kind (Boserup 1965; Johnson and Earle 2000; Wolf 1966).

As in other types of societies, kin ties remain an important source of social support and relational wealth (Harrell 1997; Johnson and Earle 2000). Preindustrial agricultural societies are overwhelmingly patrilineal (see table 1), though relatives through the female line are usually acknowledged and may be important sources of political alliances and marriage partners (Ember and Ember 1983; Goody and Tambiah 1973; Harrell 1997). Bilateral societies are not uncommon, but true matrilineality is rare in agricultural societies, and the examples that do exist are mostly small in scale (Ember and Ember 1983; Harrell 1997).

In preindustrial agricultural societies, embodied wealth in health, longevity, and knowledge usually covary with, and may often be the result of, class structure and differences in material wealth (e.g., Caldwell et al. 2006; Clark and Hamilton 2006; Lee 1973; Milanovic, Lindert, and Williamson 2007; Scott and Duncan 2002). The same is also true for the number and survival of children, the form of embodied wealth that has received the most attention in the literature. For agricultural laborers, peasants, and other types of workers—usually comprising the largest portion of the population—a large number of children is often considered ideal as it increases the labor pool available to a family, provides insurance to parents in old age and siblings in case of disability, and accounts for the likely loss of children due to high rates of mortality (Caldwell et al. 2006; Harrell 1997; Wolf 1966). While child mortality is often lower among wealthier people (Clark and Hamilton 2006; Milanovic, Lindert, and Williamson 2007; Scott and Duncan 2002), for propertied classes in agricultural societies, a large number of heirs is not always welcome as they may necessitate the division of the property and thus a dilution of social status (e.g., Baker and Miceli 2005; Goody 1990; Goody, Thirsk, and Thompson 1976; Harrell 1997; Saller 1994). While this problem is most commonly dealt with using preferential inheritance rules (see below), sometimes it may result in the limitation of family size through infanticide or other methods (e.g., Caldwell and Caldwell 2005; Dickemann 1984).

Intergenerational transmission. Agricultural societies commonly have highly codified rules regarding inheritance, especially inheritance of land. While the equal division of land between all children does occur, some type of exclusion is more common (see table 1; Baker and Miceli 2005; Harrell 1997). Such practices range from primogeniture in favor of the oldest son to ultimogeniture in favor of the youngest son (or occasionally daughter) to the exclusion of one sex or the other altogether from the inheritance of land—most commonly, the division of the father's property among sons only (Baker and Miceli 2005; Goody 1976; Harrell 1997). In contrast, the inheritance of cash, animals, and household goods may be somewhat more equal, and it is common for daughters excluded from inheriting land to inherit these items (Goody 1976, 1990; Goody and Tambiah 1973; Harrell 1997).

Given the importance of material wealth in agricultural societies, arranged marriage is common with a key consideration being the wealth or social status of the partner's family. While bride-price is the prevailing custom in small-scale agricultural societies or among people of low or moderate status, dowry marriage—a custom unique to intensive agriculturalists—characterizes high-status groups in several of the largest complex societies of Eurasia (Boserup 1970; Fortunato, Holden, and Mace 2006; Goody 1976; Goody and Tambiah 1973; Pagel and Meade 2005; table 1). The most detailed treatment is that of Goody and Tambiah (1973), who maintain that dowry is a means of passing inheritance through both sons and daughters, as opposed to bridewealth systems in which little to no wealth may be inherited through daughters.

While both polygyny and monogamy are common among small-scale agriculturalists (table 1), monogamy is the dominant form of marriage in many large-scale complex state societies (Betzig 1986; Ember and Ember 1983; Goody 1990). Goody (1976) argues that farmers are more likely to be polygynous in Africa because land is not limited, while many Eurasian farmers are monogamous because of land shortages and a motivation to limit heirs. While elite men in monogamous societies may still have sexual access to other women,

Table 1. Characteristics of 61 societies practicing intensive agriculture as defined by codes 5 (intensive agriculture using fertilization, crop rotation, or other techniques to shorten or eliminate fallow period) and 6 (intensive irrigated agriculture) on variable 232 "Intensity of Cultivation" in the 186 societies comprising the Standard Cross-Cultural Sample (Murdock 1967; Murdock and White 1969)

Parameter	% of *n* societies (*n*)
Region (v200):	
Africa	13.1 (61)
Circum-Mediterranean	37.7 (61)
East Eurasia	26.2 (61)
Insular Pacific	8.2 (61)
North America	8.2 (61)
South America	6.6 (61)
Domestic organization (v210):	
Independent nuclear family—monogamy	13.3 (60)
Independent nuclear family—occasional polygyny	18.3 (60)
Polygyny	11.7 (60)
Minimal (stem) extended families	8.3 (60)
Small extended families	31.7 (60)
Large extended families	16.7 (60)
Degree of polygamy (v861):	
Polyandry	0 (57)
Monogamy prescribed	24.6 (57)
Monogamy preferred	14.0 (57)
Limited polygyny	31.6 (57)
Full polygyny	29.8 (57)
Descent (v247):	
Patrilineal	47.5 (61)
Duolateral/ bilineal	3.3 (61)
Matrilineal	9.8 (61)
Quasi-lineages	1.6 (61)
Ambilineal	3.3 (61)
Bilateral	26.2 (61)
Descent (v70):	
Patrilineal	59 (61)
Matrilineal	8.2 (61)
Ambilineal	3.3 (61)
Bilateral	29.5 (61)
Mean size of local communities (v235):	
50–99	11.5 (52)
100–199	11.5 (52)
200–399	13.5 (52)
400–1,000	3.8 (52)
1000–5,000	5.8 (52)
5,000–50,000	15.4 (52)
50,000+	38.5 (52)
Mode of marriage (v208):	
Bride-price	45.9 (61)
Bride-service	1.6 (61)
Token bride-price	16.4 (61)
Gift exchange	6.6 (61)
Sister or female relative exchanged	3.3 (61)
Absence of consideration	14.8 (61)
Dowry	11.5 (61)

Table 1. (*Continued*)

Parameter	% of *n* societies (*n*)
Inheritance of property:	
Real property (v278):	
Absence of property rights or inheritance rules	3.6 (56)
Matrilineal (sister's sons)	1.8 (56)
Other matrilineal heirs (e.g., younger brother)	3.6 (56)
Children—with daughters receiving less	14.3 (56)
Children—equally for both sexes	12.5 (56)
Other patrilineal heirs (e.g., younger brothers)	5.4 (56)
Patrilineal (sons)	58.9 (56)
Movable property (v279):	
Absence of property rights or inheritance rules	5.5 (55)
Other matrilineal heirs (e.g., younger brother)	1.8 (55)
Children—with daughters receiving less	20.0 (55)
Children—equally for both sexes	16.4 (55)
Other patrilineal heirs (e.g., younger brothers)	5.5 (55)
Patrilineal (sons)	50.9 (55)
Distribution of property among individuals of same category:	
Real property (v280):	
Equal or relatively equal	52.5 (53)
Exclusively or predominantly to the one adjudged best qualified	9.8 (53)
Ultimogeniture (to the junior individual)	3.3 (53)
Primogeniture (to the senior individual)	21.3 (53)
No rules (or insufficient information)	13.1 (53)
Movable property (v281):	
Equal or relatively equal	52.5 (51)
Exclusively or predominantly to the one adjudged best qualified	8.2 (51)
Ultimogeniture (to the junior individual)	3.3 (51)
Primogeniture (to the senior individual)	19.7 (51)
No rules (or insufficient information)	16.4 (51)
Class stratification—prevailing type (v270):	
Absence among freemen	19.7 (61)
Wealth distinctions	21.3 (61)
Elite	1.6 (61)
Dual (hereditary aristocracy)	19.7 (61)
Complex (social classes)	37.7 (61)

Note. The Standard Cross-Cultural Sample is a group of ethnographically well-known societies from around the world chosen to facilitate cross-cultural research while attempting to avoid the problem of cultural similarity arising from historical relationships or cross-cultural contact.

monogamy limits the number of legal heirs to a man's property, thus helping to maintain the integrity of an estate in land and concentrate wealth in order to compete for social status (Gaulin and Boster 1990). In general, bridewealth persists in polygynous cultures, whereas monogamous groups may practice either bridewealth or dowry (Gaulin and Boster 1990; Goody and Tambiah 1973; Harrell 1997).

While many agriculturalists reside in nuclear families, at least for part of the domestic cycle, the usual family structure in such societies is some form of extended family (table 1). These range in size and makeup from smaller extended families including parents, their heir, and the heir's family, to larger extended families including parents, their adult children of the same gender (usually sons), and those children's families (e.g., Ember and Ember 1983; Harrell 1997). Inheritance typically takes place at the dissolution or formation of households (Goody 1976, 1990; Harrell 1997), through marriage, fissioning, or the death of an elder member.

Status and inequality. Inequality is a fundamental characteristic of societies practicing intensive agriculture (Fried 1967; Johnson and Earle 2000; Service 1962, 1975). This inequality may be between individuals or groups within the society and may have many dimensions, including different types of wealth, occupation, and gender.

Most notably, social differentiation is often organized around how much land individuals own or have access to the income of and under what kind of land tenure system (Boserup 1965; Goody 1976; Johnson and Earle 2000). Differences in land tenure run the gamut from small holdings allocated by kin groups to small holdings directly held by parents and passed to children, to larger holdings owned or legally held by landlords who either rent the land to tenants in exchange for part of the crop or hire agricultural laborers to work for them directly, and to state societies that "farm taxes" from the citizenry by means of tax collectors (Boserup 1965; Johnson and Earle 2000; Netting 1993; Richards 1993*a*; Wolf 1966).

Relatively egalitarian smallholding systems were common throughout Europe, Asia, and Africa, but large, premodern state societies in Europe and Asia often had systems of land tenure in which large amounts of land were held by small numbers of elites (e.g., Caldwell and Caldwell 2005; Johnson and Earle 2000; Goody 1976; Maddison 1971; Netting 1993; Richards 1993*a*; Wolf 1966). Even in this regard there was variation, though, from states in which land was considered the direct property of the head of state (e.g., India under the Mughals), and people were temporarily awarded the right to collect rent from it, to states in which landlords owned land directly and had the power to farm it, rent it, or sell it (e.g., premodern England; Boserup 1965; Maddison 1971; Richards 1993*a*).

While the most basic form of social inequality in agricultural societies lies in ownership of and relationship to land (landowner, landlord, tax farmer, smallholder, tenant, serf, slave), inequality may also be related to other kinds of occupational or craft specializations, commonly including artisans, soldiers, priests, and bureaucrats (Johnson and Earle 2000; Service 1975). Occupational specialization may be related to formal types of social differentiation including hierarchical systems of *castes* (hierarchical systems based on heredity that define and limit members' occupations or social opportunities) and *social classes* (hierarchical systems based on occupation, wealth, or social position; e.g., Dumont 1970). Alternately, status differences may be based on differences in monetary wealth generated by control of land or through participation in trading or commercial ventures (Goody 1976; Johnson and Earle 2000).

Gender inequality can be pronounced in agricultural societies, especially in cultures where men perform most of the agricultural labor (Boserup 1970; Sanday 1981). In such cases, women may be subject to a variety of constraints including claustration (e.g., purdah), body modification (e.g., foot binding), enforcement of modest behavior, and a strong emphasis on virginity at marriage and chastity thereafter (Harrell 1997; Low 2000). Such practices are usually more common among people of higher social status (Dickemann 1979; Low 2000). Perhaps the most pervasive form of gender inequality in agricultural societies can be found in their customs of inheritance, which are overwhelmingly patrilineal and which in more exaggerated cases involve the exclusion of women from ownership of land or other types of property altogether (Goody 1976; Low 2000). Even in cases where women may be given substantial dowries, their control of this wealth may be limited (Goody and Tambiah 1973; Sharma 1993).

The preferential marriage of people of similar social standing (also called isogamy) is quite common in agricultural societies (Dumont 2006; Harrell 1997). This may include rules or practices of endogamy by caste, social class, occupation, or wealth. The marriage of daughters up the social hierarchy (hypergyny) may also be practiced, particularly in dowry-giving cultures (e.g., Dickemann 1979), while celibacy (nonmarriage) is not infrequently practiced when resources are scarce or would become diluted by large numbers of heirs (e.g., Betzig 1986). Overall, an important effect of preferential marriage in agricultural societies is the continued concentration of wealth within families and the consequent perpetuation of inequality across generations (Harrell 1997).

Sample and Methods

In this paper we use 12 measures (five material, five embodied, and two relational) from eight populations to explore patterns of intergenerational wealth transmission in agricultural societies. Here we give critical ethnographic background, introduce our wealth variables, and discuss how they are measured.

Overview of Sample Populations

This paper presents data on intergenerational wealth transmission from eight agricultural populations. Our small sample cannot be statistically representative of all intensive agriculturalists, but it covers much of the range of geographic and social characteristics discussed above. While many of our populations had several estimates of wealth available, those analyzed here are limited by considerations of data quality or relevance to our focus on inequality in preindustrial societies. Each of the contemporary populations are experiencing varying degrees of economic development, thus measures of education and income were excluded as having unclear meaning in a preindustrial context. While it is clear that both existed in large premodern agricultural societies such as those of historical Europe and historical South Asia (e.g., Clark 2007; Richards 1993*b*), the forms of education and monetary income exhibited in recent societies have often been influenced by their incorporation in modernizing states and thus may not have the same form as in the past. Measures of reproductive success were excluded if there was evidence of a demographic transition because it was unclear whether more children would represent greater wealth under such conditions.

East Anglians

Ethnographic background. This is a historical sample composed of men's wills from preindustrial England during the years 1540–1790. The wills used are mainly from testators in East Anglia, Essex, and Suffolk and are part of a collection of more than 8,000 wills from these counties that have been transcribed. England at this time was an agricultural society with a strong mercantile component. Rural areas were occupied by landowning members of the gentry and smaller-scale farmers, while towns were centers of local commerce where there were concentrations of people working outside of agriculture including traders, craftsmen, and professionals. Further details of the society can be found in Clark (2007).

The sample consists of wills of fathers and sons, including 114 father-son pairs. The relationship of testators was estab-

lished through the details contained in the wills and sometimes in additional material from church registers of baptisms, burials, and marriages. There is some uncertainty in these matches: for a match to be declared, someone of the son's name had to appear in the will of the father, and if the son's first and last names were common, then some other details in the son's will would have to match with the father's. Wills as a source of data are described in detail in Clark and Hamilton (2006).

Wealth measures. Wills contained a variety of information, of which two variables will be used in these analyses: estate value and reproductive success (RS). Estimates of estate value were constructed from the information in wills by adding together the cash payments directed by the testator with the estimated value of houses, land, animals, and grain bequeathed by the testator in the will. As land is often the most valuable asset left in the will, this measure can also be seen as a proxy for wealth in land. The RS in this sample is the number of surviving children at the time the will was written, which was typically within a year of the testator's death. Estate value is an excellent measure of material wealth in this society, since it includes most of the large types of material wealth that were socially important in the period. The RS is also a good a good measure of embodied wealth in preindustrial England since wealthier people tended to have more surviving offspring (Clark and Hamilton 2006).

Because this data set is based on recorded wills there are special problems of bias that need to be addressed. Not all men made wills, and the frequency of will making was correlated with wealth. Occupations of men in the sample are biased toward the gentry, professionals, and yeoman farmers but also include traders, craftsmen, shepherds, and laborers in smaller numbers. For a given set of fathers making wills, richer sons were more likely to also make wills and so to enter the data set. This will bias downward the estimation of the coefficient measuring the link between the wealth of generations. Another problem is that wealth is measured with substantial error, again biasing coefficient estimates downward. A third bias is that for a father-son pair of will makers to be identified, the father had to have a son who survived to age 16 or more. Since England in these years was a Malthusian preindustrial society with slow population growth, the average man had only slightly more than one son surviving at time of death (Clark and Hamilton 2006). However, the number of surviving children was higher for wealthier individuals who were more likely to leave wills. The poorest testators left one son on average, the richest two sons. Given that wealth correlates across generations, this again increases the likelihood of wealthier father-son pairs. However, this bias will not affect the estimates of the intergenerational linkage.

Skellefteå

Ethnographic background. The Skellefteå region is a cluster of five contiguous parishes in northern Sweden. During the nineteenth century, farming was the major occupation and there were low levels of market penetration. Land was the most important resource and had strong effects on reproduction and other variables (see Low 1990 for details). Inheritance laws mandated that only men owned land, though widows could hold the land in trust for their children. During the study period, new land came into cultivation and the number of landowners increased. In the 63 villages for which tax records were read, the landowners of record increased steadily from 283 in 1830 to 511 in 1890; the average amount of land held declined from 183.46 to 106.34 hundredths of a *mantal.* While most of the population was engaged in agriculture, there were social class differences related to occupation and landownership. These categories include upper middle class (business owners with many servants), lower middle class (small businessmen, artisans, soldiers), farmers who owned land (*Bönder*), tenant farmers (*torpare*), crofters (smaller land renters), agricultural workers, and paupers. For further details, see Low and Clarke (1990) and Low, Clarke, and Lockridge (1991).

Wealth measures. We consider the embodied wealth measure RS, measured here as number of children born. The sample includes men born between 1800 and 1845 who remained alive until adulthood (18) and their kin in any of 63 villages along the Skellefteå River in Norbotten County in northern Sweden. The years of the data are 1800–1888, and the total number of pairs in the sample is 2,515. Data come from the *mantalslängder* (land tax records) for the years 1830, 1840, 1850, 1860, 1870, 1879 (records were missing for 1880), and 1890. The records link men to fathers, spouses, and children. We restricted the sample to all men age 18 and up for whom we have complete records of their reproductive lives (i.e., they died in record or were alive and age 45 or older at the end of the sample; outmigrants aged <45 were excluded). Reproductive success is an appropriate measure in this society since it is a predemographic transition society with relatively high fertility (Low 1990); there is also a relationship between material wealth (primarily in land) and RS.

Krummhörn

Ethnographic background. This is a historic population from the eighteenth and nineteenth centuries in the Krummhörn region in Ostfriesland (northwest Germany). The data derive from a reconstruction study based on church registers complemented with information from tax rolls and other sources, and the sample consists of data from 19 of the 32 parishes that existed in the Krummhörn. The Krummhörn was an ecologically and culturally separate region within Ostfriesland, bounded by the North Sea on three sides and by a relatively infertile heath in the east. It has an area of about 150 km^2 and consists mainly of very fertile marsh soil. This fertile soil was responsible for the great wealth that farmers were able to achieve as of the end of the Middle Ages. A capital- and market-oriented agriculture developed and replaced a pure

subsistence economy earlier here than elsewhere in Germany, and large-sized businesses dominated the farming economy. By the end of the nineteenth century, the marshlands covered only about 7% of the province of Hannover but produced over 22% of the agricultural profit (Meitzen 1894).

The population was characterized by a very low growth rate and a nearly stable cross-sectional size of approximately 14,000 individuals during the period under study. In an ecological context, it is possible to describe the Krummhörn as a saturated habitat consisting of only a limited number of available breeding places. The social organization was structured almost exclusively by the possession of land. The amount of land owned or under lease was decisive for the rights to vote and to stand for election in the spheres of both politics and the church. The accumulation of returns led to remarkable wealth concentration in some lineages. Consequently, a "two-class society" developed, with big farmers who owned both the land and the capital on the one hand and a large mass of landless workers on the other. In most villages, a middle class was almost completely missing.

Traditionally, the youngest son inherited the landed property (ultimogeniture), although this habit became more flexible in the latter half of the nineteenth century. Noninheriting siblings had to receive financial compensation from the heir, and as a rule, brothers received twice the amount that their sisters did. This inheritance pattern put a large economic pressure on the main heir to compensate his siblings—either by selling land or realizing other forms of capital. The social group of "full" farmers was well aware of these risks, and they manipulated both their reproductive behavior and dispersal patterns so as to minimize competition between siblings (Beise and Voland 2008; Voland and Dunbar 1995).

Wealth measures. In this paper we compare landownership between fathers and children, using the husband's land as the land estimate for daughters who did not own land in their own right. Both sexes are included since in the Krummhörn both sexes inherited wealth (although not equally and not necessarily of the same kind). Tax rolls give the amount of land owned or leased for individual persons. In this context socioeconomic status was linked to the amount of possessed land, and it was of no importance whether the land was owned or rented. Due to the social structure of the Krummhörn, the sample consists of many landless workers with zero values for land wealth. A size of 75 grasen was historically regarded as the lower limit for a "full" and self-sustainable farm and defines the group of "full farmers."

Kipsigis

Ethnographic background. Kipsigis are agropastoralists who have lived in southwestern Kenya (now Rift Valley Province) for the last 500–600 years on the lower hills of the White Highlands. Although this part of Kenya developed economically very fast both during the midcolonial and early independence periods, lifestyles remain largely traditional, reflecting both Kenyan commitment to ethnic identity and an unusual and persistent tendency among Kipsigis to remain in their home area. Since the 1930s, land has been the primary source of wealth, critical for both subsistence and market production. Livestock wealth is of both economic and cultural significance; cattle and goats are used in marriage payments and for exchange networks, domestic dairy produce, and commercial sale.

Land and livestock are generally highly correlated and are important determinants of health, wealth, and fitness for both men and women (Borgerhoff Mulder 1987*a*, 1987*b*). Land and livestock are inherited by sons following a rule of equal division; daughters disperse at marriage with no property. Inheritance is a fluid process: young men in their late teens start cultivating a small patch of land on their father's plot and gain use rights to certain livestock. On their marriage, an allocation of livestock and of farming/grazing land is made; these capital assets are seen as still "owned" by the father but effectively used by the son. In making these allocations, fathers anticipate claims from sons who are still young (and even unborn).

Livestock are also the basis of important social network capital embodied in the traditional (and now disappearing) institution of *kimanangan* wherein men allocate some of their cattle to livestock-loaning partners in a system designed to reduce spatially the risks associated with herding, such as unpredictable rainfall, raiding, and disease (Peristiany 1939); generally only the households richer in livestock have *kimanangan* partners.

Wealth measures. Land (in acres) and livestock (counts) are determined either by the Kenya Government Land Office or by field interviews. Reliability of acreage reports were very high as measured across two different surveys ($r = 0.93$). Cattle numbers, the principle source of livestock wealth, were recorded for all men in the sample in 1982–1983 and in 1991 (1991 data are used here). Reliability is estimated from the correlation between years (1983 and 1991) of $r = 0.75$ (taken from a larger sample), undoubtedly reflecting temporal changes in livestock holdings. For women, land and livestock measures are the allocations made to them by their husbands.

For some families data were available on the number of *kimanangan* (cattle-loaning) partners of fathers and sons, taken from interviews and informal conversations conducted at various times during this study; daughters do not have *kimanangan* partners—their measure is based on their husband's number of partners. These data were not systematically collected and did not exist for all male residents, but the information is not private and all cross-reports were consistent; therefore, data quality is thought to be relatively good.

Reproductive success is likely to be a good measure of embodied wealth given this high-fertility society with a moderate rate of infant mortality, and it is measured as number of children surviving 5 years. It is very high for some men due to polygyny. Due to the demographic focus of the original study (and great familiarity with the subjects due to a yearlong

time-allocation study), measures are likely to be highly reliable. For the younger generation, children under 5 years of age are common but are devalued by the probability of surviving to age 5 (.84 in the broader population; Borgerhoff Mulder 1998).

The sample includes all houses in three neighborhoods settled by Kipsigis in the first half of the twentieth century (Borgerhoff Mulder 1990). All households were visited and all reproductive-aged individuals were interviewed, either in 1983 or in both 1983 and 1991. For this study records are retained only for those who have reached 30 years of age, so as to focus on men and women who were well advanced in their reproductive and economic careers; some of the F_1 individuals were recently deceased, but their household wealth could be reconstructed.

Yomut

Ethnographic background. The Yomut are one of several large Turkmen descent groups that occupy a contiguous area in what is now the Islamic Republic of Turkmenistan (the former Turkmen Soviet Socialist Republic) and adjacent areas of Iran and Afghanistan. The Yomut of the Gorgan Plain in northern Iran divide themselves into two groups: the agriculturalist *Chomur* and the pastoralist *Charwa*, though this is a difference in emphasis and both groups practice agriculture and pastoralism. We discuss data from the agricultural *Chomur* here; data from the pastoral *Charwa* are discussed by Borgerhoff Mulder et al. (2010, in this issue). The *Chomur* practice a combination of subsistence production (primarily rainfall cultivation of wheat and barley) and production for market exchange (e.g., cotton). Most agricultural work is done by men; thus, households with large male labor pools are better able to enhance their wealth over time (Irons 1975), and investment is biased toward sons (Irons 2000). At the time of field research (1965–1974), the Yomut were a prosperous group by Iranian standards, and there was almost no migration out of the Gorgan Plain.

The Yomut are patrilineal as well as patrilocal and live in joint families consisting of parents, unmarried children, and married adult sons. Both land and livestock pass from father to son at the time of household division, which takes place either at the death of the father or when a son decides to leave the joint family because his own children are nearing the time of marriage. Most fathers try to give equal patrimonies to each son, but as conditions change this is not always possible. A son's patrimony is usually a subject of discussion among a father and all his sons for a period of time before the actual separation and granting of a patrimony occurs. After a son has received a patrimony, he does not inherit anything more at his father's death.

Wealth measures. The wealth measure used here is Yomut patrimony in land, probably the most important measure of material wealth in this society. Data comes from a 1973–1974 survey of 566 households in a random stratified sample of 21 communities including both *Chomur* and *Charwa*. The survey gathered data on household histories, wealth, and demographic history. Each household head was asked what he had received in land as a patrimony when he became independent and also what amount of land he had given as a patrimony to any of his sons who had separated from his household. The amount of land was converted into Iranian Tomans, which at the time were valued at 7 Tomans to $1.

Bengali

Ethnographic background. The Bengali ethnic group is located in northeast India (where most are Hindu) and Bangladesh (where most are Muslim); the study population is a Hindu group from the southern part of the Indian state of Assam. Bengalis are culturally and linguistically related to the dominant Hindu cultures of South Asia and follow the regional practices of patriliny, patrilocality, and the joint family. Marriages are arranged, and the woman joins her husband's household to be supervised by her mother-in-law. Dowries and bride-price rarely figure in these arranged marriages since the group is so poor. Most of the Bengalis in this sample are members of Scheduled Castes, low-status groups formerly called "untouchables."

Bengalis grow primarily rice in paddies that are plowed by hand. Men do most of the agricultural labor, control all property, and dominate selling and buying in the markets. Women do not go to the market nor work in the fields but apply themselves to tasks such as winnowing and kitchen gardening in addition to household work. Resources available to both groups are generally very low. Mean income from all sources for Bengali households in our study sample is \$979 $\pm$ \$1,071 per year, while median income is \$556. Labor migration does occur in this population but is much more common among sons than daughters. Women, however, do sometimes migrate out of the region through marriage.

Wealth measures. The Bengali data on reproductive success compare the fertility of mothers to the fertility of their sons (or in reality, son's wives, as men are monogamous and rarely marry more than once). The sample included all married reproductive-age women in the study villages; the age range was 16 to 50. Only members of scheduled castes were included, as members of higher castes may have begun to undergo a demographic transition. Current contraceptive use is only recorded for about 14% of women and shows no effect on fertility until age 40 and above, and a high fertility of 6.2 TFR (total fertility rate) is found for women in the sample (Leonetti, Nath, and Hemam 2007*a*). Data are also missing on a number of sons, many of whom have probably migrated, which may have a limited effect on the sample. Thus, the sample used is 382 of a total sample of 612. For RS we use children alive at age 5 years and those alive under age 5 years devalued by .95 (representing the risk of mortality during those ages). Measurement error is likely to be quite low as any child who survived to age 5 among the mother's offspring

or any currently living child among the son's offspring would have been reported. Given that the Bengali are a high-fertility population with a moderate rate of child mortality, RS is likely to be a good measure of embodied wealth in this society.

Khasi

Ethnographic background. The Khasi are a tribal people located in northeast India and Bangladesh; the study population comes from the eastern part of the state of Meghalaya in India. They are culturally and linguistically related to other Austro-Asiatic tribal groups from Southeast Asia, and follow the regional pattern of matriliny and matrilocality. Marriages are based on love attachments, and when a woman marries, her husband usually (but not always) joins her household. The couple often continues to reside with her mother until one or two children are born, and then they are expected to move into her own household in the same village, often in close proximity. The youngest daughter is expected to stay with her mother and inherit the house and spiritual headship of the lineage.

In the system of Khasi matriliny studied here, women have control of and direct access to resources. Khasi women own property and run the markets. They also work the fields, run businesses and work for wages, although many are housewives. Men usually provide agricultural labor and income, first to their mother's household and then to their wife's household. Khasi grow rice paddy in plowed fields but also cultivate vegetable gardens on the hillsides using hoes. Both genders share in field labor, with women dominating hillside gardening. While Khasi live on the fringe of India's fast-developing economy, wealth and market integration in this population are both low. Mean income from all sources in our study sample is \$726 $\pm$ \$495 per year while the median income is \$622 per year for Khasi households. Migration is not common among the Khasi as their tribal status makes it difficult for all but urban members to be comfortable in the larger Indian society. Women from villages also would find it more difficult than men to migrate.

Wealth measures. The Khasi data on reproductive success compare the fertility of mothers with the fertility of their daughters, who may have borne children by more than one husband (Leonetti et al. 2004). Daughter's ages range from 17 to 70 years. For RS, we count children alive at age 5 years and those alive under age 5 years devalued by .97 (representing the risk of mortality during those ages). Measurement error is thought to be quite low as any child who survived to age 5 among the mother's offspring or any currently living child among the daughter's offspring would most likely have been reported. Given that the Khasi are a high-fertility population with a moderate rate of child mortality, RS is likely to be a good measure of embodied wealth in this society.

Bengaluru

Ethnographic background. Bengaluru (formerly Bangalore) is a city of 5 million people and capital of the state of Karnataka in south central India. Ethnically, the people in the study sample are mostly Kannadigas but some are also Tamils or Telugus who have lived in the area for many generations. The people of this region share dominant social characteristics with other South Asians, most notably a patrilineal kinship system, the joint family, and arranged marriage with patrilocal residence. However, South Indians are less extremely patrilineal and patriarchal than are North Indians (e.g., Bengalis) and women often have more social and economic freedom. Among Hindu Indians, wealth is traditionally divided equally among sons at the death of the father, while daughters take their share of their parents' wealth via dowry at marriage.

In traditional South India, most people had hereditary occupations determined by caste and family membership, primarily including priests, merchants, farmers, artisans, and agricultural laborers. However, this system has been slowly breaking down for more than a century, and in modern urban India perhaps only one-quarter of people still follow hereditary occupations, while others have adopted skill-based wage-labor occupations. Traditional gender roles dictate that men do most of the market labor while women do most of the domestic labor. In modern India, men are still expected to have primary economic responsibility for their families. Though it is becoming more acceptable for women to work outside the home, the prevalence of working women varies a great deal by caste, social class, and the occupation of other household members (Shenk 2004).

The data presented here were gathered in 2001–2002 as part of a survey of 400 adults aged 45–70 that collected detailed retrospective data on three generations of the respondents' families. The older generation in the sample includes the people surveyed, born from the early twentieth century through the 1940s. The younger generation in the sample contains their children, born from the 1930s through 1970; the sample was restricted to those born before 1973 to avoid the effects of rapid economic growth that began with Indian market liberalization in the 1990s. These data capture a period in which South India's economy was slowly moving from a subsistence agricultural base with a limited cash economy in the early twentieth century to an agricultural and commercial economy with increasing emphasis on wage labor in the mid–late twentieth century. Much of the earlier generation comes from rural areas while the more recent generation is split between urban and rural areas.

Wealth measures. Both traditional and modern Indians place heavy reliance on family relationships as a means of maintaining social and economic stability and achieving status. A key way in which families bolster their positions is to arrange marriages with families having desirable characteristics. When arranging marriages, not just the characteristics of the spouse but the number and characteristics of his

or her close relations and occasionally even more distant relatives are likely to be considered (Shenk 2005). The wealth variable used in this article, *in-law networks*, reflects the number of a spouse's close relatives including parents, siblings, and siblings' spouses (the data are retrospective, so all are adults) weighted by their wealth compared to that of the focal parent or child. The analysis compares the degree of similarity between the number of people in the in-law networks of a parent and those of his/her child. Although such in-law networks are of course not directly heritable, they are heavily influenced by characteristics of both the family and individual. Though Bengaluru is undergoing economic development, social networks created through marriage are very important socially, and the ethnographic evidence suggests that they were even more significant in the past. For these reasons, in-law networks are likely to be a reasonably representative example of relational wealth in intensive agriculturalist societies.

Results and Population-Specific Discussion

Analytical Measures

Each researcher who contributed data to this project was asked to give his or her judgment for the variable α for their population. Alpha (α) denotes the relative importance of embodied, material, or relational wealth and is defined as the percentage change in a family's well-being associated with a percentage change in a particular wealth category, holding other wealth categories constant (see the introduction to this special section [Bowles, Smith, and Borgerhoff Mulder 2010]). The α estimates for the eight agricultural populations discussed above can be found in table 2. Researchers nearly universally rated material wealth as the most important wealth class in agricultural societies, with some estimates of α reaching very high levels (e.g., 0.7 or 0.8 out of 1) and the average α being 0.59. Estimates of the relative importance of embodied wealth were more moderate, with the average α being 0.27. Finally, the estimated α for relational wealth was on average just 0.14. The α judgments given by researchers are very close to several independent estimates of α for agricultural societies including the agropastoralist Nyaturu of Tanzania and eight grain- and four rice-producing areas in India. These estimates and methods of estimation are discussed in the concluding essay in this special section (Smith et al. 2010, in this issue; see also CA+ online supplement "Estimating the Inheritance of Wealth in Premodern Societies" in the online edition of *Current Anthropology*; Borgerhoff Mulder et al. 2009).

The primary quantitative measure discussed in this paper is β, the estimated percent difference in child's wealth associated with a 1% difference in parent's wealth. The β value is unit free, allowing us to compare across numerous types of wealth from different social settings. In table 3 we present β coefficients for 12 wealth types divided between the three classes of wealth (material, relational, and embodied). Our results give evidence of high levels of intergenerational transmission for material wealth, and variable (low to moderate) levels of transmission for embodied wealth and relational wealth.

Table 2. Judgments of α (wealth importance) exponents for eight agricultural societies in the project sample (see text for further explanation)

	Type of wealth		
Population	Embodied	Relational	Material
Bengali	.30	.20	.50
Bengaluru	.30	.30	.40
East Anglians	.50	.00	.50
Khasi	.40	.25	.35
Kipsigis	.20	.10	.70
Krummhörn	.15	.10	.75
Skellefteå	.10	.10	.80
Yomut (Chomur)	.20	.10	.70
Mean (SD)	.27 (.134)	.14 (.098)	.59 (.171)

In order to discuss whether the transmission of wealth is related to inequality, we have also estimated a Gini coefficient for each wealth type and calculated an average Gini coefficient for each wealth class (see table 3). The Gini coefficient is a measure of inequality ranging from 0 (equal wealth) to approximately 1 (all wealth held by a single household) and is commonly used to compare levels of inequality across societies (e.g., Milanovic, Lindert, and Williamson 2007).

Material Wealth

We have five measures of material wealth in our sample: three of land, one of cattle, and one of estate value. The β's for these variables are quite high, ranging from 0.36 to 0.64, as well as highly significant, indicating a high degree and consistency of transmission of material wealth between generations. High transmission of wealth is associated with and has the potential to generate high levels of inequality, as indicated by Gini coefficients ranging from 0.45 to 0.71. High β's also have the potential to perpetuate inequality over time; our estimates imply that a child born into the top material wealth decile in an agricultural society is much more likely to end up in the top decile as an adult than is a child born into the bottom decile (see further discussion below). These patterns are likely to lead to the persistence of wealth within families and the perpetuation of a hierarchical social structure over time. Figure 1 gives a graphical comparison of the material wealth data for four societies in our sample.

Estate value among East Anglians. The β for estate value among East Anglians, 0.642, is quite high and statistically significant. The Gini coefficient is 0.608. This is despite the fact that the estate-value data are likely to be biased downward due to (*a*) the greater likelihood of wealthy individuals entering the sample (reducing variance in the sample as com-

Table 3. Transmission coefficients (β) for different wealth types in eight agricultural societies

Wealth class, population, wealth type (*N* pairs)	β (SE)	*P* value[a]	Gini (SE)
Material wealth:			
East Anglians:			
Estate value (land; 210)	.642 (.073)	.000	.608 (.022)
Kipsigis:			
Land (270)	.357 (.041)	.000	.482 (.036)
Livestock (270)	.635 (.098)	.000	.450 (.019)
Krummhörn:			
Land (1,602)	.610 (.043)	.000	.708 (.008)
Yomut (Chomur):			
Patrimony (land; 58)	.528 (.147)	.000	.615 (.028)
Material wealth averages	.55 (.07)	.00	.57 (.05)
Embodied wealth:			
Bengali:			
Reproductive success (382)	−.074 (.057)	.191	.228 (.006)
East Anglians:			
Reproductive success (200)	.171 (.150)	.255	.415 (.016)
Khasi:			
Reproductive success (650)	.165 (.045)	.000	.198 (.004)
Kipsigis:			
Reproductive success (270)	.213 (.106)	.044	.301 (.015)
Skellefteå:			
Reproductive success (2,515)	.010 (.028)	.714	.251 (.002)
Embodied wealth averages	.10 (.07)	.16	.28 (.05)
Relational wealth:			
Bengaluru:			
In-law networks (249)	.114 (.073)	.117	.468 (.189)
Kipsigis:			
Cattle partners (102)	.041 (.139)	.767	.446 (.021)
Relational wealth averages	.08 (.11)	.47	.46 (.08)
Overall averages (all wealth)[b]	.36 (.05)	.00	.48 (.04)

[a] *P* values are calculated from two-tailed tests of the hypothesis that true β for a given row equals 0.
[b] Overall average weights the wealth class averages by the mean values of α from table 2.

pared to the real population) and (*b*) errors in measuring wealth expected when deriving data from the texts of wills. Nonetheless, these results are in keeping with expectations for the heritability of wealth in a large, complex state society with large wealth differentials and several distinct social classes, especially as estate value estimates include the key variable of land (usually the most valuable item in a will and the most significant correlate of wealth). Please see figure 1*A* for a graphical comparison of parent-offspring estate value among East Anglians.

Land in the Krummhörn. The estimated heritability of land in the Krummhörn area of Germany is 0.610 and the Gini is 0.708, estimates well in keeping with other figures for heritable wealth in complex agricultural societies and with the very stable socioecological and demographic situation that obtained in the Krummhörn during the study period. Land was the single most important source of wealth, and there was low social mobility, even lower for men than for women. While there was a certain downward mobility (due to overreproduction of the wealthy group of farmers), there was hardly any upward mobility. For instance, the correlation between a father's wealth and a child's wealth is slightly higher for sons than daughters since some daughters might marry down, while sons did not marry without sufficient wealth. See figure 1*B* for a comparison of parent-offspring landownership in the Krummhörn.

Yomut patrimony in land. The β coefficient for patrimony in land is 0.528 (Gini = 0.615), a high and statistically significant value that is consistent with other estimates for the transmission of material wealth among agriculturalists. However, the value is a bit lower than that for East Anglians and the Krummhörn, perhaps because Yomut families are larger and land is inherited relatively equally by all sons rather than through a preference for primogeniture. See figure 1*C* for a comparison of father and son land value among the Yomut.

Kipsigis land and livestock. The β coefficients for father-offspring pairings, both for land (0.357, Gini = 0.482) and for livestock (0.635, Gini = 0.450), are high, reflecting the fact that Kipsigis who settled in Abosi faced a largely unsaturated habitat and settled very large initial plots (Borgerhoff Mulder 1990). Men with many wives, or with the livestock to acquire many wives, tended to claim and protect large plots, and these were inherited by their sons. Since there can be an economy of scale to both the herding and the protection of

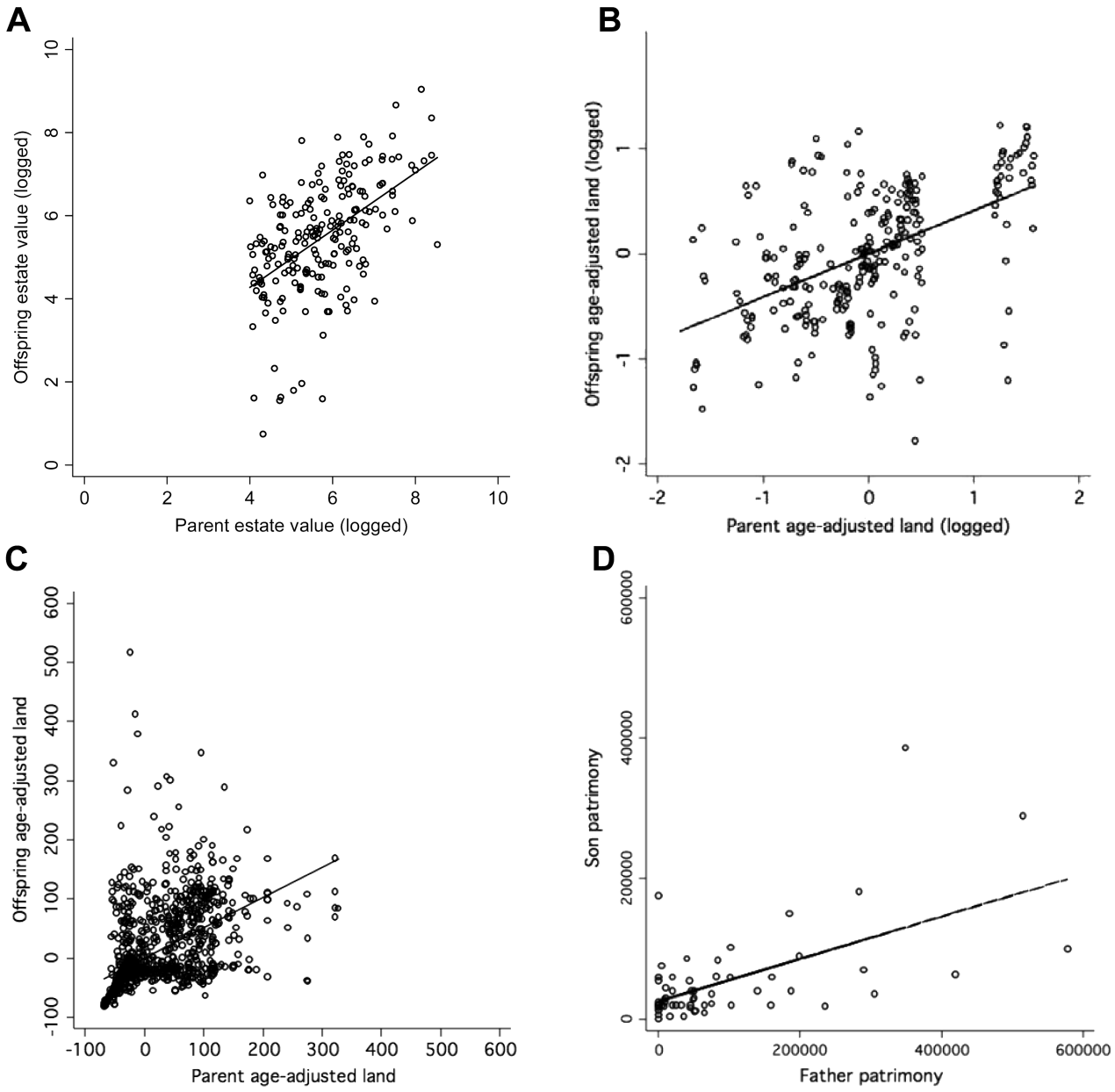

Figure 1. Comparison of parent-offspring material wealth in four societies: *A*, estate value among East Anglians, $\beta = 0.642$; *B*, parent-offspring landownership among Kipsigis, $\beta = 0.357$; *C*, parent-offspring landownership in the Krummhörn, $\beta = 0.610$; and *D*, father-son patrimony in land among the Yomut, $\beta = 0.528$. (The line through the points in each panel depicts the underlying linear regression on which the β estimates are based.)

livestock (see Borgerhoff Mulder et al. 2010), those with initially larger herds will be favored, generating high β's in unsaturated habitats. The high β's also reflect the great economic expansion in the mid-to-late colonial and early independence periods, with some Kipsigis working on adjacent European farms and investing their wages in livestock. Polygyny appears not to have diluted the parent offspring correlations. Even though wealthy men attract more wives than poorer men, women's marriages did not entirely follow an ideal free distribution (Borgerhoff Mulder 1990); in other words, wealthy men in this sample still tended to have sons who were wealthy, despite their polygyny (see Borgerhoff Mulder et al. 2010).

See figure 1*D* for a comparison of parent-offspring landownership among the Kipsigis.

Embodied Wealth

Our five measures of embodied wealth are all estimates for reproductive success, the number of surviving children left by the parent(s) as compared to the child. Two of our measures of β are close to 0, while the other three show a moderate degree of heritability (0.165–0.213), two of which are statistically significant. These findings suggest that (*a*) there can be a moderate degree of transmission with regard to RS in agricultural societies but also that (*b*) there is likely to be variability among agricultural societies on this measure. The Gini coefficients range from 0.20 to 0.42, indicating moderately high levels of inequality with regard to RS in the societies being studied.

Reproductive success among East Anglians. The estimated heritability of reproductive success among historical East Anglians is 0.171, though it is not significantly different from 0. Mortality patterns in sixteenth- to eighteenth-century England varied consistently by social class, which is likely to be a primary factor in producing the observed positive association. Error introduced by obtaining data on RS from wills and because people with more children are more likely to enter the sample is likely to bias the estimate downward, suggesting that it is possible that the actual value is higher or is significant. The Gini coefficient of 0.38, however, suggests that there is considerable variability in the existing sample.

Skellefteå reproductive success. The estimated β for reproductive success among nineteenth-century Swedish agriculturalists is 0.010, a very low figure signifying essentially no inheritance of this trait, though the Gini of 0.251 shows considerable inequality in RS in the population. Sample size cannot account for the low β since $N = 2{,}515$, a very high number for this study. This was in a period, however, when only half of all Swedes, like other northern Europeans, married overall (Low, Clarke, and Lockridge 1991). Since arable land was saturated, many people did not have the means of obtaining or supporting a spouse. Unmarried siblings might migrate or stay in their natal households and help their married sibling(s) with production and reproduction. The older generation in the sample is all fathers (who by definition married and had children), while all of their children, many of whom did not marry and thus had no recorded offspring, remain in the sample. Furthermore, while there is evidence that landholders have marginally more children and that sons of landholders are more likely to be landholders themselves, as well as more likely to marry, these associations fail to produce a consistent reproductive advantage to the offspring of parents with high RS (Low 1991; Low and Clarke 1990). This may in part reflect the movement away from agriculture during this period—entrepreneurial men who obtained land through routes other than inheritance had more children than the sons of landowners who inherited land.

Kipsigis reproductive success. At 0.213, the β coefficient for reproductive success is moderate and in keeping with the results from some other agricultural societies. The Gini coefficient of 0.301 also reflects a moderate amount of inequality in RS. Given polygyny as well as the high intergenerational correlations for land and stock between fathers and sons, this lower value is somewhat surprising and may in part reflect sample bias—specifically, the relatively young age of the children in this sample, insofar as wealth in this population primarily affects RS through polygyny and length of reproductive life span (Borgerhoff Mulder 1988). The β for RS, however, is significant only for sons and not for daughters, suggesting (again) that the intergenerational correlation of RS is driven largely by wealth and polygyny.

Bengali reproductive success. The β coefficient, -0.088, is low and not significantly different from 0. The Gini coefficient shows a moderate level of inequality in RS at 0.228. The Bengali sample is all from the scheduled castes (former untouchables) who are not only very poor but whose lives are circumscribed by social restrictions on access to economic opportunities and social resources. They are often malnourished (Leonetti et al. 2005), and their reproductive health is also poor. The low β may indicate that the data reflect demographic transition even though family planning use is very limited. It may also be due to delays in marriages in the past quarter-century as socioeconomic conditions in India have altered people's lives with costs they did not formerly face, such as longer times in school for their children. Such constraints are especially high for people with high RS since they must face the costs of marrying and educating more children (Leonetti and Nath 2009).

Khasi reproductive success. The β coefficient is 0.165 ($P = .000$), indicating moderate transmission of fertility levels between mothers and daughters among the Khasi. The Gini coefficient of 0.198 shows moderate inequality. The Khasi are a high-fertility matrilineal population (TFR of 6.7 children for women in the sample) where help from the mother's kin supports reproduction. On the other hand, because women usually have several sisters (over half have three or more), more variance in reproductive success may occur due to competition among daughters for mother's resources or help with children (Leonetti, Nath, and Hemam 2007*b*) resulting in an uneven distribution of fertility among sisters. Also, divorce rates are high (24% of women in the sample have been divorced), which may produce differences in resources and help from husbands leading to differences in RS (Leonetti et al. 2004; Leonetti, Nath, and Hemam 2007*b*). In other words, strong upward pressure from cooperation among matrilineal kin (such that big kindreds produce big kindreds in the next generation) is countered by downward pressure resulting from variance among kin and from competition over resources among kin resulting in a moderate value.

Relational Wealth

Finally, we have two measures of relational wealth, one of which (cattle partners) shows little heritability while the other (size of in-law network) shows a modest degree of transmission between parents and children. Since in-laws cannot be added or shed at will, while cattle partnerships are mutually voluntary, this difference is consistent with structural differences in the types of networks analyzed. Both measures of relational wealth show similarly high levels of inequality, however, suggesting that the difference is in the transmission processes rather than in the form of relational wealth.

Kipsigis cattle partners. The β coefficient for cattle-loaning partners is effectively 0, while the Gini coefficient 0.446 shows moderately high levels of inequality. Among Kipsigis there is no direct transmission of cattle-loaning partners—they tend to be selected from among age mates. Wealthier cattle owners tend to have more partners than owners of few cattle ($r = 0.55$, $n = 156$, $P < .001$), and therefore, to the extent that sons of wealthy fathers are wealthy themselves (see above), we would expect men with large networks to have children who have large networks. The fact that this is not the case suggests that personal factors other than wealth play an important part in obtaining partners (particularly among sons where the correlation between wealth and number of partners is lower [$r = 0.32$, $n = 102$, $P < .001$] than it is among the fathers).

Bengaluru in-law networks. A Gini coefficient of 0.468 shows a relatively high degree of inequality for in-law networks in twentieth-century Bengaluru, while a β coefficient of 0.114 ($P = .117$) suggests that network size is only modestly transmitted. These results suggest that those with larger, wealthier social networks are somewhat more effective at achieving large and wealthy social networks for their children but that there are probably other variables at play that limit the importance of this effect. For instance, family and network characteristics may be only one feature of interest in a potential spouse since much emphasis is also placed on individual characteristics (e.g., Shenk 2004, 2005).

General Discussion and Conclusions

The high transmission coefficients of material wealth (mean $\beta = 0.55$, highly significant; shown in table 3) stand in sharp contrast to the much lower coefficients of embodied wealth (mean $\beta = 0.10$, not significant) and relational wealth (mean $\beta = 0.08$, not significant). These estimates indicate that a person born into the top decile with regard to material wealth is more than 80 times more likely to end up in the top decile than is someone born in the bottom decile; the corresponding numbers for embodied wealth and relational wealth are only about 1.9 and 1.7 times more likely, respectively (see Bowles, Smith, and Borgerhoff Mulder 2010; CA+ online supplement). The average Gini coefficient for material wealth shows high levels of inequality (0.57), embodied wealth shows moderate levels of inequality (0.28), and relational wealth shows an intermediate level of inequality 0.46). These patterns suggest that in agricultural societies, highly transmitted forms of wealth may also be more unequally distributed, as is the case for material wealth, but also that relatively high levels of inequality may exist in the absence of high levels of transmission, as appears to be the case for relational wealth.

Strong transmission of material wealth is consistent across the agricultural societies in our sample, even though they are quite distinct in terms of their regions, sizes, and social traits. In fact, most of our agricultural sample excludes urban populations in large state societies that are likely to show the highest levels of inequality, and thus, our analyses may consequently underestimate the degrees of both inequality and transmission of inequality in preindustrial societies. Our findings suggest that an emphasis on heritable forms of material wealth is highly characteristic of agricultural societies and may be an essential part of and motivation for the social features common to intensive agricultural societies (as discussed in the introduction to this paper). The results for embodied capital and relational wealth, on the other hand, are much lower and more inconsistent, suggesting that while they may be moderately important in some cultures they are not as necessary a part of the social complex associated with intensive agriculture.

Why, given what we know about agricultural populations as reviewed above, should material wealth show such a distinctive pattern? We suggest that material wealth is inherently easier to transmit between generations, more subject to customary and legal control of transmission, and, especially in the case of land, central to both the subsistence needs and levels of inequality of the cultures under study. Our data suggest that heritable wealth, and especially wealth in land, may be the key factor in the high and persistent levels of inequality seen in societies practicing intensive agriculture.

It is sometimes argued that intensive agriculture enables social complexity by creating food surpluses that allow for greater concentration of population as well as the freeing of people from subsistence work to pursue other tasks. These changes are thought to both allow for and necessitate an increase in political complexity and hierarchy (e.g., Carneiro 1970, Johnson and Earle 2000; Service 1975); however, the direction of causation is the subject of much debate (Pearson 1957). For example, Boserup (1965) argues that the amount of work involved in intensive agriculture would not be undertaken if it were not made necessary by a large population, while others have argued that geographical circumscription (Carneiro 1970) and/or social inequality (Price 1995; Wolf 1966) are probably necessary to motivate people to do the additional work required.

As discussed above, land limitation is a key feature of intensive agricultural societies. In fact, the rise of intensive agriculture implies a shift from labor limitation (meaning that not all arable land is in use) among horticulturalists to land limitation (implying that all or most arable land is in use) among intensive agriculturalists (e.g., Goody 1976; Harrell

1997; Johnson and Earle 2000). Regardless of the mechanism of causation, when population densities increase to the point where most easily cultivable land is in use, intensive methods of agriculture become both necessary and cost effective (Boserup 1965; Johnson and Earle 2000). When most or all cultivable land is occupied, use rights are likely to be codified through land tenure systems including either direct ownership, or various forms of landlordship with rights to collect rents, either of which can be amenable to rules of inheritance favoring kin (Boserup 1965). Once use rights or ownership of land is codified, land itself becomes a form of heritable wealth, creating the potential for the levels of persistent inequality shown in this paper.

Milanovic, Lindert, and Williamson (2007) examine levels of income inequality in ancient societies based on data gleaned from tax censes, dwelling rents, and other fiscal documents. The authors combine data on 14 ancient and preindustrial state societies, 12 from Eurasia and two Spanish colonies in the Americas, all of which would be classified as intensive agriculturalists under our criteria. The authors report Gini indices on a scale of 0 to 100 (instead of 0 to 1 but interpreted in the same way) ranging from 23.9 for China in 1880 to 63.5 for Nueva España (Spain's colony in Mexico and the surrounding area) in 1790, with the average being 44.1. The levels of inequality reported are very similar to those found in our analyses for material wealth, and in fact the authors show that the inequality patterns seen in their historical samples are quite similar to patterns in modern preindustrial nations from which most of our nonhistorical data sets come.

As discussed above, agricultural populations also show a significant elaboration of rules of inheritance, legitimacy, property transfer, and succession to office, which have been discussed by many authors (e.g., Baker and Miceli 2005; Boserup 1965, 1970; Engels 1942 [1884]; Gaulin and Boster 1990; Goody 1976, 1990; Harrell 1997; Pagel and Meade 2005). Most notably, these include rules that limit inheritance to only one or a category of heirs as well as rules establishing legitimacy of heirship, an important mechanism to reduce the number of heirs likely to inherit. In fact, research on large premodern state societies such as ancient Rome, Soong China, and Tokugawa Japan suggests that early demographic transitions may have been effected by infanticide and the abandonment of children (e.g., Caldwell and Caldwell 2005; Saller 1994). Such practices are thought to have been more frequent among the aristocracy and landed gentry whose power was partly based on wealth, very often wealth in land, and who were therefore motivated to restrict the number of their heirs.

Perhaps perversely, the strong emphasis on material wealth in agricultural societies can also produce a greater disassociation between the RS of parents and children, especially if inheritance rules related to material wealth have strong effects on which children marry and at what ages. For example, many parts of northern and western Europe have had low marriage rates in the last several centuries (Caldwell et al. 2006; Dixon 1978; Guinnane 1997). This phenomenon is usually interpreted as a result of land saturation and restrictive inheritance rules, especially the preferential inheritance of land by oldest sons and the preferential transfer of dowries to oldest daughters (e.g., Boone 1986; Goody 1976).

These considerations may be important in explaining why our β estimates for RS are moderately low and why some of them show no relationship at all. Our higher estimates (0.165–0.213) are consistent with data showing correlations in effective family size of 0.29 between parents and sons and 0.18 between parents and daughters among Hutterites (Pluzhnikov et al. 2007) when social constraints are limited, while our very low estimates appear to be related to high levels of social constraints (such as high rates of nonmarriage) that are likely to have affected some agricultural societies in the preindustrial past. However, it has also been found that RS is more highly heritable after the demographic transition than before it (Bittles, Murphy, and Reher 2008; Reher, Ortega, and Sanz-Gimeno 2008), so by excluding data on RS from societies showing evidence of a demographic transition, we may have limited our sample to societies with lower transmission of RS, thus biasing our averages downward.

Our research has two final implications. First, anthropologists have long used Service's (1962) categorization of societies into bands, tribes, chiefdoms, and states as a practical way of discussing cultural differences in hierarchy and inequality. The empirical basis for these categories, however, was limited to detailed ethnographic observation and involved only limited quantitative evidence (see Johnson and Earle 2000 for a recent and more ethnographically detailed treatment). Our study tests some of Service's key assertions using detailed quantitative data, and our results support some of his generalizations. Most importantly, we find very clear evidence that societies practicing intensive agriculture have high levels of inequality based primarily on forms of material wealth that are easily transmitted between generations and that present a clear basis for the formation and perpetuation of high degrees of social stratification.

Our findings further imply that heritable wealth—and especially wealth in land—may be a more fundamental indicator of social inequality in preindustrial societies than the rise of cities or the formation of early states. Indeed, it may be that the combination of intensive agricultural technologies with heritable wealth is a precondition that allows the elaboration of characteristics such as social complexity, monumental architecture, and urbanization that defines ancient and modern state societies. While high population densities and circumscription certainly can be associated with the rise of inequality, it may be their relationship to land limitation that is key to the high and persistent levels of inequality in material wealth that we see in agricultural societies in both the past and the present.

There are clearly limitations in what can be inferred about the past, and especially the ancient past, from this type of data. We cannot reconstruct the process of change, nor can we be certain how representative the data we use may be of

other agrarian societies. We hope, however, that by including multiple measures from a broad range of historical as well as modern populations, we have been able to obtain reasonable estimates of the transmission of different forms of wealth among intensive agriculturalists. The consistency of our results between societies in our sample, as well as with estimates of α, β, and Gini coefficients from other agrarian societies from different places and time periods, suggests that our findings may very well reflect important patterns in agrarian societies in both the present and the past.

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