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SOCIAL MOBILITY IN MULTIPLE GENERATIONS

ABSTRACT

Despite the dominance of a two-generation approach to the study of intergenerational social mobility, *multigenerational* influences that link the characteristics of kin across three or more generations may be important in some populations. These effects include direct net effects of grandparents' socioeconomic characteristics on grandchildren, the effects of even more remote generations, the effects of family characteristics that bring extreme advantage or disadvantage at points in the past that are not uniformly tied to any specific past generation, a variety of demographic effects that both reweight socioeconomic distributions in successive generations and also incorporate multigenerational effects on demographic behavior itself, heterogeneous multigenerational effects in populations that contain more than one social mobility regime, and long run multigenerational effects that result from mobility-fertility interactions in population dynamics. Genealogical data from the Qing Dynasty Imperial Lineage and from population registry data for Liaoning, China over the past several centuries provide illustrations of all of these types of multigenerational effects. Multigenerational influence is much more multi-faceted than previous speculations and empirical investigations have implied.

SOCIAL MOBILITY IN MULTIPLE GENERATIONS

INTRODUCTION

Most research on intergenerational social mobility and other intergenerational processes assumes that these processes can be fully summarized by the associations between the characteristics of people in two generations, that is, individuals and their parents or children. Although individuals and their families carry a longer legacy, we typically assume that its influences are Markovian; that is, that the effects of earlier generations, including grandparents and earlier generations, work entirely through the parental generation. This assumption is seldom examined, nor do we often recognize that its validity may vary systematically across time and place. We tend to concentrate on intergenerational effects almost exclusively across only two generations—despite the possibility that historical events, social policies, and the social circumstances of families in one generation may ramify across several subsequent generations. Even in a Markovian world, these ramifications are hard to predict when fertility, marriage, and mortality vary across socioeconomic groups. Some families live many generations whereas others die out—and this may vary with their prosperity. Social and demographic reproduction combine in a complex way.

Mare (2011) speculates about the mechanisms for possible multigenerational effects and the conditions under which these effects are strongest. The mechanisms are diverse, including kin availability and norms, inheritance of nonperishable wealth, social isolation, generation-skipping trusts, and slavery, among other institutions. Multigenerational effects may be strongest when groups are relatively isolated. For intergenerational socioeconomic mobility, this is likely to be at the tops and bottoms of socioeconomic hierarchies. Further, intergenerational social reproduction, whether across two or multiple generations, includes differential marriage, fertility, and mortality of social groups. These ideas motivate a research agenda in which investigators examine intergenerational socioeconomic (education, occupation, income, wealth) mobility using data over three or more generations; attend to heterogeneity of mobility processes at the top, middle, and bottom of hierarchies; and study mobility and demographic processes together.

A number of recent studies have pursued a part of this agenda, providing evidence, in a wide set of empirical contexts, for net associations between grandparent and grandchild socioeconomic statuses, controlling for the two-generation associations between parents and offspring (for example, Chan and Boliver 2013; Pfeffer 2014; Zeng and Xie 2014). It is important to recognize, however, that these types of associations represent but one type of multigenerational effect. A full understanding of the ways in which social hierarchies may persist across several generations must take into account diverse pathways of influence (Mare 2014). In addition to relatively straightforward "grandparent effects," there may also be effects of other kin outside the nuclear family (aunts and uncles, great-grandparents, etc.), legacy effects of more remote ancestors who may vary in how many generations removed they are from their descendants, a complex set of multigenerational demographic effects that arise through differential fertility and mortality, and other types of longer run effects. Taken together, these make up a rich set mechanisms of multigenerational influence, many of which have thus far been ignored in studies of social mobility. In this paper, we discuss this variety of multigenerational effects in more detail and provide illustrative empirical examples, exploiting novel historical data that are better suited to exploring this broad range of multigenerational effects than the more conventional social surveys that have sustained research on stratification and mobility.

The first part of this paper discusses a variety of possible multigenerational effects in social mobility, arguing that grandparental influence, which has been the focus of almost all multigenerational stratification research to date, is a special case of a broader set of influences. The second part sets out a research strategy and model for the investigation of a variety of multigenerational effects. The third part describes the context for the empirical data that are used in this paper, the era of the Qing Dynasty in China, and our data sources. The fourth part summarizes our empirical investigations, focusing on multigenerational effects and their interdependence with demographic processes. The paper concludes with a taxonomy of multigenerational effects and a discussion of the implications of our empirical findings.

VARIETIES OF MULTIGENERATIONAL EFFECTS

Grandparents

A basic generalization of standard models of intergenerational social mobility and achievement is to incorporate the potential influences of other kin members, especially those of grandparents, who may influence their grandchildren not only indirectly through their (two-generational) impact on their own children but also directly. For example, grandparents may vary in their ability to provide financial aid for grandchildren's education, childcare and socioemotional support to offset deficits in what parents may be able to support, and financial help via bequests that "skip" the parental generation (e.g., Bengtson 2001; Cherlin and Furstenberg 1986; Mare 2011; Quisumbing 1997; Warren and Hauser 1997). These effects may be particularly strong when grandparents live with grandchildren and when patterns of family structure and old age survivorship create a balance between the need for and availability of grandparent assistance (Coall and Hertwig 2010; Uhlenberg 1996). Alternatively, the effects of grandparents may work through the benefits or deficits they afford to an individual's aunts and uncles, that is, siblings of their parents, who may thus vary in their capacity to help the individual in question (Jæger 2012). As multifaceted and complex as these types of grandparent influences may be, however, they are special cases of a broader potential set of kin and demographic influences.

Beyond Grandparent Effects: More Generations

The most obvious generalization of the multigenerational grandparent effect is the possible effect of more remote kin. Individuals' social positions and well-being may also be affected by their great-grandparents and even earlier ancestors, net of the influences of parents and grandparents. These effects are likely to be weaker than grandparent effects because direct personal contact between persons who are separated by more than two generations is rare, because explicit institutional connections across such remote kin connections are seldom in force, and because the benefits and deficits that great- and more remote ancestors may convey to great aunts and great uncles and to cousins several times removed are less like to accrue to an individual. Of course, these remote generations may still exert their effects via their stronger intervening effects on an individual's grandparents and parents, but those effects can be thought of more simply as parent or grandparent effects. Effects that go back further than those of grandparents can be represented operationally by "autoregressive" ancestor effects of an order that depends on the number of prior generations that continue to affect an individual.

Beyond Grandparents: Remote Ancestral Effects of Unspecified Generations

A second generalization of grandparent effects consists of those effects that are not linked to any specific prior generation, but instead refer to exceptional advantages or disadvantages that may be established in any one of a number of prior generations, whether as recent as the parental generation or many generations before. These exceptional circumstances may include, for example, the rapid accumulation of very high wealth because of market luck or an usually lucrative invention (e.g., Thurow 1975), the possession of an extremely advantageous title or position by one or more remote ancestors, the acquisition of unusual cultural traits (such as language) because of social isolation followed by migration, or the experience of extreme hardship through slavery, whether *de jure* or *de facto* (e.g., Blackmon 2008). The effects of these characteristics of ancestors may dissipate over subsequent generations whose experiences are less extreme and thus be fully supplanted by more proximate effects of grandparental or parental characteristics. But at the extremes these effects may nonetheless persist for many generations. In a rigid system of legacy advantages in college admissions, for example, the first ancestor to be fortunate enough to attend an elite institution may be able to "bequeath" that advantage to all subsequent generations in his family if they choose to take advantage of it (e.g., Karabel 2005). Similarly, the establishment of noble "blood lines" by a remote ancestor may be an enduring advantage to his descendants many generations hence, regardless of the specific experiences of the intervening generations. Likewise, the great wealth that an entrepreneur or inventor may amass in his lifetime may establish a family residence, asset holdings, and traditions that persist across many generations. Unlike the effects of grandparents, great-grandparents, and other remote kin, these remote ancestral effects are not tied to any specific prior generation. Rather they establish a fixed or slowly changing characteristic of a family lineage that may exert an influence beyond that of any specific ancestral relative.

Multigenerational Demographic Effects

The ways in which an individual's social position affects the distribution of social positions in subsequent generations work through both direct transmission of position statuses and through demographic processes as well. Although a person's characteristics may be associated with the characteristics of their offspring and progeny in later generations, the impact of a generation also works through the degree to which that person produces children who survive to adulthood and take on the characteristics of their parents or earlier ancestors. Whereas conventional mobility research focuses on the associations between parents' and offspring's characteristics, *conditional on the existence of the offspring*, a more complete understanding of intergenerational influence treats as problematic the degree to which offspring will come into existence as well as the effects of parents on their children (Mare and Maralani 2006). Models for the joint analysis of demographic processes and social mobility combine standard demographic models for differential fertility and mortality with intergenerational mobility (Lam 1986; Mare 1997; Mare and Maralani 2006; Maralani 2013; Matras 1961, 1967; Preston 1974; Preston and Campbell 1993).

In a multigenerational context a variety of mechanisms may link demographic and stratification processes. As in the case of two-generation processes, differential net fertility among socioeconomic groups may modify the basic processes of status transmission from grandparents (or more remote ancestors) to progeny. Although high status members of the grandparent generation are more likely to have high status grandchildren, their ability to influence the grandchild generation is enhanced if they have particularly high net fertility and diminished if not. These effects, moreover, may work through differentials in marriage patterns, in fertility within marriage, and in survival to adulthood among children and grandchildren (Maralani and Mare 2005). Each of these mechanisms may contribute to a "reweighting" of subsequent generations via differential population growth of sociodemographic groups. In addition to these mechanisms, multigenerational effects may arise because the demographic rates themselves may be subject to multigenerational influence. An individual's own marriage and fertility behavior, for example, may be influenced by not only his or her own socioeconomic position but also by the positions of grandparents or more remote ancestors. These effects may work through fertility and marriage norms established in earlier generations or by multigenerational patterns of socioeconomic advantage and disadvantage (e.g., Anderton *et al.* 1987; Iglesias and Riboud 1988).

Heterogeneous Effects and Multiple Regimes of Stratification

An obvious complication to any analysis of social mobility is the possibility that mobility patterns are heterogeneous within populations. It is common to recognize that readily identifiable subpopulations (e.g., whites and blacks in the United States) may have different mobility patterns, usually operationalized as differences in rates or other parameters that describe processes of stratification and mobility. Alternatively, we may consider a more general type of "heterogeneous effects" in which each *individual* has, in principle, a unique set of parameters governing his or her own process of mobility (e.g., Blau 1977; Xie, Brand and Jann 2012). One can imagine heterogeneous effects of grandparents or other types of multigenerational influence. Beyond this, however, we should also consider that more than one regime of stratification may be at work in a society at any given time, yet these regimes may not be explicitly confined to any fixed set of individuals. Multigenerational influences may be particularly strong at the tops and bottoms of socioeconomic hardships where institutionalized mechanisms of extreme privilege or disadvantage may have particularly persistent effects (Mare 2011). Conversely, in the working and middle class, where educational attainment plays a pivotal role in both the transmission of advantage and creating mobility opportunities, grandparent and other multigenerational influences may be weak. Unlike heterogeneity in distinct and measured subgroups or individual-specific heterogeneity, these heterogeneous regimes may have permeable boundaries such that it may be possible for individuals to circulate in and out of elite or subordinate stratification regimes. The statistical importance of these regimes, moreover, may change over time depending on the distribution of hardship and the forms that it takes. This type of "mixture" of multigenerational and two-generational influence may be particularly hard to identify by direct measurement.[1]

Multigenerational Influence in the Long Run

The various multigenerational effects that have been discussed thus far may be viewed as the marginal impacts of differences in the characteristics of one generation on the outcomes for individuals or families distributions one or several generations hence. This is the typical emphasis of stratification studies generally, whether they focus on intergenerational or multigenerational effects. Yet it is also informative to consider the long run implications of alternative types of stratification effects, whether two-generational or multigenerational. In studies that predict whether an individual attains a socioeconomic position, long run influence is

[1] An instructive example of heterogeneous processes of stratification is provided by Karabel's (2005) account of the simultaneous legacy and meritocratic processes of educational selection and credentialing at Ivy League institutions.

somewhat hypothetical inasmuch as the chances of holding a given position are affected by opportunity structures that evolve as a result of many non-demographic influences. Thus processes of socioeconomic stratification are harder to simulate many generations into the future than processes that govern the spread of genetic or cultural traits (e.g., Cavalli-Sforza and Feldman 1981). Nonetheless, demographic processes and multigenerational transmission of socioeconomic positional status may still govern the long run relative capacity of men of high status in a given generation to produce progeny who have high status relative to men in the same generation who do not have high status. As we show below, the positions that individuals hold may affect their capacity to influence who holds favorable positions many generations in the future.

EMPIRICAL INVESTIGATION OF MULTIGENERATIONAL EFFECTS

The complexity of multigenerational effects makes it a tall order to incorporate all of them in a single empirical study. The requisite data must include multiple, linked generations of records of individuals' social positions. At least three generations are required and more if great-grandparent and remote unspecified multigenerational effects are considered. Additionally, information on each generation's net fertility is required and, if possible, its components of marriage, fertility, and mortality. Where possible, it is also desirable to have markers for different parts of a population to explore the possibility of multiple mobility regimes within population subgroups or institutional sectors of a society. Finally, a model is required for specifying and estimating the separate multigenerational effects.

Empirical Context: China during the Qing Dynasty

We investigate multigenerational effects using two remarkable sets of genealogical data for China, the China Multigenerational Panel Dataset-Imperial Lineage (CMGPD-Imperial Lineage) and the China Multigenerational Panel Dataset-Liaoning (CMGPD-LN), both of which are from the Qing Dynasty of China (Lee, Campbell, and Wang 1993; Lee and Campbell 2011; Lee, Campbell, and Chen 2010). These data pertain to 12 generations of Qing emperors and their relatives from the 17th to the 20th centuries and 10 generations of male peasants in the northeastern province of Liaoning from the mid-18th to the early 20th centuries. Both data sources contain rich information on the demographic behaviors of men and their occupational or other hierarchical positions.[2] Because the data contain full male lineages, they are subject to no recall and minimal survivorship bias. Because most of the Qing Lineage lived in Beijing for most of the period under study, they are a geographically distinct population and as well as an elite impervious to upward mobility. Additionally, as discussed further below, the types of social positions to which men in the Qing Lineage had access are entirely different from the relatively modest positions to which better off Liaoning peasants could aspire. For these reasons, we analyze the two sources of data separately and make informal comparisons between them. Nonetheless the analysis not only illustrates of the multigenerational effects discussed in the previous section within each population, but also suggests differences in multigenerational processes between elite and mass populations. More details about these data and their historical context are provided below.

Model of Population Renewal and Social Mobility

We specify and estimate multigenerational effects using an extension of two-generation

[2] The term "position" encompasses occupations as well as honorific titles.

models for socioeconomic and demographic reproduction (Mare and Maralani 2006; Maralani; 2013; Song and Mare [in press]). The model specifies the effect of an individual's social position in one generation (compared to the positions of other individuals in that generation) on the expected number of offspring in a given position in the next generation; that is, the joint result of the effect of a person's position on his fertility and the effect of a person's position on the socioeconomic attainment of whatever children he has. In our application of this model we further decompose the fertility effect into a part due to differential rates of marriage (or numbers of marriages in the case of the polygamous Qing Lineage population) and differential rates of net male fertility within each marriage.[3] Although our data enable us to look at a great many generations, for the purposes of discussion, assume that we identify intergenerational relationships for four generations, that is, a generation of men and their fathers, grandfathers, and great-grandfathers. Further, men may vary in other characteristics, such as various aspects of their family lineage or other traits and are classified into homogenous groups based on these characteristics. The one-sex "social reproduction model" is

$$S_{i|jkl,c} = F_{jkl,c} \cdot m_{jkl,c} \cdot r_{jkl,c} \cdot p_{i|jkl,c} \tag{1}$$

where $S_{i|jkl,c}$ denotes the number of men in the offspring generation who are in position i ($i = 1, \ldots, I$) and group c ($c = 1, \ldots, C$) on other traits and whose fathers were in position j ($j = 1,\ldots, J$), grandfathers were in in position k ($k = 1,\ldots, K$), and great-grandfathers were in position l ($l = 1,\ldots,L$); $F_{jkl,c}$ denotes the number of group c men in the paternal generation who were in position j, whose own fathers were in position k, and whose own grandfathers were in position l; $m_{jkl,c}$ denotes the average number of wives per man in that group of men in the paternal generation; $r_{jkl,c}$ denotes the expected number of sons born to each wife of a man in that group of men in the

[3] Net male fertility refers to the number of sons who survive to adulthood (age 16 in our analysis).

paternal generation; and $p_{i|jkl,c}$ denotes the probability that a son in group c with a father in position j, a grandfather in position k, and a great-grandfather in position l survives and enter position i. The marriage (m), fertility (r), and positional mobility (p) terms are the dependent variables in models of intergenerational influence. For the c^{th} group,

$m_{jkl,c}$ = L(position, father's position, etc.; indicators of ancestral advantage; generation; other controls)

$r_{jkl,c}$ = H(position, father's position, etc.; indicators of ancestral advantage; generation; other controls)

$p_{i|jkl,c}$ = G(positions of father, grandfather, etc.; indicators of ancestral advantage; generation; other controls)

where H and G are negative binomial and logit functions respectively, and L may be a logit or negative binomial function depending upon whether the population typically practices monogamy or polygamy. This model can show the separate contributions of intergenerational mobility and differential net fertility to the reproduction of the occupational structure and the intergenerational and multigenerational effects of social position and remote ancestral advantage on each part of the reproduction process. It allows us to quantify the relative effects of demography and mobility on intergenerational socioeconomic reproduction and to simulate the long run and equilibrium implications of model estimates for the relative reproductive success of high and low status individuals.

DATA AND METHODS

Our empirical evidence comes from two sources: the China Multigenerational Panel Dataset-Imperial Lineage (CMGPD-Imperial Lineage) and the China Multigenerational Panel Dataset-Liaoning (CMGPD-LN), both of which are from the Qing Dynasty of China. The Qing

Dynasty (1636-1912) was the last dynasty of China before the Republic of China (1912-1949) and the subsequent People's Republic of China (1949-). The dynasty was founded by the Aisin Gioro clan in northeastern China, named for the ancestor from whom most clan members were descended. The Qing Empire governed over 13 million square kilometers of territory and 150 million people in the 17th century in a highly polarized society with more than 90 percent of the population engaged in agricultural work and less than 1 percent being aristocracy and government officials (Peterson 2002, p. 475; Hung 2008).

Under the highly centralized feudal monarchy, the Qing emperor had supreme authority, and people who belonged to his imperial lineage were recognized as the highest strata of the society. The Qing government delimited the imperial lineage as people who were descended from the grandfather of the first Qing emperor. At the beginning of the Qing Dynasty, the imperial lineage was a small elite group, many of whom held either official positions or noble titles. As the population grew, more and more men in the lineage became distant relatives of the emperors, most of whom had neither official positions nor noble titles. Their social statuses, however, were still higher than the commoners because they could receive annual stipends from the government. Except for several big cities, such as the Qing capital *Beijing*, most regions administered by the Qing Empire were rural, where the majority of inhabitants were peasants who engaged in subsistence farming on small plots which they owned or, more commonly, rented from the state or landlords. Non-peasants who resided in the rural areas included those employed by the state as artisans, soldiers, or civil and military officials (Lee et al. 2010).

During the Qing Dynasty polygamy was permitted and men from wealthy families could afford to have one wife and several concubines, a privilege they were likely to take if their wife did not bear sons (Hsu 1943; Mann 2002). However, sex-selective infanticide and restrictions on female remarriage led to a scarcity of females, especially in rural areas (Chen, Campbell, and Lee 2008). The skewed sex ratio as well as the tradition of high bride price prevented many impoverished men from marrying (Peterson 2002).

CMGPD-Imperial Lineage

The Qing government established the Office of the Imperial Lineage in 1652 to register lineage members, supervise lineage activities, and maintain the lineage genealogy (Wang et al. 1995). The *CMGPD-Imperial Lineage* data include information from the first emperor of Qing Dynasty (who lived in the mid-16th century), his siblings and cousins, and all of their male descendants until 1936. We restrict our sample to men who were born in 1616-1850 because the genealogy did not record birth years for men born before 1616 and men born after 1850 may not have completed their fertility by the end of the observation period, that is, the end of the Qing Dynasty. We further restrict the sample to men who survived to adulthood and can be linked to their fathers, grandfathers, and great-grandfathers. In our analysis, we only differentiate two social positions (high versus low). The high status group refers to men working in the Qing bureaucratic system or holding noble titles. Men with high bureaucratic positions include chief of the banner system, military generals, commanders in the bodyguard office, ministers, province governors, clerks, and county head commissioners. Men with noble titles include princes, dukes, and aristocrats. Some of the titles were inheritable, but often only the eldest son from a man's wife (not concubines) could inherit the title from his father. Most of these titles lost their value as the generations succeeded each other. Between families, a father's social status largely determined his sons' statuses, but within family differences among sibling's statuses were substantially subject to their mother's statuses (wives vs. concubines). In our analyses, we ignore variations among siblings and focus on between-family differences only. Overall, our Imperial Lineage sample consists of 20 percent of men in high status, most of who lived on positional salaries or noble title stipends, and 80 percent of the rest in low status. The low status men in the sample, however, still received monthly stipends from the Qing government in recognition of their statuses as descendants from the same ancestors as the Qing emperors. In this regard, they were different from the population outside the Imperial Lineage, including the Liaoning population.[4]

In our analysis of social mobility in the Qing Imperial Lineage, our main indicator of social position is the distinction between high and low positions in each generation, as discussed above. Additionally, however, we attempt to assess the persistent advantages enjoyed by men of favorable ancestry, regardless of the positions of their fathers, grandfathers, and possibly other specific kin. For the Qing Lineage we distinguish between men who were direct descendants from one or more Qing emperors and those who descended only from brothers or male cousins of the original emperor. As our empirical analyses show, lines of men who were direct descendants from several emperors enjoyed persistent advantages in their positional attainment over those who were not direct descendants.

CMGPD-LN

The *CMGPD-LN* data include information for men, most of whom were hereditary peasants, living in northeastern China between 1749 and 1909. These men were the descendants of a large group of Han Chinese immigrants who settled in Liaoning in the late 17th and early 18th centuries and a small group of Liaoning natives. Lands in Liaoning were made up of newly

[4] To test the sensitivity of our results, we also experimented with other definitions of social class, for example only including men with official positions in the high status group. The results are similar to those reported in this paper.

reclaimed lands, large state-owned estates owned by nobles or used to supply goods during wartime, and imperial tombs. Some lands were located close to the city of Shenjing, which was the old capital of the Qing Dynasty (1616-1644) before it unified China and moved its capital to Beijing. The Qing government organized all men in Liaoning in three status subpopulations: regular farming population, special duty population, and estate and servile populations.

The regular farming population included peasants who rent hereditary lands from the Qing government and paid fixed in-kind taxes in return. When new reclaimed lands became available, the government assigned them to families with more offspring. In most instances, however, most families held a fixed plot of land dating from their ancestral arrival, so that families with more offspring over generations had smaller land holdings per descendant, in general. One advantage of belonging to the regular farming subpopulation was that sons of peasants could be employed as civil or military officials via the state-sponsored exams or military service and some of them even received honorific titles. These upward mobility opportunities brought with them substantial salaries and a variety of other powers and privileges, including differential access to the social security system that protected orphans and widows, the aged, the retired, and the unemployed (Lee et al. 2010).

The special duty population included peasants who provided special goods for the imperial palace and sacrificial rituals to the Qing government, including collecting honey, raising bees, fishing, picking cotton, tanning and dyeing (Lee et al. 2010). The Qing government assigned annual service quotas and paid small cash salaries to the families, but if a family could not meet its quota, it had to pay the Qing government in cash. Compared to regular farmers, the special duty population had a lower social status because they were not allowed to seek civil or military positions. In the 18th century, however, the government did permit some special duty families to convert their population status to regular farmers if they paid off their duty, thereby allowing some possibility of upward social mobility for their descendants became possible.

The estate and servile population largely consisted of exiled nobles and their families and servants, as well as some individuals who were war captives. Compared to the regular farming and the special duty populations, they had the lowest status, without rights to take government sponsored exams, rent government owned lands, or marry outside of their own population (Ding et al. 2004). Although populations in Liaoning were not representative of the whole Chinese population during the Qing Dynasty, social stratification in Liaoning was broadly indicative of institutional and social processes that were operating elsewhere in China during that era (Lee and Campbell 1997; Campbell and Lee 2009).

The *CMGPD-LN* data include information on all the residents and their descendants in east Liaoning from 29 population registers in three year intervals. Because the starting year of the registers varies from 1749 to 1864, we define men in the first generation as those whose information appeared first in the registers. Some populations entered the registration system late because they moved into newly-reclaimed frontiers. In general, the duration of observations for the regular farming and special duty populations lasted for the period from the mid-18th century to the early 20th century, whereas the observations for the estate and servile populations showed up after the 19th century.[5] Through record linkage, paternal pedigrees can be reconstructed for as many as 10 generations.

We estimate the marriage and reproduction models using data from generations 3 to 8 and the mobility models using data from generations 4 to 9, a necessity because we lack information on grandfathers until generation 3 and great-grandfathers until generation 4. In other

[5] For a full list of the durations of the 29 population registers, see the CMGPD-LN User Guide (Lee, Campbell and Chen 2010, pp. 1-3).

words, we treat generations 3 to 8 as the generations of fathers and generations 4 to 9 as the generations of sons. We exclude generation 10 because only one family lasted 10 generations.

We measure the positions and titles of men, their fathers and grandfathers, and the status characteristics of their ancestors. Position in these data refers to whether a man had a salaried position as a government official, soldier, or artisan. Because the population is mainly rural, holding a salaried position indicates not only the status of a man but also his access to additional income and privileges (Lee *et al*. 2010). For this population we also seek to identify markers of extreme hardship that may disadvantage men beyond having a father, grandfather, or other specific kin member who was in a low position. To identify ancestral hardship, we classify ancestors by whether they were ever in the special duty group and by the number of generations that elapsed since a family had members in this group. As discussed earlier, the special duty and the servile population had lower status than the regular farmer population because they were not eligible for government positions or titles. The descendants from special duty ancestors might experience upward mobility if they or any of their predecessors changed their population status to regular farmers, but the servile population had no such options. In our analytical sample, 18 percent men belong to the special duty subpopulation, and 68 percent of their sons, 60 percent of their grandsons, 53 percent of their great-grandsons, and 44 percent of their great great-grandsons remained in this status category.

EMPIRICAL RESULTS

Descriptive Statistics

Table 1 summarizes key features of the Qing Imperial Lineage and Liaoning genealogies for our analyses. The institution and practice of marriage differ substantially between these two populations. Whereas nearly all Qing Imperial Lineage men marry and many practice polygamy, a much larger proportion of Liaoning men fail to marry and those who do marry are monogamous. This reflects the highly privileged status of Qing men combined with an imperative to produce sons. Many Liaoning men were too poor to marry or were otherwise constrained by a highly imbalanced sex ratio. Overall male net fertility (that is, numbers of sons surviving to adulthood) is higher among Qing Imperial Lineage men, a result mainly of higher proportions married, polygamy, and higher net marital fertility.

In our analysis of the Qing Imperial Lineage men, we distinguish between those who held a high government position or noble title and those who did not. Among the Liaoning men, we distinguish between those who held any non-peasant state-employed occupation (any government position, soldiers, and artisans) and those who did not. However, even allowing for the extreme differences in the kinds of "high" positions available to these two populations, the Qing Imperial Lineage men were much more likely to hold their respective high positions than the Liaoning men. Among the Qing men, 23 percent held a high position, whereas among the Liaoning men, less than 3 percent did so. In both populations, the ancestors of these men – that is, their fathers, grandfathers, and great-grandfathers – were much more likely to hold positions than the men themselves. This is not mainly the result of secular declines in numbers of men holding positions. Rather, it reflects the effects of positional status on net male fertility. That is, men who held positions sired significantly more male offspring than those who did not, resulting in higher levels of position holding among ancestors when they are viewed retrospectively relative to a particular ego.

Although the Qing Imperial Lineage men are all kin of Qing emperors, only 60 percent of them are direct descendants of emperors. Even within this elite population there is substantial heterogeneity in their number of direct ancestral emperors. In contrast, our measure of hardship in Liaoning, namely the number of generations back to an ancestor in the special duty category, shows that 18 percent of the population are in special duty for all the generations, 8 percent are regular farmers but their fathers are in the special duty group, and 3 percent are regular farmers but have a grandfather or earlier ancestors in the special duty group. Compared to regular farmers, individuals with the special duty status may have been disadvantaged in positional attainment because they were not eligible to take official positions. After families escape that status, the disadvantage may dissipate with the number of generations back to when the family held that status.

By the design of the two data sources as well as our selection of cases, the distribution of generation sequences differs between the Qing Imperial Lineage and Liaoning. Sequences are on average much shorter among Liaoning men. Because length of generational sequence is potentially confounded with number of privileged ancestors and other variables in our analyses, we control for length of sequence in all of our estimated models.

Estimated Effects of Parents and Early Ancestors on Marriage, Fertility, and Mobility

Our analyses of the Qing and Liaoning data are based on various estimated versions of the social reproduction model for marriage, fertility, and social mobility. For each population we select one model as a basis for further decomposition and simulation to illustrate the implications of the model, although we also use the full “families” of estimated models to illustrate general principles. Tables 2 and 3 present detailed model estimates for the Qing Imperial Lineage and Liaoning respectively. Figures 1 and 2 display key results using predicted probabilities and predicted numbers of wives and sons. Within each population we predict each of three outcomes, marriage, net male fertility per marriage, and whether or not a man held a high position. All marriage and fertility models include the effects of a man's own position and all mobility models include the effects of a man's father's position. Additionally, all models include measures of remote ancestral advantage (in the case of the Qing Lineage) or disadvantage (in the case of Liaoning). Within an outcome, models vary in the "order" of multigenerational effects; that is, whether only two-generation effects are included or earlier generations as well.[6]

Unlike the Imperial Lineage data, the Liaoning data, which come from triennial population registers, suffer from censoring of the fertility distributions. For the Imperial Lineage data, we restrict the sample to male cohorts who died before the end of the observation period.[7] For the Liaoning data, given its relatively short observation duration, we include male cohorts who were still alive by the end of the last observation year (1909 for most registers). To address the censoring problem for the Liaoning data, we control for (log) exposure time in our models and fix the coefficient on this variable to 1. This is tantamount to predicting a fertility rate (Powers and Xie 2008:.190).

Social Mobility and Positional Attainment

For the Qing Imperial Lineage, we find significant multigenerational effects on the probability that a man achieves a high position, including the effects of grandfather's position, great-grandfather's position, and the number of direct ancestors who were emperors. The coefficient estimates and standard errors are reported in Table 2 and predicted probabilities are shown in panel A of Figures 1 and 2. Figure 1 shows a gradient in probabilities for the Qing

[6] We also experimented with models that included multigenerational effects of fathers, grandfathers, and great-grandfathers but excluded remote ancestral effects. The estimated father, grandfather, and great-grandfather effects were extremely close in value to the ones in the models reported here.
[7] The data end in 1936 and we restrict our observations to male cohorts born before 1850. We assume that all the males in our data died before 1936 and that we observe their full fertilityhistory.

Lineage of having a high position from men whose fathers, grandfathers, and great-grandfathers all had high positions (a probability of roughly .7) to men for whom none of their fathers, grandfathers, or great-grandfathers had a high position (roughly .2).[8] The largest effect is of fathers, followed by grandfathers and by great-grandfathers, although all three effects are statistically significant. There is also a substantial contrast in the probability of having a high position between men who had several direct ancestral emperors and those who had none. When all other variables in the model are set to zero, the expected probably of a high position for a man with at least four ancestral emperors is approximately .35 whereas for a man with no ancestral emperors the probability is approximately .18 (Panel A of Figure 1). That we see such strong effects in the presence of controls for the statuses of three generations of "recent" ancestors, for various measures of family size, and for length (in generations) of the observation period is strong evidence of remote ancestral influence in this elite population.

In Liaoning we also find evidence of multigenerational effects from the positions of fathers, grandfathers, and great-grandfathers as well as from remote ancestors who were confined to the special duty status group. Panel B of Figure 1 shows the gradient in probabilities of having a position among men with various combinations of ancestors having or not having a position. These range from approximately .33 for men from three generations of position holders down to approximately .015 for men with no recent ancestors who held positions. Although this contrast is quite dramatic, than two percent of Liaoning men held positions. The very low probabilities for the fourth pair of bars in panel B of Figure 1 represents the experience of the overwhelming bulk of families observed in the *CMGPD-LN* data. In addition, the estimated effects from the number of generations removed from an ancestor in the special duty group also shows that individuals descended from distant ancestors who were had especially low status still

[8] These effects are evaluated where all other categorical variables in the model are zero.

suffer from disadvantages beyond those that one would expect from fathers, grandfathers, and great-grandfathers. When all other variables in the model are set to zero, the expected probably of a high position for a man with ancestors in the low status special duty group back to three or more generations is approximately 0.01 whereas for a man with no ancestral hardship the probability is approximately .02 (Panel B of Figure 2). The results suggest that not only can remote ancestors bring extra privileges to the life opportunities of descendants, but also their hardship may endure generations beyond their own.

Marriage and Fertility

In the Qing Imperial Lineage whether a man held a high position had a substantial effect on the number of women he was able to marry. As shown in Table 2, we find highly significant effects of a man's own position on his number of marriages. In contrast to the pattern of results for social mobility, however, the positions of fathers, grandfathers, and great grandfathers do not affect marriage. Remarkably, however, we see significant differences among men's expected numbers of marriages among men who vary in their number of ancestral emperors. For fertility, by contrast, there are no significant positional effects and only small (and negative) effects of remote ancestors. Men who had high positions averaged almost one wife more than those who did not (Panel A of Figure 2). Because the number of surviving sons per wife does not vary between men with and without high positions, differentials in numbers of wives account for all of the net fertility variation between men with different positional statuses. Similarly, men with four or more ancestral emperors averaged approximately one half of a wife more than those with no ancestral emperors. Fertility differentials among men with different numbers of ancestral emperors are small and negative, again implying that overall net reproduction differences among men with different numbers of ancestral emperors is entirely due to differences in numbers of wives.[9]

In Liaoning, a population without polygamy but extensive nonmarriage, the pattern of socioeconomic and remote ancestral effects on marriage and fertility differ from the Qing Imperial Lineage. The positional statuses of both men and their fathers affect both marriage and fertility within marriage. Socioeconomically advantaged men are more likely to marry and have more children within marriage. Additionally, social disadvantages also reduce the probability of marriage and the expected fertility of men in Liaoning. As shown in Table 3, members of the servile population had significantly lower probability of marriage, that is, almost 13% ($e^{-0.142} - 1$) less than regular farmers and have fewer expected surviving sons by about 7% ($e^{-0.070} - 1$). The results of marriage and fertility disadvantages associated with ancestral special duty status, shown in panel B of Figure 2, suggest a curvilinear pattern. Whereas men in the special duty group had a significantly higher probability of marriage and more expected offspring, men whose families converted their status from special duty group to regular farmers had lower marriage probabilities and fewer offspring. This pattern may occur because special duty families with more offspring were more likely to fulfill the annual service quota assigned by the Qing government and pay off their service by cash. Additionally, as the lands allocated to the regular farming families were largely fixed since their ancestors' arrival in Liaoning, families with more offspring may have had less land per male offspring. This policy might have been a fertility disincentive for regular farmers.

[9] The small negative effects of remote ancestors may arise because men's motivation to take on additional wives may be linked to failure of early wives to bear (enough) sons.

Components of the Social Reproduction Effect

Taken as a whole, our models represent a number of pathways through which prior generations of ancestors affect subsequent generations. These include the distinct effects of fathers, grandfathers, great-grandfathers, and "remote" ancestors who were particularly advantaged or disadvantaged. Additionally, they include the separate effects of ancestors' positions (that is, the social mobility/immobility effect) and of differential reproduction of prior generations through differential marriage and net fertility. We can combine these various effects to quantify their relative importance. For each ancestral trait, we decompose its social reproduction effect (*SRE*) into parts associated with mobility, marriage, and fertility.

Based on the social reproduction model discussed above, we define the *SRE* for a targeted position category relative to a baseline category of positions in each generation that affects an individual's own position. For example, the difference in the expected number of individuals who are in position category *i* for those whose fathers were in position category *j* relative to those whose fathers were in position category *j'* is, assuming that grandfathers were in position *k* and great-grandfathers were in position *l* and suppressing notation for other variables in the model,

$$SRE_{i|jkl} = \frac{S_{i|jkl}}{F_{jkl}} - \frac{S_{i|j'kl}}{F_{j'kl}} = m_{jkl}r_{jkl}p_{i|jkl} - m_{j'kl}r_{j'kl}p_{i|j'kl} \tag{2}$$

where all notation is as defined above for equation (1). The *SRE* is the advantage of men in position *j* over men in position *j'* to produce sons who are in position *i*. It combines the ability of relatively advantaged men to improve the life chances of their offspring with the number of surviving offspring that these men produce. We provide formal definitions of social reproduction effects for grandfathers, great-grandfathers, and remote ancestors in the Appendix.

To evaluate the contribution of each process to the overall social reproduction effect, we decompose the *SRE* into three parts: marriage, net fertility, and mobility. When evaluating one of the three effects (e.g., marriage effect), we control the other two effects at their average levels (e.g., average net fertility for each marriage and average mobility). For the effect of father's position, if $\bar{r}_{.kl} = \frac{(r_{jkl}+r_{j'kl})}{2}$, $\bar{m}_{.kl} = \frac{(m_{jkl}+m_{j'kl})}{2}$, $\bar{p}_{i|.kl} = \frac{(p_{i|jkl}+p_{i|j'kl})}{2}$ and $\overline{mr_{.kl}} = \frac{(m_{jkl}r_{jkl}+m_{j'kl}r_{j'kl})}{2}$, then

$$SRE_{i|jkl} = (m_{jkl} - m_{j'kl}) \cdot \bar{r}_{.kl} \cdot \bar{p}_{i|.kl} + \bar{m}_{.kl} \cdot (r_{jkl} - r_{j'kl}) \cdot \bar{p}_{i|.kl} + \overline{mr_{.kl}} \cdot (p_{i|jkl} - p_{i|j'kl}) \quad (3)$$

which contains terms for marriage, net fertility, and social mobility. We isolate the three components of the reproduction effect for contrasts involving the several family background variables included in our models, including father's, grandfather's, and great-grandfather's positions as well as remote ancestral conditions.[10]

Our results, based on the preferred model for the Qing Lineage in Table 2, namely the first-order marriage model, the first-order reproduction model and the third-order mobility model, and for the preferred model for Liaoning, namely the second-order marriage and fertility and third-order mobility models, are presented in Table 4. These results are based on a dichotomous indicator of the positions of men and their fathers, grandfathers, and great-grandfathers. For the Qing Imperial Lineage the total reproductive effect of father's position -- that is, the net difference in number of surviving sons who have a high position between a father who has such a position and one who does not—is almost a full son in a high position. As

[10] In practice, these effects and their components are evaluated at specific levels of the other variables in the model. In this example, the effect of the contrast between the j^{th} and the j'^{th} level of father's position is evaluated at the k^{th} position of grandfathers and the l^{th} position of great-grandfathers. Because most of our models are based on additive effects of father's, grandfather's, and great-grandfather's positions, the estimated effects and decomposition are the same regardless of the specific levels of the other variables in the model.

shown in the third column of Table 4, approximately two thirds of this effect is attributable to the net intergenerational association between a father's and a son's positional status. The balance of the reproductive effect comes from differences in the expected numbers of wives for a man in the paternal generation who have a high position and one who does not. As shown in the estimates for the fertility models, men's positional statuses do not affect children born per wife in the Qing Lineage, but they do affect number of wives. For a constant number of children per wife, more wives leads to more sons. Grandfathers and great-grandfathers have much smaller reproductive effects, approximately one tenth of a high position son in the first case and a twentieth in the second case. This effect is entirely due to social mobility patterns because grandfather's and great-grandfather's positional statuses do not affect marriage or fertility. For the remote ancestral effect, operationalized here as the contrast between men who are direct descendants of at least four ancestral emperors relative to those who have no direct ancestral emperors, the overall effect is approximately .34 of a son in a high position. Roughly three fourths of this effect is attributable to a mobility effect and the balance is due to the greater number of wives obtained by men with remote ancestral advantage. Speaking broadly, for the Qing Lineage, two-generational effects are strongest, but we see a large effect of remote ancestral advantage as well. In both cases the differential social mobility effects are substantially enhanced by differential fertility.

In Liaoning, intergenerational effects of any kind are smaller than in the Qing Imperial lineage, a result of the small number of men who are able to acquire positions in this population. The effect of a man having a position in the paternal generation is approximately .31 of a son who has a position. Roughly two thirds of this effect is attributable to the intergenerational association of father's and son's positional status and the balance is due in roughly equal parts to the advantage that a man with a position has in getting married and to his higher net fertility within marriage. Relative to the two generation effects, the multigenerational effects in Liaoning are small. Remote ancestral disadvantage has a modest effect, which is greater than the net great-grandfather effect but smaller than the grandfather effect.

Net and Total Effects of Grandfathers, Great-Grandfathers, and Remote Kin

Another aspect of the interdependence of demographic processes and social mobility in multiple generations is the total effects of grandparents, great-grandparents, and remote kin.[11] As shown in Table 4, net effects of the position of kin decline in strength as the number of intervening generations increases, a pattern that holds for overall social reproduction as well as positional mobility considered alone. Father effects are stronger than grandfather effects and great-grandfather effects are weaker still. Our models imply, however, that more remote kin may affect later generations not only directly but also indirectly through their effects on intervening generations. Provided that all net associations are positive, the total (zero-order) associations between the positions of grandfathers and grandsons are also positive but likely to be smaller than the total association between fathers and sons. By extension, the total association between the positions of great-grandfathers and their great-grandsons are smaller than the associations between kin who are only one or two generations apart.[12] The patterns of association that we observe for positional mobility by itself, however, may be quite different when we also take account of the cumulative impact of differential fertility, marriage, and mortality. The total *joint* effects of positional mobility and demographic processes may not decline with the number of

[11] Formulas for the estimates discussed in this section are presented in the appendix.
[12] In a purely Markovian system, it is a formal property of the model that total associations decline geometrically with number of generations of separation. In second and higher order models, total associations are likely to decline monotonically as well, although at a lower rate.

intervening generations. Rather, the total effects of grandfathers and great-grandfathers may have a cumulative impact across generations.

Table 5 compares net and total associations of father, grandfather, great-grandfather positions with son positions as well as the net and total associations of remote ancestral advantage or disadvantage and son position. The net combined effects of fertility, marriage, and social mobility on numbers of progeny who hold high positions, as also shown in Table 4, are dominated by the net effect of the paternal generation. However, as shown in the second column of Table 5, for the Qing Dynasty, the total associations increase monotonically from father to grandfather to great-grandfather. Whereas a man in the paternal generation who holds a high position can expect to have approximately one more son in a high position than a man who holds a low position, a man in the great-grandfather generation can expect to have approximately 2.5 more high position great-grandsons than a man who has a low position. For Liaoning, a high position man has approximately the same total expected number of high position progeny in each subsequent generation. The persistent differentials in number of high position progeny for high and low position men, whether growing across generations as in the case of the Qing Dynasty or approximately constant as in the case of Liaoning, arises from the combined effects of demographic processes and social mobility. Differentials in marriage and net fertility offset the tendency for positional advantages in social mobility by themselves to decay across generations. The third column of Table 5 shows the total associations between the position status in each generation and the probability of having high position descendent. These probability differences provide the total associations across generations due to social mobility alone, that is, without the influences of fertility and marriage. These total associations indeed show a pattern of decline across generations in both the Qing Lineage and Liaoning populations. That demographic effects may persist more strongly across generations suggest that, under some circumstances, positional inequalities, in combination with demographic differentials may have very long run effects.

Positional Effects in the Very Long Run: Equilibrium Distributions

Using our models, it is possible to estimate the eventual reproductive impact of high (vs. low) positional status after many generations. In the long run, to what degree does a man who holds a high position, compared to one who does not, have decedents who themselves high positions? Additionally, to what degree do these long run effects depend on (a) whether or not grandfathers and great-grandfather's position affect an ego's positional status and (b) differential marriage and fertility? To answer these questions, we use our estimated models to simulate the long run and equilibrium differences in distributions of positions held by the descendants of men in high and low status positions under alternative assumptions. Panels A and B of Figure 3 present our results for the Qing Imperial Lineage and Liaoning respectively.

In the absence of differential fertility and marriage among men who hold and do not hold high positions, there is *no* long run effect of positional status on the number of high status descendants. As shown in the three grey lines at the bottom of Figures 3, men from high status positions have more high status sons (as a result of the positive association of positional status across generations), but this effect dies out after a few generations. This illustrates the well-known property of Markov processes that they cause populations to "forget" their past. After a half dozen generations and in equilibrium, patterns of intergenerational mobility imply that the descendants of men in high status positions are no more likely than the descendants of men in lower status positions to themselves be in high status positions. A qualification to this conclusion, however, is that in the presence of grandfather and great-grandfather effects on mobility, the *speed* with which a population approaches equilibrium is slower than in the purely Markovian (two-generation) case.

In contrast, when we allow for patterns of differential marriage and net fertility that appear in the Qing and Liaoning data, the resulting equilibrium distributions are quite different. Given differential marriage and fertility, high status men produce significantly more high status descendants, not only in the first few descendant generations but also in the very long run. These equilibria, moreover, depend on whether the mobility process is Markovian or includes grandparent and great-grandparent effects. Under a first-order Markov model, among men in the Qing Imperial Lineage, the equilibrium effect of being in a high status position is approximately 2.4, meaning that, in the long run, a man in a high position has approximately 2.4 times as many high status descendants as his counterpart in a lower status position. Under a model of both father and grandfather effects, this effect is approximately 2.9 times as many high status descendants, and in a third-order model (that is, with father, grandfather, and great-grandfather effects), the preferred model in our statistical analysis, the effect is almost 3.2.

In Liaoning, the same general patterns hold, but the contrasts among alternative models and the overall impact of differential marriage and net fertility are notably higher. In Liaoning the effects of holding a high status position on the equilibrium level of high status ancestors range from approximately 2.8 under the Markovian model to 4.7 under the preferred model with father, grandfather, and great-grandfather effects on having a position. Further, the convergence to equilibrium is notably slower for the higher order models. These greater equilibrium contrasts stem in part from the larger relative effects of grandfathers and great-grandfathers in Liaoning compared to the Imperial Lineage (compare panels A and B of Figure 1) and from the larger and more complex effects of positional status on marriage and fertility in Liaoning (compare the two panels of Figure 2).

Overall, the pattern of equilibrium effects illustrates several important principles of intergenerational and multigenerational effects on positional attainment. First, non-Markovian effects on mobility slow down the convergence to equilibrium. Because of high positive associations between ancestors and offspring, high status men can increase the number of high status descendants. Although this effect eventually dissipates in the absence of differential net fertility, it persists longer when mobility effects are non-Markovian. Second, intergenerational mobility is inherently equalizing inasmuch as movement among status groups offsets the tendencies of some status groups to grow more rapidly than others because of differential fertility. Were the status groups “islands,” that is, be subject to no intergenerational mobility, then fertility differentials would imply differential rates of population growth (Mare 1997). Third, on the other hand, differential net fertility that favors higher status men amplifies the effects of intergenerational (im)mobility. The short term advantages enjoyed by the descendants of high status men dissipate in the absence of fertility differences. Net fertility differences, in contrast, magnify and sustain these short term effects, even resulting in a very long run equilibrium advantage of men in higher status position. When socioeconomic differences in marriage opportunities, fertility, and maternal and child mortality are high, this is a powerful mechanism of multigenerational influence.

CONCLUSION

The links between the social positions of ancestors and the positions of descendants are complex and multifaceted. Many types and combinations of effects are possible and whether they exist in any given historical context remains a matter for empirical investigation. So many effects are possible because (1) multigenerational effects may occur through lagged effects of past generations across anywhere from one to an infinite number of generations; (2) additional effects may occur from conditions at no specific generational lag but rather from fixed or variable circumstances that arise at different "remote" points in the past for different families; and (3) multigenerational effects may work through the mobility and position attainment process itself or through the demographic processes—marriage, fertility, and mortality – that modify the effects of social mobility on intergenerational socioeconomic reproduction.

Figure 4 illustrates the domain of multigenerational effects created by logically possible combinations of two-generational and multigenerational mobility and net fertility effects. This grid shows that multigenerational effects arise from the intersection of net fertility (rows) and socioeconomic mobility (columns). The upper left corner cell of this grid corresponds to standard two-generational studies of social mobility that exclude both demographic processes and multigenerational effects. The second cell on the top row includes grandparent effects on mobility but no higher order, remote, or demographic effects. The second cell in the first column includes the effects of differential net fertility but no grandparent or remote effects either via mobility or demographic processes. The remaining 17 cells of the 20-cell grid make up the possible additional effects that are the subject of this paper. They combine the demographic and grandparent effects that have been investigated by prior studies, they add more distant specific ancestors (great-grandfathers, etc.) as well as effects of unspecified remote ancestors, and they combine demographic and mobility effects at each level of multigenerational influence.

That nearly all studies of social mobility can be placed in one (1,1) cell of this grid; that only a small number of studies can be placed in the (1,2) and (2,1) cells; and that, to date, only the present study has investigated the greater range of possible multigenerational models may stem in part from absence of adequate data and failure to realize the full logical range of multigenerational and demographic processes. But it no doubt also reflects a commitment to describing mobility processes in the mid to late 20th Century in developed countries; as well as to the beliefs that net fertility differentials among classes or socioeconomic groups are small and that mobility is in fact a two-generation process in which educational attainment and stratification substantially weaken family influences, whether proximate or remote (e.g., Hout 1988). Although these latter assumptions seem plausible enough for this period and the societies on which mobility studies have been most commonly done, relatively little research has explicitly examined them. Moreover, to the extent that we seek to broaden the spatial-temporal scope of mobility studies and develop a more general understanding of how stratification systems are maintained and evolve, we should be more open to the possibilities considered in this paper. This is all the more true if we recognize that, even in developed contemporary societies, a single model of intergenerational influence may be inadequate to capture the heterogeneity of stratification systems that may coexist within a single society in a single period (Mare 2011). Subgroups within societies, sustained by social, economic, or spatial segregation, may differ from the majority of the population or from the "average model" for the society as a whole. These groups may be completely isolated or be sustained despite permeable boundaries that prevent total isolation. An entire society may be organized in a common institutional structure within which there may be quantitative variation in how strongly a fixed set of family socioeconomic variables are related. In other words, given a common model there may be "heterogeneous effects" of family background on achievement in later life (e.g., Xie, Brand, and Jann 2012). But another possibility is that even the relevant kin and the type of multigenerational influence—in short, the model itself—varies among groups. Even within mid-20th Century societies in which stratification systems are centrally organized around educational differentiation and two-generational effects and fertility differences are small, some parts of the population may be subject to multigenerational effects. Yet across societies and through time, the relative sizes of these population subgroups may vary in ways that are, as yet, unknown. Although one may imagine in principle a "mixture model" that represents the several stratification regimes that may coexist within a single society and the relative numbers of persons who participate in them, the specification and implementation of such a model is, at this time, beyond the state of the art.

In the research reported in this paper we take the alternative approach of studying distinct populations that potentially differ substantially in their stratification systems yet coexist in the same broad temporal and spatial context. This provides the opportunity to explore possible multigenerational effects and their variation even within the same society. The Liaoning and Qing Imperial Lineage populations fit together in a historically unique way in that they are based on a similar though not identical geographical location and historical period. On the other hand, unlike mass and elite populations in contemporary industrialized or post-industrial economies, for Liaoning and the Qing Lineage there was virtually no opportunity of social mobility between them. Moreover, the structures of opportunity and inequality and marriage norms differed so much between these populations that rigorous quantitative comparison is difficult. These populations, however, provide a rich illustration of multigenerational effects. In both Liaoning and the Qing Lineage, men's social positions are affected by the positions of their fathers as one can see in virtually every other population, but they are also associated with the positions of their grandfathers and great-grandfathers. Men in the Qing Lineage also benefitted from having ancestors in the remote past who had extreme advantages, while lingering effect from ancestral hardship emerged for the population in the Liaoning. Remote ancestral advantages or disadvantages arise even among men who were identical in their family conditions for up to three generations in the past. These results suggest that extraordinary advantages or disadvantages of other kinds that nonetheless do not occur at any fixed time in one's past may bring an enduring benefit or adversity for families.

The Qing Lineage and Liaoning analyses also show the role of demographic processes. Whereas among the Qing Lineage one's marriage and fertility behavior is affected by one's own position but not one's father's or grandfather's position, in Liaoning both one's own and father's positions affect these demographic outcomes. In both populations, persons with high levels of remote ancestral privilege also enjoy a reproductive advantage, even among men who have similar own, father's, and grandfather's positions. The strong socioeconomic differentials in marriage and net fertility imply that the intergenerational reproduction of inequality occurs not only because men from advantaged families are more likely to achieve high positions but also because highly advantaged men in prior generations had more sons who survived to adulthood. Our results also illustrate the general principle that intergenerational mobility alone, whether following a Markovian or higher order autoregressive multigenerational scheme, has at most a transitory effect on men's ability to influence the socioeconomic distribution of later generations. When combined with strong differentials in net fertility, a variety of mobility patterns are consistent with multigenerational influence into the indefinite future.

APPENDIX: NET AND TOTAL EFFECTS

This appendix presents formulas for net and total effects of kin characteristics. These formulas use the coefficient estimates reported in Tables 2 and 3 to obtain the estimates reported in Tables 4 and 5.

Net Social Reproduction Effects

Net social reproduction effect of father (F): the effect of a high position father on his number of high position sons through the father's own marriage, fertility, and his sons' mobility for given positions of the grandfather and the great-grandfather, that is,

$$Net\ SRE^{F} = \frac{S_{1|100}}{F_{100}} - \frac{S_{1|000}}{F_{000}} = m_{100} r_{100} p_{1|100} - m_{000}\, p_{1|000}.$$

We denote high position = 1 and low position = 0. $S_{1|100}$ ($S_{1|000}$) denotes the number of men in the son generation who are in high positions and have fathers in high positions (low positions), grandfathers in low positions, and great-grandfathers in low positions. Likewise, F_{100} (F_{000}) denotes the number of men in the father generation who are in high positions (low positions) and have fathers and grandfathers both in low positions. m_{100} (m_{000}) denotes the number of marriages or the probability of getting married for a man in the father generation who is in a high position (low position) and has a father and a grandfather both in low positions. r_{100} (r_{000}) denotes the expected number of sons born to each wife of a man in the father generation who is in a high position (low position) and has a father and a grandfather both in low positions. $p_{1|100}$ ($p_{1|000}$) denotes the probability that a man in the son generation born to a father in a high position (low position) and a grandfather and a great-grandfather both in low positions will attain a high position.

Net social reproduction effect of grandfathers (GF): the effect of a high position grandfather on his number of high position grandsons through the father's marriage, fertility, and the grandsons' mobility given fixed positions of the father and the great-grandfather, that is,

$$Net\ SRE^{GF} = \frac{S_{1|010}}{F_{010}} - \frac{S_{1|000}}{F_{000}} = m_{010} r_{010} p_{1|010} - m_{000} r_{000} p_{1|000},$$

where all notation is as defined above for the net effect of fathers, except that now fathers' and great-grandparents' positions are fixed whereas grandfathers' positions are allowed to vary.

Net social reproduction effect of great-grandfathers (GGF): the effect of a high position great-grandfather on his number of high position great-grandsons through the father's marriage, fertility, and the great-grandsons' mobility given positions of the father and the grandfather fixed, that is,

$$Net\ SRE^{GGF} = \frac{S_{1|001}}{F_{010}} - \frac{S_{1|000}}{F_{000}} = m_{001} r_{001} p_{1|001} - m_{000} r_{000} p_{1|000},$$

where all notation is as defined above for the net effect of fathers, except that now fathers' and grandfathers' positions are fixed whereas great-grandfathers' positions are allowed to vary.

Net social reproduction effect of ancestors: the effect of a group of extremely advantaged/disadvantaged ancestors (e.g., having four or more direct ancestors who were emperors) on their number of high position descendants through the father's marriage, fertility, and the descendants' mobility given positions of the father, the grandfather, and the great-grandfather fixed, that is,

$$Net\ SRE^{ANCESTOR} = \frac{S_{1|000,4}}{F_{000,4}} - \frac{S_{1|000,0}}{F_{000,0}} = m_{000,4} r_{000,4} p_{1|000,4} - m_{000,0} r_{000,0} p_{1|000,0},$$

where all notation is as defined above for the net effect of fathers, except that now the number of ancestral emperors is varied from zero to four, rather than fixed at zero as it is above.

In keeping with our preferred statistical models, that is, first-order marriage and fertility and third-order mobility models for the Qing Imperial Lineage, we equate $m_{010} = m_{000} = m_0$ and $r_{010} = r_{000} = r_0$. Likewise, we allow $m_{010} = m_{01}$, $m_{001} = m_{00}$, and $r_{010} = r_{01}$, $r_{001} = r_{00}$ for Liaoning because the second-order marriage and fertility and third-order mobility models are most consistent with the data.

Total Social Reproduction Effect

Total social reproduction effect of fathers (F): the effect of a high position father on his number of high position sons through the father's own marriage, fertility, and his son's mobility given positions of the grandfather and the great-grandfather fixed. It equals the net social reproduction effect of fathers,

$$Total\ SRE^{F} = Net\ SRE^{F}.$$

Total social reproduction effect of grandfathers (GF): the effect of a high position grandfather on his number of high position grandsons through his own and the father's marriage, fertility, and the father's and the grandson's mobility given the great-grandfather's position fixed, that is,

$$Total\ SRE^{GF} = \frac{\sum_{i=0}^{1} S_{1|i10}}{GF_{100}} - \frac{\sum_{i=0}^{1} S_{1|i00}}{GF_{000}}$$

$$= \sum_{i=0}^{1} m_{100} r_{100} p_{i|100} m_{i10} r_{i10} p_{1|i10} - \sum_{i=0}^{1} m_{000} r_{000} p_{i|000} m_{i00} r_{i00} p_{1|i00}$$

where $S_{1|i10}$ ($S_{1|i00}$) denotes the number of men in the son generation who are in high positions, have fathers in position {*i* = high, low}, grandfathers in high positions (low positions), and great-grandfathers in low positions. Likewise, GF_{100} (GF_{000}) denotes the number of men in the grandfather generation who are in high positions (low positions) and have fathers and grandfathers both in low positions. The terms m_{100} (m_{000}) and r_{100} (r_{000}) denote the number of marriages or the probability of getting married and the expected number of sons born to a wife for a man in the grandfather generation who is in a high position (low position) and has a father and a grandfather both in low positions. Similar definitions can be applied to the marriage and fertility terms, m_{i10} (m_{i00}) and r_{i10} (r_{i00}), for a man in the father generation. The mobility terms, $p_{i|100}$ ($p_{i|000}$) and $p_{1|i10}$ ($p_{1|i00}$), refer to mobility probabilities for men in the father generation and in the son generation, respectively.

Total social reproduction effect of great-grandfathers (GGF): the effect of a high position great-grandfather on his number of high position great-grandsons through his own, the grandfather's, and the father's marriage and fertility as well as the grandfather's, the father's and the grandson's mobility, that is,

$$Total\ SRE^{GGF} = \frac{\sum_{j=0}^{1}\sum_{i=0}^{1} S_{1|ij1}}{GGF_{100}} - \frac{\sum_{i=0}^{1}\sum_{j=0}^{1} S_{1|ij0}}{GGF_{000}} =$$

$$\sum_{j=0}^{1}\sum_{i=0}^{1} m_{100}r_{100}p_{j|100}m_{j10}r_{j10}p_{i|j10}m_{ij1}r_{ij1}p_{1|ij1} -$$

$$\sum_{j=0}^{1}\sum_{i=0}^{1} m_{000}r_{000}p_{j|000}m_{j00}r_{i00}p_{i|j00}m_{ij0}r_{ij0}p_{1|ij0},$$

where $S_{1|ij1}$ ($S_{1|ij0}$) denotes the number of men in the son generation who are in high positions and have fathers in position {*i* = high, low}, grandfathers in position {*j* = high, low}, and great-grandfathers in high positions (low positions). GGF_{100} (GGF_{000}) denotes the number of men in the great-grandfather generation who are in high positions (low positions) and have fathers and grandfathers in low positions. The terms m_{100} (m_{000}), m_{j10}(m_{j00}), and m_{ij1} (m_{ij0}) denote the number of marriages or the probability of getting married for men in the great-grandfather generation, the grandfather generation, and the father generation, respectively. Similarly, we can define the expected number of sons born to each wife of a man, namely *r*, based on the same rules as we define terms of marriages. The terms $p_{j|100}$ ($p_{j|000}$), $p_{i|j10}$ ($p_{i|j00}$), and $p_{1|ij1}$ ($p_{1|ij0}$) denote the mobility probabilities for men in the grandfather, father, and son generations, respectively.

Total social reproduction effect of ancestors (e.g., four+ emperors): the effect of a group of extremely advantaged/disadvantaged ancestors on their number of high position descendants through the great great-grandfather's, the great-grandfather's, the grandfather's, and the father's marriage and fertility as well as the great-grandfather's, the grandfather's, the father's and the grandson's mobility, that is,

$$Total\ SRE^{ANCESTOR}$$
$$= \sum_{k=0}^{1}\sum_{j=0}^{1}\sum_{i=0}^{1} m_{000,4}r_{000,4}p_{k|000,4}m_{k00,4}r_{k00,4}p_{j|k00,4}m_{jk0,4}r_{jk0,4}p_{i|jk0,4}m_{ijk,4}r_{ijk,4}p_{1|ijk,4}$$
$$- \sum_{k=0}^{1}\sum_{j=0}^{1}\sum_{i=0}^{1} m_{000,0}r_{000,0}p_{k|000,0}m_{k00,0}r_{k00,0}p_{j|k00,0}m_{jk0,0}r_{jk0,0}p_{i|jk0,0}m_{ijk,0}r_{ijk,0}p_{1|ijk,0}$$

where the terms $m_{000,4}$ ($m_{000,0}$), $m_{k00,4}$ ($m_{k00,0}$), $m_{jk0,4}$ ($m_{jk0,0}$), and $m_{ijk,4}$ ($m_{ijk,0}$) denote the number of marriages or the probability of getting married for men in the great great-grandfather, great-grandfather, grandfather, and father generations, respectively. The expected number of sons born to each wife of a man, namely *r*, is defined in the same way. . Accordingly, the mobility terms, $p_{k|000,4}$ ($p_{k|000,0}$), $p_{j|k00,4}$ ($p_{j|k00,0}$), $p_{i|jk0,4}$ ($p_{i|jk0,0}$), and $p_{1|ijk,4}$ ($p_{1|ijk,0}$) denote mobility probabilities for men in the great-grandfather, grandfather, father, and son generations.

Total Mobility Probability Differences

We estimate the total mobility probability effect of fathers by controlling for fathers', grandfathers', and great-grandfathers' statuses in the mobility model. Likewise, we estimate the total mobility probability effect of grandfathers by controlling for grandfathers' and great-grandfathers' statuses in the mobility model.

Total mobility effect of father (F): the effect of a high position father on the probability of his son to attain a high position given positions of the grandfather and great-grandfather fixed, that is,

$$Total\ ME^{F} = p_{1|100} - p_{1|000}.$$

Total mobility effect of grandfather (GF): the effect of a high position grandfather on the probability of his grandson to attain a high position given the great-grandfather's position fixed, that is,

$$Total\ ME^{GF} = \sum_{i=0}^{1} p_{1|i10}\, p_{i|100} - \sum_{i=0}^{1} p_{1|i00} p_{i|000}.$$

Total mobility effect of great-grandfather (GGF): the effect of a high position great-grandfather on the probability of his great-grandson to attain a high position, that is,

$$Total\ ME^{GGF} = \sum_{j=0}^{1} \sum_{i=0}^{1} p_{1|ij1} p_{i|j10} p_{j|100} - \sum_{j=0}^{1} \sum_{i=0}^{1} p_{1|ij0} p_{i|j00} p_{j|000}.$$

Total mobility effect of ancestors (e.g., four+ emperors): the effect of a group of extremely advantaged/disadvantaged ancestors on the probability of their descendant to attain a high position, that is,

$$Total\ ME^{ANCESTOR} = \sum_{k=0}^{1} \sum_{j=0}^{1} \sum_{i=0}^{1} p_{1|ijk,4} p_{i|jk0,4} p_{j|k00,4} p_{k|000,4}$$
$$- \sum_{k=0}^{1} \sum_{j=0}^{1} \sum_{i=0}^{1} p_{1|ijk,0}\, p_{i|jk0,0} p_{j|k00,0} p_{k|000,0}.$$

The definitions of mobility terms are the same as those in the total social reproduction effects of fathers, grandfathers, great-grandfathers, and ancestors.

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TABLE 1
DESCRIPTIVE STATISTICS

VARIABLES	CMGPD-IMPERIAL LINEAGE (*N* = 19,051) Mean (median)	Std. Dev	CMGPD-LN (*N* = 74,249) Mean (median)	Std. Dev
Population status (%):				
Imperial population	100			
Regular farming population			76.20	
Special duty population			17.87	
Servile/Serf			5.93	
Average number of Marriages	1.44 (1)	1.15	0.77(1)	0.42
Marriage Distribution (%):				
0	12.32		24.33	
1	52.25		75.67	
2	23.28			
3	7.87			
4-16	4.28			
Total number of adult sons	1.13 (1)	1.33	0.75 (0)	1.16
Adult sons distribution (%):				
0	39.02		58.54	
1	32.29		21.74	
2	15.65		11.24	
3	7.16		5.11	
4-15	5.87		3.37	
Number of adult sons per marriage	0.88 (1)	0.93	0.94 (1)	1.22
Distribution of number of adult sons per marriage for married men †:				
0	31.22		48.32	
(0,1)	47.35		27.10	
(1,2)	14.95		13.98	
(2,3)	4.48		6.41	
(3-15)	2.00		4.18	
Ego's position % (=1)	22.6		2.81	
Father's position % (=1)	37.3		6.30	
Grandfather's position % (=1)	48.6		8.32	
Great-grandfather's position % (=1) .	57.7		8.87	
Number of male siblings	1.83 (1)	1.94	1.57 (1)	1.67
Number of male cousins	3.73 (2)	6.02	1.96 (1)	2.70
Number of male second cousins . . .	11.16 (6)	13.24	4.94 (4)	4.39
Number of ancestral emperors:				
None %	40.11			
One %	17.10			
Two %	28.88			
Three %	5.23			
Four or more %	8.68			

TABLE 1 CONTINUED

VARIABLES	CMGPD-IMPERIAL LINEAGE (*N* = 19,051) Mean (median)	Std.Dev	CMGPD-LN (*N* = 74,249) Mean (median)	Std.Dev
Number of generations back to an ancestor with special duty status (%):				
No special duty ancestors			71.25	
One			17.87	
Two			7.78	
Three or more			3.10	
Generation Sequences:				
Generation 3 %	0.68		24.79	
Generation 4 %	3.61		25.36	
Generation 5 %	8.68		23.62	
Generation 6 %	13.37		16.97	
Generation 7 %	16.37		7.59	
Generation 8 %	19.84		1.53	
Generation 9 %	18.58		0.13	
Generation 10 %	12.77			
Generation 11 %	5.02			
Generation 12 %	1.08			

NOTE.—The descriptive statistics are calculated based on all persons from the first father's generation through the last son's generation. † The maximum number of sons per marriage for the imperial sample is 9 and for the LN sample is 15.

TABLE 2
SOCIAL REPRODUCTION MODEL ESTIMATES FOR THE QING IMPERIAL LINEAGE

DEPENDENT VARIABLE	(1) MARRIAGE number of marriages, $m_{jkl,c}$			(2) REPRODUCTION number of sons, $r_{jkl,c}$			(3) MOBILITY position, $p_{i\|jkl,c}$ (high=1)		
	First-order	Second-order	Third-order	First-order	Second-order	Third-order	First-order	Second-order	Third-order
Ego's position (=1)	0.482*** (0.013)	0.472*** (0.014)	0.473*** (0.015)	0.005 (0.017)	0.015 (0.018)	0.014 (0.019)	. . .	. . .	. . .
Father's position (=1)	. . .	0.016 (0.014)	0.019 (0.015)	. . .	-0.030 (0.017)	-0.034 (0.019)	1.867*** (0.041)	1.695*** (0.044)	1.681*** (0.044)
Grandfather's position (=1). .	. . .	. . .	-0.007 (0.014)	. . .	. . .	0.014 (0.017)	. . .	0.485*** (0.044)	0.426*** (0.046)
Great-grandfather's position (=1)							. . .	. . .	0.203*** (0.045)
Number of male siblings . . .	0.008** (0.003)	0.007* (0.003)	0.003 (0.003)	0.004 (0.004)	0.004 (0.004)	0.005 (0.003)	-0.023* (0.010)	-0.031** (0.010)	-0.027** (0.010)
Number of male cousins . . .	. . .	0.005*** (0.001)	0.005*** (0.001)	. . .	0.001 (0.001)	0.001 (0.001)	. . .	0.009** (0.003)	0.010** (0.003)
Number of male second-cousins	. . .	. . .	0.002*** (0.001)	. . .	. . .	-0.0002 (0.001)	. . .	. . .	-0.002 (0.002)
Number of ancestral emperors (ref = 0):									
One	0.228*** (0.018)	0.219*** (0.018)	0.210*** (0.018)	-0.235*** (0.023)	-0.237*** (0.022)	-0.237*** (0.023)	0.216*** (0.056)	0.180** (0.057)	0.160** (0.058)
Two	0.283*** (0.016)	0.272*** (0.016)	0.258*** (0.016)	-0.113*** (0.020)	-0.115*** (0.019)	-0.114*** (0.020)	0.193*** (0.051)	0.162** (0.051)	0.157** (0.053)
Three	0.286*** (0.028)	0.273*** (0.028)	0.247*** (0.029)	-0.109*** (0.036)	-0.109** (0.036)	-0.108** (0.037)	0.496*** (0.087)	0.436*** (0.088)	0.449*** (0.089)
Four or more	0.377*** (0.023)	0.339*** (0.024)	0.310*** (0.025)	-0.150*** (0.031)	-0.156*** (0.032)	-0.154*** (0.034)	0.953*** (0.070)	0.857*** (0.073)	0.854*** (0.075)

TABLE 2 CONTINUED

DEPENDENT VARIABLE	(1) MARRIAGE number of marriages, $m_{jkl,c}$			(2) REPRODUCTION number of sons, $r_{jkl,c}$			(3) MOBILITY position, $p_{i\|jkl,c}$ (high=1)		
	First-order	Second-order	Third-order	First-order	Second-order	Third-order	First-order	Second-order	Third-order
Generation sequences:									
Generation 3	baseline	baseline	baseline	baseline	baseline	baseline	. . .	. . .	. . .
Generation 4	0.070	0.087	0.044	-0.010	-0.002	-0.006	baseline	baseline	baseline
	(0.068)	(0.068)	(0.069)	(0.081)	(0.081)	(0.082)			
Generation 5	0.048	0.069	0.064	-0.117	-0.111	-0.120	-0.745***	-0.820***	-0.923***
	(0.065)	(0.065)	(0.066)	(0.077)	(0.078)	(0.079)	(0.099)	(0.099)	(0.104)
Generation 6	-0.139*	-0.120	-0.116	0.0002	0.002	-0.007	-0.926***	-0.988***	-1.131***
	(0.065)	(0.065)	(0.066)	(0.077)	(0.077)	(0.077)	(0.097)	(0.097)	(0.104)
Generation 7	-0.247***	-0.213***	-0.197**	0.030	0.032	0.0234	-1.098***	-1.096***	-1.254***
	(0.065)	(0.065)	(0.066)	(0.077)	(0.077)	(0.078)	(0.098)	(0.098)	(0.108)
Generation 8	-0.293***	-0.250***	-0.232***	-0.077	-0.074	-0.082	-1.154***	-1.119***	-1.258***
	(0.065)	(0.065)	(0.066)	(0.077)	(0.078)	(0.078)	(0.098)	(0.098)	(0.108)
Generation 9	-0.346***	-0.297***	-0.272***	-0.264***	-0.261***	-0.269***	-1.079***	-1.010***	-1.141***
	(0.065)	(0.066)	(0.067)	(0.078)	(0.079)	(0.079)	(0.100)	(0.100)	(0.112)
Generation 10	-0.361***	-0.304***	-0.272***	-0.558***	-0.554***	-0.561***	-1.141***	-1.037***	-1.168***
	(0.066)	(0.067)	(0.068)	(0.080)	(0.081)	(0.082)	(0.106)	(0.108)	(0.120)
Generation 11	-0.426***	-0.367***	-0.332***	-0.788***	-0.783***	-0.791***	-1.080***	-0.968***	-1.097***
	(0.070)	(0.071)	(0.072)	(0.090)	(0.091)	(0.091)	(0.128)	(0.130)	(0.141)
Generation 12	. . .	. . .	. . .	. . .	. . .	. . .	-0.688***	-0.628**	-0.760***
							(0.199)	(0.203)	(0.211)
log (marriages)	. . .	. . .	. . .	offset	offset	offset	. . .	. . .	. . .
Constant	0.277***	0.226***	0.203**	0.015	0.016	0.021	-1.358***	-1.561***	-1.495***
.	(0.063)	(0.064)	(0.065)	(0.076)	(0.077)	(0.077)	(0.092)	(0.095)	(0.104)
N	18,830	18,830	18,830	16,511	16,511	16,511	18,921	18,921	18,921

DATA SOURCE.— The China-Multigenerational Panel Dataset (CMGPD-Imperial Lineage)

NOTE.— Model for marriages is Poisson regression; for reproduction is negative binomial regression; and for mobility is logistic regression. Standard errors in parentheses. We count the number of ancestral emperors from the ego's generation and backwards for the marriage and the reproduction model, but from the ego's father's generation and backwards for the mobility model. We highlight our preferred models.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

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TABLE 3
SOCIAL REPRODUCTION MODEL ESTIMATES FOR LIAONING

DEPENDENT VARIABLE	(1) MARRIAGE being married, $m_{jkl,c}$			(2) REPRODUCTION number of sons, $r_{jkl,c}$			(3) MOBILITY position, $p_{i\|jkl,c}$ (high=1)		
	First-order	Second-order	Third-order	First-order	Second-order	Third-order	First-order	Second-order	Third-order
Ego's position (=1)	2.719*** (0.179)	2.543*** (0.180)	2.534*** (0.180)	0.325*** (0.023)	0.283*** (0.024)	0.288*** (0.024)	. . .	. . .	. . .
Father's position (=1)	. . .	0.470*** (0.050)	0.450*** (0.051)	. . .	0.105*** (0.019)	0.115*** (0.020)	2.470*** (0.060)	2.182*** (0.065)	2.145*** (0.065)
Grandfather's position (=1) . . .	. . .	. . .	0.050 (0.038)	. . .	. . .	-0.054** (0.019)	. . .	0.837*** (0.068)	0.737*** (0.071)
Great-grandfather's position (=1)							. . .	. . .	0.372*** (0.076)
Number of male siblings	0.103*** (0.006)	0.092*** (0.006)	0.077*** (0.007)	-0.008** (0.003)	-0.010*** (0.003)	-0.017*** (0.003)	0.001 (0.017)	0.002 (0.017)	-0.017 (0.019)
Number of male cousins	. . .	0.053*** (0.004)	0.051*** (0.004)	. . .	0.011*** (0.002)	0.010*** (0.002)	. . .	0.025** (0.010)	0.026** (0.010)
Number of male second-cousins	. . .	. . .	0.013*** (0.003)	. . .	. . .	0.006*** (0.001)	. . .	. . .	0.018** (0.006)
Number of generations back to special duty status (ref =none):									
One	0.356*** (0.029)	0.371*** (0.029)	0.372*** (0.029)	0.120*** (0.012)	0.125*** (0.013)	0.122*** (0.013)	-1.446*** (0.138)	-1.372*** (0.138)	-1.357*** (0.138)
Two	-0.495*** (0.031)	-0.484*** (0.032)	-0.479*** (0.032)	-0.175*** (0.025)	-0.169*** (0.025)	-0.171*** (0.025)	-0.876*** (0.155)	-0.794*** (0.155)	-0.774*** (0.156)
Three or more	-0.452*** (0.045)	-0.444*** (0.045)	-0.438*** (0.045)	-0.371*** (0.045)	-0.368*** (0.045)	-0.364*** (0.045)	-0.555** (0.200)	-0.517** (0.200)	-0.495* (0.201)
Servile status	-0.182*** (0.039)	-0.142*** (0.039)	-0.131*** (0.039)	-0.081*** (0.023)	-0.070** (0.023)	-0.069** (0.023)			

TABLE 3 CONTINUED

DEPENDENT VARIABLE	(1) MARRIAGE being married, $m_{jkl,c}$			(2) REPRODUCTION number of sons, $r_{jkl,c}$			(3) MOBILITY position, $p_{i\|jkl,c}$ (high=1)		
	First-order	Second-order	Third-order	First-order	Second-order	Third-order	First-order	Second-order	Third-order
Generation sequences:									
Generation 3	baseline	baseline	baseline	baseline	baseline	baseline	. . .	. . .	. . .
Generation 4	-0.038	-0.037	-0.050	-0.018	-0.017	-0.022	baseline	baseline	Baseline
	(0.030)	(0.030)	(0.030)	(0.013)	(0.013)	(0.013)			
Generation 5	-0.157***	-0.145***	-0.157***	-0.098***	-0.094***	-0.098***	-0.267***	-0.266***	-0.284***
	(0.029)	(0.029)	(0.029)	(0.014)	(0.014)	(0.014)	(0.066)	(0.067)	(0.067)
Generation 6	-0.323***	-0.304***	-0.311***	-0.271***	-0.267***	-0.270***	-0.672***	-0.667***	-0.688***
	(0.031)	(0.031)	(0.031)	(0.018)	(0.018)	(0.018)	(0.083)	(0.084)	(0.084)
Generation 7	-0.549***	-0.530***	-0.534***	-0.682***	-0.681***	-0.681***	-1.218***	-1.243***	-1.254***
	(0.037)	(0.037)	(0.037)	(0.033)	(0.033)	(0.033)	(0.141)	(0.142)	(0.142)
Generation 8	-0.614***	-0.575***	-0.579***	-1.252***	-1.244***	-1.245***	-0.931***	-0.924***	-0.938***
	(0.068)	(0.068)	(0.068)	(0.107)	(0.107)	(0.107)	(0.268)	(0.269)	(0.270)
Generation 9	. . .	. . .	. . .	. . .	. . .	. . .	-0.384	-0.356	-0.371
							(0.612)	(0.622)	(0.629)
Married (=1)	. . .	. . .	. . .	control	control	control	. . .	. . .	. . .
log (time exposure)	. . .	. . .	. . .	offset	offset	offset	. . .	. . .	. . .
Constant	1.213***	1.095***	1.062***	0.448***	0.419***	0.406***	-3.603***	-3.773***	-3.864***
	(0.025)	(0.026)	(0.027)	(0.012)	(0.012)	(0.013)	(0.058)	(0.064)	(0.068)
N	65,318	65,318	65,318	50,109	50,109	50,109	53,057	53,057	53,057

DATA SOURCE.— The China-Multigenerational Panel Dataset (CMGPD-LN)

NOTE.—Model for marriages is logistic regression; for reproduction is negative binomial regression; and for mobility is logistic regression. Standard errors in parentheses. We count the number of generations back to special duty status from the ego's generation and backwards for the marriage and the reproduction model, but from the ego's father's generation and backwards for the mobility model. We highlight our preferred models.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

TABLE 4
COMPONENTS OF NET SOCIAL REPRODUCTION EFFECT ON NUMBER OF HIGH STATUS PROGENY

	MARRIAGE	NET FERTILITY	MOBILITY	NET SOCIAL REPRODUCTION
QING DYNASTY				
Father	0.304	0.003	0.644	0.951
Grandfather	0	0	0.097	0.097
Great-Grandfather	0	0	0.043	0.043
4+ Ancestral Emperors	0.151	-0.061	0.246	0.336
LIAONING				
Father	0.033	0.042	0.23	0.305
Grandfather	0.004	0.005	0.032	0.041
Great-Grandfather	0	0	0.006	0.012
3+ Generations Back to Special Duty Status	-0.002	-0.006	-0.008	-0.016

DATA SOURCE.—The China-Multigenerational Panel Dataset Imperial Lineage and Liaoning.
NOTE.—Formulas for calculating components of net social reproduction effect are presented in equation (3). These formulas use the coefficient estimates reported in Tables 2 and 3 to obtain the estimates reported in Tables 4 and 5. To obtain the demographic and mobility estimates, we fix the number of male siblings, male cousins, and male second-cousins at 1, 2, and 4 respectively. All the other control variables are fixed at their baseline levels.

TABLE 5
NET AND TOTAL SOCIAL REPRODUCTION EFFECT ON NUMBER OF HIGH STATUS PROGENY

	NET EFFECT	TOTAL EFFECT	TOTAL MOBILITY PROBABILITY DIFFERENCE
QING DYNASTY			
Father	0.951	0.951	0.363
Grandfather	0.097	1.482	0.230
Great-Grandfather	0.043	2.579	0.155
4+ Ancestral Emperors	0.336	18.065	0.246
LIAONING			
Father	0.305	0.305	0.131
Grandfather	0.041	0.290	0.066
Great-Grandfather	0.012	0.319	0.047
3+ Generations Back to Special Duty Status	-0.016	-0.120	-0.018

DATA SOURCE.— The China-Multigenerational Panel Dataset Imperial Lineage and Liaoning.
NOTE.—Formulas for calculating net and total social reproduction effects as well as total mobility probabilities are presented in the Appendix. These formulas use the coefficient estimates reported in Tables 2 and 3 to obtain the estimates reported in Tables 4 and 5. To obtain the demographic and mobility estimates, we fix the number of male siblings, male cousins, and male second-cousins at 1, 2, and 4 respectively. All the other control variables are fixed at their baseline levels.

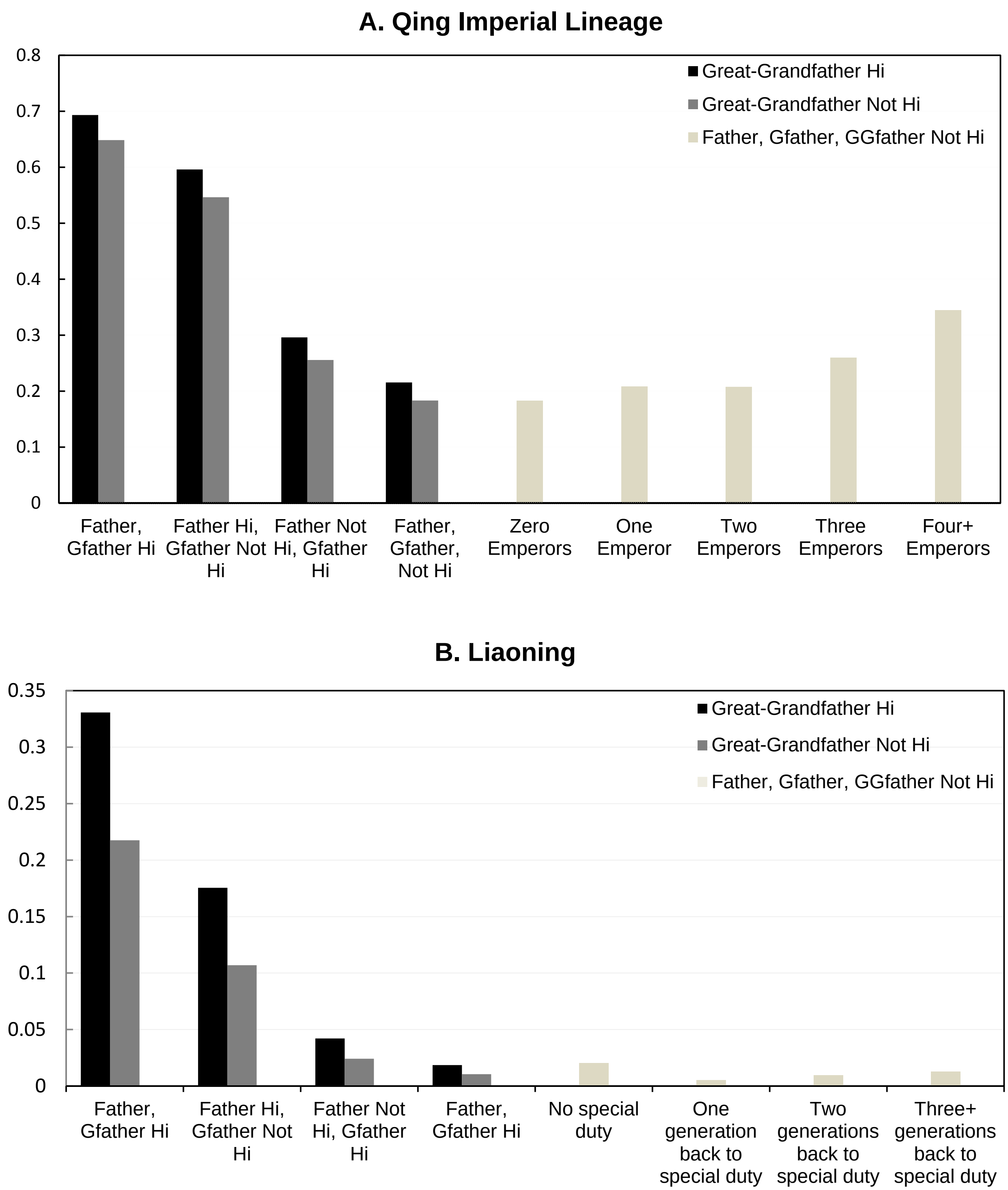


FIG. 1.—Probability of high position by father's, grandfather's, and great-grandfather's positions and number of ancestral emperors or generations back to special duty status; A, Qing Imperial Lineage results based on 3rd order mobility, 1st order marriage-fertility model; B, Liaoning results based on 3rd order mobility, 2nd order marriage-fertility model.

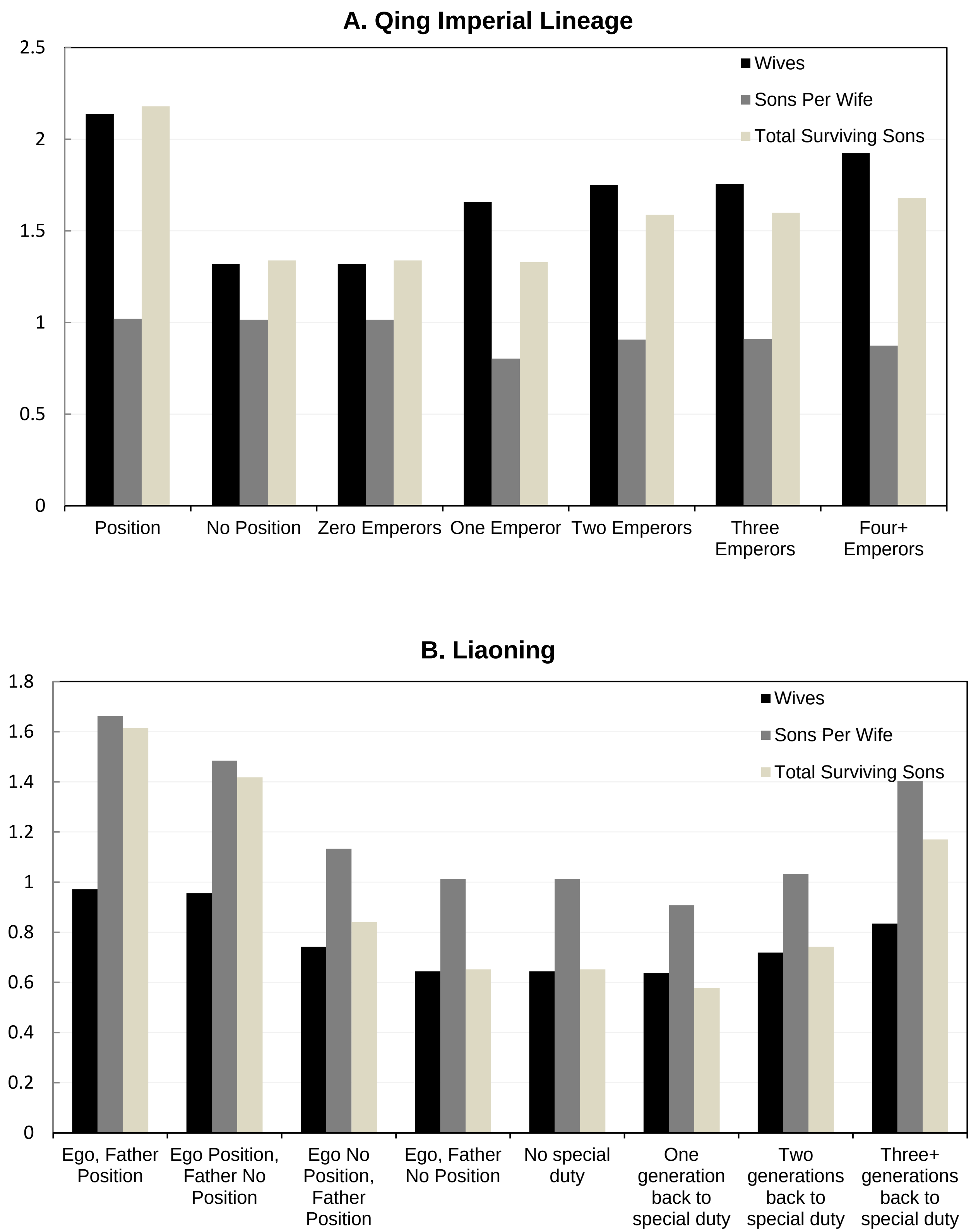
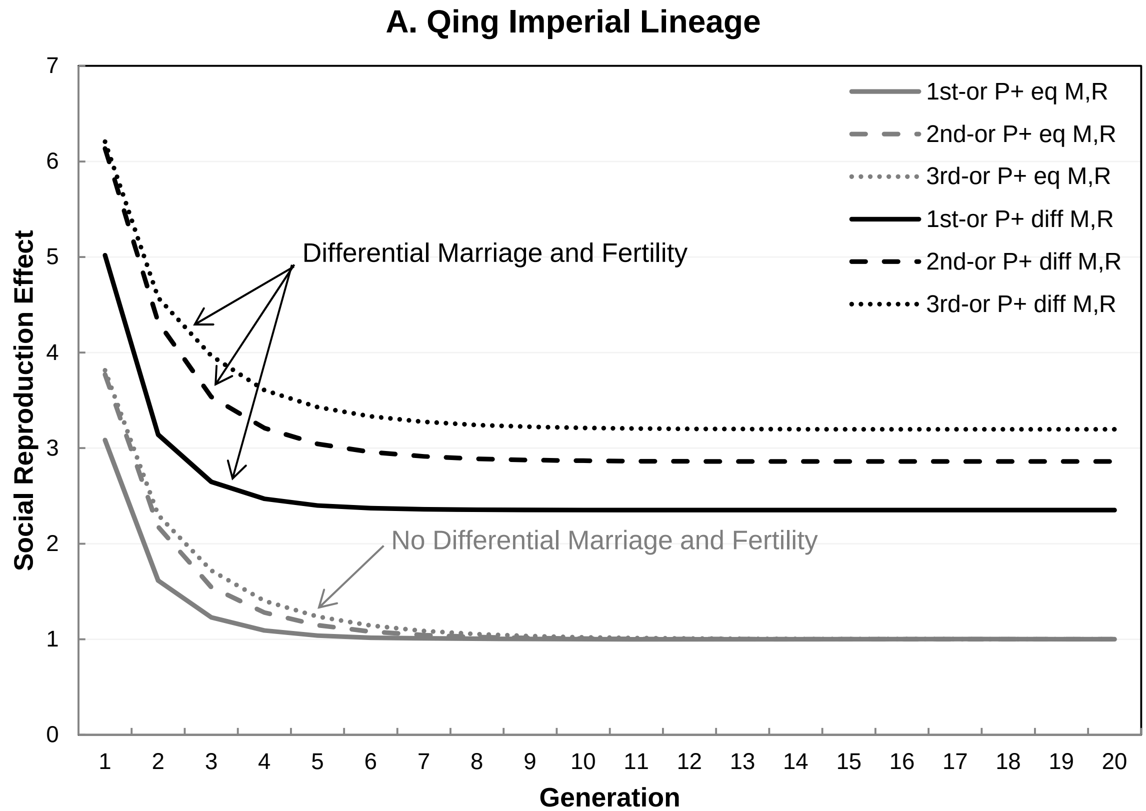


FIG. 2.— Number of wives and sons by positional status and number of remote ancestral emperors or generations back to special duty status; A, Qing Imperial Lineage results based on 3rd order mobility, 1st order marriage-fertility model; B, Liaoning results based on 3rd order mobility, 2nd order marriage-fertility model.



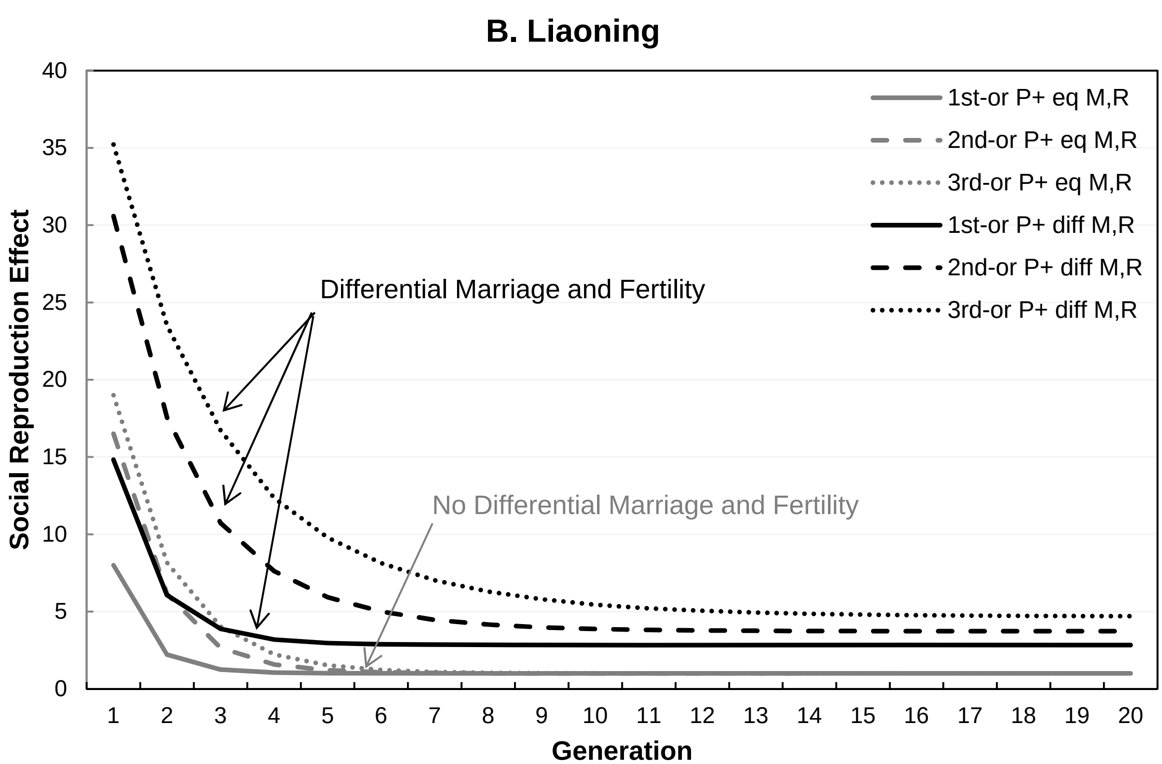


FIG. 3.—Equilibrium reproduction effect of holding a high status position; A. Qing Imperial Lineage; B, Liaoning.

		Mobility			
	Generations	**Father**	**Grandfather**	**Great-Grandfather+**	**Unspecified Remote**
Net Fertility	**None (Assumed)**	**Standard 2-Generation Mobility Studies**	**Chan-Boliver, Zeng-Xie, Warren-Hauser, etc.**		
	Ego	**Mare-Maralani, Preston, Matras, Lam, etc.**		**(Qing)**	**(Qing)**
	Father			**(Liaoning)**	**(Liaoning)**
	Grandfather+				
	Unspecified Remote			**(Qing & Liaoning)**	**(Qing & Liaoning)**

FIG. 4.—Taxonomy of multigenerational effects.