

Villages, Descent Groups, Households and Individual Outcomes in Rural Liaoning,  
1789-1909

Cameron Campbell  
UCLA  
[camcam@ucla.edu](mailto:camcam@ucla.edu)

James Lee  
University of Michigan  
[jql@umich.edu](mailto:jql@umich.edu)

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## ABSTRACT

We make use of a uniquely detailed and voluminous longitudinal, individual- and household-level dataset from rural Liaoning in northeast China during the eighteenth and nineteenth century to compare the role of communities, kin networks, and households in determining individual social and demographic outcomes in late imperial China. We assess the importance of these levels of social organization by examining how individual chances of attainment, fertility, marriage, and mortality were correlated with rates at the level of the household, the household group, the descent group, and the village. We then examine relations across outcomes by measuring how individual chances for each outcome were associated with rates for other outcomes at each of the four levels of social organization. Results indicate that each of these levels of social organization were important, though the precise pattern of associations varied by outcome. Finally, motivated by recent results for contemporary China that suggest that villages dominated by single kin groups or small numbers of kin groups have better provision of public goods (Tsai 2004), we carry out a preliminary assessment of the importance of 'collective efficacy' in late imperial Liaoning villages by examining whether residents of villages that were more homogeneous in terms of their descent group composition had better provision of public goods, as reflected in more favorable demographic outcomes.

## **Introduction**

We examine the roles of kin and community in determining the individual social and demographic outcomes of a quarter-million Chinese peasants living in five hundred villages in northeast China between 1774 and 1909. This exercise is part of our long-term effort to use techniques from demography and quantitative sociology to longitudinal, individual-level data to reconstruct the organization and behavior of social and kin networks in historical and contemporary China. While our previous work has focused on kin within the household, with this and other recent analyses we now consider the role of kin and other social networks outside the household as well.

Our primary goal is to examine how individual chances of attainment, mortality, fertility, and marriage correlated within administrative household, administrative household groups, biological descent groups, and administrative villages. Analyzing these correlations identifies the loci of interactions, perceptions, and decisions that affected demographic and social outcomes and provides insight into the relative importance of each of these levels of social and economic organization. At the same time such analyses reveal the interrelationships of attainment, mortality, fertility, and marriage within the demographic micro-regimes formed by social and kin networks at these different organizational scales.

Our related secondary goal is to examine how village and descent group organization interacted to shape individual outcomes. Inspired by Frankenberg's (2004) translation of the concept of 'collective efficacy' (Sampson and Raudenbush 1999; Sampson, Raudenbush, and Earls 1997) from urban neighborhoods in developed countries to rural villages in developing countries, we hypothesize that villages dominated by single descent groups or a very small numbers of descent groups will have higher levels of 'collective efficacy' and that this will be reflected in more favorable social and demographic outcomes for residents. In villages where residents are related to each other, mutual trust should be higher and provision of public goods should be more straightforward (Tsai 2004). We expect the resulting higher levels of 'collective efficacy' to be reflected in more favorable demographic rates, including earlier marriage, higher marital fertility, and later death.

We divide our paper into four parts. First, we outline existing claims about the role of kin networks in late imperial Chinese society, and show how this analysis relates to the literature. In this context, we lay out our expectations about how village and descent group organization interact to affect 'collective efficacy' and specify hypotheses about the influence of descent group diversity on demographic outcomes. We then introduce the data we use for this analysis and summarize the methods we use to calculate associations among demographic and social outcomes. Finally, we present our results and conclude with some brief remarks about the implications of these findings.

## **Background**

There is a general consensus that the link between kinship and demographic and social behavior is virtually universal to all human societies. Most scholars distinguish between two ideal model family systems: a relatively simple conjugal family system characteristic of Western, particularly northwestern Europe, and a comparatively more extended family system characteristic of a much wider geographic area stretching from East Asia and South Asia to Eastern and Southern Europe. Many European demographic historians have focused on describing the West, especially Northwest European conjugal family system and the preventive population check that characterized its demographic behavior. Their general conclusion is that while the social organization of such societies was relatively simple, their demography, and particularly their nuptiality, were sensitive to economic circumstances (Goldstone 1986; Levine 1987; Schofield 1985; Weir 1984; Wrigley and Schofield 1981).

At least in theory, kinship should have been an important determinant of individual outcomes in China. Chinese kin groups are well known not only to influence demographic decisions, but in many cases actually make such decisions (Lee and Wang 1999). Thus marriage, reproduction, education, employment, and even survivorship are often determined not by individuals but by kin, sometimes within and sometimes without the household. Many Chinese kin groups used to follow formal rules to define the jurisdiction of kin authority by residence, family relationships, and gender (Ebrey 1984, 1991; Liu 1959) as well as to transmit and manage power and resources, not just belonging to the kin group, but to individual members (Bian 1997).

International comparisons have confirmed the validity of some claims about European and Asian families, but have challenged our understanding of the links between kinship networks and demographic behavior. They have, for example, discovered little historical support for the long-held assertion that larger, more complex households better insulated members from economic pressure. Moreover they have not been able to substantiate many of the claimed behaviors above. Mortality rates from a comparison of eighteenth and nineteenth century rural communities were equally sensitive to short-term economic stress in southern Sweden, eastern Belgium, and northern Italy where households were relatively simple as in northeastern China and northeastern Japan where households were both larger and more complex. Such work on the importance of kinship in East Asian, particularly specific Chinese and Japanese populations, have documented how such social organization shielded individual behavior from short-term economic fluctuations but rendered them vulnerable to social circumstances (Bengtsson, Campbell, and Lee 2004; Lee and Campbell 1997).

A more complete understanding of the role of kinship networks in shaping demographic and social outcomes requires moving beyond the household to consider kin living elsewhere. The need for such analyses has long been recognized, but data limitations have hitherto precluded such research (Plakans 1984). Kin who lived apart interacted with each other in a variety of ways, sharing information as well as social, political, and economic resources. The genealogies that have been used in previous studies of kinship networks document kin ties, but do not provide information on residence, thus it is impossible to compare effects of kin according to whether or not they

lived in the same household or village. Household registers document residence, but usually do not have adequate generational depth to reconstruct pedigrees and identify kin who lived outside the household.

This analysis is accordingly a substantial advance over efforts by others to study associations between kinship and social and demographic behavior. By longitudinally linking individuals for whom we have historical household registers over as many as seven generations, we can trace a subset of our population from the middle of the eighteenth century to the beginning of the twentieth, and reconstruct their kin networks. From 1789 onward, the registers organize individuals by household, thus we can distinguish kin according to the closeness of their relationship, and whether they lived in the same household or village. We can compute measures of the aggregate characteristics of different units of kin organization, including the household, household group, and the descent group, and compare their effects, controlling for village of residence. In the future, with the additional collection of corollary auxiliary information on local economic, institutional, and social conditions we expect to relate behavior not just to kinship, but also to environmental circumstances, including economic circumstances and occupational history.

This analysis is also a substantial advance over our own previous efforts to examine the associations between kinship and social and demographic outcomes. Most of our previous analyses have focused on effects of characteristics of kin in the same household, in particular, how the number, relationship, and positions held by close kin affected mortality outcomes (Campbell and Lee 1996, 2000; Lee and Campbell 1997). More recently, we explored the role that distant kin played in attainment processes, and showed that while having distant kin who held position increased individual's own chances of attainment, descent lines were not able to monopolize official positions (Campbell and Lee 2003). This analysis is distinguished from such previous analyses by its emphasis on the role of aggregate characteristics of kin networks at different scales, and the interaction among demographic and social processes.

Our data allow us to account for the communities in which kin networks were embedded. The community has long been recognized as a primary unit of social organization and potentially important determinant of individual outcomes, demographic and otherwise. Ethnographies of urban neighborhoods and rural villages have been a staple of the fields of anthropology and sociology since their inceptions. Whether an urban neighborhood or a rural village, the community is a physical, economic, and social context that individuals experience every day. It is accordingly a key locus for social interactions that circulate information and shape aspirations, expectations, preferences, and norms. In rural areas, the community may be the primary source of economy opportunity and access to education, health care, and other services.

In the United States, quantitative research on community effects focuses on the hypothesis that neighborhood context affects demographic, health, and socioeconomic attainment above and beyond what can be accounted for by individual and family characteristics (Wilson 1987). Empirical results have been mixed, reflecting the

enormous complexity of the appropriate definitions, data and methods (Jencks and Meyer 1990). Several specific mechanisms have been proposed to account for reported effects, including socialization through peer groups, physiological effects of stress from living in a poor neighborhood, social capital and 'collective efficacy' (Sampson, Morenoff, and Gannon-Rowley 2002). Recent studies assess the importance of hypothesized mechanisms, especially 'collective efficacy,' through innovative approaches to data collection and analysis (Sampson and Raudenbush 1999; Sampson, Raudenbush, and Earls 1997).

Recent quantitative studies in developing countries focus on implications of community context for reproductive behavior and health. The potential importance of community context was recognized some time ago (Freedman 1974) and major data collections such as the World Fertility Survey and the Demographic and Health Survey included modules for community contextual variables. Early analyses based on these data examined how community characteristics, especially the presence of family planning programs or the availability of contraception, affected fertility-related behavior (Tsui et al. 1981, Entwisle et al. 1984, 1989, 1996). Other studies examine the importance of measured and unmeasured community characteristics on mortality, especially among infants and children (Sastry 1996). A number of mechanisms have been suggested to explain observed effects, including direct effects of availability of programs and services, social learning and influence via personal networks (Watkins, Behrman and Kohler 2002, Rosero-Bixby and Casterline 1993, Entwisle et al. 1996), and better provision of public goods in villages with more social capital and higher levels of collective efficacy (Frankenberg 2004, Tsai 2004).

We take advantage of our data not only to assess the relative importance of kin group and community in determining individual outcomes, but to investigate how they interact. Following the lead of Frankenberg (2004), we assess whether villages with higher levels of 'collective efficacy' had higher levels of wellbeing, as reflected in demographic outcomes. We capture the 'collective efficacy' of a village with an entropy measure of descent group diversity. We assume that villages in which residents were more likely to be related to each other had higher levels of mutual trust and social cohesion that facilitated the provision of public goods such as security, irrigation, mutual assistance in fieldwork, and so forth. Tsai (2004) has already reported that in contemporary China, villages dominated by single descent groups appear to be more effective at provision of public goods.

## **Data**

The data we use are a subset of one of the larger and longer individual level longitudinal panel data sets assembled for micro-level historical studies. To construct this larger dataset, we have linked as many as seventeen generations from the seventeenth century to the present with 275,000 individual histories, their households, their descent groups, and their demographic and social outcomes. For this analysis, we make use of household register data for 1749 to 1909 that come from triennial registers for almost 500 villages from Liaoning province dating from 1749 to 1909 which we have entered into

machine readable form. We have linked the register populations to other historical populations recorded in family genealogies and grave inscriptions from these same villages, and to other contemporary populations of their descendants recorded in current censal and household registers as well as retrospective surveys. We have also located and linked a variety of contextual information about the region and specific communities.

The household register data have four distinct features that make them uniquely suited to address a variety of substantive questions in historical demography and family sociology. First, they are longitudinal and individual-level and include not only demographic information, but social, economic, and political information as well. Second, they locate individuals within their households and kin groups, distinguishing kin by relationship and co-residence. Third, they follow the population from the middle of the seventeenth century to the beginning of the twentieth. Four, the regions and villages covered by the data are numerous and varied enough to test many of the assertions about the relationships between kinship and demography over space and time. Thus while the population covered by the data may not be representative of China or even Liaoning in a formal statistical sense, the great diversity of contexts suggests that these results transcend the specific populations under analysis.

We have been able to produce such historical data because of the internal consistency of the core household register data, their availability through the Genealogical Society of Utah and the Liaoning Provincial Archives, and the sustained efforts of teams of colleagues and data entry operators in the Peoples Republic of China. We have described the data and data entry operation elsewhere (Ding, Guo, Lee, and Campbell 2004; Lee and Campbell 1997; Lee and Wang 1999). In addition, since 1998 an on-going collaborative project with the Liaoning Provincial Local History Office allows us to visit these villages to collect historical and contemporary population sources, survey specific lineages, and record analogous contemporary information to the historical records. All together we have spent over 500 person-days in fieldwork visiting almost 50 of the largest villages to collect over 30 bound genealogies and over 50 genealogical charts and lists. We have also collected and transcribed dozens of long historical grave inscriptions, half a dozen other inscriptions, and half a dozen contemporary village census or household registers. Most importantly we have completed retrospective and contemporary surveys in over a dozen villages recording each individual born in the village since 1949, their birth, marriage, death dates, education, occupation, and migration history and have linked these contemporary and historical populations.

Table 1 summarizes the currently linked data: 1.3 million observations of 250 thousand individuals who lived between 1750-1909 of which 1,066,004 observations for 187,389 individuals have been checked and cleaned, 80 largely patrilineal genealogies with some 25,000 largely male descendents and their spouses who lived between 1650-2000, 30 inscriptions from 1770-1940 with as many as 1000 linked relatives, and 11 retrospective surveys and 3 contemporary household registers with over 15,000 individuals born between 1880-2002. By supplementing the household registers with genealogies and other historical sources, we can trace 20,000 individuals from the arrival of their descent group founders in Liaoning in the late seventeenth century forward to the

present. In addition, by surveying contemporary descendants from these historical populations and linking them to the registers, we can trace 50,000 people from the present back to the mid-eighteenth century.

For this analysis we make use of the triennial historical household registers that provide detailed information on social outcomes, demographic behavior, and kinship organization for a population of hereditary royal peasants between 1749 and 1909. As summarized in table 1, we have completed data entry and data cleaning of the household registers for 23 administrative populations, and cleaning the recently entered data for a twenty-fourth population, Wuhu. While we do not make use of the linked genealogies and other data in this analysis, we have begun to examine it in another manuscript (Campbell and Lee 2004).

*Table 1 here*

The institutional contexts of these populations varied dramatically. While most of these populations produced grain, several of them produced more specialized goods. The Dami population gathered honey, the Gaizhou Mianding population raised cotton, and the Diaopitun population produced animal furs. While most of these populations consisted of royal peasants, some such as Aerjishan were royal serfs. Others such as Gaizhou Mianding were in-between. As a result of such institutional variation, the opportunities for economic, educational, political, and social advancement varied across populations. Members of some populations were eligible to take state examinations, serve in state offices, and to earn state titles; others were not.

The registers record these populations more completely than almost any other historic rural population in China because they were affiliated with the imperial household as royal peasants or royal serfs, and because they were organized under the Han Martial Banners, and therefore liable for military service. The Imperial Household Agency surveyed and registered the population triennially beginning in 1749 with the establishment of the General Office of the Three Banner Commandry and designed a system of internal cross-checks to ensure data consistency and accuracy. First, they assigned every person in the banner population to a residential household called a *linghu* and registered them on a household certificate. Then they organized households into local household groups called *zu*, and compiled annually updated local household registers. Finally, every three years they compared these local registers and household certificates with the previous larger population and household register to compile a new register. They deleted and added people who had exited or entered in the last three years and updated the ages, relationships, and official positions of those people who remained as well as any changes in their given names. Each register, in other words, completely superseded its predecessor.

The registers list each individual one to a column in order of their relationship to the household head, with his children and grandchildren listed first, followed by coresident siblings and their descendants, and uncles, aunts, and cousins. Wives are always listed immediately after their husbands, unless a co-resident widowed mother-in-

law supercedes them. For each person in the target population the registers report the following information: relationship to their household head; name(s) and name changes; adult banner status; age; animal birth year; lunar birth month, birth day, and birth hour; marriage, death, or emigration, if any during the intercensal period; physical disabilities, if any and if the person is an adult male; name of their household group head; banner affiliation; and village of residence. For adult males, the registers also record official titles and occupations that allow us to measure individual income or wealth. 4 percent of males held such titles at some point in their life; they and their families comprise the rural local elite. For working-age males, the registers also record whether or not they were considered disabled (Campbell and Lee 2003b). Additional information, such as reproductive histories, are available through record linkage and comparison. Since individuals are listed in the same order in successive registers, longitudinal linkage of entries is straightforward.

As Map 1 shows, the more than 500 Liaoning villages are arranged in four distinct regions over an area of 40,000 square kilometers, approximately the size of the Netherlands: a southern coastal region on the Liaodong peninsula facing the Bohai Gulf, a commercialized agricultural plain centered on Haicheng, an administrative center located on the Liaodong Plain around the provincial capital, and an agricultural north in the hills and mountain ranges directly north and northeast of the capital. These pronounced regional differences enable us to test a variety of hypotheses about socioeconomic conditions and demographic behavior, and measure regional characteristics as well as shared processes and relationships. The common immigration origins and institutional background of our communities allow us to control for such particular circumstances. While our results only illuminate the behavior of specific Chinese populations, we can draw from them implications for the demography not of China as a whole, but of specific social, economic, and political systems. This strategy, comparing local rather than national contexts, avoids the problem of representativeness normally inherent in community studies.

These registers have a number of features that distinguish them as a source for historical demography. In contrast with historical Chinese demographic sources such as genealogies that only record adult males, the historical registers record most boys and some girls from childhood, as well as all women from the time of their marriage. Unlike genealogies, they also provide detail on village and household residence. In contrast with parish registers, an important source for European historical demography, they allow for precise measurement of the population at risk of experiencing most demographic events and social outcomes. We have already used the registers to investigate the determinants of individual survivorship (Campbell and Lee 1996, 2000, 2002, 2004), marriage (Lee and Campbell 1998a, 1998b), migration (Campbell and Lee 2001), ethnic identity (Campbell, Lee, and Elliott 2002), and social mobility (Campbell and Lee 2003a). We have also examined trends in demographic outcomes (Lee and Campbell 2005). These publications also detail the strengths and limitations of the register data relevant to the analysis of each outcome.

One of the most important features of the register data is that they follow families for as many as seven generations, from the middle of the eighteenth century to the

beginning of the twentieth. The population is closed, in the sense that the registers followed families that moved from one village to another within the region. Entries into and exits from the region were rare, and when they did occur, their timing was recorded (Lee and Campbell 1997, 223-237; Lee and Wang 1999, 149-153). Through linkage within the registers, therefore, we can identify the paternal kin of individuals, even if they live in other households or even villages. Table 2 summarizes the results of the linkage we have already carried out within the household registers. We can locate a great-great-grandfather within the registers for 50.2 percent of men overall, and 83.0 percent of men who first appear after 1900. Figure 1 presents these information in graphical form, summarizing the proportion of children in each register for whom specified patrilineal ancestors can be located.

*Table 2 and Figure 1 here*

Through such linkage, we have grouped the individuals in the registers into descent groups defined by descent from a common male ancestor who may have lived before the earlier register in 1749. By assuming that households with the same surname who are listed consecutively in a register are related, these descent lines can be further aggregated into 2,136 descent groups defined by descent from a male founder who preceded the registers. The 743 largest groups account for 95 percent of the population. The small descent groups with only a few identified members consist mostly of members of households that were first recorded in the registers in the late nineteenth century or beginning of the twentieth and could not be linked to a larger group.

The registers also identify an analytically interesting unit of family organization between the residential household and the descent group: the household group. Household groups were administrative units that consisted of anywhere between one and one or more closely related residential households, all in the same village and in close proximity to each other, and all part of the same descent group. Headship of the household group was an unsalaried official position and the lowest rung in the administrative hierarchy. Household group heads had a variety of powers and responsibilities.

Our data allow for an analysis that distinguishes the roles of each of four levels of social and family organization in accounting for individual social and demographic outcomes: village, descent group, household group, and household. Table 3 provides the mean numbers of lower levels of organization within each level. Thus it provides the average numbers of observations, and distinct individuals, households, household groups, and descent groups per village, and so on. The data are clearly adequate to distinguish correlations across and within levels of organization. There are an average of 5.12 descent groups per village, 3.60 household groups per descent group, 2.91 households per household group, and 9.11 individuals per household.

*Table 3 here*

## **Methods**

We first assess the relative importance of the household, household group, descent group, and village as units of social organization through discrete-time event-history analyses of four outcomes: male attainment of official position, male first marriage, male marital fertility, and mortality by sex. For the three binary outcomes, attainment of position, first marriage, and mortality, we estimate logistic regressions. The dependent variable in each case is the probability of experiencing the outcome of interest in the period between the current register and the next. For female marital fertility, the dependent variable is the number of male births between the current register and the next that survive to be registered. Since this is a count, we estimate a Poisson regression. For all four event-history analyses, analysis is restricted to the registers where the one immediately succeeding or the one after that is available, thus the outcomes of interest occur in either the next three or four years.

We model the individual probability of attainment, male marriage, male fertility, and mortality as a function of the incidence or prevalence of these outcomes in the village, descent group, household group, and household, along with a set of control variables. For mortality and fertility, we calculate the relevant rates per 1000 at risk at each level. For male marriage, we use prevalence, in the form of the number of males per 1000 aged 16-55 *sui* currently married. For attainment, we also use prevalence, in the form of the number of males per 1000 aged 16-55 *sui* who currently hold a position. When we generate incidence or prevalence indices for these outcomes at each level to use as right-hand side variables, we exclude the experience of the index individual's unit from the calculation for the unit above. Thus measures for the village exclude the individual's descent group; measures for the descent group exclude the individual's household group; measures for the household group exclude the individual's household; and measures for the household exclude the individual.

Equations 1 and 2 summarize the basic forms of the models we estimate. The first model, summarized by equation 1, examines associations within outcomes. The transformed probability of an outcome  $y$  for individual at time  $t$  is a linear function of a constant term, a set of control variables, the village average for that outcome  $x_v$ , the descent group average  $x_{vd}$ , the household group average  $x_{vdg}$ , and the household average  $x_{vdgh}$ . As noted above, each average excludes information from the level below that contains the individual. Coefficients reflect the association between the individual's chances of experiencing the outcome and the rates at the different levels. The second model, summarized by equation 2, examines associations across outcomes.  $\mathbf{X}_v$  is a vector of averages at the village level for the four outcomes,  $\mathbf{X}_{vd}$  is a vector of averages at the descent group level, and so forth. Table 4 summarizes the means and standard deviations of the right hand side measures  $\mathbf{X}$  at each level. Controls not listed in table 4 include fixed effects of register year and region. With these fixed effects, the coefficients for the characteristics of the four units of social organization reflect comparisons within the same geographic region at the same point in time. We also include controls for the age of the index individual.

$$f(p(y_{vdghit})) = a_0 + \mathbf{B}_0\mathbf{X} + b_1x_v + b_2x_{vd} + b_3x_{vdg} + b_4x_{vdgh} \quad (1)$$

$$f(p(y_{vdghit})) = a_0 + \mathbf{B}_0\mathbf{X} + \mathbf{B}_1\mathbf{X}_v + \mathbf{B}_2\mathbf{X}_{vd} + \mathbf{B}_3\mathbf{X}_{vdg} + \mathbf{B}_4\mathbf{X}_{vdgh} \quad (2)$$

Table 4 here

By including the prevalence or incidence of the outcome at each level in each event-history analysis, we identify the units of kinship or community organization that were the most important loci for determining the chances of the outcomes of interest. To the extent that one of the four levels that we consider was meaningful for determining a particular outcome, an individual's chances of experiencing that outcome should be correlated with the incidence or prevalence of the outcome at that level. If a particular level is unimportant for determining an outcome, correlations between individual risks and the incidence or prevalence at that level should be zero. Effects of common membership in higher or lower levels are accounted for by the incidence or prevalence measures at those levels.

Through such an analysis, we identify the units of organization that were meaningful in the sense of forming the world that on a day-to-day basis dominated the interactions, decisions, perceptions, and resource flows that governed demographic and social outcomes. To the extent that the individuals who composed one unit had relevant interactions with each other but not with members of the larger unit one level up, estimations should reveal associations with prevalence or incidence within the lower-level unit but not within the higher-level one. If the interactions that an individual had with other members of one level were entirely accounted for by their common membership of a higher level, only a correlation with the higher level should be apparent.

Thus, for example, if the primary units of organization in late imperial Chinese society were the household and village, event-history analysis should reveal that individual risks of each of the four outcomes were most tightly correlated with rates in the household and village, and uncorrelated with rates in the household group and descent group. If the interactions between kin who lived in separate households had more concrete implications, whether because they shared tangible resources like land or labor or intangible resources like prestige, then analysis should reveal that individual outcomes were also correlated with rates for the same outcome in the household group or descent group.

We examine associations in attainment and male marriage indices to measure the flow of economic, social, and political resources, tangible and intangible, within each unit of organization. Thus we include the prevalence of official positions among males to measure directly how the social, economic, and political status of a unit affected the outcomes of members. Official positions measured with the attainment indices carried with them considerable prestige, substantial salaries and perquisites and in many cases administrative power. The prevalence of male marriage is intended as a more indirect measure of how the social, economic, and political standing of a unit affected outcomes for its members. In late imperial China, male marriage was highly competitive because of an overall shortage of marriageable females, thus units of organization with higher

than expected proportions married shared something tangible like economic resources or intangible like prestige that advantaged their men in the competition for brides.

Male marriage chances in late imperial Chinese society depended not only on individual characteristics, but also on family economic, political, and social status. Identifying the unit of organization within which marriage chances were correlated locates the boundaries of kin groups within which economic resources as well as less tangible social and political resources like power and prestige circulated. For example, to the extent that male marriage chances were determined largely by local marriage market characteristics and the characteristics of their own household, not the household group or descent group, then marriage chances should be correlated within households but not within household groups or descent groups. Since we consider the proportion married indicative of economic, social, or political status, we are of course interested in how it affects attainment, fertility, and mortality chances.

Our inclusion of the mortality and fertility rates is more exploratory, and motivated by a desire to understand interrelationships between demographic processes affected each other, the marriage market, and attainment chances. We are especially interested in seeing how fertility and mortality affected the chances of other outcomes. We expect mortality to have increased male marriage chances, for two reasons. First, kin networks may have responded to the loss of the labor of a member through death by bringing in a bride for a never-married male. To the extent that males who in a kin group competed for brides, in effect forming a queue and marrying in order of seniority, higher death rates may have improved marriage chances by advancing the queue more quickly.

In a separate set of models, we examine the interaction between village and kin group organization. Following Tsai (2004) and Frankenberg (2004), we hypothesize that the villages that are more homogeneous with respect to descent groups will have higher levels of mutual trust and social cohesion, generating higher levels of ‘collective efficacy’ that results in better provision of public goods such as security, irrigation, mutual aid and other tasks that require coordination and cooperation. We expect that in a rural setting, higher levels of ‘collective efficacy’ will generate favorable demographic outcomes, including earlier marriage, higher marital fertility, later death, and higher social attainment.

We summarize the variables in this analysis in table 5. To measure descent group diversity within a village, we calculate an entropy-based index. We use an entropy measure of descent group diversity, summarized by equation 3. In the equation,  $N$  is the total population of the village, and  $n_i$  is the number of individuals in the village who are members of descent group  $i$ . Thus the measure is the products of the proportion of village population in each descent group and the log of that proportion. For a village in which there is only one descent group, the measure will be 0. Higher values correspond to increasing diversity. A village evenly divided between two descent groups will have a value of 0.69, and a village evenly divided between ten descent groups will have a measure of 2.3.

$$E = - \sum (n_i/N) \ln (n_i/N) \quad (2)$$

Table 5 here

We also assess the importance of the share of village population accounted for by the individual's descent group. At the very least, larger descent groups within the village should have enjoyed returns to scale. They should have been able to offer more assistance to their members, whether by backing them in local disputes or carrying out collective projects. We expect that the numerically dominant descent groups within a village were also better poised to capture the benefits from public goods generated within the village. The measure ranges from just above 0 for individuals who had no kin living in the same village, to 1 for individuals living in villages made up of a single descent group.

We also examine how the geographic spread of a descent group affects the outcomes of its members. We hypothesize that descent groups whose members were distributed among more than one village will have more favorable outcomes. One of the roles frequently claimed for descent groups in China was that of safety net. Individuals who had kin living in other villages should have been less affected by local shocks specific to the village in which they lived because of the availability of help elsewhere. Kin in other villages should also have been a source of information about opportunities, economic and otherwise. We measure the geographic spread of a descent group with another entropy measure, constructed as in equation 2, where  $n_i$  is the number of descent group members living in village  $i$ , and  $N$  is the total number of members of the descent group.

## Results

We organize our discussion of results of the assessment of the importance of village, descent group, household group, and household by outcome. We begin with male first marriage, followed by attainment of official position, female marital fertility, and mortality. For each of the four outcomes, we begin by considering how individual chances correlated with the rates for the same outcome within the village, descent group, household group, and household, as well as close kin. To gain insight into the interrelationships among outcomes, we then examine how individual chances correlated with the rates of the other three outcomes at each of the four levels of organization. We present the relevant results in tables 6 through 9. As mentioned earlier, this identifies the locus within which the tangible or intangible resources that determined risks. Later, after completing the discussion of relationships within and across outcomes at different levels, we discuss the results on village descent group diversity.

Tables 6 through 9 here

### *Marriage*

For male marriage prospects, every level of organization appeared to matter, in the sense that there were correlations at every level when common membership in higher and lower levels was accounted for. The results for male first marriage in column A of Table 6 reveal that men who lived in villages where higher proportions of men were already married were themselves more likely to marry. This likely reflects geographic variation in marriage market conditions. Within the village, marriage chances for men varied further according to which descent group they were in. The men in descent groups in which higher proportions of males were already married were themselves more likely to marry. Within the descent group, men in household groups where higher proportions of males were married were themselves more likely to marry. Finally, within a household group, households in which higher proportions of males were married were themselves more likely to marry.

When it came to male marriage prospects the benefits of the economic, social, and political resources associated with being related to someone with an official position were limited to members of the residential household. Table 7 presents associations across outcomes for the different levels of organization. According to the results for marriage in column A, men who lived in households in which higher proportions of men held official positions were themselves more likely to marry. Households within the same group appeared to have competed in the marriage market. There was actually an adverse effect of having higher proportions of males in the household group who held official position.

The kin groups that were especially successful at reproduction within marriage were also successful at acquiring brides for their sons. Thus according to the results for effects of female marital fertility at the bottom of table 7, men whose kin had higher levels of marital fertility had higher chances of marrying. Unmarried men in descent groups that had higher marital fertility were more likely to marry. There was further differentiation among household groups within the same descent group, and among households within the same descent group. This was not an effect of local marriage markets that was intertwined with local variation in marital fertility: there was no effect of marital fertility at the village level. Neither was this due to some general effect on marriage and marital fertility of the prosperity. Possession of position by kin benefited males only if the kin who held position lived in the same household. Results on the determinants of female marital fertility in column C reveal an identical pattern, in which kin who hold position increase marital fertility if they live in the same household, but actually reduce it if they live in another household.

### *Attainment*

Kin networks played a key role in stratification in rural society. Variation in attainment of official position among descent groups within the same village was more important than variation between villages. Results in column B of table 6 reveal that living in a village in which higher proportions of males held official position did not increase the chances that a male would himself attain an official position. Within the village, however, being a member of a descent group in which higher proportions of men

held an official position raised the chances of obtaining one. There was further differentiation among household groups in the same descent group, and among households in the same household.

The relationship between attainment and demographic behavior again appears to have been confined to kin within the same household. Results in column B of table 7 indicate that men in households in which higher proportions of men were married were more likely to attain an official position. Results in the same column indicate that men living in households that had higher levels of marital fertility were also more likely to attain an official position. In light of the results for determinants of male marriage in column A, the implication is that within households, attainment, male marriage chances, and marital fertility all seem to have covaried. Households that were especially successful at one were more successful at the others.

### *Fertility*

For female marital fertility, every level of organization was important, just as was the case earlier with male first marriage. According to column C of table 6, married women had higher chances of bearing children in the next three years if they lived in villages in which other women had higher marital fertility, or were members of descent groups, household groups, or households in which the other women had higher marital fertility. Given that the measures of fertility rely on births that survived to be registration, this may either reflect correlations in actual fertility, or correlations in mortality in infancy and early childhood. Either way, it is clear that there was substantial variation within the population in the success with which the residents of villages and the members of kin networks reproduced themselves.

As was the case with male marriage, relationship to someone who held an official position was only beneficial if they were in the same household. Women who lived in households in which higher proportions of males held official position had higher birth rates. Kin with official positions who were part of other households or other household groups actually depressed the chances that a woman would have a child, just as they depressed the chances that an unmarried man would marry in the next three years. This is further evidence that marriage, reproduction, and attainment covaried at the level of the household, so that households successful at one appear to have been successful at the others.

### *Mortality*

The village was a much more important source of variation in mortality than the descent group. According to columns D and E of table 6, living in a village in which death rates were high raised the chances of dying. Among residents of the same village, being a member of a descent group that had higher death rates had no effect on the chances of dying. Variation in death rates between descent groups in the same village, in other words, was random. At lower levels of organization within the descent group, there were associations. Being a member of a household group or a household in which death

rates were high raised the chances of dying. This likely reflects common exposure to the same sources of infection. Household groups generally consisted of adjacent households. Their members had frequent more contact with each other than they did with other members of the same descent group. They were also more likely to experience the same local environment.

Mortality was intertwined with other demographic outcomes, but the relationships are less consistent than the ones among marriage, attainment, and fertility, reflecting the complexity of the determinants of mortality. Male mortality was higher in households in which higher proportions of males were married, but female mortality in such households was actually lowered. Male mortality was higher in households in which higher proportions of men held position, a reflection perhaps of the price of privilege that we have observed in previous analyses, according to which higher status males in Liaoning actually appear to have experienced higher mortality risks (Lee and Campbell 1997). Finally, males experienced higher mortality in villages, household groups, and households in which female marital fertility was higher.

In the hope of illuminating the mechanisms underlying the findings for mortality, we consider mortality by age group and sex in tables 8 and 9. The results indicate that for mortality, the relevant units of organization varied slightly according to age and sex. Male child mortality was correlated at each of the four levels, adult male mortality was correlated within villages, household groups, and households, and elderly mortality was correlated only within household groups and households. Female child mortality was correlated only within households, though this result is subject to the caveat that it was based only on data from a region around what is now Shenyang that had less incomplete registration of daughters. Adult female mortality, like adult male mortality, varied between villages, household groups, and households. Elderly female mortality varied within each level.

Tables 8 and 9 here

Relationships between mortality by age and sex and the other demographic outcomes were complex. The most consistent relationship was that male child mortality was actually higher in villages, descent groups, household groups, and households that had higher levels of marital fertility. Whether this was cause or effect, of course, remains unclear. Couples experiencing higher child mortality may have had higher birth rates, or couples with higher birth rates may have had experienced higher levels of male mortality.

#### *Village and descent group interactions*

At first glance, descent group diversity within a village was actually associated with beneficial demographic outcomes, not adverse ones. According to table 10, the effects of descent group diversity were strong for all of the demographic outcomes, though not attainment. Villages that were diverse in terms of their descent group composition had earlier male first marriage, lower male death rates, and lower female death rates. Early male first marriage, of course, is likely to reflect conditions in the local

marriage market. Custom dictated against marrying someone with the same surname, especially if they were members of the same patrilineal descent group. Families in single descent group villages had to search for brides in neighboring villages. In more diverse villages, families had the opportunity to find brides locally, without searching neighboring villages. The apparent beneficial effects of descent group diversity on mortality may similarly reflect the implications of such diversity for patterns of exposure to disease. Villagers were most likely to interact with kin. Among villages of the same size, residents of a single surname village may have been liable to interact with anyone, because village residents were all kin. In a diverse village of the same size, a resident may have had a much smaller circle of kin with whom they interacted, reducing the chances that they would be exposed to disease. Table 11, which distinguishes effects on mortality by age and sex, offers some confirmation. Effects of descent group diversity were much stronger for male child mortality and male elderly mortality than for male adult mortality. Children and the elderly were much more vulnerable to the infectious diseases that spread through casual contact.

The higher marital fertility of residents of less diverse villages, meanwhile, suggests that residents of such villages actually did enjoy some important advantages. It is hard to explain the fertility effect of descent group diversity in terms of the patterns of contacts implied by different levels of diversity. Indeed, if the same network-based mechanisms we offered to account for marriage and mortality effects were relevant for fertility, we would expect diversity to be associated with higher fertility. Our fertility measures are based on children who survive infancy and early childhood and are registered by their parents. To the extent that infant and early childhood mortality was correlated with mortality in later childhood, more diverse villages should have seen more children surviving to be registered by their parents. This is not the case. We suggest that the higher marital fertility of less diverse villages is partial evidence that such villages had higher levels of 'collective efficacy' and that these were reflected in improved demographic outcomes.

### *Implications*

In conclusion, both village and kin were important determinants of demographic and social outcomes. For each outcome, there were strong correlations within different levels of organization. The patterns of associations varied, implying that the loci of interactions that were relevant for determining each outcome varied. For marriage, village and kin were all important. For attainment, village was unimportant but kin group was. For mortality, village was important, as were household and household group, but descent group was not.

There were associations across outcomes as well. The clearest was the link between attainment, marriage, and reproduction at the household level. The households that were especially successful by one of these measures appear to have been successful by the other two as well. Beyond the household, the evidence of was more mixed. Kin who held official position but lived in other households appear if anything to have been competitors in the marriage market, and even seemed to suppress marital fertility.

Our tests of the effects of descent group diversity, meanwhile, yielded mixed results. By some measures, in particular marriage and mortality, descent group diversity within the village appeared to have beneficial effects. We did offer explanations for such effects in terms of the implications of descent group diversity for local marriage markets and patterns of exposure to disease. By another measure, fertility, descent group homogeneity within the village appeared beneficial. More homogeneous villages had higher marital fertility. We are unable to explain that as an artifact as we did the effects on marriage and mortality, and suggest that Tsai (2004) is correct that villages that are more homogenous with respect to descent group are better at the provision of public goods, and that this is reflected in demographic outcomes.

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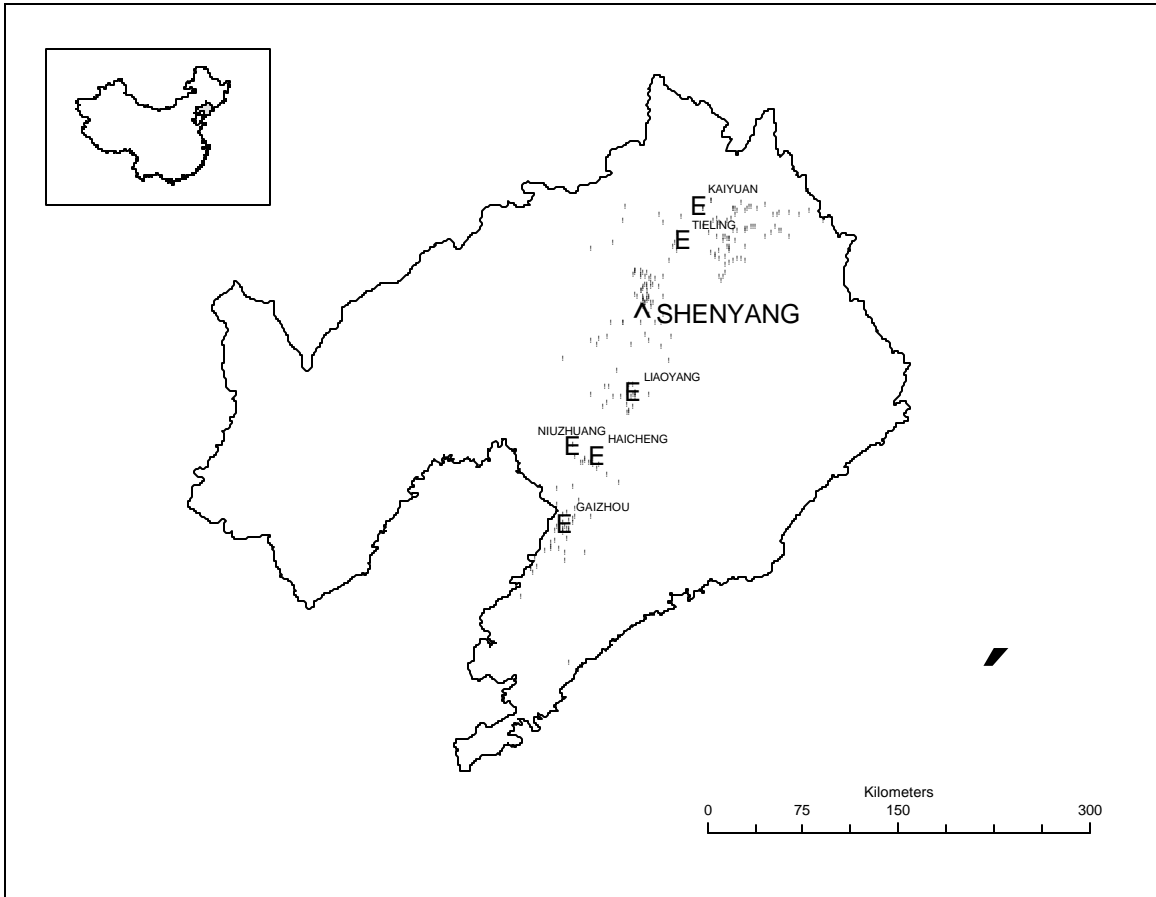
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Map 1 Liaoning Historical Study Populations

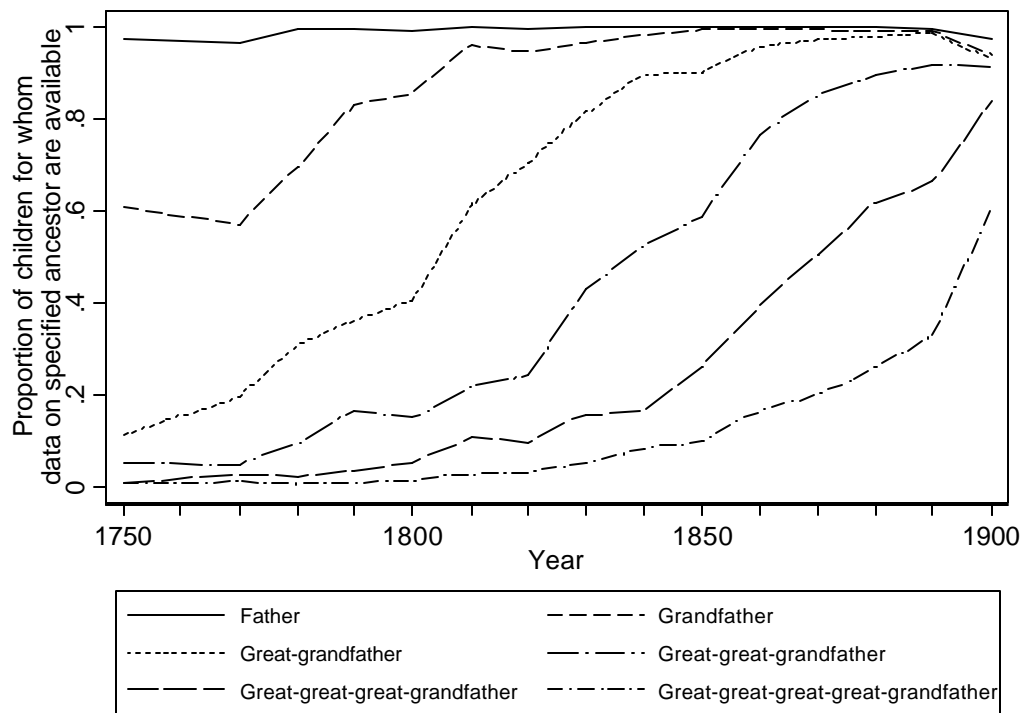


Figure 1 Children by numbers of generations that their ancestry can be traced in the registers

Table 1. Demographic Sources for Liaoning

Location	Period	Registers	Observations	Coding	Genealogies	Inscriptions etc.	Survey
Aerjishan	1813-1909	18	13,622	Done			
Bakeshu	1759-1909	32	48,709	Done	7	5	5
Changzhaizi	1768-1909	25	46,810	Done	10	14	4
Chengnei	1798-1909	24	55,671	Done			
Dadianzi	1756-1909	27	76,984	Done	2	1	
Dami	1759-1909	32	31,544	Done	2		
Daoyitun	1774-1909	35	118,633	Done	20	7	6
Daxintun	1749-1909	29	86,956	Done	10		1
Diaopitun	1768-1909	26	70,153	Done			
Feicheng	1756-1909	39	70,175	Done	8	5	
Gaizhou Manhan	1753-1909	20	50,110	Done			
Gaizhou Mianding	1789-1909	25	56,051	Done			
Gaizhou	1762-1909	27	42,834	Done	4		
Guosantun	1774-1909	34	35,073	Done	4	2	1
Haizhou	1759-1909	26	119,207	Done	14	5	2
Langjiabao	1756-1909	25	47,340	Done	1	3	2
Nianmadahaizhai	1749-1909	29	53,882	Done	4	9	1
Niuzhuang Liuerbao	1780-1906	23	50,253	Done	16	20	5
Wangduoluoshu	1792-1909	16	18,404	Done			
Wangduoluoshu	1864-1910	8	9,043	Done			
Shengding							
Wangzhihuitun	1765-1909	28	60,339	Done		5	
Waziyu	1777-1906	21	55,522	Done			
Wuhu	1789-1906	23		Entering			
Zhaohuatun	1774-1909	26	50,865	Done	1	1	

Table 2. Males by Number of Generations of Ancestry in Registers (March 2004)

Paternal Ancestor	Percentage of males for whom specified ancestor can be located	
	All males	Appearing after 1900
Father	89.6	92.8
Grandfather	78.6	89.2
Great-grandfather	65.2	87.1
Great-great-grandfather	50.2	83.0
Great-great-great-grandfather	34.3	73.2
Great-great-great-great-grandfather	19.4	51.3
Great-great-great-great-great-grandfather	8.7	25.0
Great-great-great-great-great-great-grandfather	3.3	9.8
	N	
	103402	23112

Table 3. Average numbers of lower-level units within each unit

	Villages	Descent groups	Household groups	Households	Individuals	Observations
Average numbers of						
Observations	1173.76	227.11	63.10	21.71	2.38	
Distinct individuals	492.54	95.30	26.48	9.11		
Distinct households	54.06	10.46	2.91			
Distinct household groups	18.60	3.60				
Distinct descent groups	5.17					
N	541	2796 <sup>a</sup>	10064	29247	266463	635005

a There are 2136 distinct descent groups in the registers. 2796 is a count of distinct descent groups within villages, in which descent groups spread across multiple villages are counted once for each village their members appear in.

Table 4. Means of the right-hand side variables used in analyses of associations across and within outcomes

	Mean	S.D.
Male deaths in next 3 years per 1000		
Village, excluding descent group	51.39	31.54
Descent group, excluding household group	49.91	41.72
Household group, excluding household	54.51	64.11
Household, excluding self	52.70	81.72
Female deaths in next 3 years per 1000		
Village, excluding descent group	64.16	28.28
Descent group, excluding household group	63.49	41.58
Household group, excluding household	69.01	77.05
Household, excluding self	67.03	106.07
Adult males 16-55 <i>sui</i> currently married (per 1000)		
Village, excluding descent group	644.74	116.76
Descent group, excluding household group	659.19	128.65
Household group, excluding household	656.14	184.39
Household, excluding self	696.59	240.43
Adult males 16-55 <i>sui</i> with official position (per 1000)		
Village, excluding descent group	61.62	177.87
Descent group, excluding household group	61.30	196.09
Household group, excluding household	56.95	192.67
Household, excluding self	59.68	200.94
Male births in next 3 years per 1000 married adult females 16-45 <i>sui</i>		
Village, excluding descent group	167.09	57.41
Descent group, excluding household group	171.63	80.33
Household group, excluding household	171.04	120.92
Household, excluding self	175.95	172.99

Table 5. Means of the right-hand side variables used in the assessment of effects of descent group diversity

	Mean	S.D.	Minimum	Maximum
Population				
Village	211.0		1	2361
Descent group	92.4		1	1119
Household group	26.0		1	344
Household	9.4		1	117
Population (log base 1.1)				
Village	56.15	12.87	0.00	81.49
Descent group	47.49	12.07	0.00	73.66
Household group	34.19	10.00	0.00	61.28
Household	23.46	8.81	0.00	49.97
Entropy measures of diversity				
Descent groups within village	1.35	0.90	0.00	3.14
Descent group among villages	0.48	0.52	0.00	2.38
Proportion of village same descent group	0.44	0.35	0.00	1.00

Table 6. Event-history analyses of associations within outcomes

	Male first marriage (A)		Male attainment (B)		Female marital fertility (Based on male births) (C)		Male mortality (Ages 1-75 <i>sui</i> ) (D)		Female mortality (Ages 1-75 <i>sui</i> ) (E)	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Village, excluding descent group	0.0006	0.00	0.0003	0.47	0.0009	0.00	0.0022	0.00	0.0016	0.00
Descent group, excluding household group	0.0007	0.00	0.0020	0.00	0.0004	0.00	0.0001	0.64	-0.0001	0.86
Household group, excluding household	0.0008	0.00	0.0030	0.00	0.0006	0.00	0.0013	0.00	0.0013	0.00
Household, excluding self	0.0009	0.00	0.0036	0.00	0.0006	0.00	0.0015	0.00	0.0015	0.00
Observations	34505		146333		93018		261965		162939	
Log-likelihood	-19075.8		-3326.3		-45106.4		-46216.8		-35862.6	
Pseudo R squared	0.032		0.0937		0.0232		0.0891		0.06	

Table 7. Event-history analyses of associations within and across outcomes

	Male first marriage (A)		Male Attainment (B)		Female marital fertility (Using male births) (C)		Male mortality (Ages 1-75 <i>sui</i> ) (D)		Female mortality (Ages 1-75 <i>sui</i> ) (E)	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Male deaths in next 3 years per 1000										
Village, excluding descent group	0.0006	0.47	0.0002	0.96	-0.0003	0.50	0.0011	0.05	0.0016	0.01
Descent group, excluding household group	0.0000	0.94	-0.0006	0.66	-0.0001	0.66	0.0000	0.90	0.0001	0.87
Household group, excluding household	-0.0005	0.12	0.0005	0.66	-0.0001	0.77	0.0009	0.00	0.0006	0.01
Household, excluding self	-0.0002	0.17	0.0001	0.92	-0.0002	0.26	0.0012	0.00	0.0024	0.00
Female deaths in next 3 years per 1000										
Village, excluding descent group	-0.0005	0.39	0.0017	0.43	0.0001	0.77	0.0011	0.01	0.0010	0.04
Descent group, excluding household group	0.0009	0.02	-0.0027	0.09	0.0002	0.39	0.0003	0.32	-0.0001	0.67
Household group, excluding household	0.0006	0.00	-0.0008	0.31	0.0003	0.03	0.0007	0.00	0.0011	0.00
Household, excluding self	0.0001	0.65	-0.0012	0.06	-0.0001	0.53	0.0015	0.00	0.0011	0.00
Adult males currently married (per 1000)										
Village, excluding descent group	0.0006	0.00	-0.0003	0.62	-0.0002	0.11	0.0000	0.94	0.0002	0.10
Descent group, excluding household group	0.0007	0.00	0.0008	0.08	0.0001	0.15	0.0000	0.84	0.0000	0.75
Household group, excluding household	0.0008	0.00	0.0000	0.95	0.0000	0.81	0.0001	0.10	0.0001	0.08
Household, excluding self	0.0009	0.00	0.0013	0.00	0.0001	0.06	0.0001	0.00	-0.0005	0.00
Adult males with position (per 1000)										
Village, excluding descent group	-0.0001	0.63	0.0004	0.33	0.0001	0.22	0.0000	0.72	-0.0001	0.39
Descent group, excluding household group	-0.0002	0.30	0.0022	0.00	-0.0004	0.00	-0.0002	0.24	0.0003	0.06
Household group, excluding household	-0.0004	0.04	0.0032	0.00	-0.0002	0.07	-0.0001	0.54	-0.0002	0.15

Household, excluding self	0.0006	0.00	0.0032	0.00	0.0003	0.00	0.0003	0.00	0.0000	0.95
Male births in next 3 years per 1000 married adult females										
Village, excluding descent group	-0.0002	0.36	0.0004	0.65	0.0009	0.00	0.0004	0.02	0.0000	0.93
Descent group, excluding household group	0.0004	0.03	-0.0004	0.52	0.0004	0.00	0.0002	0.14	0.0002	0.24
Household group, excluding household	0.0004	0.00	0.0005	0.20	0.0006	0.00	0.0003	0.00	0.0003	0.00
Household, excluding self	0.0006	0.00	0.0008	0.00	0.0006	0.00	0.0001	0.03	0.0001	0.24
Observations	34505		146333		93018		261965		162939	
Log-likelihood	-19015.4		-3291.01		-45082.4		-46027.7		-35692.2	
Pseudo R squared	0.035		0.1033		0.0237		0.0928		0.0645	

Table 8. Event-history analyses of associations within mortality outcomes for each age group and sex

	Male Mortality						Female Mortality					
	1-15 sui		16-55 sui		56-75 sui		1-15 sui (Central Region)		16-55 sui		56-75 sui	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Village, excluding descent group	0.0028	0.00	0.0018	0.00	0.0000	0.91	0.0052	0.10	0.0027	0.00	0.0007	0.00
Descent group, excluding household group	0.0013	0.00	0.0002	0.54	-0.0001	0.52	0.0001	0.94	-0.0001	0.84	0.0005	0.05
Household group, excluding household	0.0011	0.00	0.0014	0.00	0.0004	0.00	-0.0009	0.31	0.0007	0.00	0.0007	0.00
Household, excluding self	0.0009	0.00	0.0010	0.00	0.0003	0.00	0.0015	0.00	0.0012	0.00	0.0005	0.00
Observations	71553		155640		17335		3493		122497		18203	
Log-likelihood	-10660.67		-22529.52		-7375.44		-737.44		-22301.84		-6974.61	
Pseudo R squared	0.04		0.04		0.03		0.06		0.02		0.04	

Table 9. Event history analyses of associations between outcomes and mortality for each age group and sex

	Male Mortality						Female Mortality					
	1-15 sui		16-55 sui		56-75 sui		1-15 sui (Central Region)		16-55 sui		56-75 sui	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Male deaths per 1000												
Village, excluding descent group	0.0002	0.85	0.0014	0.09	0.0014	0.17	0.0112	0.04	0.0016	0.06	0.0016	0.12
Descent group, excluding household group	0.0005	0.39	-0.0004	0.37	0.0003	0.54	-0.0038	0.29	0.0002	0.53	-0.0002	0.72
Household group, excluding household	0.0008	0.06	0.0009	0.00	0.0009	0.02	0.0010	0.53	0.0004	0.25	0.0008	0.04
Household, excluding self	0.0009	0.00	0.0012	0.00	0.0014	0.00	0.0024	0.01	0.0027	0.00	0.0021	0.00
Female deaths per 1000												
Village, excluding descent group	0.0001	0.90	0.0024	0.00	0.0001	0.86	-0.0040	0.22	0.0012	0.07	0.0013	0.08
Descent group, excluding household group	0.0002	0.76	0.0004	0.35	0.0002	0.67	0.0003	0.91	-0.0007	0.12	0.0003	0.54
Household group, excluding household	0.0002	0.43	0.0006	0.00	0.0012	0.00	-0.0002	0.85	0.0010	0.00	0.0015	0.00
Household, excluding self	0.0014	0.00	0.0016	0.00	0.0014	0.00	0.0021	0.00	0.0011	0.00	0.0012	0.00
Adult males currently married (per 1000)												
Village, excluding descent group	-0.0001	0.59	0.0002	0.31	-0.0001	0.60	0.0012	0.32	0.0003	0.12	0.0002	0.39
Descent group, excluding household group	-0.0004	0.05	0.0002	0.17	0.0001	0.51	-0.0007	0.28	0.0000	0.87	0.0001	0.55
Household group, excluding household	-0.0001	0.34	0.0001	0.23	0.0003	0.02	-0.0006	0.10	0.0001	0.19	0.0002	0.12
Household, excluding self	0.0003	0.00	0.0001	0.28	0.0001	0.08	0.0005	0.15	-0.0010	0.00	-0.0001	0.39
Adult males with position (per 1000)												
Village, excluding descent group	-0.0001	0.42	0.0001	0.69	0.0000	0.92	0.0003	0.48	-0.0001	0.35	-0.0001	0.64
Descent group, excluding household group	-0.0003	0.28	0.0001	0.73	-0.0002	0.33	0.0001	0.85	0.0002	0.30	0.0005	0.07
Household group, excluding household	-0.0001	0.74	-0.0002	0.30	0.0003	0.23	-0.0010	0.10	-0.0001	0.71	-0.0002	0.42
Household, excluding self	0.0007	0.00	0.0002	0.21	-0.0002	0.43	0.0004	0.28	0.0000	0.96	-0.0002	0.41

Male births per 1000 married adult females												
Village, excluding descent group	0.0011	0.00	0.0001	0.82	0.0004	0.20	-0.0010	0.58	0.0005	0.05	-0.0007	0.04
Descent group, excluding household group	0.0009	0.00	0.0000	0.83	0.0000	0.98	0.0017	0.14	0.0001	0.80	0.0002	0.50
Household group, excluding household	0.0003	0.07	0.0003	0.00	0.0002	0.10	-0.0005	0.37	0.0003	0.01	0.0004	0.00
Household, excluding self	0.0008	0.00	-0.0003	0.00	0.0001	0.19	0.0002	0.59	0.0001	0.33	0.0000	0.78
Observations	79273	155640		27052		5855		122497		29241		
Log-likelihood	-11723	-22395.6		-11627.3		-1204.8291		-22098.4		-11210.5		
Pseudo R squared	0.0473	0.0434		0.0353		0.0573		0.0258		0.0436		

Table 10. Event-history analyses of associations of outcomes with population size and diversity

	Male first marriage		Male attainment		Female marital fertility (Based on male births)		Male mortality (Ages 1-75 <i>sui</i> )		Female mortality (Ages 1-75 <i>sui</i> )	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Population (log base 1.1)										
Village	0.0004	0.84	0.0169	0.02	0.0082	0.00	0.0096	0.00	0.0069	0.00
Descent group	-0.0009	0.61	-0.0121	0.10	0.0016	0.16	-0.0021	0.09	-0.0013	0.37
Household group	0.0029	0.06	0.0329	0.00	0.0024	0.02	0.0064	0.00	0.0088	0.00
Household	0.0187	0.00	0.0480	0.00	0.0048	0.00	-0.0014	0.17	-0.0078	0.00
Entropy measures of diversity										
Descent groups within village	0.0662	0.01	-0.0434	0.67	-0.0902	0.00	-0.0738	0.00	-0.0703	0.00
Descent group among villages	0.0189	0.50	0.0815	0.44	-0.0556	0.00	-0.0060	0.77	-0.0156	0.50
Proportion of village same descent group	0.0719	0.31	0.4287	0.15	-0.0252	0.58	0.0324	0.53	-0.0773	0.19
Observations	53917		220843		140738		388910		245987	
Log-likelihood	-28960		-4663.42		-66498.9		-69552.8		-54305.8	
Pseudo R squared	0.02		0.06		0.02		0.09		0.05	

Table 11. Event-history analyses of associations of mortality by age group and sex with population size and diversity

	Male mortality						Female mortality					
	1-15 sui		16-55 sui		56-75 sui		1-15 sui		16-55 sui		56-75 sui	
	Coeff.	p	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.	Coeff.	p.
Population (log base 1.1)												
Village	0.009	0.00	0.006	0.00	0.013	0.00	0.021	0.04	0.008	0.00	0.006	0.01
Descent group	0.002	0.44	-0.004	0.06	-0.002	0.29	-0.007	0.45	-0.002	0.38	0.000	0.84
Household group	0.008	0.00	0.004	0.02	0.009	0.00	0.000	1.00	0.009	0.00	0.010	0.00
Household	0.010	0.00	-0.006	0.00	-0.001	0.44	-0.015	0.09	-0.010	0.00	-0.005	0.00
Entropy measures of diversity												
Descent groups within village	-0.127	0.00	-0.018	0.53	-0.112	0.00	-0.190	0.20	-0.063	0.03	-0.085	0.02
Descent group among villages	-0.058	0.21	0.012	0.70	-0.008	0.81	-0.185	0.19	0.002	0.94	-0.047	0.20
Proportion of village same descent group	-0.122	0.32	0.118	0.12	-0.010	0.91	-0.027	0.94	-0.053	0.50	-0.119	0.20
Observations	109976		234292		44642		7325		185688		45883	
Log-likelihood	-15925		-34385		-18927		-1507		-33764		-17523	
Pseudo r-squared	0.04		0.04		0.03		0.04		0.01		0.03	