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Wealth Stratification and Reproduction in Northeast China, 1866-1907

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Introduction

In the last two decades, there has been growing interest in socioeconomic differentials in fertility in historical populations (Harrell 1985; Wolf 1995; Hadeishi 2003; Clark and Hamilton 2006; Manfredini and Breschi 2009; Shiue 2010; Tsuya, Wang, Alter, and Lee et al 2010, Wang, Lee, and Campbell 1995). This research reflects scholarly efforts to elaborate Malthusian theory about the relationship of population growth to material wealth. According to the basic Malthusian model, in pre-industrial societies, population growth depends on the balance of population with available resources (Malthus 1970; Laslett and Wall 1972; Wrigley and Davies et al 1997). In particular, population growth rates are balanced with available resources by variations in real income (Galor and Weil 2000; Galor and Moav 2002; Clark 2007). In England and other societies characterized by a 'preventive' check, fertility is tied to real income via variations in the timing or prevalence of marriage, which in turn determines eligibility to reproduce (Easterlin 1978, Wrigley 1987). The original interest in socioeconomic differentials in fertility was motivated at least partly by the notion that they constituted indirect evidence of Malthusian processes: cross-sectional differences in fertility by socioeconomic status are evidence that fertility responds to income, and raises the possibility that fertility could also vary over time in response to changes in real income.

More recently, fertility differentials by socioeconomic status have attracted renewed attention because of potential importance to the relative growth rates of subpopulations, and long-term changes in population composition (Clark and Hamilton 2006, Clark 2007, Mare and Maralani 2006, Musick and Mare 2004). Most relevant to this study, Clark (2007) suggests that a positive association between socioeconomic status and reproduction that he claimed was unique to England helped predispose that country to having an Industrial

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Revolution by steadily increasing the share of the population with attitudes and skills conducive to success in a market economy. Even though Harrell (1995), Lee and Campbell (1997), Wang, Campbell, and Lee (2010), Wang, Lee, and Campbell (1995), and Wolf (1995) all report positive associations between socioeconomic status and fertility, Clark (2007) suggests that in historical China, the association between socioeconomic status and reproduction was not positive, and that there was accordingly no mechanism based on reproduction and inheritance to diffuse attitudes and skills through the population over time. Most of these and other studies of historical fertility differentials focuses on the role of income or occupation, and few directly address the role of wealth (Clark and Hamilton 2006). Wealth differentials in reproduction are nevertheless important because in both contemporary and historical societies, wealth inequality tends to be more pronounced than income inequality. At least in principle, wealth may also be easier to transmit across generations than income.

Accordingly, we not only investigate the applicability of Malthusian theory about material wealth and demographic behavior in pre-transitional China at the micro level, but also try to better understand relationships between wealth stratification and population dynamics in rural China. In the last two decades, scholarship on population behavior in historical China has challenged the Malthusian paradigm (Wang, Lee, and Campbell 1995; Lee and Campbell 1997; Zhao 1997, 2002; Lavelly and Wong 1998; Lee and Wang 1999), which characterized population growth in pre-transitional China as dominated by a “positive check” in which variations in death rates regulated population growth. In the traditional Malthusian conception of the Chinese demographic regime, there was no role for a “preventive” check like the one that characterized England because according to Malthus and his intellectual heirs, fertility in China did not vary according to income or wealth. Although many studies show that marital fertility in pre-transitional China was in fact moderate (Barclay et al. 1976; Liu 1985, 1992, 1995a, 1995b; Wang, Lee, and Campbell 1995; Lee and Campbell 1997; Zhao 1997, 2002; Lee and Wang 1999; Lee, Wang, and Ruan 2001; Wang, Campbell, and Lee 2010), the understanding of low marital fertility in China and East Asia is still very limited. Since traditional views of Chinese population dynamics do not account for the existence of birth control in pre-transitional populations, scholars often attribute this moderate level of fertility in China and East Asia to “poverty and malnutrition”, low coital frequency, or some other social custom such as breastfeeding that lengthened birth intervals (Clark 2007, Lavelly 2007; Wolf 2001; Wolf and Engelen 2007). Therefore, it is especially important to understand fertility behavior and its relation to material wealth in pre-transitional China at the micro-level.

This study examines wealth differentials in reproduction in historical rural China by using newly available longitudinal individual level demographic and household level land holding data. Specifically, it applies event-history analysis to linked population and land register data to examine the association between landed wealth and reproduction in Shuangcheng, Heilongjiang province in Northeast China. We analyze fertility at two levels. We begin with descriptive, aggregate indices such as the Total Fertility Rate. Examination of aggregate indices and comparison with results from other sources helps validate the data and identify potential shortcomings. At the individual level, we examine the influence of socioeconomic and household context on fertility by application of event-history techniques. We focus on two substantive issues: whether greater family wealth brings greater reproductive success in this population, and how family wealth interacted with other household conditions to influence reproduction.

We divide the paper into five parts. The remainder of the introduction provides background on the current understanding of the relationship between economic conditions and reproduction in European and Chinese populations and describes the historical context of the

population and land in Shuangcheng. In part two, we describe the data. We discuss the linked population-land dataset used in our analysis. In part three, we summarize our method. We also introduce the event-history models that we use to examine the association between landed wealth and reproductive success and the influence of other social and household context on reproduction. Part four presents our results. It begins the discussion of results by reviewing the pattern of age-specific marital fertility rates and total marital fertility rates, and then proceeds to a review of the results from our event-history analysis. Part five concludes the paper with some remarks about the implications of our findings.

1.1 Material wealth and reproduction

According to the Malthusian model, in pre-transitional societies, real wages or income per person determines fertility. At the same time, in pre-transitional societies, fertility was not controlled by individual couples but social institution and custom (Wrigley 1987; Wrigley and Davies et al 1997). In England and other parts of northwest Europe where marriage was late, not universal, and depended on access to resources, prices and income mainly affected fertility by influencing the timing and prevalence of marriage (Easterlin 1978; Wrigley 1987). In Western Europe before the industrial revolution, at times when real wages were low, couples delayed their entrance into marriage and thus the initiation of child bearing, achieving the strategy of “preventive check.” At the same time, when real wages fell below subsistence level, rising mortality rates usually result in a lower net fertility. Malthus and his successors largely discounted the possibility of regulation of fertility by married couples.

Although this theory has been a standard model to analyze population growth in England and other parts of northwest Europe, empirical evidence that associates higher income with higher fertility is still relatively weak. This is especially true at the micro-level, as individual level data directly measuring income and wealth are scarce for pre-transitional societies. For European populations, early studies on this topic usually use such community level characteristics as occupation or production of a parish as a variable to test the association between wealth and fertility (Vinovskis 1978; Wrigley 1987; Wrigley and Davis et al 1997). While these studies do reveal a positive association between income and fertility at the aggregate level, how this model applies at individual level is still largely unknown.

Recent studies of fertility in historical Europe have examined socioeconomic differences, in many cases making use of measures of wealth such as tax status or landholding (Bengtsson and Dribe 2010; Breschi, Derosas, Manfredini, and Rettaroli 2010; Clark and Hamilton 2006; Hadeishi 2003; Manfredini and Breschi 2009; Tsuya, Wang, Alter, and Lee et al 2010). These studies mostly but not uniformly suggest a positive relationship between socioeconomic status and fertility in pre-transitional Europe. Hadeishi's results on fertility in Nuits, France, reveals that changes in fertility are positively associated with family wealth as measured by tax payment (2003). In their study of the link between income and reproductive success and social status in England 1585-1638, Clark and Hamilton (2006) identify a robustly positive association between wealth and reproductive success. Rich families had higher net fertility. Manfredini and Breschi (2009) demonstrate a positive association between taxation level and fertility in a mid-nineteenth century Tuscan community, Casalguidi, Italy. Women living in middle and high taxation level households were more likely to give births than those living in low taxation level households. Bengtsson and Dribe (2010) also identify a positive correlation between total fertility rate and household's landholding status in Southern Sweden. However, a study on the population living in city of Venice, Italy reveals a negative association between income and fertility; artisan and shopkeepers had lower fertility than day laborers (Breschi, Derosas, and Manfredini et al. 2010).

For some time, fertility in historical China received less attention because women in pre-transitional China married early and universally, and researchers largely discounted the possibility that married couples limited their fertility. Malthus originally characterized China as a country with high and unchanging fertility in which a mortality-based “positive check” regulated population growth. However, numerous empirical studies in the last three decades reveal that, despite early and universal marriage for women in China, the total fertility rates in some pre-transitional Chinese populations are in fact moderate and even lower than those of some European countries (Barclay et al. 1976; Lee and Campbell 1997; Lee and Wang 1999; Lee, Wang, and Ruan 2001; Liu 1985, ¹⁹⁹², 1995a, 1995b; Wang, Campbell, and Lee 2010; Wang, Lee, and Campbell 1995; Zhao 1997; 2002). Within marriage, Chinese people used such strategies as infanticide to regulate family size according to economic conditions, leading to a “preventive check” based on net fertility (Lee and Wang 1999; Wang, Campbell, and Lee 2010). These new findings suggest that pre-transitional Chinese populations did actively respond to changes in economic conditions. Therefore, it is even more imperative to re-examine the role of material wealth on reproduction in China, thereby achieving a better understanding of the implications of social stratification in China for demographic behavior and population dynamics.

In the last two decades, scholars have employed data drawn from genealogies and population registers in China to analyze the relation between socioeconomic status and reproductive success at individual and household levels (Harrell 1985; Wang, Lee, and Campbell 1995; Wolf 1995; Lee and Campbell 1997; Shiue 2010; Wang, Campbell, and Lee 2010). These studies focus on income, occupation or other measures of status, not wealth. Harrell (1985) uses genealogical data on three lineages in Xiaoshan, Zhejiang province, between 1550 and 1850. He employs social status of the males recorded on the genealogies, such as imperial degrees and offices, as an indirect measure of family wealth. Similarly, in a recent study of the relation between human capital and reproduction in pre-transitional China, Shiue (2010) employs genealogical data in Tongcheng, Anhui province, between 1300 and 1850, measuring family wealth by imperial titles acquired from state sponsored exams.¹ Wang, Lee and Campbell (1995) use genealogies of the imperial lineage of the Qing dynasty (1644-1911) to examine the influence of socioeconomic status on fertility. They classify the Qing nobility into low and high status.

In addition to genealogies, population registers also provide information on socioeconomic status at the individual level for the analysis of the association between wealth and reproduction. Arthur Wolf uses household registers created in Taiwan by the Japanese colonial government to investigate this issue (1995). His study is one of the few Chinese studies to use a measure of wealth, as opposed to income or occupation. In his study, among other individual and household level characteristics, he employs not only husbands' occupation, but the amount of land tax paid by household (1995: table 17.6). Moreover, the Eight Banner population registers compiled by the Qing dynasty also provide rich social economic and household contextual data for the analysis of fertility at the individual level.² Wang, Campbell, and Lee (2010) also employ data drawn from the Eight Banner population registers compiled by the Shengjing Imperial Household Agency between 1749 and 1909 to examine the role of socio economic conditions and other household characteristics on net fertility among the banner peasants in Liaoning province.³ In their study, they use grain prices to proxy for changes in economic conditions and real income, and husband's

¹Shiue (2010) classifies the imperial titles into several categories to measure the degree of wealth.

²The Eight Banners was a civil and military administrative system organized by the Qing dynasty (1644-1911) to govern the Manchurian and Mongolian provinces in Greater North and Northeast China as well as the Qing garrison populations in China Proper. The populations administered by the Eight Banners were called bannermen.

occupation—artisan, soldiers, officials, and bannermen without status—as a measure for the couple's socioeconomic status.

These studies also reveal a diverse picture of the influence of socioeconomic status on fertility. Although in general material wealth or socioeconomic status is positively associated with fertility, a negative or a weak association is sometimes apparent. Harrell's (1985) analysis shows that in all the three lineages, the branches (*fāng*) with more degree holders grew faster than those with fewer degree holders. Harrell suggests that this was not only because degree holders and other members of their branches married earlier, but also because they had more fecund wives. Shiue's (2010) analysis of genealogies in Anhui reveals different patterns of associations between father's status and the total number of sons in the two periods, 1300-1650 and 1650-1800, respectively. During 1300-1650, gentry families and even moderate income families had more sons. However, during 1650-1800, gentry families and even moderately wealthy and near gentry families tended to have smaller family sizes. Shiue suggests that the increasing cost of the education necessary to achieve or transmit gentry status drove gentry families to deliberately control fertility to achieve a smaller family size. Wang Feng, James Lee, and Cameron Campbell's study on the imperial lineage shows that lower nobility tended to have wider birth intervals than higher nobility (1995).

Some of the results also suggest that while greater wealth and income lead to higher fertility, positive correlations between status and fertility are not universal. Arthur Wolf's study reveals that among Hokkien in Hai-shan, women from landed households had much higher fertility than those from landless households (1995, table 17.6). However, within the landed class, although the highest taxed group tended to have higher fertility than those who paid lower land tax, the middle level of land tax payers did not have elevated fertility (1995). Wang Feng, Cameron Campbell, and James Lee's study on banner peasants in Liaodong reveals that wives of soldiers were more likely to have registered children than those of bannermen without any state stipend (2010 tables 11.5 and 11.6). However, the association between income and fertility was not statistically significant for wives of officials and artisans, the other two groups with state salaries.⁴

Along with Wolf's (1995) study, this is one of the few studies of historical Chinese fertility that employs direct measures of wealth. We use household level land holding data and individual level demographic data to examine fertility differentials by wealth in a population in Shuangcheng county in northeast China between 1866 and 1907. These data are transcribed from population and land registers compiled by the banner government in the Qing dynasty Shuangcheng. The registered land ownership provides direct measurement to the wealth status for each registered household, thereby allowing a more accurate assessment of the association between wealth and net fertility. In the next section, we present the historical background of the Shuangcheng population.

1.2 The population and society of Shuangcheng

The population we analyze in this paper consists of official immigrants to Shuangcheng county in Heilongjiang and their descendants. The data cover them from 1866 to 1912 (map

³The Shengjing Imperial Household Agency was an institution established by the Qing government to administer the imperial court in Shenyang and related properties. The agency had authority over a variety of different hereditary populations: artisans, farmers, officials, and soldiers, many of whom had different obligations to the Imperial Household and different opportunities for individual advancement. These populations belonged to the Eight Banners, and the Shengjing Imperial Household Agency compiled registers for these hereditary populations.

⁴Wang, Campbell, and Lee's regression analyses do show that wives of officials were more likely to have second and higher-order registered births than bannermen without state salary. However, the correlation between husband being officials and having first registered birth was not statistically significant (2010: tables 11.5 and 11.6).

1). Shuangcheng was established in 1815 under a government-organized relocation of metropolitan bannermen, an elite population who depended on state stipends for their livelihoods. Located in the northeast frontier of China, Shuangcheng was largely unpopulated in the early nineteenth century. The state owned all land and prevented free migration to this area. In 1815, in response to the fiscal challenge of supporting metropolitan bannermen, the court established a state farm in Shuangcheng, planning to relocate metropolitan bannermen from Beijing and Rehe there to become farmers (map 2). The court also relocated rural bannermen from other parts of Northeast China to Shuangcheng to help the metropolitan bannermen adapt to the rural environment. Between 1815 and 1830, 3,000 rural and 698 metropolitan banner households resettled in the 120 banner villages in Shuangcheng, living on and farming land allocated by the state (map 1) (Chen 2009).

The official immigrants in Shuangcheng therefore consisted of a mix of urban and rural origin immigrants with differentiated social status. During the settlement stage, the state scattered immigrants from the same place of origin, banner affiliation, and ethnicity into different villages and classified all official immigrants into two categories, metropolitan bannermen, who originated from Beijing and Rehe, and rural bannermen, who originated from other rural areas of Northeast China (map 2) (Chen 2009).⁵ In general, metropolitan bannermen, as original urban dwellers, had a higher social status than rural bannermen. The previous lifestyles of the metropolitan and rural bannermen differed as well. Metropolitan bannermen had led a life of leisure in the city, living on state stipends without any knowledge or experience of farming (Chen 2009). In contrast, most of the rural bannermen from other parts of Northeast China were already farmers in their place of origin.

Upon the settlement of the area by these immigrants, the state used its control over land allocation to establish a state mandated social hierarchy in Shuangcheng, assigning immigrants differentiated entitlement rights to state land. Metropolitan and rural bannermen, as official immigrants, enjoyed state land and became the local elite. Each metropolitan banner household was allocated 64.4 hectares of land and each rural banner household received 33.7 hectares (Chen 2009). Along with the settlement of official immigrants, a large number of unofficial immigrants also moved to Shuangcheng without the state's permission. These unofficial immigrants, including both bannermen and civilian commoners, were excluded from state land allocation and could only work as tenants and laborers for metropolitan and rural bannermen. Thus, the state land allocation policy endowed metropolitan and rural bannermen as haves and determined unofficial immigrants as have-nots.

Moreover, within the haves, the state also placed metropolitan bannermen in the top stratum and rural bannermen in a lower stratum. First, in land allocation, the state assigned differentiated entitlement rights to metropolitan and rural bannermen, with each metropolitan household enjoying twice the land as a rural banner household did. Second, as early as the planning stage, the state had designated rural bannermen to be laborers for metropolitan bannermen. The state mixed the residences of metropolitan and rural bannermen. It settled rural bannermen in Shuangcheng first. By 1820, four years before the arrival of the first group of metropolitan bannermen, 3,000 households of rural bannermen had arrived in Shuangcheng and begun clearing land. The state's goal was to have rural bannermen prepare land and housing for metropolitan bannermen. This differentiation

⁵Other than their different places of origin, the Shuangcheng banner population also had a diverse ethnic background. Metropolitan bannermen consisted of three ethnicities: Manchu, Mongol, and Xibe, and rural bannermen consisted of six ethnicities: Manchu, Mongol, Xibe, Han bannermen, Baerhu, and Taimanzi (Chen 2009). Despite the presence of different ethnicities, results from our analysis elsewhere suggest that ethnicity did not make a difference in immigrants' population behavior and wealth status. It is the state population category of metropolitan and rural bannermen that determines their different social status and demographic differentials.

between metropolitan and rural bannermen was maintained until 1906, when the state allowed free transactions of allocated land (Chen 2009).

The abundant and fertile land in Shuangcheng and favorable government treatment led to rapid growth of both the metropolitan and rural banner populations. The size of the two populations increased substantially over time. The population of metropolitan bannermen started at 187 in 1824. As a consequence of immigration and natural increase, the metropolitan banner population reached 2,324 in 1866 (Chen 2009). Although the immigration of metropolitan bannermen concluded in the 1840s, the size of its population further increased to 4,838 in 1912, an average annual growth rate of 2.4 percent.⁶ The population of rural bannermen increased from 14,670 in 1824 to 27,028 in 1869, and then to 43,948 in 1910, an average annual growth rate of 2.3 percent.⁷ The total population of metropolitan and rural bannermen therefore grew from 14,857 in 1824 to 48,721 in 1910.

The marriage patterns of metropolitan and rural bannermen shared some key features with other Chinese populations. Among rural bannermen, women married early and universally. Among both rural and metropolitan bannermen, men married relatively late, and a relatively large share of men never married at all (Chen, Campbell, and Lee 2008). By the age of 15 *sui*, about 50 percent of the females in the metropolitan banner households and 60 percent of those in the rural banner households married. By age 30 *sui*, almost all females in the rural banner households were married, but about 10 percent of females of the metropolitan banner households remained single. This high percentage of single women in metropolitan bannermen persisted until 40 *sui* and did not disappear until 55 *sui*. For males, by age 20 *sui*, about 63 percent of the males in metropolitan bannermen and 65 percent of those in rural bannermen were unmarried. By age 30 *sui*, about 14 percent of the males in metropolitan bannermen and 25 percent of those in rural bannermen were unmarried. Finally, by age 55 *sui*, about 10 percent of the males in metropolitan bannermen and 18 percent of those in rural bannermen remained unmarried.

Moreover, in Shuangcheng, the timing of first marriage was closely associated with socioeconomic status. Socioeconomic status had opposite effects on the timing of marriage for men and women (Chen, Campbell, and Lee 2008). Like other parts of China, in Shuangcheng males married hypogamously and females married hypergamously. Therefore, men with higher socioeconomic status were more likely to marry early, and those with lower status tended to marry late or not marry at all. At the same time, women from families with higher socioeconomic status tended to marry late, while those from families with lower status married early. Specifically, for males, not only were those from families with salaried state positions more likely to marry, but also a much higher percentage of metropolitan banner males were eventually married.⁸ For females, daughters of metropolitan bannermen and soldiers and officers married later than those of rural bannermen and regular farmers.

⁶Since the population increase between 1824 and 1866 resulted from both immigration and natural increase, to measure the rate of natural increase, we calculate the annual growth rate of the metropolitan banner population based on the population data of 1866 and 1910 to.

⁷Since by 1824, the majority of rural bannermen had settled in Shuangcheng, we calculate the annual growth rate of the rural banner population based on the population data of 1824 and 1910.

⁸In Shuangcheng, metropolitan banner males married later than rural banner males. However, once they entered their marriage age, metropolitan banner males were more likely to marry. Our descriptive results show that by age 30 *sui*, 86 percent of metropolitan banner males were married, which was 11 percent more than rural banner males (Chen, Campbell, and Lee 2008). Therefore, although results of our regression analysis of timing of first marriage suggest that metropolitan banner males were less likely to marry than their rural banner counterparts, it only indicates that metropolitan banner males started to marry later. Overall, metropolitan banner males were more likely to marry.

1.3 Land distribution in Shuangcheng

As the haves, metropolitan and rural bannermen owned the majority of the farm land in Shuangcheng. The land consisted of two major categories: land allocated by the state (*jichan di*) and land acquired by residents on their own (*nazu di*).⁹ The state-allocated land was defined as early as the planning stage of Shuangcheng. In 1813, Fujun, the Qing governor of Jilin, planned the 120 banner villages and enclosed 165,600 hectares of land in these villages to be allocated to the official banner immigrants. The government divided the land in each village into plots with equal sizes and allocated them to metropolitan and rural banner households upon their arrival. Metropolitan and rural banner households enjoyed these allocated plots as their private property; they were exempted from taxes and rents and could pass these plots down to their descendants. The allocated land always accounted for the majority of registered farm land in Shuangcheng. In 1883, by which time most farmable land in Shuangcheng was cleared, state allocated land accounted for 51 percent of the registered farm land (Chen 2009).

In addition to the state allocated land, the banner immigrants also cleared more waste land on their own. This later comprised the category of *nazu*, or rent-paying, land. The immigrants' private land clearing probably started soon after the settlement. Beginning in the 1840s, in order to increase government revenue, the state not only opened more land in Shuangcheng, allowing bannermen to claim the amount they wanted, but also registered the land the immigrants had previously cleared. Upon the registration of these lands, the land owners had to pay a rent to maintain official land ownership. Between 1845 and 1856, the government registered a total of 107,309 hectares of *nazu* land (Chen 2009). The government continued to register the land privately cultivated by metropolitan and rural bannermen. By 1883, the amount of *nazu* land reached 145,993 hectares, accounting for 40 percent of the registered farm land in Shuangcheng.

Throughout the history of Shuangcheng, the land distribution among metropolitan and rural bannermen was relatively egalitarian. As figure 1 shows, the distribution of allocated and acquired land altogether exhibited a pattern of stratification without concentration. What stratification there was existed in the top and bottom deciles. The top decile of households owned 31 percent of land, and the bottom decile of households owned only one percent of land. Therefore, landless households only accounted for 10 percent of the metropolitan and rural banner households.

Moreover, the land distribution also reveals that the majority of metropolitan and rural banner households in the Qing dynasty Shuangcheng were relatively wealthy families in the sense that they had abundant land. As table 1 shows, in 1876, 90 percent of the households had 38.8 hectares of land and above, and a *per capita* land holding of 4.7 hectares and above. In Qing dynasty Shuangcheng, each hectare of land yielded about 1,400 kilograms of grain in a year of good harvest or 700 kilograms in a bad year (Chen 2009). Therefore, the majority of metropolitan and rural bannermen lived well above the subsistence level. Due to their smaller household size, the metropolitan banner population especially had a large per-capita land holding. Only the bottom 10 percent of households were landless.

The relatively equitable land distribution among metropolitan and rural bannermen resulted from two contrasting principles that determined the distributions of the allocated and acquired land respectively. While the state followed the principle of equal distribution to

⁹In addition to *jichan* and *nazu* land, the Shuangcheng local government also controlled land under the category of *suique*, which assigned as a form of salary supplement to officials and soldiers with active posts. This category of *suique* land, however, only accounted for a small proportion of the registered farm land in Shuangcheng. By 1876, metropolitan and rural bannermen altogether owned 83 percent of the registered farm land in Shuangcheng (Chen 2009).

allocate land within each population category, it allowed unequal distribution of acquired land. State regulations stipulated that each banner household could only own one plot of allocated land.¹⁰ This principle of equal distribution was so strictly enforced that sometimes a son could not inherit his father's plot if he already owned one plot of allocated land (Chen 2009). At the same time, the plot allocated to metropolitan banner households was twice the size of that allocated to rural banner households. Therefore, the distribution of allocated land exhibited a pattern of equality within each category and inequality between categories.

In contrast to the principle of equal distribution of *jichan* (allocated) land, the government allowed bannermen to claim as much *nazu* (acquired) land as they were capable. Therefore, the distribution of acquired land was extremely unequal. As figure 2 shows, the acquired land was concentrated among less than half of the metropolitan and rural banner households. In 1870, about 60 percent of households had no acquired land. At the same time, the top decile of households had 67.9 percent of the acquired land. The share of land accounted for by the top one percent of households was 22.1 percent; the next four percent of households accounted for 27.5 percent, and the next five percent of households had 18.3 percent of land. Although the distribution of acquired land was ostensibly equalized in 1876 and 1889, it remained concentrated. In 1889, the share of land owned by the top one percent of households declined substantially, to 17.1 percent. At the same time, the shares of land accounted for by the next four percent and the next five percent of households increased slightly to 28.6 and 19.2 percent. Therefore, the share of land for the top decile of households was 64.9 percent in 1889, only a three percentage-point reduction from 1870.

The average size of acquired land held by metropolitan and rural banner households also varied greatly across the land holding strata. As table 2 shows, in the entire period under analysis, the top decile of households held more than 110 hectares of land. Compared to that of the top decile of households, the average size of land held by the second and third deciles of households significantly dropped. In principle, the bottom 60 percent of households had no acquired land. This concentrated distribution of acquired land resulted in stratification in the distribution of all land.

Thus, entitlement rights to state land and a bannerman's own ability jointly determined wealth status for metropolitan and rural bannermen. While membership in the categories of metropolitan and rural determined differentiated entitlement rights to state allocated land, a rural bannerman was as likely as a metropolitan bannerman to acquire a large amount of *nazu* land by his own ability. Despite their disadvantaged status in their entitlement to allocated land, some rural bannermen were able to enter the top strata in land holding because of their large holdings of acquired land. In 1876, nine percent of the rural banner households were in the top decile of all Shuangcheng banner households in land ownership (Chen 2009).

Above all, the metropolitan and rural bannermen we analyze in this paper are relatively wealthy populations by the standards of historical China. Unlike the typical population described by the Malthusian model, in which wages are at the subsistence level, metropolitan and rural bannermen not only enjoyed abundant land in a frontier area, but also had firm entitlement rights to the land. At the same time, however, in this wealthy population, there was still considerable stratification in land ownership. As figure 1 shows, about 10 percent of the banner households were nearly landless, which consisted of 13.2 percent of the metropolitan and 8.6 percent of the rural banner households. Therefore, the

¹⁰Our linked population-land dataset reveals that some households actually acquired more than one plot of allocated land. However, the majority of households still had only one plot of allocated land.

Shuangcheng population and land dataset is suitable for analyzing the association between wealth and reproduction.

2. Data

The data we analyze in this paper are transcribed from the Qing Eight Banner population and land registers for residents in the 120 villages in what is now Shuangcheng county in Heilongjiang province. The registers provide longitudinal, individual-level demographic and socioeconomic information for metropolitan and rural bannermen living in these villages between 1866 and 1912, and household-level landholding records for the same population between 1870 and 1889. Using a dataset that links household-level landholding data to population register data, we focus our analysis on the association between landed wealth and registered male births among metropolitan and rural bannermen between 1866 and 1900. In this section, we introduce the Eight Banner population and land registers in Shuangcheng and the dataset we use for analysis, including the characteristics of the data and its advantages and limitation for fertility analysis.

2.1 Population registers

The banner population registers in Shuangcheng were compiled and maintained by the local banner government in the Qing.¹¹ We have collected all of the available registers dated between 1852 and 1912, and we have completed data entry for 260 registers for metropolitan and rural banner population living between 1866 and 1912.¹² In total, the registers we have entered provide 1.3 million annual observations for 108,100 linked individuals. At the time of relocation, the state transferred the metropolitan and rural banner immigrants' records from their places of origin to Shuangcheng. The Shuangcheng banner government then compiled these immigrants' records into the local register according to their residence and new banner affiliation, preserving all information transferred from their place of origin. Entries in each register were grouped first by village, then by household group (*yihu*) and then by household. The registers first recorded information about the household head: his place of origin, ethnicity, original banner affiliation, occupation, name, age, and any vital demographic event that had occurred since the last update. The registers also recorded the name, age, and occupation of the head's immediate family members—parents, wife, and children—and then of any other relatives living with him. The register listed all household members in order of the proximity of their relationship to the household head.

Throughout the history of the Shuangcheng state farm, the banner population registers served as official references for administration and land allocation. The state assigned metropolitan and rural bannermen into different registers that documented their different membership and entitlement rights to state land. Only those recorded on the metropolitan and rural banner registers were eligible for state land allocation. Moreover, the government also controlled the migration of metropolitan and rural bannermen; any absence without official excuse was annotated as 'absconded' (*tao*) in the registers. Because population registration played an important role in land allocation, the Shuangcheng local government

¹¹All the banner registers are part of the archives of the local administration called *Shuangchengpu Zongguan Yamen Dang'an*, which is preserved in Liaoning Provincial Archives. Besides the household registers, there are other 1,555 volumes of administrative documents dating from 1850-1924. However, most of the records from 1830 to 1866 were burnt during a rebellion happened in 1866. So, we cannot say for sure when the government began to register the banner household annually.

¹²The Utah Genealogical Society also has the complete set of registers in microfilm form. We have acquired all the microfilmed registers from Utah Genealogical Society.

In addition to metropolitan and rural banner households, there are also registers for floating bannermen, unofficial banner immigrants to Shuangcheng. Because of the unofficial status of floating bannermen, their population registration had poorer quality than that of metropolitan and rural bannermen. Therefore, we do not include floating bannermen in our analysis.

updated registers annually. In the eleventh lunar month of each year, the local government compiled a cleaned copy of the updated register and sent it to the provincial government for review. This update frequency exceeded the standard stipulated by the Qing government, which normally required the Eight Banner administration only to update population registers triennially.¹³

Therefore, compared to extant banner population registers in other locations in China, the Shuangcheng banner population registers have higher quality and are more suitable for fertility analysis. One important contrast is with the Eight Banner population registers that Wang, Campbell, and Lee (2010) use for their fertility analysis. The registers provide 1.5 million observations of demographic and socioeconomic information for approximately 270,000 people residing in Liaodong, Liaoning province, between 1749 and 1909 (2010). Although the Liaodong banner population registers have greater geographical and periodical coverage, they were only updated every three years. Children who were born but died before the next register were omitted, as were many children who died before the register following. Compared to the Liaodong banner population registers, Shuangcheng banner population registers have fewer omissions of children who died before they could be registered. Moreover, unlike the banner population registration in Liaodong, which had obligations for labor service, the Shuangcheng population registration aimed to identify elites for the purpose of land allocation. As a result, Shuangcheng bannermen were motivated to register their newborns earlier than their counterparts in Liaodong. This is especially true for metropolitan bannermen. In Shuangcheng, the mean ages of first registration for the children of metropolitan bannermen were 3.02 *sui* for boys and 3.73 *sui* for girls,¹⁴ and the mean ages of first registration for rural bannermen were 4.38 *sui* for boys and 4.45 *sui* for girls. In contrast, the bannermen in Liaodong registered their sons at an average of 5.8 *sui* and daughters at 6.1 *sui* (Lee and Campbell 1997). These differences in the age of first registration also indicate that the Shuangcheng population data has fewer omissions of male and female births.

Despite all the advantages mentioned above, the Shuangcheng registers also have limitations that constrain the analysis. First, the registers still omit completely many daughters of rural bannermen. In figures 3 and 4, we present the age and sex distribution of metropolitan and rural bannermen respectively. As the figures show, the registers for the metropolitan and rural banner populations omitted daughters, although this issue was more severe in rural banner population. As shown in figure 4, girls of age 1-5 *sui* accounted for less than one percent of the total rural banner population. The under-registration of females in rural bannermen persisted in the following age groups until 16-20 *sui*. Only beginning in the age group 21-25, when the majority of women were married, did this problem disappear. The age structure of females of rural bannermen reveals that many rural banner households did not register their daughters at all. Only when these women married were they registered, as wives in their husbands' households. However, the quality of female registration in the metropolitan banner population registers was much better.¹⁵ As figure 3 shows, there was omission for girls of age 1-5 *sui*, as females of this age group accounted for less than four percent of the metropolitan banner population. By age 6-10 *sui*, this problem was ameliorated, although females were still slightly under-registered. Again, the problem of

¹³In the Qing, the state regulation stipulated that banner population registers should be updated every three years. To our knowledge, the banner population registers in Shuangcheng are the only ones that were updated annually.

¹⁴*Sui* is a traditional way for Chinese people to calculate age. An infant is counted as one *sui* at birth and two *sui* at age one. So, on average, a mean age measured in *sui* is one and a half years higher than the actual mean age.

¹⁵In fact, to our knowledge, the quality of female registration for the metropolitan banner population registers is the best among the banner population registers we have found in China. It is not only better than that of the rural banner population registers, but also better than that of the Liaodong banner population registers. Therefore, if we are to analyze female fertility, the metropolitan banner population registers are more suitable than those of the other two populations.

under-registration of females disappeared in age group 21-25 *sui*, the age when the majority of women became married. Due to the omission of daughters among rural bannermen, we focus our analysis on fertility as reflected in male births.

Second, the registers also omitted boys who died before their parents had an opportunity to register them. Some boys were only registered after they had survived infancy and early childhood. As figures 3 and 4 show, in both metropolitan and rural banner populations, there were omissions of males in the age group of 1-5 *sui* for males. Boys of age 1-5 *sui* accounted for less than 6 percent of the metropolitan banner population (figure 3) and less than 4 percent of the rural banner population (figure 4). This omission of boys disappeared in age group 6-10 *sui* for both populations. Therefore, we do not have record for some boys who died in infancy and early childhood.

To solve this problem, in our estimates of aggregate fertility rates, we adjust the raw fertility calculated from the data based on assumptions about the level of infant and child mortality. In table 3, we present mortality rates for registered boys between ages 1-5 *sui* in the metropolitan and rural banner populations. As table 3 shows, for metropolitan banner population, the mortality rates were 0.079 for the 1 *sui* group and 0.076 for the 2 *sui* group. Based on these rates, by 3.02 *sui*, the average age at which the boys of metropolitan bannermen were first registered, about 150 of every 1,000 births would die without being registered. The rural banner population had recorded lower infant and child mortality rates than metropolitan bannermen. As table 3 shows, the mortality rates were 0.048 for the 1-*sui* group, 0.054 for the 2-*sui* group, 0.042 for the 3-*sui* group, and 0.040 for the 4-*sui* group. Thus, by 4.38 *sui*, the average age of first registration for boys of rural bannermen, about 160 of every 1,000 births would have died. However, the low male infant and child mortality rates in Shuangcheng, especially those for the 1-*sui* group, probably indicate that families of metropolitan and rural bannermen registered their newborns at least a couple of months after the birth. Therefore, the infant mortality rates in the first few months, the period with the highest mortality level, were not reflected in the registers. To account for these likely omission, we adjust our fertility rates to assume that the number of boys who died without being registered was 200 per 1,000 births. As we show in the above text, since the early registration of boys by the metropolitan families helped to offset their higher infant and child mortality rates, the numbers of boys omitted by metropolitan and rural banner population registers were probably similar.

2.2 Land registers

In addition to population registers, the Shuangcheng local banner government also maintained land registers. In contrast with the population registers, which were updated annually, the government only compiled a complete set of updated land registers every five years or at the time of some land related special event. Although the extant land registers were compiled between 1870 and 1907, complete land registers covering the entire population in Shuangcheng were mostly created in the years of 1870, 1876, 1887, and 1889. So far we have coded 23 land registers compiled in these four years, which contain 19,609 observations of land holding information for metropolitan and rural banner households as well as some civilian commoners and unofficial banner immigrants.

The land registers follow a structure similar to that of the population registers. They first group land owners by their village of residence. Then, the registers recorded in a sequence the name of land owner,¹⁶ the land type, land size, and, in some occasions, the location of

¹⁶In traditional China, although land ownership was registered under the name of individuals, they were in fact owned by the household in which the individual resided. Therefore, the observations of land records in Shuangcheng land registers represented the land ownership of a household.

the plot. Once a plot was transferred between owners, the local officials would write the new owner's name directly beneath that of the previous owner. When transcribing the land registers to a dataset, we kept all the above information.

This structure of the land registers allowed us to link records of land ownership to the population registers. We first used software to link the records of land ownership to the population dataset based on matching the date, village of residence, and name of the land owner. After the automated linkage, some observations of the land records remained unlinked due to changes in land owners' name or village of residence. Then, we had coders in China manually link the remaining observations to the population dataset. In the end, we linked 13,155 observations of land records to the population dataset. With this linkage, we have constructed a dataset that contains longitudinal individual level demographic data and household level land holding data. The individual level demographic and socioeconomic data cover the period 1866-1912. The linked land data provide information about the ownership of allocated land for households living in 80 of the 120 banner villages in 1876 and the ownership of acquired land for households living in all 120 villages in 1870, 1876, 1887, and 1889.

3. Methods and variables

For our analysis of fertility, we begin with descriptive results on the overall fertility level in Shuangcheng. We estimate the age specific and total fertility rates of women in the metropolitan and rural banner populations between 1866 and 1907.¹⁷ Then, we employ discrete-time event-history analysis to examine the association between net marital fertility with landed wealth as well as other household socioeconomic and demographic characteristics. We say net fertility because there is no way to adjust individual-level data for the omission of children who died in infancy and early childhood. Our outcome variables reflect children who survived long enough for their parents to register them. We estimate two sets of logistic regression models, using a household's total land holding—allocated land and acquired land combined—and a household's ownership of acquired land respectively to measure the land holding status. We first examine whether women residing in households with larger land holdings had higher fertility. Second, we examine whether women of higher social status had higher fertility. Our outcome variable indicates whether or not a married woman had a registered male birth in the next year. Since the government reformed its policy related to land in the early twentieth century, we restrict our regression analysis to the net male fertility of women in first marriage during the period of 1866-1900.

Our explanatory variables, or covariates, measure the influence of household's land holding, other socioeconomic status of the household and individual and family and kin characteristics on the likelihood of having a registered male birth in the next year. We present the covariates we use in the analysis in tables 4 and 5. In our regression models, estimated odds ratios for a covariate reveal the proportional change in the odds of having a registered male birth that is associated with a one-unit change in that covariate, holding the values of other covariates equal. When an explanatory variable is an indicator variable, for example, membership in a particular group, the odds ratio reflects the proportional difference in the chances of having a male birth in that group, relative to the chances of having a male birth for a specified reference category.

¹⁷Beginning in 1908, three years before the fall of the Qing dynasty, the quality of registration declined. The update of vital demographic events became sporadic. Therefore, we exclude the last four years from the calculation of fertility.

3.1 Landholding status

We introduce two sets of covariates to indicate the household's landholding status. As table 4 shows, in the first set of regression models, we introduce a set of covariates that measure a household's relative location in the distribution of all land, allocated and acquired land altogether, among metropolitan and rural bannermen. Since the linked population-land dataset only provides information on the ownership of allocated land in 1876, we use a household's ownership of all land in 1876 to represent its land holding status for the entire period under analysis. Based on some previous analysis on changes in landownership in Shuangcheng, we find landownership was stable over time; the majority of households remained in the same land holding strata throughout the period for which land data are available (Chen 2009).¹⁸ Accordingly, this measurement represents the landholding status of the majority of households during the entire period under analysis.

According to the distribution of all land in 1876 (figure 1), we divide the metropolitan and rural banner households into six categories: the top decile, the second decile, the third decile, the fourth to fifth deciles, the sixth to ninth deciles, and the bottom decile. While the other deciles of households all had at least some land, the bottom decile of households were the landless. We use the bottom decile of households as the reference category. Since land was an indispensable source of income and subsistence in rural societies, more land should have allowed families to have more children. If socioeconomic status and infant and child mortality were inversely associated, families with more land may also have had fewer omitted births. Overall, we expect a positive association between a household's landholding status and the likelihood that the married females living in this household would have a registered male birth.

For the second set of regression models, we introduce a set of covariates measuring a household's ownership of acquired land (table 5). We focus on the ownership of acquired land (*nazu*) for two reasons. First, as we show in figures 1 and 2, the concentrated distribution of acquired land is the major cause of stratification in landed wealth in Shuangcheng. Since the state equally distributed allocated land within metropolitan and rural banner populations, the differences between households' holdings of acquired land determine their relative wealth status. The more acquired land a household had, the wealthier it is compared to other households in the same population category. Second, the data on the ownership of acquired land are longitudinal, tracing changes in land ownership in 1870, 1876, 1887, and 1889. Since the acquired land was the major category that the residents of Shuangcheng transacted, the longitudinal data more accurately captures changes in a household's land holding status throughout the time under analysis.

Based on the distribution of acquired land, we divide all the metropolitan and rural banner households into four categories: the top decile, the second decile, the third and fourth deciles, and the bottom 60 percent of households (figure 2). For the years land registers are available, we classify a household into one of the above categories based on its recorded land ownership in that year. Then, for the years the land registers are not available, we assign a household its land holding status in the most recent year for which land registers are available. Again, we do so based on findings in previous analysis, which reveals considerable persistence of household land holding status in Shuangcheng (Chen 2009). We use the bottom 60 percent of households in the distribution of acquired land as reference

¹⁸In her doctoral dissertation (2009), Chen studies changes in landownership in Shuangcheng, comparing the distributions of allocated land in 20 villages in 1876 and 1906. She also compares changes in the ownership of acquired land for the 120 villages in 1870 and 1889. Both comparisons reveal that although villagers in Shuangcheng did practice land transactions, the distribution of land ownership in Shuangcheng was stable over time and the majority of the households remained in the same land holding stratum throughout the period that land data are available.

category. As figure 2 and table 2 indicate, this group almost had no acquired land. We also expect a positive association between a household's status in the distribution of acquired land and the likelihood of a married female member having a registered male birth.

3.2 Other socioeconomic status

In addition to the direct measurement of land ownership, some other measures of socioeconomic status also indicate power and prestige, all of which may affect reproduction because they determine a family's ability to accumulate the resources needed for a larger family. In our regression models, we introduce three sets of covariates measuring aspects of socioeconomic status at the household and individual levels: membership in population categories, government positions, and educational attainment. First, we use membership in population category to measure a household's social status and entitlement rights to allocated land. In Shuangcheng, the two population categories—metropolitan and rural bannermen—indicate not only bannermen's social status but also their differentiated entitlement to state allocated land. Metropolitan bannermen occupied a higher social status than rural bannermen and, in general, had twice as much allocated land as rural bannermen. We expect that due to the associated socioeconomic status and access to allocated land, population category makes a difference in net marital fertility.

Moreover, we also measure each woman's social standing by any salaried state position held by her husband. Among the metropolitan and rural banner populations, there were two major categories of state positions: soldiers and officials. Since the Eight Banners was originally a military system, all positions in the banner administration had military titles, even though some of them had duties resembling those in a civil government. Soldiers in the Shuangcheng local banner government acted as functionaries, and occasionally, they would be sent to battle field at times of war or rebellion. Each soldier had an annual stipend of 24 *taels* of silver (Chen 2009). In addition, they also had rent income from their assigned salary land. Official positions in Shuangcheng included a variety of government posts, from Tax Preceptor and clerk to the Area Commander-in-chief who run the entire banner government. According to their rank and duty, officials had an annual salary ranging from 36 to 155 *taels* of silver plus rent income from assigned salary land (Chen 2009).¹⁹ In such rural society as Shuangcheng, where the majority of population was farmers and peasants, these salaried state positions brought stable, non-agricultural income as well as prestige. Therefore, we classify husbands' status into three categories: those without salary state position, soldiers, and officials.

Finally, to assess the influence of family wealth on chances of having a registered birth, we also consider husband's educational attainment and possession of purchased titles. We measure husband's educational attainment with a variable indicating whether they had earned a degree title by passing one of the official exams. Since the education required to succeed in official exams demands substantial investments, it indirectly measures a household's wealth status. Many studies of the association between socioeconomic status and fertility in historical China use degree-holding as a measure of status (Harrell 1985; Shiue 2010; Wang, Campbell, and Lee 2010). Anyone who passed an exam and acquired a degree was not only a member of the local educational elite, but also likely to be from a wealthy family that had the means to invest in education. Purchased titles were very expensive, and possession of one was similarly indicative of substantial family wealth. Based on previous findings that wealthier families measured by higher social status and

¹⁹In Shuangcheng, a Tax Preceptor and a vanguard had an annual salary of 36 *taels* of silver, and the Area Commander-in-chief had an annual salary of 155 *taels* of silver.

more degree holders had higher fertility, we expect social and economic privilege to have positive effects for the chance of having a registered male birth.

3.3 Family and household context

Based on previous findings, we also expect family and household context to affect net marital fertility. In this paper, we also introduce the five sets of covariate that have been used to analyze the effects of household context on marital fertility in the banner population in Liaodong (Wang, Campbell, and Lee 2010): household gender and age composition, husband's relationship to household head, the presence of the mother's in-laws, sex-composition of surviving children, and the age difference between spouses. First, household gender and age composition, which measures the dependency ratio, indicates the stage of a family in its life cycle and its ability to support more children. We measure household gender and age composition by three indicators: the number of adults (16-55 *sui*), the proportion of children below 15 *sui*, and the proportion of elderly above age 56 *sui*. We expect a higher proportion of children and elderly to have negative effects on the chance of having a birth because an elevated dependency ratio strained household resources.

Second, we use two sets of covariates—husband's relationship to household head and the coresidence status of in-laws—to measure a couple's status in the household and thus their ability to accumulate enough resource and support for child bearing. Households in traditional China were complex and hierarchical, with married couples co-residing with the husband's parents and siblings. Previous studies on the effects of household context on demographic behaviors reveal that a person's position in a household significantly affected his or her demographic outcome (Lee and Campbell 1997; Lee and Wang 1999; Campbell and Lee 2004; Wang, Campbell, and Lee 2010). In traditional China, the household head had the authority to allocate resources among household members. Therefore, a member's relationship to head determines his or her position in the household. We classify husband's relation to household head into three categories: head, stem kin of head, and non-stem kin of head. We expect that the closer to the head that a husband was, the more likely his wife would have a registered birth. Moreover, we also expect the presence of husband's parents to affect a woman's chance of having a registered birth. On one hand, in-laws' desire for grandchildren may influence the couple's opinion and thus their behavior in reproduction. On the other hand, in-laws may assist with child care, thereby affecting a couple's decisions about reproduction.

Third, under the assumption that reproductive behavior is based on a couple's conscious calculation (Easterlin 1978; Wrigley 1987), we expect the sex composition of surviving children to affect a couple's decision of having an additional birth. Due to the significant under-registration of daughters in the population registers, we mainly consider the situation of surviving sons, classifying the surviving children into three categories: no registered living child, only daughter(s) registered and alive, at least one son registered and alive.

Fourth, we consider age-related factors that affect net fertility. In this regard, we not only control wife's age, but also the age difference between spouses. A woman's fecundity is closely associated with her age; fertility declines as an adult woman reaching an older age. We classify woman's age into five year age groups. Moreover, spousal age difference may also affect fertility, as it often implies conjugal power. Conjugal power refers to the relative power between husband and wife, which may affect decisions related to reproduction (Skinner 1993). Women older than or at the same age as her husband may have more power to influence the family's decision on reproduction. Some empirical evidence on fertility in populations in Europe and Asia also reveal fertility differentials by spousal age differences; women with older husbands tended to have lower fertility, and women with younger husbands had higher fertility (Wolf 1995: table 21.1; Wrigley, Davies et al. 1997: 418;

Wang, Lee, and Tsuya et al. 2010). In our regression model, we classify spousal age differences into three categories: wife is older, husband is 6 or more years older than wife, and husband is as old as the wife but no more than 6 years older.

Finally, we also control for the effects of time period. As figure 2 shows, the holdings of acquired land accounted for by the top one percent of households declined over time. This is due to land transactions and ongoing land clearing that increased the total amount of acquired land for metropolitan and rural bannermen. We therefore divide the time period under analysis into three periods to capture these subtle trends in land concentration: 1866-1875, 1876-1888, and 1889-1900.

4. Results

In this section, we begin our discussion of results by presenting the age-specific marital fertility and total marital fertility rates for women in metropolitan and rural banner populations. We not only compare the age-specific marital fertility rates of the two populations to understand the reproductive behavior of each population category but also compare the fertility rates of the Shuangcheng banner population with other populations in China and in the world. Then, we discuss the results from our regression model on the effects of land holding and other socioeconomic status and household context on net fertility.

4.1 Age-specific and total fertility rates

The descriptive results of fertility rates based on registered births in Shuangcheng, which we present in table 6, reveal differences in registration and reproduction by gender and population category. From table 6, we see serious under registration of female births by rural bannermen.²⁰ While the raw total fertility rates based on male births were 2.33 for metropolitan bannermen and 2.20 for rural bannermen, those based on female births were only 1.77 for metropolitan bannermen and 0.50 for rural bannermen. These results indicate that metropolitan and rural bannermen not only differed from each other in social status, but also had different behaviors when it came to registering female births. Metropolitan bannermen, with higher social status and an urban origin, were more likely to register their daughters, whereas rural bannermen tended not to register their daughters at all. Due to the omission of female births, in our subsequent analysis, we focus on male births only.

Wives of metropolitan and rural bannermen also differed from each other in their fertility schedules, with those of rural bannermen having lower fertility rates in early age and continuing to bear child after 45 *sui*. As table 6 shows, wives of metropolitan bannermen between age 16 and 35 *sui* had higher age-specific marital fertility rates than their rural banner counterparts. Then, the fertility of the two categories converged at the age group 36-40 *sui*, and, after 40 *sui*, wives of rural bannermen had higher fertility rates than those of metropolitan bannermen. The fertility schedule of wives of metropolitan bannermen evidenced signs of deliberate fertility control based on age; after 35 *sui*, most of them appeared to stop bearing children. In contrast, the reproductive behavior of their rural banner counterparts spanned the entire period of their fecund years, with lower fertility rates in early ages.

Since male births in Shuangcheng appear to be well recorded for both metropolitan and rural bannermen, we estimate total marital fertility rates and total fertility rates at the aggregate

²⁰In descriptive results not presented here, we calculate the age specific and total fertility rates by period but do not observe differences in the fertility rates across these periods. Therefore, we present fertility rates in Shuangcheng for the entire period of 1866-1907 and, instead, focus on the comparison of fertility rates by gender and population category.

level for the Shuangcheng population. Based on the raw total marital fertility rates for male births in table 6, we adjust the total fertility rates assuming a mortality level of 200 deaths per thousand live births between birth and the mean age of registration. Then, based on the sex ratio of 106 male to 100 female births, we use the inflation factor of 1.94 to obtain total fertility rates that include both male and female births. Thereby, we estimate the total marital fertility rate in Shuangcheng to be 6.96 per woman for the rural bannermen, or 6.86 if omitting the fertility of age group 46-50 *sui*, and 6.03 per woman for metropolitan bannermen, or 5.79 if omitting the fertility of age group 46-50 *sui*.²¹ The above results show that wives of metropolitan bannermen had much higher fertility than their rural banner counterparts. Given the fact that metropolitan banner households enjoyed more allocated land and had higher per-capita land-holding (table 1), this higher level of fertility was very likely associated with their wealth status.

Moreover, compared to the historical populations in China whose fertility data are available, the fertility rates of the metropolitan and rural bannermen respectively are relatively high, but by no means the highest. As table 7 shows, with the exception of Hai-shan and Hsin-chu Hokkien and Hakka in major and uxori-local marriage, the total marital fertility rates of metropolitan bannermen is higher than those estimated for other historical populations in China, which ranged from 5.30 to 6.10. The total marital fertility rate of rural bannermen was comparable to those of historical populations in Hunan and Anhui and higher than those of populations in Beijing and Liaodong. At the same time, the fertility rates of metropolitan and rural bannermen were lower than those of the Hai-shan and Hsin-chu Hokkien and Hakka. This low fertility level of metropolitan and rural bannermen was especially prominent if we compare them with those of the landed class in Hai-shan Hokkien. According to Wolf (1995: 291), the total marital fertility rates of the landed Hai-shan Hokkien ranged from 7.59 to 8.30 for those in major marriage, from 7.17 to 8.99 in uxori-local marriage, and 6.02 to 6.10 in minor marriage.

At the same time, when compared with those of historical populations in some Western European countries, the marital fertility rates of Shuangcheng bannermen were still relative low, a characteristic of marital fertility in historical China in general. While wives of metropolitan and rural bannermen began child-bearing in age 15-19 *sui*, their total marital fertility were only 6.86 and 5.79.²² These rates were much lower than those of Belgium and France, 9.1 per woman, Germany, 8.6 per woman, Switzerland, 7.8 per woman, Scandinavia, 7.7 per woman, and England, 7.6 per woman, before 1790 (Clark 2007:73). Given the wealth of the Shuangcheng banner populations, this relatively moderate fertility level is clearly not a product of poor nutrition.

4.2 Determinants of marital fertility

After reviewing the general pattern of fertility in Shuangcheng, we present in tables 8 and 9 the results of event-history analyses that assess the influence of land ownership, population category, other family and individual socioeconomic status, and the household context on chances of having a male birth. We organize our discussion of results topically, beginning with time period and land holding status, proceeding to population category and family and individual status, and concluding with family and household context.

4.2.1 Time period—Time period significantly affected the level of fertility in Shuangcheng. As tables 8 and 9 reveal, women living in the period 1876-1888 were 7 or 8

²¹Following the same procedure, we estimate the total fertility rate to be 5.65 per woman for metropolitan bannermen and 5.34 per woman for rural bannermen.

²²In order to compare the fertility rates of Shuangcheng bannermen with those of European populations, which were usually calculated for age 20-49, here we omit the fertility rates for age group 45-49.

percent more likely to have a registered male birth than those living in 1866-1875. Moreover, the fertility level significantly increased in the final time period considered in the analysis; women living in 1889-1900 were 57 percent more likely to have a registered male birth than those living in 1866-1875 (table 8). These results reveal a significant increase of fertility level over time, especially in the last decade of the nineteenth century.

4.2.2 Land holding—The results of our regression models reveal that, in Shuangcheng, household land ownership positively affected a woman's likelihood of having a registered male birth. This effect was apparent whether the wealth measure was the ownership of allocated and acquired land combined or acquired land only. As table 8 shows, when other factors are held equal, compared to the landless in the bottom decile of households, women in the top decile of households were 16 percent more likely to have a registered male birth. Although the odds ratio was not statistically significant for the second and third deciles of households, women in the two groups, the fourth to fifth deciles and the sixth to ninth deciles of households were 13 and 10 percent respectively more likely to have a registered male birth than those in the bottom decile of households.

Similarly, women in the top two deciles of households in the distribution of acquired land have greater chance of having a registered birth than those without acquired land. Table 9 reveals that when other conditions are held equal, women in the top decile of households in the ownership of acquired land were 7 percent more likely to have a registered birth than those without acquired land. Women in the second decile of households had a 9 percent higher chance of having a registered birth. The ownership of acquired land, however, had no significant effect on the reproductive success of women in the third and fourth deciles of households with acquired land.

In general, the above findings are in line with our expectation that richer families are more successful in reproduction. At the same time, the results also reveal that the fertility differentials are more prominent between the landed and landless than between the groups within the landed class. As table 8 shows, women in the sixth to ninth deciles of households in the distribution of all land, which were the bottom group in the landed category, were still 10 percent more likely to have a registered male birth than those in the landless households. In contrast, the positive association between fertility and ownership of acquired land was more moderate. Although the top decile of households in the ownership of acquired land had on average 110 more hectares of land than the bottom 60 percent of households, women in the top decile of households were only 6 percent more likely to have a registered male birth than those in households without acquired land. This is mainly because the majority of the households without acquired land nevertheless had substantial allocated land, 64.4 or 33.7 hectares.

4.2.3 Other socioeconomic status—In both sets of regression models, population category had negative effects on a woman's reproductive success. As tables 8 and 9 show, when other conditions are held equal, wives of metropolitan bannermen were actually 11 to 22 percent less likely to have a registered birth. This result is contrary to our expectation that women from family of higher social status and better entitlement rights to material wealth are more successful in reproduction. This is also counterintuitive as our descriptive results reveal that women of metropolitan bannermen had much higher fertility rates than their rural banner counterparts.

In fact, further examination of these counter-intuitive results from the regression models reveals that metropolitan bannermen had higher fertility rates mainly because they in general enjoyed greater landed wealth than rural bannermen. Once their wealth status is controlled, wives of metropolitan bannermen were less likely to have a registered male birth than their

rural banner counterparts who had the same level of landed wealth. Given that metropolitan bannermen exhibited more signs of deliberate fertility control in our descriptive statistics, this negative effect of population category on fertility suggests that metropolitan banner families were more responsive to wealth status, adjusting their demand for children according to their land holding status.

Moreover, the results of our regression models also show that husband's occupation and exam titles had at most moderate effects on wife's chance of having a registered male birth. As tables 8 and 9 show, in seven of the eight regression models, husband being an official or soldier did not have a statistically significant effect on wife's chance of having a registered male birth. Similarly, husband holding an exam title did not significantly affect wife's reproduction prospect. These results are similar to the ones reported by Manfredini and Breschi (2009) from their analysis of the population of Casalguidi, Italy; when households' taxation levels are held equal, the profession and occupation of the household head—day laborer, sharecropper/tenant, farmer, artisan, nobles/middle class—had no statistically significant effect on fertility (2009).

Above all, our results reveal negative or weak effects of exam title or official position on fertility. This is in contrast with most previous findings on the positive relationship between socioeconomic status and fertility (Harrell 1985, Wang, Lee, and Campbell 1995; Wang, Campbell, and Lee 2010). The differences probably result from the fact that while previous studies use socioeconomic status alone as a measurement of prestige and family wealth, our study separates landed wealth from other socioeconomic characteristics. Comparing these findings with those in previous studies, we suggest that in traditional China, political and educational achievements were closely tied wealth. Therefore, the elites tended to have higher fertility. We speculate that it was the otherwise unmeasured wealth of elites considered in other studies that accounted for their elevated fertility.

4.2.4 Household and family context—A household's age composition, mainly the proportion of children below age 15 *sui*, had significant effects on a woman's reproductive prospects. As our results show, when the number of adults and the proportion of elderly as well as other variables were equal, a one unit increase in the proportion of children between 1 and 15 *sui* increased a woman's likelihood of having a registered male birth by 49 percent in table 8. In table 9, the increase was 58 percent. At the same time, neither the total number of adults in the households nor the proportion of elderly had significant effect on reproductive success. These findings are in line with those for the Liaodong banner population studied by Wang, Campbell, and Lee (2010). This may indicate that families with more children were prosperous and had been especially successful in reproduction in the past.

A couple's status within the household significantly affected their reproductive success. Results in both tables 8 and 9 reveal that, compared to the wife of household head, wives of the head's coresiding relatives were less likely to have a registered male birth. This effect is especially strong when we use the ownership of all land to measure a household's wealth status. As table 8 shows, when we control for the effect of time period, wife of household head's stem kin was 8 percent less likely to have a registered male birth than that of household head. Moreover, compared to household head, husband being non-stem kin of the head reduced a woman's likelihood of having a registered male birth by 11 percent. This finding again confirms the collective nature of decision making in Chinese family (Lee and Campbell 1997, Lee and Wang 1999, Campbell and Lee 2004). Since the household head allocated collective family resources, status and power within the household affected a woman's reproductive prospects in two ways. First, a couple's status within the family affected their access to family resources they needed to care for a newborn and increase the

chances it would survive to be registered. Second, a couple's access to collective resources may also have affected their fertility directly, by allowing them to entertain preferences for larger family size.

The coresidence status of husband's parents also significantly increased a woman's reproductive success. As table 8 shows, compared to women who did not coreside with their parents-in-law, women who coresided with the husband's father had 19 percent higher chances of having a registered male birth (model 4). Women who lived with their mother-in-law had a 13 percent higher chance of having a birth. Coresiding with both of in-laws increased a woman's chance of having a registered male birth by 18 percent. Table 9 also shows similar results: after controlling for time period, coresidence with father-in-law only increased a woman's likelihood of having a registered male birth by 16 percent, residing with mother-in-law only increased this likelihood by 6 percent, and the presence of both in-laws increased a woman's likelihood of having a registered male birth by 9 percent. These findings are consistent with those in the Liaodong banner population (Wang, Campbell, and Lee 2010).

The sex composition of the surviving children of a couple also significantly affected their reproduction. As table 8 shows, after controlling for the effects of time period (models 2 and 4), women who only had living daughters had 12 percent higher chances of having a male birth than women who had no living children. However, once a woman had at least one son alive, her likelihood of having an addition registered male birth was reduced by 17 percent. Table 9 reveals a similar pattern: compared to those without registered children, having only daughters registered and alive increased a woman's likelihood of having a registered male birth by 12 percent, and having at least one son registered reduced this likelihood by 21 percent. These results suggest that couples of the Shuangcheng bannermen deliberately controlled their reproductive behavior according to the sex composition of their living children.

Finally, spousal age differences also affected women's reproductive success in Shuangcheng. According to table 8, compared to couples in which the husband was as old as his wife but no more than 6 years old, husband being six or more years older reduced a woman's risk of having a registered male birth by 13 to 17 percent. At the same time, wife being older than her husband had no statistically significant effect on her likelihood of having a registered male birth. Results in table 9 suggest a similar pattern; although couples in which the wife was older tend to have higher risk of having a registered male birth in model 1, this effect disappears after controlling for time period. Interestingly, the effects of spousal age differences on net fertility in Shuangcheng differ from those found in the other two Chinese populations—the Liaodong banner population and Haishan Hokkian. In those populations, women who were older than their husband tended to have a higher fertility (Wolf 1995: 353; Wang, Campbell, and Lee 2010). Instead, the results of Shuangcheng banner populations resemble those found in European and Japanese populations; in populations in England, Sart, Belgium, Scania, Sweden, Shimomoriya and Niita, Japan, woman with a husband 6 or more years older had relative low fertility (Wrigley, Davies et al. 1997: 418; Wang, Lee, and Tsuya et al. 2010), while women who were older than their husband had no statistically significant difference in their risk of having a registered birth (Wang, Lee, and Tsuya et al. 2010).

5. Conclusion and discussion

In this paper, we demonstrate a positive association between landed wealth and net fertility in Shuangcheng at both the aggregate and individual level. First, at the aggregate level, the relatively high fertility rates of the Shuangcheng bannermen populations suggest that the

abundant land in the frontier allowed for higher marital fertility. As our descriptive results show, wives of the metropolitan banner population had a total marital fertility rate of 6.86 births per woman. With the exception of the Hokkian and Hakka populations in Taiwan studied in Wolf (1995), the total marital fertility rate of metropolitan bannermen was the highest among those of other Chinese populations whose fertility data have been studied. Moreover, compared to that of the imperial lineage members living in Beijing—one of the cities of origin of metropolitan bannermen—the fertility rate of metropolitan bannermen was much higher. The total marital fertility rate of the Beijing nobility was only 5.30 births per woman (Wang, Lee, and Campbell 1995). Similarly, although the total marital fertility rate of 5.79 per woman for rural bannermen is lower than that of metropolitan bannermen, it is still higher than that reported for many other historical Chinese populations. This higher level of fertility in general could be linked to the abundant land owned by metropolitan and rural bannermen in Shuangcheng; in theory each metropolitan household owned 64.4 hectares and each rural household owned 33.7 hectares of allocated, and many households also owned acquired land. This level of landed wealth could not be achieved in any region in inland China during the nineteenth century. Thus, we speculate that the frontier setting of Shuangcheng allowed for higher fertility rates.

Second, within the metropolitan and rural banner populations, landholding was also positively associated with a woman's net fertility. Our regression analysis shows, women living in households with larger ownership in both allocated and acquired land—except those living in the second and third deciles of households—are more likely to have a registered male birth than those living in households without land (table 8). Moreover, the likelihood of having a male birth increases in the higher strata of landholding. Therefore, the cross-sectional differences in reproductive behavior of the Shuangcheng banner population fit in the Malthusian thesis about the association between wealth and population growth in pre-transitional populations. Together with similar results found in populations in Hsiao-Shan, Zhejiang (Harrell 1985), Taiwan (Wolf 1995), Italy (Manfredini and Breschi 2009), and France (Hadeishi 2003), this study suggests that in many pre-transitional populations outside of England, wealth was positively correlated with reproductive success.

While substantiating the Malthusian thesis about the positive correlation between material wealth and fertility, our study also reveals that in contrast with Malthusian generalizations about China, fertility in Shuangcheng is not uncontrolled. First and foremost, the total marital fertility rates for both metropolitan and rural banner populations are still moderate in comparison to those of the Western European populations. Although these moderate fertility rates exhibit a typical East Asian pattern, the wealth status of metropolitan and rural bannermen rules a role for poor nutrition. The relatively low infant and child mortality rates in Shuangcheng also suggest that malnutrition was not a problem for the Shuangcheng banner populations. As table 3 shows, among the registered births, the mortality rates for age 2-5 *sui* did not exceed 76 deaths per 1,000 children for metropolitan bannermen and 54 deaths per 1,000 children for rural bannermen. These rates were much lower than those in the pre-transitional English population, where the mortality rate age group 1-4 was 81.4 deaths per 1,000 children or above (Wrigley and Davies et al 1997: 215). Therefore, the combination of low fertility and low mortality in Shuangcheng is highly unlikely to reflect poverty or malnutrition.

At the same time, the clear pattern of fertility differentials based on household and socioeconomic status suggests that both metropolitan and rural banner populations controlled their fertility according to family circumstances. As we see from the results of our regression analysis, other than wealth status, household context—the co-residence status of husband's parents, the couples' position in the household, the sex composition of living children, and spousal age difference—also significantly affected a woman's net fertility.

Although it is possible that such customary practice as prolonged breastfeeding (Lavelly 2007) and spousal separation existed and affected the fertility outcome, these results suggest that the decision of having a registered birth was collectively made through a series of negotiation with family hierarchies, between the couple, within the stem family, and at the household level. The significant effect of sex composition of surviving children especially suggests that couples had clear preferences for the desired number and sex composition of children. Once a couple achieved its goal, the likelihood of having an additional registered male birth declined.

Moreover, compared to that of rural bannermen, the reproductive success of metropolitan bannermen was especially sensitive to wealth status. The regression results reveal that once wealth status was held equal, wives of metropolitan bannermen were actually less likely to have a registered male birth than those of rural bannermen. This phenomenon indicates that in order to achieve the same fertility level as rural bannermen, metropolitan bannermen needed the guarantee of more material resources than their rural banner counterparts. Thus, the higher total marital fertility rate for metropolitan bannermen was a result of their much greater landholding wealth than rural bannermen, not their higher status.

Metropolitan bannermen's dependence on material wealth is probably related to their hardship in the resettlement process, an urban penalty which we identify in our analysis of mortality of the two populations (Chen, Campbell, and Lee 2006). As our previous study shows, despite the higher socioeconomic status of metropolitan bannermen, in 1870-1890, half a century after their initial settlement in the rural environment, male mortality rates were still higher for metropolitan bannermen than for rural bannermen in all age groups except the old (Chen, Campbell, and Lee 2006). In the period 1890-1912, even after the long-term adaptation process closed the gaps in infant mortality rates between metropolitan and rural bannermen, metropolitan bannermen's mortality deficit persisted in other age groups. Given their wealth status, the explanation for this persisting mortality could not be merely malnutrition or starving but perhaps more a matter of lifestyles brought from metropolitan bannermen's place of origin. Very likely, this vulnerability of metropolitan bannermen made them especially cautious at adjusting their demand for children according to the available material source.

Above all, our study reveals a significantly positive correlation between wealth and reproductive success in Shuangcheng. We suggest that agency within the Shuangcheng banner populations played a key role by enabling them to adjust their reproductive behavior to accommodate their wealth status. At the same time, while most of the fertility differentials by wealth and socioeconomic status are consistent with agency, they do not rule out other explanations, like spousal separation, differences in coital frequency and breastfeeding, and even nutrition.

Finally, the positive association between wealth and net fertility also has implications for male reproduction and social stratification in rural China. While in this paper we show that greater wealth brought more children, in her dissertation, Chen (2009) also confirms the importance of reproductive success to wealth accumulation. In Shuangcheng, not only was greater landed wealth associated with a larger household size, but also downward mobility in land ownership usually resulted from reproductive failure. This was especially true for families that failed to have a male heir. Therefore, male reproduction is important to sustain family wealth. At the same time, as our analysis of marriage pattern in Shuangcheng reveals, males living in families with higher socioeconomic status had better chance to marry, while those with lower socioeconomic status married late or did not marry at all (Chen, Campbell, and Lee 2008). Thus, the rich had better chances to reproduce and be prosperous. The poorer households, however, tended to become extinct.

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Figure 1.
Distribution of allocated and acquired land combined among the metropolitan and rural banner households, 1876.
Sources: Chen 2009.

Figure 2.
Distribution of acquired land among metropolitan and rural banner households, 1870-1889.
Sources: Chen 2009.

Figure 3.
Age-Sex distribution of metropolitan bannermen (1866-1912).

Figure 4.
Age-Sex distribution of rural bannermen (1866-1912).

Map 1.

Communities covered by the Shuangcheng Household Register data, 1866-1912 Source: Ren, Yuxue, James Z. Lee, and Cameron Campbell. 2009. "Xingzheng shijian yu zhidu de chongtu yu chongsu: yi Qingdai Shuangchengpu minjie de chuxian wei zhongxin." (Conflict and reconstruction of administrative reality and policy: taking the emergence of civilian division in the Qing dynasty Shuangchengpu as the center of study.) Unpublished Manuscript, Ann Arbor: University of Michigan.

Map 2.
Sending communities of banner immigrants to Shuangcheng.
Sources: Chen 2009.

Table 1

Average size of all land (allocated and acquired combined) held by metropolitan and rural banner households, 1876.

Households	Average land holding by household (hectare)	Metropolitan banner		Rural banner	
		Household size	Per-capita land holding	Household size	Per-capita land holding
Top decile	234.2	5.2	45.0	12.9	18.2
Second decile	121.6	5.3	22.9	10.8	11.3
Third decile	88.2	4.3	20.7	9.8	9.0
Fourth to fifth deciles	66.9	3.8	17.8	9.2	7.3
Sixth to ninth deciles	38.8	4.0	9.7	8.3	4.7
Bottom 10 percent	2.0	2.6	0.7	6.5	0.3

Table 2

The average size of acquired land held by each metropolitan and rural banner household, 1870-1889.

Households (Date)	Average size of acquired land (hectare)			
	Top decile	Second decile	Third to fourth decile	Bottom 60 percent
1870	124.1	36.3	11.2	0.0
1876	148.4	47.4	18.6	0.4
1887	112.6	33.6	9.6	0.0
1889	110.5	36.5	11.6	0.1

Table 3

Age-Specific Mortality Rates of boys age 1-5 *sui* in metropolitan and rural banner populations, 1866-1907.

Age (<i>sui</i>)	Age-Specific Mortality Rates				
	1	2	3	4	5
Metropolitan bannermen	0.079	0.076	0.054	0.047	0.046
Rural bannermen	0.048	0.054	0.042	0.04	0.026

Table 4

Means and percentage distribution of variables used in the event history analysis of marital reproduction in Shuangcheng, 1866 to 1900, using the ownership of both allocated and acquired land in 1876 as measurement of wealth.

Variables	Obs	Mean	Min	Max
Having a male birth in the next available register	95,376	0.11	0	1
Household composition				
N. of people aging between 16 and 55 <i>sui</i>	95,376	9.34	0	73
Proportion of people aging 1 to 15 <i>sui</i>	95,376	0.25	0	1
Proportion of people aging 56 <i>sui</i> and above	95,376	0.11	0	1
Time period (ref: 1866-1875)				
1876-1888	95,376	0.41	0	1
1889-1900	95,376	0.27	0	1
Husband's relation to head (ref: head)				
Stem	95,376	0.27	0	1
Non_stem	95,376	0.47	0	1
Registered children (ref: no living child)				
No sons, only daughter(s) registered	95,376	0.09	0	1
At least one son registered	95,376	0.68	0	1
Metropolitan bannermen (ref: rural bannermen)	95,376	0.08	0	1
Land holding status (ref: bottom decile)				
Top decile	95,376	0.12	0	1
2nd decile	95,376	0.12	0	1
Third decile	95,376	0.12	0	1
Fourth to fifth deciles	95,376	0.14	0	1
Sixth to ninth deciles	95,376	0.42	0	1
Age difference between spouses (ref: similar ages)				
Husband older	95,376	0.31	0	1
Wife older	95,376	0.30	0	1
Wife's age (ref: 21-25 <i>sui</i>)				
16-20	95,376	0.06	0	1
26-30	95,376	0.19	0	1
31-35	95,376	0.17	0	1
36-40	95,376	0.15	0	1
41-45	95,376	0.13	0	1
46-50	95,376	0.11	0	1
Husband's occupation				
High salaried officials	95,376	0.03	0	1
Soldiers	95,376	0.06	0	1
Government students	95,376	0.00	0	1
Status of in-laws (ref: neither of in-laws present)				
Father-in-law present	95,376	0.07	0	1
Mother-in-law present	95,376	0.22	0	1

Variables	Obs	Mean	Min	Max
In-laws both present	95,376	0.27	0	1

Table 5

Means and percentage distribution of variables used in the event history analysis of marital reproduction in Shuangcheng, 1866 to 1900, using the ownership of acquired land as measurement of wealth.

Variable	Obs	Mean	Min	Max
Having a male birth in the next available register	168,470	0.10	0	1
Household composition				
N. of people aging between 16 and 55 <i>sui</i>	168,470	9.82	0	73
Proportion of people aging 1 to 15 <i>sui</i>	168,470	0.24	0	1
Proportion of people aging 56 <i>sui</i> and above	168,470	0.11	0	1
Time period (ref: 1866-1875)				
1876-1888	168,470	0.38	0	1
1889-1900	168,470	0.32	0	1
Husband's relation to head (ref: head)				
Stem	168,470	0.25	0	1
Non_stem	168,470	0.50	0	1
Registered children (ref: no child)				
No sons, only daughter(s) registered	168,470	0.08	0	1
At least one son registered	168,470	0.68	0	1
Metropolitan bannermen (ref: rural bannermen)	168,470	0.09	0	1
Household's ownership of acquired land (ref: no acquired land (bottom 60%))				
Top decile	168,470	0.16	0	1
Second decile	168,470	0.12	0	1
Third to fourth decile	168,470	0.21	0	1
Age difference between spouses (ref: similar ages)				
Husband older	168,470	0.39	0	1
Wife older	168,470	0.27	0	1
Wife's age (ref: 21-25 <i>sui</i>)				
16-20	168,470	0.06	0	1
26-30	168,470	0.20	0	1
31-35	168,470	0.17	0	1
36-40	168,470	0.15	0	1
41-45	168,470	0.13	0	1
46-50	168,470	0.10	0	1
Husband's occupation (ref: no salaried position)				
High salaried officials	168,470	0.02	0	1
Soldiers	168,470	0.06	0	1
Government students	168,470	0.00	0	1
Status of in-laws (ref: neither of in-laws present)				
Father-in-law present	168,470	0.06	0	1
Mother-in-law present	168,470	0.20	0	1
In-laws both present	168,470	0.23	0	1

Table 6

Fertility rates by sex of registered births and population category in Shuangcheng, 1866-1907.

Population category	Age group (<i>sui</i>)							Total	16-45 <i>sui</i>
	16-20	21-25	26-30	31-35	35-40	41-45	46-50		
Age-specific fertility									
<i>Male births</i>									
Metropolitan	0.060	0.092	0.103	0.089	0.073	0.039	0.009	2.33	2.29
Rural	0.051	0.083	0.087	0.084	0.073	0.042	0.021	2.20	2.10
<i>Female births</i>									
Metropolitan	0.044	0.078	0.073	0.077	0.052	0.027	0.003	1.77	1.75
Rural	0.016	0.024	0.020	0.017	0.013	0.006	0.003	0.50	0.44
Age-specific marital fertility									
<i>Male births</i>									
Metropolitan	0.110	0.123	0.122	0.099	0.073	0.039	0.009	2.87	2.83
Rural	0.084	0.097	0.096	0.084	0.073	0.042	0.021	2.49	2.39
<i>Female births</i>									
Metropolitan	0.081	0.104	0.086	0.085	0.052	0.027	0.003	2.19	2.17
Rural	0.027	0.028	0.022	0.017	0.013	0.006	0.003	0.58	0.57

Table 7

Comparison of the total marital fertility rates of Shuangcheng populations with other historical populations in China

Location and category of population	Period	TMFR	
		16-45	16-50
Shuangcheng bannermen	1866-1907		
Metropolitan		6.86	6.96
Rural		5.79	6.03
Hai-shan and Hsin-chu			
Hokkien	1906-1945		
Major marriage		7.61	--
Minor marriage		6.02	--
Uxorilocal		7.48	--
Hsin-chu Hakka	1906-1945		
Major		7.69	--
Minor		6.19	--
Uxorilocal		7.50	--
Liaodong bannermen	1749-1840	5.38	--
Hunan	1296-1864	--	6.00
Anhui	1462-1864	--	6.10
Jiangsu	1517-1877	--	5.80
Beijing	1700-1890	5.30	--
Anhui	1520-1661	5.40-8.20	--

Sources: Hai-shan and Hsin-chu Hokkien and Hsin-chu Hakka, Wolf (1995:291). Liaodong, Wang, Campbell, and Lee (2010). Hunan, Anhui (1462-1864), and Jiangsu, Liu (1995b). Anhui (1520-1661), Telford (1992, 1995).

Table 8

The association between ownership of allocated and acquired land combined, household context, and socioeconomic status and having a registered male birth in Shuangcheng, 1866-1900.

	Registered male birth							
	Model 1		Model 2		Model 3		Model 4	
	Odds Ratio	p-Value	Odds Ratio	p-Value	Odds Ratio	p-Value	Odds Ratio	p-Value
Household composition								
N. of people aging between 16 and 55 <i>sui</i>	1.01	0.00	1.00	0.87	1.00	0.17	1.00	0.08
Proportion of people aging 1 to 15 <i>sui</i>	1.49	0.00	1.49	0.00	1.48	0.00	1.48	0.00
Proportion of people aging 56 <i>sui</i> and above	1.21	0.10	1.09	0.46	1.00	0.98	0.85	0.17
Time period (ref: 1866-1875)								
1876-1888			1.07	0.01			1.07	0.01
1889-1900			1.57	0.00			1.58	0.00
Husband's relation to head (ref: head)								
Stem	0.94	0.06	0.92	0.02				
Non_stem	0.90	0.00	0.89	0.00				
Registered children (ref: no child)								
No sons, only daughter(s) registered	1.08	0.06	1.12	0.00	1.08	0.06	1.12	0.00
At least one son registered	0.82	0.00	0.83	0.00	0.82	0.00	0.83	0.00
Metropolitan bannermen (ref: rural bannermen)	0.85	0.00	0.82	0.00	0.89	0.02	0.86	0.00
Land holding status (ref: bottom decile)								
Top decile	1.14	0.01	1.16	0.01	1.14	0.02	1.16	0.01
2nd decile	1.07	0.20	1.08	0.13	1.07	0.18	1.09	0.11
Third decile	1.09	0.11	1.08	0.14	1.09	0.12	1.08	0.14
Fourth to fifth deciles	1.13	0.02	1.13	0.02	1.12	0.02	1.13	0.02
Sixth to ninth deciles	1.10	0.05	1.09	0.07	1.10	0.05	1.10	0.06
Age difference between spouses (ref: similar ages)								
Husband older	0.83	0.00	0.80	0.00	0.87	0.00	0.84	0.00
Wife older	1.04	0.13	1.01	0.56	1.03	0.27	1.00	0.99
Wife's age (ref: 21-25 <i>sui</i>)								
16-20	0.79	0.00	0.82	0.00	0.78	0.00	0.80	0.00
26-30	1.06	0.07	1.04	0.18	1.07	0.03	1.06	0.07

	Registered male birth							
	Model 1		Model 2		Model 3		Model 4	
	Odds Ratio	p-Value	Odds Ratio	p-Value	Odds Ratio	p-Value	Odds Ratio	p-Value
31-35	0.98	0.54	0.96	0.23	1.00	0.99	0.99	0.73
36-40	0.79	0.00	0.78	0.00	0.83	0.00	0.82	0.00
41-45	0.44	0.00	0.42	0.00	0.46	0.00	0.45	0.00
46-50	0.18	0.00	0.18	0.00	0.20	0.00	0.20	0.00
Husband's occupation								
High salaried officials	1.04	0.46	1.04	0.52	1.04	0.52	1.03	0.61
Soldiers	0.95	0.35	0.98	0.67	1.00	0.92	1.04	0.45
Government students	0.90	0.57	0.86	0.40	0.85	0.34	0.80	0.22
Status of in-laws (ref: neither of in-laws present)								
Only father-in-law present					1.20	0.00	1.19	0.00
Only mother-in-law present					1.10	0.00	1.13	0.00
In-laws both present					1.12	0.00	1.18	0.00
Log likelihood	-31,386.14		-31,231.71		-31,379.97		-31,220.49	
Observations	95,376		95,376		95,376		95,376	
Derees of freedom	24		26		25		27	
LR Chi2	1,920.25		2,229.12		1,932.60		2,251.55	

The association between ownership of acquired land, household context, and socio-economic status and having a registered male birth in Shuangcheng, 1866-1900.

Table 9

	Registered male birth							
	Model 1		Model 2		Model 3		Model 4	
	Odds Ratio	p-value	Odds Ratio	p-value	Odds Ratio	p-value	Odds Ratio	p-value
Household composition								
N. of people aging between 16 and 55 <i>sui</i>	1.00	0.08	1.00	0.32	1.00	0.74	1.00	0.01
Proportion of people aging 1 to 15 <i>sui</i>	1.58	0.00	1.59	0.00	1.58	0.00	1.58	0.00
Proportion of people aging 56 <i>sui</i> and above	1.03	0.74	0.94	0.51	0.95	0.60	0.83	0.05
Time period (ref: 1866-1875)								
1876-1888			1.08	0.00			1.08	0.00
1889-1900			1.42	0.00			1.43	0.00
Husband's relation to head (ref: head)								
Stem	0.95	0.09	0.95	0.07				
Non_stem	0.91	0.00	0.91	0.00				
Registered children (ref: no child)								
No sons, only daughter(s) registered	1.08	0.02	1.12	0.00	1.08	0.02	1.11	0.00
At least one son registered	0.78	0.00	0.79	0.00	0.79	0.00	0.79	0.00
Metropolitan bannermen (ref: rural bannermen)	0.86	0.00	0.78	0.00	0.89	0.00	0.80	0.00
Household's ownership of acquired land (ref: no acquired land (bottom 60%))								
Top decile	1.06	0.01	1.07	0.00	1.06	0.02	1.07	0.00
Second decile	1.08	0.00	1.09	0.00	1.08	0.00	1.08	0.00
Third to fourth decile	1.02	0.27	1.02	0.34	1.02	0.29	1.02	0.38
Age difference between spouses (ref: similar ages)								
Husband older	0.88	0.00	0.83	0.00	0.91	0.00	0.87	0.00
Wife older	1.05	0.03	1.02	0.24	1.04	0.06	1.02	0.47
Wife's age (ref: 21-25 <i>sui</i>)								
16-20	0.78	0.00	0.81	0.00	0.78	0.00	0.80	0.00
26-30	1.05	0.06	1.03	0.20	1.05	0.04	1.04	0.12
31-35	0.94	0.02	0.92	0.00	0.95	0.04	0.94	0.01
36-40	0.79	0.00	0.77	0.00	0.80	0.00	0.79	0.00

	Registered male birth							
	Model 1		Model 2		Model 3		Model 4	
	Odds Ratio	p-value	Odds Ratio	p-value	Odds Ratio	p-value	Odds Ratio	p-value
41-45	0.45	0.00	0.44	0.00	0.46	0.00	0.46	0.00
46-50	0.18	0.00	0.18	0.00	0.19	0.00	0.18	0.00
Husband's occupation (ref: no salaried position)								
High salaried officials	0.99	0.84	0.98	0.75	0.99	0.80	0.98	0.70
Soldiers	1.01	0.88	1.04	0.34	1.05	0.17	1.09	0.02
Government students	0.98	0.89	0.93	0.54	0.93	0.58	0.88	0.30
Status of in-laws (ref: neither of in-laws present)								
Only father-in-law present					1.16	0.00	1.16	0.00
Only mother-in-law present					1.03	0.20	1.06	0.01
In-laws both present					1.05	0.05	1.09	0.00
Log likelihood	-53,963.37		-53,961.15		-53,807.95		-53,802.49	
Observations	168,470		168,470		168,470		168,470	
Derees of freedom	22		23		24		25	
LR Chi2	3,141.09		3,145.54		3,451.93		3,462.86	