Chaste Widowhood*

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Abstract

Why did so many widows never remarry in late imperial China? Chaste widowhood made continued fidelity after a husband's death a valued form of female virtue, and the state publicly recognized qualifying women through *jingbiao*. I examine whether population pressure helped shape customary restrictions against widow remarriage. By discouraging widow remarriage, chaste widowhood could limit widows' return to fertility-bearing unions, a post-marital margin of demographic adjustment. I combine two newly assembled sources: linked Chinese genealogy microdata and chaste-woman cases from the *Ming Shilu*. Cross-prefecture comparisons show more chaste-woman cases where recorded male population exceeds the local scale predicted by land area, productive potential, and broad geography, a proxy for population pressure. Within prefectures over time, after accounting for common period shocks, more chaste-woman cases appear when the genealogy-recorded population measure is higher. The relationship remains positive across alternative period lengths and coverage requirements and after accounting for genealogy coverage and composition, the observed flow of married male deaths, and local recognition capacity. Genealogy-based evidence also shows more young-widow cases relative to unusually late marriages, a proxy for remarriage, in periods when the same prefecture has a higher genealogy-recorded population measure. The relationship is not stronger in places with greater state reach. Together, the results suggest that population pressure contributed to the formation and strengthening of customary restrictions against widow remarriage.

Keywords: Culture, Gender Norms, Fertility, Population Pressure
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1 Introduction

Chaste widowhood, or the expectation that a woman remain unmarried after her husband's death, appeared in a range of historical societies. Rules surrounding widow remarriage could shape family status, women's conduct, and the boundaries of acceptable female sexuality. In Joseon Korea, for example, the national code barred descendants of remarried women from civil and military office, making a widow's marital conduct consequential for later generations (Deuchler, 1992). Early modern Spain also celebrated the devout and sexually abstinent widow as an ideal (Bilinkoff, 1999).[1]

Late imperial China brought this ideal to an immense scale and made it unusually visible. Through the national institution of *jingbiao*, widows who met the standard of chastity could be publicly recognized by the state and honored by their lineages. The broader chaste widow cult made widow remarriage morally costly, while continued fidelity after a husband's death could be converted into public honor. Existing accounts explain this cultural system through Confucian moral discourse, state recognition, lineage honor, local activism, and concerns over female chastity and sexual propriety (Elvin, 1984; Lu, 2010; Fei, 2012). A complementary demographic interpretation is that population pressure helped strengthen the chaste widow cult that sustained customary restrictions against remarriage.

From the late fourteenth through the early seventeenth centuries, China's population expanded on a massive scale, while official registration totals captured only part of the increase (Liang, 1980; Maddison, 1998; Cao, 2000; Deng, 2003). Over the same period, the chaste widow cult expanded in reach and public prominence through state commendation, lineage honor, local activism, and a wider moral discourse surrounding female fidelity (T'ien, 1988; Lu, 2010; Fei, 2012). A separate corpus of poetry shows that both the share of widow-related poems portraying widows positively and the prevalence of such poems in the full corpus peak in the same era.[2] These developments occurred at the same time, raising a question: did population pressure contribute to the formation and strengthening of the customary restrictions behind chaste widowhood?

The logic is that widow remarriage affected fertility exposure. In the classic account, preventive checks reduce fertility by limiting the number of women of reproductive age who are exposed to fertility-bearing unions, through late marriage or non-marriage (Hajnal, 1965). Chaste widowhood concerned remarriage after first marriage. Its eligibility rules generally targeted women who became widows while still young enough to remarry and bear children, and

[1] Akerlof and Rayo (2020) use this European case to illustrate how family narratives can shape gender identity.

[2] Related work uses traditional narratives to measure gender attitudes and stereotypes (Michalopoulos and Xue, 2021).

rewarded continued fidelity thereafter (Elvin, 1984). The custom operated in a moral environment in which widow remarriage was increasingly stigmatized, and it reinforced that hierarchy by attaching public honor to widow non-remarriage. By discouraging widow remarriage, it reduced widows' return to fertility-bearing unions after a husband's death. As population pressure rose, norms that restricted this fertility-bearing margin could become more strongly selected, transmitted, and reinforced.

Empirically, I use the number of women who received *jingbiao* as an institutionalized measure of the local prominence of the chaste widow cult. A cultural-evolutionary perspective emphasizes that the prevalence and strength of norms can respond to the social and economic environments in which they are transmitted (Boyd and Richerson, 1985; Nunn, 2012; Giuliano and Nunn, 2021). The relevant process need not require individual households to understand or intend the broader demographic consequences of widow non-remarriage. Under greater pressure on local resources, a norm restricting remarriage could become more persistent and widely reproduced within communities and lineages even when individuals understood it primarily in terms of fidelity, virtue, reputation, and honor. Where this culture became stronger, more women sustained the conduct associated with exemplary widowhood and were brought forward through the formal commendation system. The number of *jingbiao* cases therefore captures the extent to which chaste widowhood became established, enacted, and publicly expressed in a locality. The *jingbiao* institution could in turn reinforce the culture by publicizing and rewarding exemplary conduct, although the estimates do not identify that feedback.

Using Chinese genealogy microdata and *Ming Shilu* chaste-woman records, I first show that chaste-woman cases are more common where recorded male population exceeds the local scale predicted by land area, productive potential, and broad geography. This comparison provides a proxy for population pressure. I then show that the relationship remains positive in comparisons within prefectures over time. The pattern is also present after trimming genealogy outliers and accounting for observable differences in genealogy coverage and composition.

A central measurement challenge is the lack of local population estimates observed repeatedly across much of China before the twentieth century. Genealogies help fill this gap because their time-stamped individual records can be aggregated consistently across places and periods. Their unusual combination of geographic breadth and temporal depth makes it possible to exploit both spatial and within-prefecture variation.

Existing quantitative work has drawn on detailed genealogies to study fertility, human capital, and social mobility, often following a relatively small set of lineages in considerable depth (Shiue, 2017; Hu, 2023; Shiue, 2025). Related work using detailed household-register data from Liaoning has examined marriage, fertility, human capital, mortality, kinship, and intergenerational mobility (Campbell and Lee, 2008; Song, Campbell, and Lee, 2015; Ding,

Du, and Shi, 2020; Butaeva, Durlauf, and Shapoval, 2026). The source used here provides much broader geographic coverage at the cost of less uniform individual detail. A related validation paper demonstrates the promise of crowd-sourced Chinese genealogies for demographic and economic history using a single-surname version of the data (Xue, 2025). The broader FamilySearch material used here spans nearly all surnames represented in the study-period material.[3]

The second source contains 3,490 record-level *jingbiao* entries for chaste and related forms of female virtue extracted from the *Ming Shilu*. Of these, 2,629 can be assigned geographically and mapped to the common prefecture geography. The main outcome retains the chaste-woman categories and aggregates the commendations by prefecture and period. The main sample uses 50-year periods over the overlap in the two sources, from the period beginning in 1350 through the period beginning in 1600.

The empirical results are consistent with this interpretation. The empirical results are consistent with the proposed interpretation. Within prefectures, periods with greater population pressure have more chaste-woman cases. The relationship remains positive across checks that address genealogy coverage and outliers. It also remains positive after controlling for male deaths with spouse links, while male births do not predict the chaste-woman outcome. As an additional consistency check, the genealogy data do not show demographic patterns running in the opposite direction: periods with a higher genealogy-recorded men-alive measure have more young-widow cases relative to unusually late marriages, a proxy for remarriage. The appendix also considers heroic female virtue records, which are associated with death or violent defense of chastity. Adding them to the outcome leaves the association positive. Used on their own, heroic records show no comparable association, although their relative rarity limits the power of that comparison; Appendix I reports the results. Taken together, the results suggest that population pressure contributed to the strengthening of a cultural norm limiting widows' return to fertility-bearing unions.

The argument brings together several strands of scholarship that are often discussed separately: the economic history of women and the family, cultural economics research on the origins of gender norms, and the historical demography literature on preventive checks. Chaste widowhood links these literatures through a specific margin of women's lives: widow remarriage after first marriage. It gave public force to ideas about female virtue and affected whether widows returned to marriage and childbearing. Its relationship with demographic conditions therefore connects women's position within the family to the historical formation of social norms governing marriage and fertility.

[3]Dai's related study uses a larger set of genealogies than the lineage studies cited above, assembling 211 modern *jiapu* from the Yangtze Valley and 210,383 occupational observations. Its twentieth-century period and regional focus differ from the source and period used here (Dai, 2025).

First, the study of chaste widowhood contributes to research on marriage, family institutions, and women's economic position in historical societies. Goldin's work has shown how women's work, earnings, and labor-market opportunities changed over the course of American economic development (Goldin, 1990). Research on western Europe connects marriage patterns to women's work and household organization (De Moor and Van Zanden, 2010). Related work shows how economic development and technological change can alter institutions governing women's rights and their position within the family (Doepke and Tertilt, 2009; Doepke, Tertilt, and Voena, 2012). For late imperial China, historians have shown that women's family position was shaped by household strategies, property arrangements, lineage organization, and moral institutions (Elvin, 1984; T'ien, 1988; Mann, 1997; Bernhardt, 1999; Sommer, 2000; Birge, 2002; Theiss, 2005). Chaste widowhood brings widow remarriage into this literature as a feature of women's lives after first marriage. By attaching moral and reputational consequences to remarriage and public honor to continued widowhood, the custom shaped widows' ability to form another marital household and their position within the family and marriage market.

A second contribution concerns research on the historical origins of gender norms. This literature examines how economic and demographic conditions shaped women's roles and beliefs about appropriate female behavior. Work on the transmission and evolution of gender norms shows how beliefs about women's roles can persist across generations, shape women's work and fertility, and change as economic conditions evolve (Fernández, Fogli, and Olivetti, 2004; Fernández and Fogli, 2009; Fernández, 2013). Other work links persistent gender norms to historical production technologies (Boserup, 1970; Alesina, Giuliano, and Nunn, 2013), frontier conditions and demographic imbalances (Bazzi et al., 2023), the long-run effects of male-biased sex ratios (Grosjean and Khattar, 2019), and economic incentives surrounding women's chastity (Becker, 2024). Here, population pressure is the material condition examined in relation to the formation and changing force of a norm governing widow remarriage after first marriage.

Third, the historical formation of customary restrictions against widow remarriage speaks to the historical demography literature on preventive checks in China. Work on Chinese demographic adjustment emphasizes household and marriage-market margins including nuptiality, fertility control, adoption, and infanticide (Lee and Wang, 1999; Lee, Campbell, and Wang, 2002). Lee and Campbell (1997) specifically identify customary restrictions against widow remarriage as one component of the preventive check. The question here is whether population pressure helps explain why that restriction became prominent.

Fourth, using genealogies to measure population raises a general concern that changes in the records may reflect changes in coverage or recording practices rather than changes in

population itself. I address this in several ways, using information on record volume, record richness, life-event reporting, and the completeness of kinship links.

The remaining sections proceed as follows. Section 2 gives a brief history of chaste widowhood in imperial China. Section 3 develops the preventive-check interpretation and the proposed cultural mechanism. Section 4 describes the genealogy data and the *Ming Shilu* records. Section 5 presents the empirical strategy and main results. Section 6 reports robustness checks, Section 7 examines bottom-up responses and state reach, and Section 8 presents related evidence on young widowhood and late marriage in genealogies. Sections 9 and 10 discuss the broader implications and conclude.

2 Chaste Widowhood in Imperial China

Chaste widowhood was both a moral ideal and a social practice. At its core was the expectation that a widow should remain loyal to her deceased husband and refrain from remarriage. In late imperial China, this expectation acquired an institutional form through *jingbiao*, which allowed widows who met official standards of chastity to be publicly honored by the state and their lineages.[4] The system worked primarily through honor, reputation, and certification rather than criminal prohibition. It raised the moral and reputational costs of remarriage while turning continued fidelity after a husband's death into a source of public honor (Elvin, 1984; Birge, 2002; Lu, 2010). Together, these ideals, practices, and forms of recognition formed what historians have called the chaste widow cult (Lu, 2010; Fei, 2012).[5]

Formal commendation was only one part of this cultural system. Household expectations, local reputation, biographies and other writing, arches, shrines, and lineage commemoration supplied models of exemplary widowhood that could be admired, emulated, and invoked in local moral life (Elvin, 1984; Fei, 2012). These practices allowed the ideal to be reproduced well beyond the women who themselves received official recognition. *Jingbiao* provided an especially visible form of certification within this broader cultural world.

Historians have emphasized the ways this system regulated women's sexuality, labor, and reproduction and tied them more closely to the husband's lineage and to an orthodox moral order (T'ien, 1988; Mann, 1997; Lu, 2010). A related cultural economics literature studies the economic origins of customs that restrict women's sexual behavior, emphasizing monitoring

[4] *Jingbiao* refers to formal public commendation by the state. In practice, recognition could be materialized through public honor, inscription, arch construction, or related local commemoration, but the category used here is the court-recognized commendation recorded in the *Ming Shilu*.

[5] Comparative research on marriage and kinship institutions shows how moral prescriptions governing marriage can reshape family organization and the transmission of social norms (Goody, 1983; Schulz et al., 2019). More broadly, research on the economics of religion emphasizes how religious norms and institutions can shape fertility and demographic transition (Becker, Rubin, and Woessmann, 2024).

problems and incentives surrounding paternity and female chastity (Becker, 2024).[6] Other scholarship complicates a simple top-down account by emphasizing variation, household circumstances, women's participation in claims for recognition, and the honor or material support that chastity could provide (Sommer, 2000; Birge, 2002; Fei, 2012).[7]

The roots of widow chastity predate the Ming dynasty (1368–1644). Song and Yuan debates over widow remarriage helped narrow the moral legitimacy of remarriage among elite families (Birge, 2002). By the fifteenth century, widow chastity had become a legible public honor with recognizable standards and established channels of state and lineage recognition (Elvin, 1984; T'ien, 1988).

Remarriage and continued widowhood implied different household and reproductive trajectories. A widow who remarried entered a new household and could return to a fertility-bearing union. A widow who remained with her deceased husband's family could continue caring for children and elderly in-laws and contributing domestic and productive labor. Her own support could come from her labor, household property, children, in-laws, and wider kin (Bernhardt, 1999; Sommer, 2000; Birge, 2002; Fei, 2012). Quantitative evidence from Liaoning and Shuangcheng likewise shows that household circumstances mattered for widow remarriage: widows with sons were substantially less likely to remarry (Chen, Campbell, and Lee, 2014). These arrangements could make continued widowhood materially sustainable even in the absence of a husband.[8] For younger widows, remaining widowed rather than remarrying therefore also limited their return to a fertility-bearing union.

Eligibility rules make the demographic logic especially clear. Formal age criteria for recognized faithful widowhood began under the Yuan. The Ministry of Rituals proposed recognition for widows who had been bereaved before 30 *sui* and had reached at least 50 *sui* (Elvin, 1984).[9] Age 50 roughly marked the end of the childbearing period, so the rule effectively required a widow to pass through the remaining reproductive years without remarriage. These criteria were maintained until 1723, when the rule was relaxed to 15 years of fidelity and attainment of 40 *sui*; later reductions placed still more emphasis on the duration and intention of fidelity (Elvin, 1984). The changing age cutoffs show that recognized chaste widowhood was organized around life-cycle timing, remarriage, and reproductive exposure. The source's reported ages are consistent with this emphasis. Among 106 chaste-widow entries with an observed age at

[6] For a broader review of chastity-guarding practices, see Becker and Novak (n.d.).

[7] Related work considers the connection between cotton textiles, women's work, and widow chastity (Xue, 2015; Liang, Wang, and Yamauchi, 2021).

[8] The property and inheritance consequences of widow remarriage varied across periods and family circumstances and could further shape these arrangements; see Bernhardt (1999), Sommer (2000), and Birge (2002).

[9] *Sui* refers to traditional Chinese age reckoning, so the thresholds should be read as institutional life-cycle cutoffs instead of exact Western ages.

the husband's death, the mean age at widowhood is 24.6 years and the median is 25. Age information is available for only a subset of entries, so these figures describe reported ages rather than the full set of recognized widows. They nevertheless show that the institution often concerned women for whom remarriage and further childbearing remained possible.

Formal recognition became a recurring and increasingly extensive practice. Elvin reports 277 faithful widows in the Jiaxing prefectural gazetteer for Jiaxing county alone, while the flow of candidates expanded further in the Qing (Elvin, 1984). By 1749, Jiangsu province produced more than 200 virtuous-woman candidates in a single year; by the nineteenth century, some local campaigns identified hundreds or even thousands of candidates for recognition (Elvin, 1984). Recognized chaste widowhood appeared across court records, local gazetteers, family writing, commemorative inscriptions, arches, shrines, and lineage histories.

Public recognition magnified the social consequences of widow chastity. Official commendations, local biographies, arches, shrines, and inscriptions made exemplary widowhood visible and could enhance the prestige of a household or lineage. The state could also use chastity to project moral order and connect local family practice to orthodox political values (Elvin, 1984; T'ien, 1988; Mann, 1997). Some commendations carried material benefits. Under the Yuan and Ming, families of canonized women could be excused from labor service; under the early Qing, families of recognized virtuous widows could receive funds for ceremonial arches (Elvin, 1984). Formal commendation required nomination and verification, so recognition combined local initiative with bureaucratic certification.[10]

Although the language and administration of commendation were mediated by officials and local literati, the recognition system was not formally confined to elite women. The regulations extended recognition to commoner households and excluded women who already held titles derived from the official status of husbands or sons (Fei, 2012). The recognition system therefore reached beyond elite moral discourse, although access to nomination and documentation was likely easier for families connected to literati and lineage networks.[11] Recognized chaste widowhood is best understood as an elite-mediated institution with broader social reach.

Two court-recognized cases illustrate the conduct honored as faithful widowhood. In 1406, the court commended Wu shi, wife of Chen Ruyan, a commoner from Wu County in Suzhou. She was twenty-nine at the time of the court record, with an elderly mother-in-law and a son only ten months old. The household was poor, but Wu was literate. She spun hemp to provide

[10]The *Da Ming huidian* rules discussed by Elvin (1984) describe age thresholds, local reporting, investigation, and sanctions for false nominations. For the role of literati activism and local claims-making around chastity recognition in the late sixteenth and early seventeenth centuries, see Fei (2012).

[11]Only 39 of the 3,490 entries in the underlying *Ming Shilu* extract report an official position held by a child of the recognized woman.

food and clothing, cared for her mother-in-law, and later taught her son the *Classic of Filial Piety* and the *Analects*. The record states that she remained steadfast and did not remarry, and the court ordered that her household gate be marked in recognition of her chastity.[12] Her case shows that recognized widow chastity combined prolonged non-remarriage with the everyday work of supporting a household and raising a child after a husband's death.

In 1425, the court commended Yu shi, wife of Qian Zishun, a commoner of Jiaxing County. Her husband died when she was twenty-five, leaving a three-year-old son. The record says that she vowed not to remarry, cared for her mother-in-law, and remained chaste for fifty-five years until her death.[13]

These examples concern faithful widowhood, the category most closely related to the main outcome in the empirical analysis. The official vocabulary also included related forms of female virtue. Faithful widows were honored for preserving chastity over time after a husband's death. Heroic women, including women who died in defense of chastity or resisted sexual violation, belonged to the same broader moral world. Later discussions sometimes distinguished the two: heroic widowhood emphasized a decisive act of resolve, while faithful widowhood emphasized the long-term preservation of chastity after widowhood (Elvin, 1984). Together, these categories show how female chastity became an object of public honor and state recognition.

3 Population Pressure and Widow Remarriage Norms

Population pressure arises as population grows relative to the resources available to support it. In a Malthusian setting, this pressure can be relieved through two broad types of checks (Galor and Weil, 2000). Positive checks operate through mortality: famine, epidemic, war, and other crises reduce population after pressure has accumulated. Preventive checks operate before births occur. They reduce fertility by lowering exposure to childbearing, especially the number of women of reproductive age in fertility-bearing unions and the years they spend in those unions. The classic example is the European Marriage Pattern, in which late first marriage and permanent female non-marriage limited entry into fertility-bearing unions (Hajnal, 1965).[14] Historical China differed sharply on this margin: female marriage was nearly universal, and

[12] *Ming Taizong Shilu*, juan 56, Yongle 4, seventh month; see also Li, Yang, and Xu (1995).

[13] *Ming Shilu leizuan* records the case under Hongxi 1, tenth month, p. 313; see also Li, Yang, and Xu (1995).

[14] Marriage was also institutionally regulated in parts of central and eastern Europe. In early modern Bohemia, manorial authorities could require permission to marry, charge fees, and intervene in particular matches (Ogilvie, 2005). On some Russian serf estates, estate rules, fines, and taxes also influenced marriage timing and household formation (Dennison, 2003). These cases provide a comparison in the institutional regulation of marriage. The Chinese mechanism differed in working through the cultural valorization and public commendation of widow non-remarriage rather than through a formal requirement to obtain permission to marry.

female infanticide had produced a shortage of single women relative to men (Lee and Campbell, 1997; Lee and Wang, 1999).

Widow non-remarriage therefore operated on both the marriage-market and fertility margins. In a setting with relatively few unmarried women, a young widow who did not remarry remained outside the pool of potential wives and did not return to a fertility-bearing union. Unlike late first marriage or permanent non-marriage, this margin operated after first marriage, when a widow could otherwise re-enter marriage and childbearing.

Research on preventive checks in China shows how demographic adjustment could operate through household and marriage-market behavior (Lee and Wang, 1999; Lee, Campbell, and Wang, 2002). In the Liaoning evidence, customary restrictions against widow remarriage are identified as one such mechanism (Lee and Campbell, 1997).[15] Later event-history evidence from Liaoning and Shuangcheng shows that widows' remarriage chances varied substantially with household and kin circumstances (Chen, Campbell, and Lee, 2014). These restrictions were sustained through cultural expectations surrounding fidelity, remarriage, and female virtue, which could be reinforced through social sanction and public recognition (Lu, 2010; Fei, 2012).

A cultural-evolutionary perspective allows changing social and economic conditions to shape the prevalence of cultural traits over time (Boyd and Richerson, 1985; Nunn, 2012; Giuliano and Nunn, 2021). Greater population pressure could alter the relative material costs and benefits of widow remarriage. Remarriage could return a young widow to a fertility-bearing union, while continued widowhood could preserve her place in the deceased husband's household and her role in caring for existing children and kin. These material tradeoffs could affect remarriage behavior directly. They could also shape how households, lineages, and local communities evaluated widow non-remarriage. Where continued widowhood became relatively more attractive under prevailing material conditions, it could receive greater social approval and acquire greater moral value.

Stronger local approval could in turn reinforce continued widowhood and make such cases more likely to be regarded as exemplary and brought forward for recognition. Related work on religious groups provides a framework for how costly behavioral restrictions can persist when they strengthen group participation and reduce free riding (Iannaccone, 1992). Cultural transmission can operate through socially learned norms and rules of thumb without requiring individuals to evaluate their broader demographic consequences (Boyd and Richerson, 1985;

[15]Available local evidence suggests that widow non-remarriage extended well beyond the women formally commended by the state. In the rural Liaoning populations studied by Lee and Campbell (1997) and Lee and Wang (1999), only about one-tenth of widows ever remarried. In selected Qing genealogies examined by Guo (2001), 58.33 percent of widows under thirty remarried, implying that more than two-fifths did not. The estimates differ in age coverage, region, and source construction, but both indicate that continued widowhood was a common social experience rather than an exceptional status confined to recognized women.

Nunn, 2012). Because such norms govern marriage and remarriage, their transmission can also affect fertility behavior and fertility transitions (Spolaore and Wacziarg, 2022; Beach and Hanlon, 2023; Blanc, 2023). The *jingbiao* institution then gave qualifying cases a visible public form through which exemplary conduct could be recognized (Elvin, 1984; Lu, 2010). Public recognition could further reinforce the norm by making particular cases visible and prestigious, although the estimates do not separately identify this feedback.

Figure A.1 summarizes this proposed sequence. Population pressure could affect continued widowhood directly through the material tradeoffs surrounding remarriage and indirectly through changes in the local value attached to widow non-remarriage. Qualifying cases could then enter the *jingbiao* system and appear in the *Ming Shilu*.

The empirical analysis therefore uses chaste-woman commendations as an observable expression of the local prominence of this cultural institution and asks whether that prominence increased with population pressure.

4 Data and Measures

The first dataset is a newly assembled Chinese genealogy microdataset. The underlying records contain person identifiers, gender, birth and death years and places, lineage identifiers, and kinship links where available. Existing quantitative work has drawn on genealogies and household registers to study fertility, marriage, human capital, mortality, kinship, and mobility, often following a relatively small set of lineages or populations in considerable depth and recording unusually rich information on each individual (Campbell and Lee, 2008; Song, Campbell, and Lee, 2015; Shiue, 2017; Ding, Du, and Shi, 2020; Hu, 2023; Shiue, 2025; Butaeva, Durlauf, and Shapoval, 2026). Appendix D.1 situates the source in this literature.

The distinctive strength of the genealogy microdata used here is their combination of broad geographic and long temporal coverage with linked individual-level demographic information.[16] They encompass nearly all Chinese surnames and cover localities across much of China over several centuries. This scale is particularly useful for studying factors that vary meaningfully only over substantial geographic distances or long periods. At the same time, the individual records make it possible to construct repeated local measures of population,

[16]Republican governments also pursued national population statistics. The 1912 exercise used police-conducted household surveys, the 1928 exercise used household surveys organized by the Ministry of Home Affairs, and the 1936 exercise used reports from the Bao-jia household administration system (Luo, 1997). These exercises counted persons through household-based administrative systems, but their geographic coverage, reporting standards, and completeness varied, and the surviving material is generally aggregate rather than accessible nationwide individual-level microdata. More detailed census surveys in the Republican period were confined to selected counties and cities. The 1953 and 1964 national censuses also collected individual information, but the materials generally available to researchers are aggregate tables and tabulations rather than unrestricted person-level records. The 1982 census marked the beginning of the modern census series with systematic computer tabulation and more accessible research data. See Wang (1990).

marriage, childbearing, widowhood, and family structure.

4.1 Measuring Local Population

For this analysis, I construct a genealogy-recorded men-alive measure from the number of men alive in each decade. I de-duplicate individuals by ID and retain male records with a mappable birthplace and usable birth and death years. Appendix B describes the construction and sample restrictions.

Across the mappable genealogy source, 85,910 male records have usable birth and death years. At the local geography level, a man is counted as alive at decennial benchmark t if his recorded birthplace can be assigned to that unit, his birth year is weakly before t, and his death year is strictly after t. The resulting counts are aggregated to prefectures. Thus the variable measures the number of recorded male genealogy members alive at a decennial benchmark, rather than births, deaths, or newly written genealogy entries in that decade. For the main 50-year specification, the genealogy-recorded men-alive measure is the mean across the decennial benchmarks observed within each period. The resulting regressor is $\log(1 + \text{mean genealogy-recorded men alive})$ for each prefecture-period.

The resulting measure tracks changes in the local demographic base through male genealogy records. Genealogies are selective, and the density of genealogical recording varies across regions, so its level is not a census count. Men are used because Chinese genealogies are patrilineal sources in which male records are more consistently observed than women's records, especially because daughters are often omitted and women's later lives are less systematically documented. Male records therefore provide the most consistent basis for constructing a time-varying population measure from the genealogy source. The empirical strategy includes prefecture fixed effects to absorb persistent differences in genealogy coverage and other local characteristics, and period fixed effects to absorb changes common across prefectures over time. Later robustness checks address variation in the genealogy source more directly by trimming predictor outliers and adding controls for record volume and composition.

4.2 Other Genealogy-Based Measures

The linked individual records support a broader set of measures used throughout the analysis. Birth and death dates and spouse links allow me to construct male births and deaths of married men, which are used to distinguish the population measure from contemporaneous genealogy recording and from the mechanical creation of potential widows. For women, linked information on marriage, childbirth, spouses, and children permits measures of observed marriage age, age at first linked childbirth, early motherhood of sons, and survival to later ages. Combining women's ages with husbands' death dates and marital links also makes it possible to identify young-widow cases and unusually late marriages, which Section 8 uses to study

continued widowhood relative to likely remarriage.

The records also provide measures of the genealogy source itself. I construct prefecture-period measures of record volume and growth, the availability of life-event information, record richness, and the completeness of parent, spouse, and child links. These variables are used to assess whether changes in the genealogy-recorded population measure instead reflect changes in the amount or composition of surviving genealogy information. Appendix C gives detailed definitions of the individual measures.

4.3 *Ming Shilu* chaste-woman records

The second dataset records women commended in the *Ming Shilu*. I use the *jingbiao* section in the women's history volume of *Ming Shilu leizuan*, which compiles imperial commendations from the Ming Veritable Records.[17] These are court records of formal recognition, distinct from local biographies or private inscriptions. Relative to local gazetteers, the source has two advantages: comparability and geographic coverage. First, *jingbiao* was a national institution of recognition: women were commended through a common imperial vocabulary and within the same institutional category of female virtue. The resulting records therefore measure recognized chaste widowhood under a broadly comparable institutional framework across regions. Local officials and elites still shaped which cases were nominated and transmitted upward, but the category being recognized was defined through the same state institution.

Second, the *Ming Shilu* is a central court chronicle with geographic reach across the empire. Gazetteer evidence depends on uneven survival and on local compilation and editorial choices. The court record does not depend on whether a locality's gazetteer survives or on the criteria used by a particular gazetteer editor. For these reasons, the *Ming Shilu* records are especially useful for comparing the local prominence of recognized chaste widowhood across prefectures and periods.

The main chaste-woman outcome uses court-recognized *jingbiao* entries marked *jiefu* or *jienu*. These records capture an institutionalized public expression of the customary restriction against widow remarriage: they identify women publicly commended for chaste widowhood after their husbands' deaths. I track heroic categories separately. They often concern death or violent defense of chastity and belong to the broader politics of female virtue. The records occasionally report a woman's age at widowhood, but this information is too infrequent to support a systematic age-at-widowhood measure and is not used in the main outcome.

[17] The source volume is Li, Yang, and Xu (1995). The empirical data use the *jingbiao* entries in this volume. Related work demonstrates the potential for quantitative analysis of the Qing Veritable Records (Keller, Shiue, and Yan, 2026).

4.4 Common Geography and Baseline Sample

The two sources are aggregated to a common CHGIS prefecture geography, creating a shared spatial unit for the panel. Appendix D.3 describes the translation of FamilySearch place labels and *Ming Shilu* locations into this geography, including fractional allocation when a source location spans more than one prefecture.

The baseline panel contains 107 prefectures observed over six 50-year periods, for 642 prefecture-period observations. The periods begin in 1350, 1400, 1450, 1500, 1550, and 1600; the first and last are partial because the two sources overlap from 1370 to 1630. The baseline requires mappable genealogy birthplaces to cover at least 75 percent of a prefecture's area between 1370 and 1630. A stricter 90 percent requirement is used as a robustness check. The thresholds describe geographic support in the genealogy source, not the share of people observed or the share of panel cells with data. Both requirements also require at least 75 percent of each prefecture's area to lie inside the historical administrative geography relevant to the study period. These prefectures are concentrated in long-settled Han regions and in the demographic core of imperial China.

5 Population Pressure and Chaste Widowhood

The empirical analysis examines whether population pressure contributed to the force of customary restrictions against widow remarriage. The genealogy data provide a time-varying measure of local population size, using male life histories because men are more consistently recorded in patrilineal genealogies. The demographic interpretation concerns the local population as a whole.

The sample is concentrated in long-settled Han regions of an overwhelmingly agrarian economy. In these settings, increases in local population placed greater demands on an established resource base, making population size informative about the demographic pressure associated with Malthusian dynamics (Lee and Campbell, 1997; Cao, 2000; Deng, 2003). Appendix D.2 discusses how out-migration, including movement toward frontier areas, enters the interpretation of the local population measure.

5.1 Cross-Prefecture OLS

I begin with a cross-prefecture comparison. For each prefecture, I average the logged male-population measure and the logged chaste-woman outcome over the study window. Column 1 of Table 1 relates average chaste-woman cases to average local male population while controlling directly for prefecture area, agricultural suitability, ruggedness, latitude, longitude, and distance to Qufu. The association is positive and statistically significant.

Table 1: Cross-Prefecture OLS: Population Relative to Predicted Local Scale

	OLS	Predicted local scale	
	(1)	(2)	(3)
	Direct controls + area	Basic	Expanded
Local male population	0.082**		
	(0.041)		
Population relative to predicted local scale		0.112***	0.107**
		(0.042)	(0.042)
Predicted local population scale		0.268***	0.260***
		(0.042)	(0.044)
Capacity characteristics	✓	Basic	Expanded
Distance to Qufu	✓	✓	✓
Mean of Dep. Var.	0.728	0.728	0.728
Observations	107	107	107
R^2	0.483	0.320	0.320

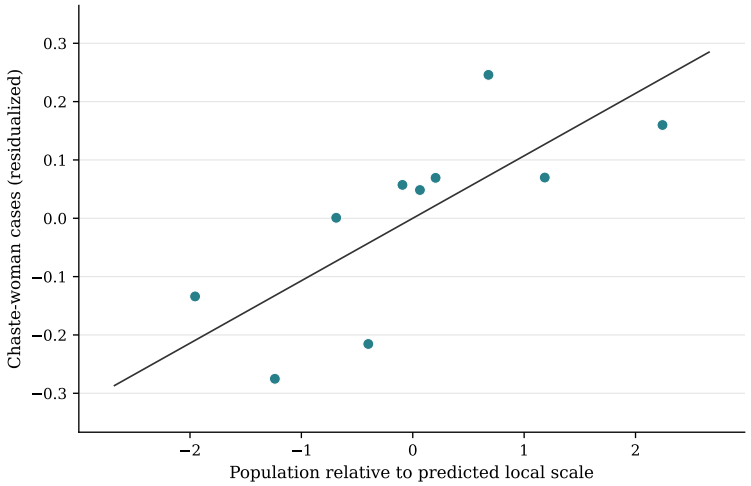
Notes: The dependent variable is each prefecture's average of log(1 + chaste-woman cases) over the 50-year study periods in the 75 percent coverage sample. Local male population is the corresponding average of log(1 + genealogy-recorded men alive). Column 1 controls separately for prefecture area, agricultural suitability, logged ruggedness, latitude, longitude, and logged distance to Qufu. Column 2 predicts local male population using prefecture area, agricultural suitability, logged ruggedness, latitude, and longitude. Column 3 adds two rice measures, two wheat measures, and modal soil type to that prediction. For each crop, the two measures are mean attainable yield among positive raster cells and the share of valid cells with positive yield. Population relative to predicted local scale is observed minus predicted population. Logged distance to Qufu is included in the outcome regressions in columns 2 and 3 but not in the population predictions. Heteroskedasticity-robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Population size alone does not establish that a place faced greater pressure on local resources. More productive or more extensive land can support more people. Columns 2 and 3 therefore introduce a predicted local population scale. Column 2 predicts average local male population from prefecture area, agricultural suitability, ruggedness, latitude, and longitude. Column 3 adds, for rice and wheat separately, mean attainable yield among positive raster cells and the share of valid cells with positive yield, as well as modal soil type. Population relative to predicted local scale is observed population minus that prediction. Distance to Qufu remains a control in the outcome regressions and is not used to predict population. The basic prediction explains 37 percent of the cross-prefecture variation in average local male population, and the expanded prediction explains 41 percent.

The coefficient on population relative to predicted local scale is positive and statistically significant in columns 2 and 3. Prefectures with more male population than is predicted by their land area, productive potential, and broad geography also have more chaste-woman cases. Figure 1 shows the corresponding partial relationship for the expanded specification

in column 3. The residual captures population relative to predicted local productive scale and provides the cross-prefecture proxy for population pressure used here. It is not a direct measure of carrying capacity, since unobserved productivity, migration, settlement history, and differences in genealogy coverage may also affect the residual.

Figure 1: Population Relative to Predicted Local Scale and Chaste Widowhood



Notes: The figure uses the 107 prefectures in the 75 percent coverage sample. Each point is the mean of one of 10 equal-sized bins. The predicted local scale includes prefecture area, agricultural suitability, ruggedness, latitude, longitude, the mean attainable yield and positive-cell share for rice and wheat, and modal soil type. Both axes are residualized for predicted local population scale and distance to Qufu; the solid line is the corresponding linear fit.

5.2 Within-Prefecture Estimates

The cross-prefecture evidence motivates the panel design but cannot remove stable differences in recording, settlement, institutions, or unobserved local productivity. The main unit of analysis is the prefecture by 50-year period. The core estimating equation is

$$\log(1 + C_{p\tau}) = \beta \log(1 + G_{p\tau}) + \alpha_p + \delta_\tau + X_p' \lambda_\tau + \varepsilon_{p\tau}, \tag{1}$$

where $C_{p\tau}$ is the count of chaste-woman cases in prefecture p and 50-year period τ, $G_{p\tau}$ is the mean number of genealogy-recorded men alive in that period, α_p are prefecture fixed effects, δ_τ are period fixed effects, and $X_p' \lambda_\tau$ allows period effects to vary with prefectural characteristics. The coefficient β is identified from changes within the same prefecture over time, after accounting for common period effects and differential trends associated with prefectural characteristics. The panel analysis retains the genealogy-recorded men-alive measure as its

treatment. Appendix H.1 shows that replacing it with the residualized population-pressure measure used in the cross-prefecture analysis leaves the within-prefecture estimate unchanged, because predicted local scale is time invariant and absorbed by prefecture fixed effects.

Table 2: Population Pressure and Chaste Widowhood: Panel Estimates

	75% coverage		90% coverage	
	50-year	30-year	50-year	30-year
	(1)	(2)	(3)	(4)
Genealogy-recorded men alive	0.110**	0.085***	0.088*	0.083**
	(0.048)	(0.029)	(0.052)	(0.032)
Prefecture FE	✓	✓	✓	✓
Period FE	✓	✓	✓	✓
Period FE × prefectural characteristics	✓	✓	✓	✓
Mean of Dep. Var.	0.728	0.500	0.727	0.497
Observations	642	1,070	510	850
R^2	0.681	0.591	0.681	0.590

Notes: The dependent variable is log(1+chaste-woman records), using all geocoded *Ming Shilu* chaste-woman cases. Columns 1 and 2 impose the 75 percent genealogy coverage requirement; columns 3 and 4 impose the 90 percent requirement. All four columns also require at least 75 percent of each prefecture's area to lie inside the historical administrative geography relevant to the study period. Within each requirement, the first column uses 50-year periods and the second uses 30-year periods. Standard errors are clustered by prefecture and reported in parentheses. Each outcome record is first placed in the historical administrative geography appropriate to its location and date and then translated into the common prefecture geography; records whose historical location spans multiple common prefectures are allocated by normalized area shares. The treatment variable is log(1 + mean genealogy-recorded men alive), where the mean is taken across observed decades in the period. The prefectural characteristics interacted with period fixed effects are prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu. Qufu is included here as distance to a major Confucian center. The first and last periods are partial because the parsed *Ming Shilu* outcome covers 1370–1630. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The prefecture fixed effects absorb stable differences across places, including lineage organization, genealogy compilation practices, administrative status, proximity to higher-level authority, the preservation of local family records, and persistent differences in the local capacity to nominate and transmit commendation cases.

The period fixed effects absorb changes common to all prefectures, including changes in the national recognition regime, aggregate population conditions, and the volume or character of surviving records. They therefore separate the within-prefecture relationship from national changes occurring over the same period.

The period interactions with prefectural characteristics extend the logic of Column 2 of

Table 1 to the panel. They allow the relationship between the outcome and fixed prefectural characteristics to vary across periods, addressing the possibility that places with different land area, productive potential, terrain, or geography followed systematically different trajectories. The interactions include prefecture area, agricultural suitability, ruggedness, latitude, longitude, and distance to Qufu. Distance to Qufu provides a rough proxy for the local prominence of Confucian institutions and norms (Kung and Ma, 2014; Jia and Kung, 2025). The estimate therefore compares changes within a prefecture after accounting for common period shocks and characteristic-specific period effects. The sample contains 642 prefecture-period observations, covering 107 prefectures over six 50-year periods under the 75 percent genealogy coverage requirement and the requirement that at least 75 percent of each prefecture's area lie inside the historical administrative geography relevant to the study period. Standard errors are clustered by prefecture.

Table 2 presents the central result. Under the 75 percent genealogy coverage requirement, the association is positive and statistically significant in both the 50-year and 30-year specifications. The estimates remain positive under the stricter 90 percent genealogy coverage requirement, with the 30-year estimate statistically significant and the 50-year estimate less precisely estimated. In the 75 percent 50-year panel, a one log point increase in the genealogy-recorded men-alive measure is associated with roughly a 0.110 log point increase in the chaste-woman outcome. Using within-prefecture variation, a one-standard-deviation increase in the logged population measure is associated with about 0.12 standard deviations in the logged chaste-woman outcome. The underlying interpretation concerns the local population as a whole; recorded men alive supply its most consistently observed historical proxy. Against the broader population expansion shown in Appendix F, the estimate is consistent with population pressure contributing to the growing force of customary restrictions against widow remarriage.

A separate specification distinguishes average population differences between prefectures from changes within prefectures. The decomposition enters the prefecture mean of the population measure and the deviation from that mean separately, while retaining period fixed effects, prefectural characteristics, and period interactions with those characteristics. Both components are positive and statistically significant, indicating that the relationship appears both across prefectures with different average population levels and within prefectures as population changes over time. Appendix H reports the decomposition together with a pooled specification that omits prefecture fixed effects.

6 Population Scale, Genealogy Measurement, and Recognition Capacity

The robustness checks address whether the results reflect mechanical population scale, changes in genealogy coverage or composition, local recognition capacity, broader female virtue commendation, or omitted differences in productive potential. Table 3 reports the population-scale checks separately from the other exercises. Table 4 reports the genealogy, recognition-capacity, expanded-outcome, and productive-potential checks.

6.1 Population Scale, Male Deaths, and Female Eligibility

A count outcome could rise mechanically with the number of men. More men may imply more marriages, more husband deaths, and more potential widows even when the probability that a widow remained chaste did not change. To assess this possibility, I use the number of married men who died in each prefecture and period, identified by a recorded death year and a linked spouse in the genealogies. Each man is counted once and assigned by his birthplace and death period.

Table 3: Population Pressure, Male Deaths, and Female Eligibility

	Chaste-woman outcome		Treatment replacement	Female genealogy outcomes	
	(1)	(2)	(3)	(4)	(5)
	Baseline	Male deaths added	Male births	Survive to 50	Any age 50+
Genealogy-recorded men alive	0.110**	0.123*		-0.059**	-0.012
	(0.048)	(0.068)		(0.024)	(0.012)
Recorded male births			0.028		
			(0.050)		
Prefecture FE	✓	✓	✓	✓	✓
50-year period FE	✓	✓	✓	✓	✓
Period FE × prefectural characteristics	✓	✓	✓	✓	✓
Mean of Dep. Var.	0.728	0.728	0.728	0.806	0.983
Observations	642	642	642	515	515
R^2	0.681	0.682	0.678	0.442	0.374

Notes: The table reports prefecture-period regressions with standard errors clustered by prefecture. All columns include prefecture fixed effects, 50-year period fixed effects, and interactions between period fixed effects and prefectural characteristics. Columns 1–3 use log(1 + chaste-woman cases) as the dependent variable. Column 2 additionally controls for log(1 + married men who died), constructed from genealogy entries with a recorded death year and a linked spouse. These deaths are assigned by the man's birthplace and death period, with fractional geographic allocation when needed. Column 3 replaces the men-alive measure with recorded male births. Columns 4 and 5 use, respectively, the share of women in the genealogies surviving to age 50 and an indicator for any woman in the genealogies aged 50 or older. A missing female birth year is supplemented with a linked husband's birth year when available. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Controlling for this measure leaves a positive, though less precisely estimated, associa-

tion between local population and chaste-woman cases. The number of observed married male deaths itself has a small and statistically insignificant coefficient, suggesting that the association is not simply a consequence of more husbands dying in places with more men.

Two related checks clarify what the population measure is capturing. Male births provide a useful comparison because they measure a flow of new births in the genealogies rather than the number of men alive in a period. If the baseline result mainly reflected periods of heavier genealogy recording, other contemporaneous genealogy counts such as male births should also tend to predict the outcome. They do not: replacing the men-alive measure with contemporaneous male births produces no comparable relationship. The contrast suggests that the result is related to the population represented in the genealogies rather than to a general increase in genealogy activity.

The share of observed women surviving to age 50 declines with the genealogy-recorded men-alive measure, while the presence of any observed woman aged 50 or older is unrelated to it in the available sample. These outcomes do not suggest that the result is driven by larger genealogies mechanically containing more long-lived women who could become eligible for recognition.

Taken together, these checks weaken a purely mechanical population-scale interpretation, while leaving open the possibility that the observed association combines demographic scale with changes in the salience or recognition of widow chastity.

6.2 Genealogy Coverage and Population Measurement

Genealogical records provide broad historical coverage, but the number and composition of observed lineages vary across places and periods. The population measure may therefore reflect changes in genealogical coverage, preservation, or compilation intensity as well as local population size. The estimated relationship could also be driven by a small number of prefecture periods with unusually rich genealogical records.

The baseline specification already absorbs many sources of this variation. Prefecture fixed effects absorb stable differences across prefectures in genealogy preservation, lineage activity, archival survival, and other time-invariant traits. Period fixed effects absorb aggregate changes over time in genealogy production and survival, as well as shifts in national *jingbiao* standards and administrative practice. Interactions between period fixed effects and prefectural characteristics allow these trends to differ by land area, baseline terrain, geography, agricultural suitability, and distance to Qufu. I then run additional checks that change the construction of the population measure or control directly for genealogy record volume.

Columns 1 and 2 of Table 4 trim observations outside the 1st–99th and 5th–95th percentiles of the predictor, respectively. Both estimates remain positive and are close in magnitude.

Table 4: Additional Specifications for Population Pressure and Chaste Widowhood

	Dependent variable: log(1 + chaste-woman records)										
	(1) Trim 1–99	(2) Trim 5–95	(3) Person	(4) Male	(5) Growth	(6) Social	(7) Kin base	(8) Kin links	(9) Exam	(10) Heroic	(11) Rice, wheat, soil
Genealogy-recorded men alive	0.114**	0.116**	0.113**	0.108**	0.133*	0.108**	0.108**	0.104**	0.105**	0.101**	0.131**
	(0.047)	(0.046)	(0.049)	(0.049)	(0.071)	(0.048)	(0.048)	(0.047)	(0.049)	(0.050)	(0.056)
Kin links								✓			
Prefecture FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
50-year period FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Period FE × traits	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional period traits											✓
Record controls			✓	✓	✓						
Genealogy composition						✓					
Sample with kin links							✓	✓			
Chaste + heroic outcome										✓	
Mean of Dep. Var.	0.723	0.710	0.728	0.728	0.763	0.737	0.737	0.737	0.728	0.798	0.728
Observations	635	609	642	642	527	634	634	634	642	642	642
R^2	0.684	0.695	0.682	0.681	0.705	0.683	0.681	0.682	0.686	0.685	0.718

Notes: The table reports regressions at the prefecture and period level. Standard errors are clustered by prefecture and reported in parentheses. All columns include prefecture fixed effects, 50-year period fixed effects, and the baseline interactions between period fixed effects and prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu. The treatment variable is log(1 + mean genealogy-recorded men alive). Columns 3–5 add controls that vary over time for genealogy record volume; column 5 also controls for record growth. Column 6 adds measures that vary over time for record richness and life event information. Columns 7 and 8 use the sample with kin-link data; column 8 adds the standardized mean number of parent, spouse, and child links per genealogy record. Column 9 adds logged examination candidate density, constructed within the same 50-year period. Column 10 expands the dependent variable to include heroic female virtue records. Column 11 additionally interacts period fixed effects with the rice and wheat suitability measures and modal soil type. For each crop, the two measures are mean attainable yield among positive raster cells and the share of valid cells with positive yield. Qufu is treated here as distance to a major Confucian center, not as a state capacity proxy. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Columns 3–5 control directly for the volume of genealogy records. Column 3 adds the log number of all genealogy person records in the same prefecture period. The coefficient on the genealogy-recorded men-alive measure is essentially unchanged. Column 4, which instead controls for the log number of male genealogy records, yields a similarly positive estimate. Column 5 adds record growth across periods; the association remains positive. Together, these checks suggest that the main result is not mechanically driven by outliers or by changes over time in the volume of genealogy records.

6.3 Changing Composition of Genealogies

I next examine whether the result is sensitive to changes in the composition of the genealogy records observed in a prefecture-period cell. A shift toward better-preserved or more socially prominent lineages could raise the recorded men-alive count because these lineages leave more complete histories. The same shift could increase the number of observed chaste-woman cases if such lineages were more likely to preserve, organize, or transmit claims for public commendation. The estimated relationship could then capture a common change in genealogy composition rather than population pressure.

To address this concern, I add two controls derived from the genealogy records. The first is a standardized record richness index, built from the completeness of kinship links and the availability of life event information in the genealogy records. The second is the share of genealogy records containing life event information. These controls vary by prefecture and period, so they account for changes in source richness within the same prefecture over time. These controls capture differences in record completeness and lineage organization and may also partly reflect differences in socioeconomic background or status, although they do not measure those characteristics directly. Column 6 uses the 634 of 642 baseline panel cells for which both the record-richness index and the life-event share are observed. The population coefficient remains positive and statistically significant, close to the baseline estimate. Changes in observable genealogy richness and event documentation therefore do not account for the association.

An additional check uses an indirect measure of kin-link completeness: the mean number of parent, spouse, and child links per genealogy record in a prefecture period. The measure captures the extent to which individuals in a cell are linked to parents, spouses, and children in the genealogy. Columns 7 and 8 of Table 4 use the sample with kin-link data; the relationship between the genealogy-recorded men-alive measure and chaste-woman cases is positive both before and after adding this measure. This result is consistent with the other checks of genealogy composition.

6.4 Changing Recognition Capacity

A separate concern is that the production of recognized chaste-woman records may vary with local capacity to bring cases into official recognition. Places with more examination candidates may have had stronger literati networks, greater familiarity with the moral vocabulary of commendation, and better access to the channels through which cases were nominated, documented, and transmitted.

I therefore control for examination candidate density as a measure of local recognition capacity that varies over time. It proxies a prefecture's connections to literati and institutional networks that could help nominate, document, and transmit commendation cases. Column 9 adds this control. The coefficient remains positive when it is included.

6.5 Heroic Female Virtue Records

The main outcome uses *jiefu* and *jienu* records. The source also contains heroic female virtue categories, such as *liefu* and *lienu*, associated with death or violent defense of chastity. Column 10 adds these categories to the outcome and leaves the population coefficient positive. Appendix I also estimates the heroic categories on their own. That estimate is close to zero, but the heroic outcome contains relatively few cases, limiting the power of the comparison.

6.6 Expanded Productive-Potential Controls

The expanded predicted local scale in the cross-prefecture analysis uses prefecture area, agricultural suitability, ruggedness, latitude, and longitude, and adds two measures each for rice and wheat: mean attainable yield among positive raster cells and the share of valid cells with positive yield. It also adds modal soil type. Column 11 of Table 4 adds the rice, wheat, and soil characteristics to the panel through interactions with period effects, while retaining the baseline interactions for prefecture area, agricultural suitability, ruggedness, latitude, longitude, and distance to Qufu. It therefore allows prefectures with different productive potential to follow different period-specific outcome paths, using the full set of characteristics from the expanded local-scale prediction. The 75 percent 50-year coefficient remains positive and statistically significant. The estimating sample is unchanged.

7 Bottom-Up Responses and State Reach

A central interpretation question is whether the relationship between the genealogy-recorded men-alive measure and chaste-woman cases reflects changes in norms against widow remarriage arising through households, lineages, and local communities or a top-down state campaign. In the more local account, greater population pressure could increase the value attached to widow non-remarriage within households, lineages, and local communities, contributing to the

formation and strengthening of the norm through family expectations and local reputation. The state then formally recognized some of the women whose conduct met the standards of *jingbiao*.

In the top-down account, officials respond to demographic pressure by promoting widow chastity more actively through the institutions of moral recognition. The two channels could coexist, since *jingbiao* recognition required state action. Historical work on chastity recognition in the late sixteenth and early seventeenth centuries makes this mixed institutional logic clear: local elites could use the promise of imperial commendation to press cases upward, so official recognition could also reflect local claims-making (Fei, 2012). These possibilities motivate tests of whether the relationship between the genealogy-recorded men-alive measure and chaste-woman cases varies with state reach. If the association mainly reflects stronger state promotion where official reach was greater, it should weaken with distance from political and communication centers and with greater ruggedness.

Table 5: Population Pressure and State-Reach Interactions

	State-reach proxy		
	Relevant capital	Courier	Ruggedness
	(1)	(2)	(3)
Genealogy-recorded men alive	0.114**	0.109**	0.113**
	(0.047)	(0.048)	(0.051)
Genealogy-recorded men alive × proxy	-0.030	-0.002	0.013
	(0.038)	(0.030)	(0.024)
Prefecture FE	✓	✓	✓
50-year period FE	✓	✓	✓
Period FE × prefectural characteristics	✓	✓	✓
Mean of Dep. Var.	0.728	0.728	0.728
Observations	642	642	642
R^2	0.681	0.681	0.682

Notes: The table reports interaction specifications at the prefecture-period level. Standard errors are clustered by prefecture and reported in parentheses. The treatment variable is log(1+mean genealogy-recorded men alive). Column 1 uses logged geodesic distance to the period-specific Ming capital: Nanjing in the 1350 period, Beijing after the 1421 move, and a 21-year Nanjing/29-year Beijing weighted distance for the 1400–1449 period. Columns 2 and 3 use logged geodesic distance to the nearest imperial courier route and logged ruggedness. Each proxy is centered before interacting with the genealogy-recorded men-alive measure. The geographic measures are time invariant and are absorbed by prefecture fixed effects. The prefectural characteristics interacted with period fixed effects are prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu, which is kept separate as a measure of proximity to a major Confucian center. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

I examine this possibility with three interaction checks. The first uses distance to the political capital relevant to each period. Nanjing is used for the 1350 period, Beijing for the periods after the 1421 move, and the 1400–1449 period uses a year-weighted distance because it straddles the transition. This captures proximity to central political authority and the geographic reach of the imperial administration (Sng, 2014). The second uses distance to the nearest imperial courier route, which captures access to the communications network through which official information and administrative pressure could travel. The third uses ruggedness, which captures terrain barriers to communication, travel, and administrative penetration. Rugged terrain has been used in economic history and political economy as a measure of geographic isolation and limited accessibility (Nunn and Puga, 2012). In each case, I interact the genealogy-recorded men-alive measure with the relevant state reach proxy while retaining prefecture fixed effects, period fixed effects, and the period-by-trait controls used in the central specification.

Table 5 gives little evidence that the relationship between the genealogy-recorded men-alive measure and chaste-woman cases is stronger where state reach was greater. None of the three interaction coefficients is statistically distinguishable from zero, and their magnitudes are small relative to the main association. The results therefore provide no evidence that proximity to political authority, access to courier routes, or easier terrain amplified the relationship.

These results provide little support for a top-down account in which population pressure generated more chaste-woman cases primarily where the state could promote widow chastity more effectively. They are instead consistent with a setting in which norms against widow remarriage formed and strengthened through households, lineages, and local communities, while the state certified recognized cases through the existing *jingbiao* institution.

8 Young Widowhood and a Remarriage Proxy in Genealogies

The genealogy records provide an additional way to examine whether women's marital behavior moves in the same direction as the *Ming Shilu* results. They do not provide conventional longitudinal histories of women after a husband's death, but the way women enter Chinese genealogies makes it possible to construct marital patterns informative about continued widowhood and remarriage.

Chinese genealogies are organized around patrilineal descent, and wives enter the genealogy through marriage to men in the lineage. A woman who remained widowed could continue to be recorded in relation to her deceased husband and his lineage, whereas a remarried woman could appear through a later husband's lineage. The genealogy structure therefore provides

two complementary signals. The first is a woman whose husband died while she was young and who remains recorded with the deceased husband's lineage. The second is a marriage observed at an unusually late age. Because the source does not systematically identify whether an observed marriage was a woman's first marriage or a remarriage, sufficiently late observed marriages can be used as a proxy for remarriage.

I construct the first measure using women whose observed husband's death occurred by the time they reached age 30 or 35. I refer to women who remained attached to the deceased husband's genealogy after such an early husband death as young-widow cases.[18] The age-30 cutoff follows the historical eligibility logic of *jingbiao*: a standard rule recognized women bereaved before thirty *sui* who maintained fidelity into later life (Elvin, 1984). The age-35 definition provides a broader sensitivity check while remaining well within the observed childbearing range.[19]

The comparison measure uses women with an observed marriage at age 30 or 35 or older. Female first marriage in historical China was generally early, often occurring in the late teens or early twenties (Ebrey, 1990). An observed marriage at age 30 was therefore far outside the usual range of first marriage, and one at age 35 still more so.[20] A late observed marriage could also follow divorce, but divorce was governed by the legal code and was comparatively rare in imperial Chinese society (Jiang, 2005; Hsieh, 2008). Together with the unusually early distribution of first marriage, this makes marriage observed at ages 30 or 35 a useful proxy for remarriage. Given the rarity of divorce, many such remarriages are likely to have followed widowhood.

The two measures capture almost entirely distinct sets of women. No woman widowed by age 30 also has an observed marriage at age 30 or older, and no young-widow case overlaps with a marriage recorded at age 35 or older. This separation is consistent with the two measures capturing different marital paths: continued attachment to a deceased husband's lineage after early widowhood on one side, and entry into a marriage at an unusually late age on the other.

For each pair of age cutoffs, I aggregate the young-widow and late-marriage counts to prefecture-period cells and estimate the same within-prefecture specification as before. The

[18]Of the 12,248 women with an observed husband death in the source window, 12,214 have one linked spouse and 34 have two. Including the latter produces nearly identical estimates; the unrestricted results are reported in the note to Table 6.

[19]FamilySearch coverage is reasonably good from 1200–1900, a span within imperial China; observations before 1200 are sparse, while those after 1900 belong to post-imperial China. Among linked births dated 1200–1900 with a calculated maternal age from 12 through 60, 10.3 percent were to mothers aged 35 or older.

[20]In the same 1200–1900 historical material described in the preceding footnote, the observed marriage-age distribution among women with an observed marriage age has a mean of 21.4 years and a median of 21 years. These observed marriages may include remarriages, since the source does not universally identify whether a marriage was a woman's first. Even with remarriages included, only 3.7 percent of observed marriages occurred at age 30 or older and 1.3 percent at age 35 or older; 10.8 percent occurred after age 25. The underlying distribution of first-marriage ages would therefore be still more concentrated at younger ages.

Table 6: Population Pressure, Young Widowhood, and a Remarriage Proxy

	Late marriage, a proxy for remarriage	
Young-widow cutoff	Age 30 or older	Age 35 or older
Panel A. Prefecture assigned using husband's birthplace		
Widowed by age 30	0.081**	0.105***
	(0.036)	(0.031)
Widowed by age 35	0.130***	0.154***
	(0.043)	(0.042)
Observations	642	642
Panel B. Prefecture assigned using woman's birthplace		
Widowed by age 30	0.074**	0.100***
	(0.031)	(0.031)
Widowed by age 35	0.110***	0.136***
	(0.039)	(0.041)
Observations	642	642

Notes: Each cell reports the coefficient on the genealogy-recorded men-alive measure from a separate prefecture-period regression among women with exactly one linked spouse. The dependent variable is log(1 + young-widow cases) − log(1 + late-marriage cases). Young-widow cases are women whose observed husband died by the stated age cutoff and who remained recorded with the deceased husband's lineage. Late marriage is an observed marriage at or above the stated age cutoff and is used as a proxy for remarriage. Panel A assigns each case to a prefecture using the husband's birthplace; Panel B uses the woman's birthplace. All specifications include prefecture fixed effects, 50-year period fixed effects, and interactions between period fixed effects and prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu. Standard errors clustered by prefecture are in parentheses. The treatment variable is log(1 + mean genealogy-recorded men alive). Retaining the 34 women with two linked spouses leaves the estimates virtually unchanged. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

dependent variable is $\log(1 + \text{young-widow cases}) - \log(1 + \text{late-marriage cases})$, so a positive coefficient indicates that young-widow cases become more common relative to the remarriage proxy as the genealogy-recorded men-alive measure rises. Panel A of Table 6 assigns women using the husband's birthplace, which is the more complete location measure; Panel B instead uses the woman's birthplace.

The contrasts are positive and statistically significant in every specification. The result holds using either age 30 or age 35 to define young widowhood and either age 30 or age 35 to define unusually late marriage. Higher values of the genealogy-recorded men-alive measure

are therefore associated with more women remaining attached to a deceased husband's lineage after early widowhood relative to women observed entering marriages at unusually late ages. This contrast also helps interpret the commendation evidence. Norm violations can elicit punishment and other oppositional responses that help maintain existing norms (Molho et al., 2020; Kleef, 2024). More public commendations therefore need not mechanically imply that widow non-remarriage was becoming more common; in principle, they could also reflect efforts to reinforce chastity when adherence was under pressure. If the increase in *jingbiao* primarily reflected such a response to declining widow non-remarriage, the genealogy-based relative measure should move in the opposite direction. Instead, the genealogy records show relatively more of the marital pattern associated with continued widowhood and less of the pattern associated with remarriage as the population measure rises.

9 Discussion

The central finding speaks to the historical formation and changing force of what historians have called the cult of female chastity and the chaste widow cult (Lu, 2010; Fei, 2012). Chaste widowhood involved more than an individual decision about remarriage. It comprised ideals, practices, and forms of public honor that attached social and moral value to continued fidelity after a husband's death. A cultural-evolutionary perspective asks how changing social and economic conditions can alter both behavior and the value attached to it over time (Boyd and Richerson, 1985; Nunn, 2012; Giuliano and Nunn, 2021). A related institutional literature emphasizes how formal and informal rules governing family life emerge (Anderson and Bidner, 2023).

The estimates indicate that population pressure was associated with a shift toward continued widowhood and with more chaste-woman cases. One possible first step is material: population pressure could alter the relative costs and benefits of remarriage and continued widowhood. These changing incentives could affect remarriage behavior directly, while also changing how households, lineages, and local communities evaluated widow non-remarriage. Where continued widowhood became relatively more attractive and more strongly approved, the social and moral value attached to it could increase as well. The evidence is therefore consistent with population pressure contributing both to the behavior underlying chaste widowhood and to the strengthening of the norm, although the estimates do not separately identify these two channels.

A separate possibility is that population expansion coincided with broader economic changes and with more women having sons while young. A son could give a widow stronger reasons to remain in her deceased husband's household.[21] A larger number of such women

[21]Consistent with this possibility, Chen, Campbell, and Lee (2014) find that widows with sons were sub-

could therefore raise chaste-woman cases even without any change in the social value attached to widow non-remarriage. The results provide little support for this explanation. Controlling for the number of women with an early son leaves the coefficient on the genealogy-recorded men-alive measure positive and statistically significant. The relationship between the population measure and chaste-woman cases is also no stronger where early motherhood of sons is more prevalent, and neither the count nor the share of women with an early son is significantly associated with chaste-woman cases in the corresponding specifications. Table A.7 reports these results.

The state-reach results provide little reason to think that differences in the center's reach shaped where chaste-woman cases became more common as population pressure rose. The relationship is no stronger near the capital or along easier routes, offering little support for an account in which a geographically uneven campaign from the center generated the pattern. State recognition could nevertheless matter once a case had been established and nominated locally. *Jingbiao* joined local nomination to imperial recognition and turned individual cases into public examples. Official commendation also conferred status, and people can learn from and emulate those viewed as prestigious (Henrich and Gil-White, 2001). Certification could therefore augment and reinforce norms that had formed or strengthened within households, lineages, and local communities, carrying exemplary cases beyond the households in which they arose (Elvin, 1984; Fei, 2012). The estimates do not identify the size of this reinforcing role, but they distinguish it from variation in state reach across prefectures.

The comparison with the European Marriage Pattern clarifies the preventive-check margin examined here. Hajnal's classic formulation emphasizes late marriage and permanent celibacy as ways of limiting women's exposure to childbearing before first marriage (Hajnal, 1965). One influential account attributes the emergence of this marriage pattern to post-Black Death changes in agricultural production that improved women's employment prospects and delayed marriage (Voigtländer and Voth, 2013). Related evidence from preindustrial France identifies age at first marriage as an important form of preventive adjustment, while inheritance reform during the French Revolution raised age at marriage and reduced completed fertility (Cummins, 2020; Gay, Gobbi, and Goñi, 2026). Historical China differed on this margin because female marriage was nearly universal. Research on Chinese demographic adjustment instead identifies a range of household and marriage-market responses, including customary restrictions on widow remarriage (Lee and Campbell, 1997; Lee and Wang, 1999; Lee, Campbell, and Wang, 2002). The genealogy evidence is consistent with this distinction: population pressure is unrelated to observed marriage age and age at first linked childbirth (Table A.6), while it is associated with more young-widow cases relative to likely remarriage (Table 6). The relevant

stantially less likely to remarry in both Liaoning and Shuangcheng.

preventive check therefore operates after first marriage, through whether young widows return to fertility-bearing unions.

These findings also speak to debates over China's long-run development. Traditional Malthusian interpretations often portray Chinese population growth as repeatedly pressing against resources, with adjustment occurring largely through lower living standards and positive checks (Malthus, 1992, 1802; Lavely and Wong, 1998). Together with the preventive-check evidence discussed above, the results reinforce a less passive view of Chinese population dynamics. Population pressure was associated with the growing prominence and force of chaste widowhood, which limited young widows' return to fertility-bearing unions. The findings therefore add a cultural dimension to China's demographic response to population pressure: norms governing reproductive behavior could themselves change as demographic conditions changed.

10 Conclusion

Why did chaste widowhood become so prominent in late imperial China? Existing accounts emphasize Confucian morality, gender hierarchy, lineage honor, and state recognition. The evidence here adds an explanation centered on population pressure. In the long-settled agrarian regions studied here, population growth placed greater pressure on an established resource base. These conditions could contribute to the formation and strengthening of norms against widow remarriage and increase the moral and social value attached to continued widowhood. The *jingbiao* system gave these norms a public form by rewarding women, often widowed while still young, who remained faithful to a deceased husband.

I examine this argument by combining linked Chinese genealogy microdata with chaste-woman commendations from the *Ming Shilu*. Cross-prefecture and within-prefecture comparisons both show more chaste-woman cases when population pressure is greater. The relationship survives a range of checks on the genealogy and commendation records, while the evidence on young widowhood and unusually late marriage moves in the same direction. The state-reach results provide little support for top-down campaigning as the main explanation.

Customary restrictions on widow remarriage formed part of the preventive checks discussed in China's historical demography (Lee and Campbell, 1997). The results suggest that population pressure contributed to the development and force of the norms underlying that restriction. By giving widow non-remarriage moral and public rewards, the custom could limit young widows' return to fertility-bearing unions. This adds a cultural component to China's demographic adjustment. The results reinforce a view of China's long-run population dynamics that included preventive adjustment rather than simply uncontrolled population growth followed by declining living standards or mortality.

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Appendix

A Conceptual Framework

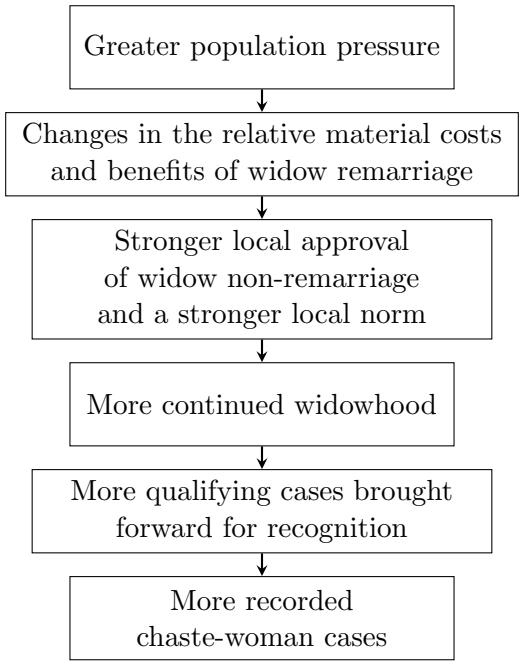


Figure A.1: Conceptual Framework

Notes: The figure describes a proposed sequence. The final stage is observed in the *Ming Shilu*. The male-death check addresses whether the relationship is mechanically generated by a larger observed flow of men whose deaths could create potential widows; it does not distinguish changes in continued widowhood from changes in the nomination and recognition of qualifying cases.

B Sample Construction

The estimating sample is the intersection of the genealogy panel and the *Ming Shilu* chaste-woman panel after both sources have been mapped into the same prefecture geography and assigned to the same time periods. The 50-year panel is the baseline; the 30-year panels in columns (2) and (4) of Table 2 reaggregate the same underlying source data using shorter periods under the two coverage requirements. The sample is formed in five steps.

The genealogy coverage requirement measures geographic coverage rather than the share of the historical population observed. It is calculated before period aggregation using all mappable genealogy records born between 1370 and 1630, regardless of gender. For each prefecture, I take the union of the geographic footprints represented by these records and divide that area by the total area of the prefecture. The 75 percent requirement retains prefectures with a coverage share of at least 0.75; the 90 percent requirement requires at least

0.90.

1. The FamilySearch genealogy data provide the records used to reconstruct the number of men alive in each decade.

2. These counts are aggregated to prefectures. The baseline estimation sample contains 107 prefectures observed over six 50-year periods under the 75 percent genealogy coverage and 75 percent historical-area requirements. The corresponding 90 percent genealogy coverage requirement yields 85 prefectures.

3. The geocoded *Ming Shilu* chaste-woman records are mapped to the same prefectures.

4. These records are aggregated to the corresponding periods. The 30-year versions use the same source data with shorter periods. A separate 90 percent coverage requirement is used for the last two columns of Table 2.

5. The estimating sample includes prefecture-period cells with an observed genealogy measure, an assignable chaste-woman outcome, and nonmissing prefectural characteristics for the baseline period interactions. The outcome is treated as complete within the common geography, so prefecture-periods without a chaste-woman record are coded as zero.

The resulting 75 percent panel contains 642 prefecture-period observations in the baseline: 107 prefectures times six 50-year periods. Before imposing the 107-prefecture restriction, 227,137 unique person records born between 1370 and 1630 have birthplaces mappable to the common prefecture geography. Of these, 216,328 fall within the 107 prefectures retained in the baseline sample, so the baseline retains 95.2 percent of the mappable records in the study window. These counts include both men and women and do not require an observed death year. This count includes men and women and does not require an observed death year. The corresponding 30-year estimating sample contains 1,070 observations with the same 107 prefectures. Under the 90 percent genealogy coverage requirement, together with the same 75 percent historical-area requirement, the baseline and 30-year panels contain 510 and 850 observations, respectively, from 85 prefectures. The chaste-woman outcome in the 75 percent baseline estimating sample contains 1,347 weighted records. Because the common source window runs from 1370 to 1630, the first 50-year period is observed only from 1370 onward and the last only through 1630. The 30-year panels have analogous partial periods at the boundaries.

C Variable Definitions and Sources

Table A.1 summarizes the measures used in the analysis, along with their construction and data sources.

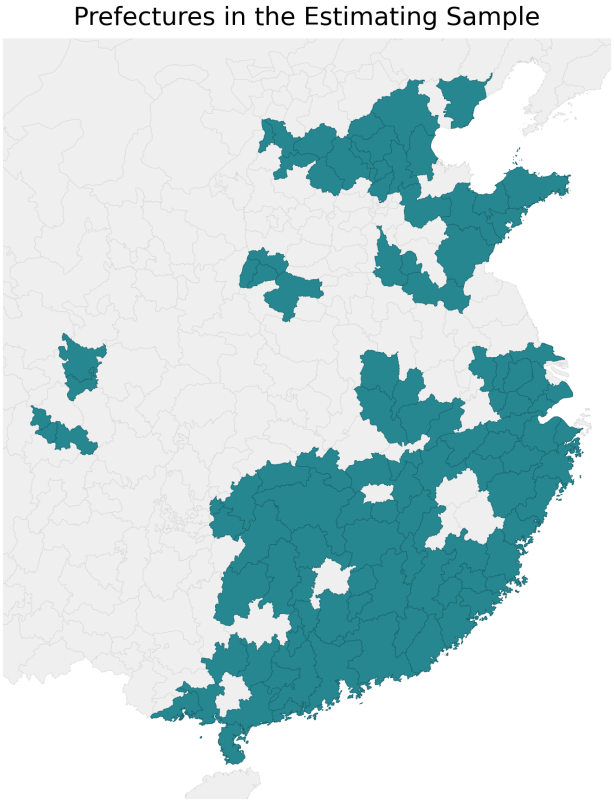


Figure A.2: Prefectures in the Estimating Sample

Notes: Dark polygons are the 107 prefectures in the baseline estimating sample. Light polygons are other prefectures in the common geography. Eligibility requires at least 75 percent of prefecture area to be covered by some mappable genealogy data from 1370–1630 and at least 75 percent of the prefecture area to lie inside the historical administrative geography relevant to the study period, together with the treatment and control restrictions described above.

Table A.1: Variable Definitions, Construction, and Sources

Variable	Construction	Source
Outcome variables		
Chaste-woman records	Court-recognized *jiefu* and *jienu* records, geocoded to prefectures and fractionally allocated when needed; each panel sums them within its prefecture-period cells and uses $\log(1+x)$.	Li, Yang, and Xu (1995).
Heroic female virtue records	Court-recognized *liefu*, *lienu*, and related heroic records, mapped and aggregated the same way.	Li, Yang, and Xu (1995).
Share surviving to age 50	Share of women with usable lifespan information whose observed lifespan reaches age 50, using the same birth-year fallback and prefecture-period construction.	FamilySearch.

Table A.1 continued

Variable	Construction	Source
Any woman observed to age 50	Indicator for a prefecture-period containing at least one woman observed to survive to age 50.	FamilySearch.
Main treatment		
Genealogy-recorded men alive	For each mapped locality and decade, the number of recorded male genealogy members alive at that benchmark. These locality counts are aggregated to prefectures; each panel then uses the mean across observed decades within the prefecture-period cell and applies $\log(1+x)$.	FamilySearch.
Between-prefecture population component	Prefecture mean of the logged local male-population measure across the six 50-year periods.	FamilySearch.
Within-prefecture population component	Deviation of the logged local male-population measure from its prefecture mean in each 50-year period.	FamilySearch.
Additional population measures		
Male births	Number of recorded male births assigned by birth year to each prefecture-period cell and transformed using $\log(1+x)$.	FamilySearch.
Male deaths with spouse links	Number of male genealogy records with an observed death year and at least one spouse link. Each man is counted once, assigned to the 50-year period of his death year and to prefecture geography using his birthplace; fractional allocation is applied when a source locality spans prefecture boundaries. The resulting cell count is transformed using $\log(1+x)$, with cells containing no observed death coded as zero.	FamilySearch.
Genealogy coverage and composition measures		
Logged genealogy person records	Logged total number of genealogy person records in the prefecture-period cell.	FamilySearch.
Logged genealogy male records	Logged total number of male genealogy records in the prefecture-period cell.	FamilySearch.
Genealogy record growth	First difference in logged genealogy person records across adjacent periods in the panel.	FamilySearch.
Record richness index	Standardized index based on the completeness of kinship links and life event fields in genealogy records in the prefecture-period cell.	FamilySearch.
Share with life event information	Share of genealogy records in the prefecture-period cell containing life event information.	FamilySearch.

Table A.1 continued

Variable	Construction	Source
Kin-link completeness proxy	Standardized mean number of observed parent, spouse, and child links per genealogy record in the prefecture-period cell.	FamilySearch.
Female death-year share	Share of female genealogy records in the prefecture-period cell with an observed death year.	FamilySearch.
Female marriage-year share	Share of female genealogy records in the prefecture-period cell with an observed marriage year.	FamilySearch.
Female share with life event information	Share of female genealogy records in the prefecture-period cell containing life event information.	FamilySearch.
Logged examination candidate density	Logged successful examination candidates per prefecture-period cell, normalized by interpolated prefecture population; used as a time-varying proxy for local recognition capacity.	Zhu and Xie (1980); interpolated prefecture population.
Geographic characteristics and distances		
Agricultural suitability	Time-invariant prefecture agricultural-suitability measure.	FAO GAEZ v3.0 and CHGIS.
Mean attainable rice yield	Prefecture mean attainable yield among positive raster cells for rain-fed, intermediate-input rice.	FAO/IIASA GAEZ v3.0 and CHGIS.
Share of valid cells with positive rice yield	Share of valid raster cells with positive attainable yield for rain-fed, intermediate-input rice.	FAO/IIASA GAEZ v3.0 and CHGIS.
Mean attainable wheat yield	Prefecture mean attainable yield among positive raster cells for rain-fed, intermediate-input wheat.	FAO/IIASA GAEZ v3.0 and CHGIS.
Share of valid cells with positive wheat yield	Share of valid raster cells with positive attainable yield for rain-fed, intermediate-input wheat.	FAO/IIASA GAEZ v3.0 and CHGIS.
Modal soil type	Most common valid soil class in the prefecture; used only in the expanded period-interaction specification.	Harmonized World Soil Database and CHGIS.
Latitude and longitude	Centroid latitude and longitude of the prefecture polygon.	CHGIS.
Logged distance to relevant capital	Logged WGS84 geodesic distance from the prefecture centroid to Nanjing in the 1350 period, Beijing after the 1421 capital move, and a year-weighted Nanjing/Beijing distance in the 1400–1449 transition period.	CHGIS.
Logged distance to nearest imperial courier route	Logged WGS84 geodesic distance from the prefecture centroid to the nearest imperial courier route.	G.W. Skinner Data Archive and CHGIS.

Table A.1 continued

Variable	Construction	Source
Logged distance to Qufu	Logged straight-line distance from the prefecture centroid to Qufu, the birthplace of Confucius and a major Confucian ritual center.	CHGIS; see also Kung and Ma (2014).
Logged ruggedness	Logged mean ruggedness of the prefecture polygon.	NASA SRTM and CHGIS.
Prefecture area	Area of the prefecture polygon.	CHGIS.
Period interactions with prefectural characteristics	Baseline interactions with prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu; the expanded robustness specification also interacts period effects with rice attainable yield, rice suitable-area share, wheat attainable yield, wheat suitable-area share, and modal soil type.	

D The Genealogy-Based Population Measure

D.1 Genealogies in Economic and Demographic History

Genealogies have long been used in historical demography because they record family links, life dates, descent, and place information at the individual level. For China, early work showed both the promise and the difficulties of this source. Liu (1978) discussed Chinese genealogies as a source for population studies. Telford (1986) used a nineteenth-century lineage to study fertility and population growth. Harrell (1987) emphasized the missing people and missing events in genealogical records. Zhao (1994, 2001) showed how selection and survivorship could bias demographic estimates derived from genealogies. Campbell and Lee (2002) linked genealogies to household registers in Liaoning and showed how local lineage records and state population records could describe different populations. For a broader discussion of Chinese genealogies in demographic and economic history, see Shiue (2016). Related work using detailed Liaoning household-register data examines later-life mortality and paternal-grandparent coresidence (Zang and Campbell, 2018).

Recent work has extended the use of genealogies from historical demography to economic history. Shiue (2017) uses clan data to study human capital and fertility before modern growth. Shiue and Keller (2022) uses Chinese genealogies to study assortative matching in marriage over several centuries. Hu (2025) uses lineage evidence to study moderate fertility in Ming–Qing China from a unified-growth perspective. Shiue (2025) uses digitized Tongcheng genealogies to study intergenerational mobility over the long run. Dai (2025) uses modern *jiapu* compilations with occupational information to study China's historical occupational structure. Together, this work shows that genealogies can be used not only to reconstruct

demographic patterns, but also to study fertility behavior, marriage matching, social mobility, lineage organization, and economic structure.

Most of these applications exploit unusually detailed information for particular lineages or regional populations. The genealogy microdata used here have a different comparative advantage: broad geographic coverage over a long time span. This makes it possible to compare both across places and within the same place over time, extending the range of historical hypotheses that can be examined with pre-twentieth-century Chinese microdata.

An adjacent literature examines online, crowd-sourced genealogies as large-scale demographic data. Using population-scale family trees assembled from Geni, Kaplanis et al. (2018) studies kinship, longevity, and population structure across many generations. Studies using online trees and the FamiLinx database examine representativeness, survivorship, mortality, and methods for correcting selection bias (Chong et al., 2022; Stelter and Alburez-Gutierrez, 2022; Calderón-Bernal, Alburez-Gutierrez, and Zagheni, 2023; Colasurdo and Omenti, 2024). Historical applications use crowdsourced genealogies to study fertility and the demographic transition in France, as well as the effects of inheritance reform on fertility (Blanc, 2023; Gay, Gobbi, and Goñi, 2026). Together, these studies provide a precedent for using collaboratively assembled family trees at scale while explicitly addressing variation in coverage and selection.

D.2 Constructing the Measure

The source used here draws on digitized and crowd-sourced Chinese genealogies and provides person-level observations across a wide range of regions in China and many centuries. Xue (2025) introduces and validates this type of source using a single-surname dataset. The present analysis uses FamilySearch lineage records covering the study period. The source remains shaped by lineage compilation and survival, but it covers a much wider set of places and lineages than the small-area or single-lineage genealogies commonly used in earlier demographic studies.

Chinese genealogies are patrilineal records. They record men more consistently than women, especially because daughters are often omitted, and provide less complete information on wives, remarriage, and people who left the lineage. For that reason, this source is better suited to measuring male population over time than to constructing a direct widowhood-incidence series.

The population measure follows place rather than a particular lineage. The number of genealogy-recorded men observed in a place can therefore rise through natural increase or in-migration and fall through out-migration. It can also change when lineages enter or disappear from the surviving genealogy record. The measure therefore captures changes in the locally recorded population rather than natural increase alone. To the extent that changes in the measure reflect actual population movement, migration is part of the demographic adjustment captured by the local population measure rather than a component that should necessarily be

removed.

In an expanding agrarian economy, movement toward frontier areas could relieve population pressure in established settlements by reducing the population remaining in the place of origin. More generally, migration can provide an outlet from Malthusian pressure by moving people toward places with greater economic opportunity (Blanc and Wacziarg, 2025). The imperial government sometimes encouraged or organized such frontier settlement, while household registration and its associated tax and labor obligations made movement among established communities more difficult, though not impossible (Cao, 1997; Von Glahn, 2012). The local population measure therefore need not distinguish natural increase from migration for the interpretation used here: both affect the number of people sharing a local resource base.

D.3 Geographic Harmonization

Many crowd-sourced genealogy records on FamilySearch are displayed using modern administrative locations. Most are modern county locations, which are linked to the China 2000 county geography, with the central districts of large cities consolidated into a single local unit. The matching procedure also retains records identified only at the prefecture level and records expressed in historical place names. For records expressed in historical place names, including names using older prefectural terms, the match is instead made to the corresponding 1911 county or prefecture boundary, at the most specific administrative level supported by the historical label.

Each matched place is represented by its corresponding source polygon and overlaid on the common CHGIS prefecture geography defined by the 1911 boundaries. Records assigned to a source unit that intersects more than one common prefecture are allocated across the intersecting prefectures according to normalized area shares. This procedure provides a common panel geography while retaining records expressed at broader or historical locations.

The resulting measure uses male records aggregated to prefecture-period cells and is interpreted as the genealogy-recorded men-alive measure. Prefecture fixed effects absorb persistent differences across places in genealogy coverage and record-making traditions. They do not address changes in the source within a prefecture over time. The robustness checks therefore examine whether the result is driven by time-varying genealogy availability, using predictor trimming, controls for record volume, and measures of record richness and composition.

E Chaste-Woman Measure

The outcome comes from the women's history volume of *Ming Shilu leizuan*, which compiles imperial commendation records from the Ming Veritable Records. The "jingbiao" section contains entries for women commended for chastity, loyalty, or related forms of female virtue.

The collection contains 3,490 source records, of which 2,629 can be assigned geographically to the common prefecture geography used in the empirical analysis.

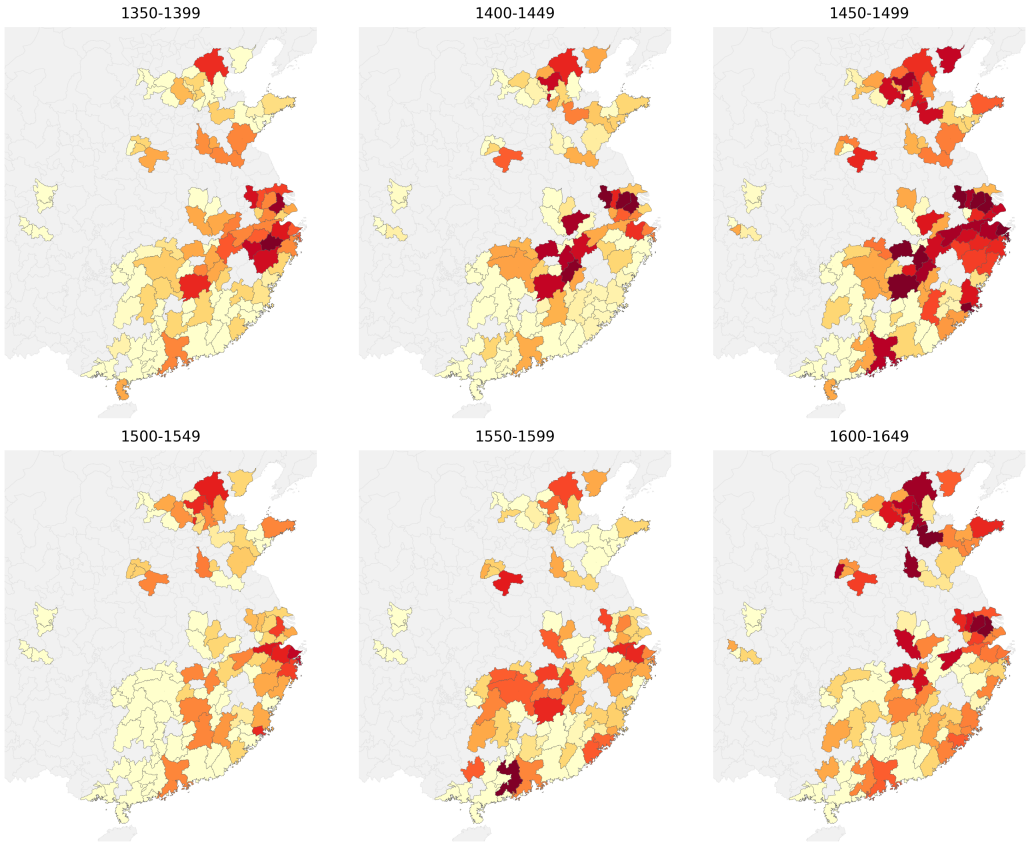


Figure A.3: Chaste-woman records in the *Ming Shilu*, by 50-year period

Notes: The figure shows the same 107-prefecture estimating sample used in the 75 percent regression results, plotted separately by 50-year period. The mapped value is log(1 + chaste-woman records) in each prefecture-period cell. Light gray polygons are prefectures outside the estimating sample.

The chaste-woman measure groups entries labeled *jiefu* and *jienu*. These labels identify women commended for remaining chaste after widowhood. Related heroic categories, such as *liefu*, *lienu*, and other virtue labels, are excluded from this measure and examined separately. The measure is therefore a count of chaste-woman commendations, not a count of all women or all widows.

Each record retains the calendar year in its source entry. Geographic assignment proceeds in two stages. First, each source location is assigned to the historical administrative geography appropriate to its place and year. Because administrative boundaries changed over the Ming, a historical prefecture is not treated as having a fixed geographic extent throughout the dynasty. Second, the historical location is translated into the common CHGIS prefecture geography based on 1911 boundaries.

Of these geographically assigned records, 2,077 are located at the county level and 552 identify a historical prefecture but no county. For these, I use the CHGIS overlay between the historical prefecture polygon and the common geography. An entry is divided across the common prefectures in proportion to the share of the historical prefecture's area overlapping each one, with the resulting shares normalized to sum to one. This expands the 552 prefecture-only entries into 3,698 destination-record rows before aggregation, but each original entry continues to contribute one total unit.

The historical geographic correspondence determines the prefecture allocation, while the calendar year attached to the source record determines its 50-year period. The resulting measure sums these contributions within each prefecture-by-50-year-period cell. For each prefecture-period cell, the dependent variable is $\log(1 + \text{chaste-woman records})$.

F Aggregate Trends

Historical demographic work describes the fourteenth through early seventeenth centuries as a period of substantial population recovery and growth following the disruptions surrounding the Yuan–Ming transition (Lavely and Wong, 1998; Cao, 2000). Figure A.4 places the study period within this broader demographic expansion.

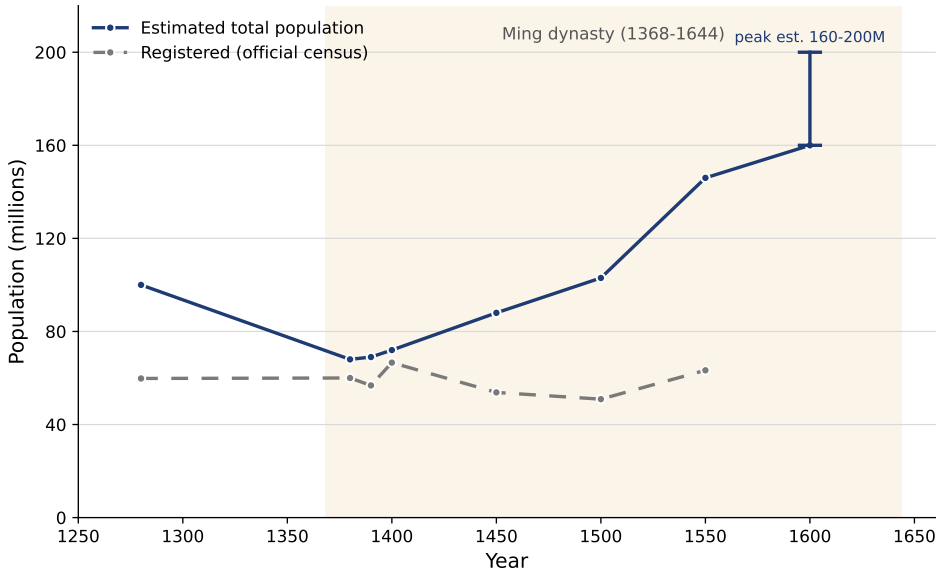


Figure A.4: Population of China, 1280–1600. Estimated total population is from Maddison (1998); registered population comes from the official census series in Liang (1980). Both series are compiled in Deng (2003). The early-seventeenth-century peak bar spans the 160–200 million range reported in demographic histories of the late Ming (Cao, 2000; Deng, 2003). Registered totals track a tax and labor-obligation base, so they sit well below estimated totals throughout.

Population recovered following the Yuan–Ming transition, continued to grow through the

sixteenth century, and reached a late-Ming peak in the early seventeenth century. The estimated series implies considerably greater growth than the registered series, but both indicate substantial population expansion over the period covered by the study (Lavely and Wong, 1998; Cao, 2000; Deng, 2003).

In an overwhelmingly agrarian economy, population growth in long-settled regions increased the number of people supported by an established local resource base. Adjustment could occur through more intensive land use, changes in cultivation and markets, or migration. In this setting, changes in local population are informative about changes in population pressure. The large gap between estimated and registered totals also illustrates why official registration figures should not be treated as complete population counts: registration primarily served taxation and labor obligations.

G Cultural Evaluation of Widowhood

Poetry provides a separate descriptive measure of how widowhood was portrayed in cultural production. Xue (2020) introduced the use of poetry to construct measures of cultural values, beliefs, and attitudes, and Xue (2026) extends this approach to trace the evolution of multiple cultural traits in China over time. The same corpus is used here to examine cultural attitudes toward widowhood. Detailed descriptions of the construction, processing, and geocoding of the corpus appear in Xue (2020, 2026).

I identified candidate poems by applying a fixed lexical rule to the concatenated title and text. The rule searched for explicit widowhood terms, including *guafu* (寡妇/寡婦), *yishuang* (遗孀/遺孀), *shuang* (孀), *li* (嫠), *weiwangren* (未亡人), and *weiwangfu* (未亡妇/未亡婦). It also searched for *shougua* (守寡), *jushuang* (居孀), and *shuangju* (孀居). A poem entered the candidate set if at least one of these strings appeared in its title or text. The only exclusion was a poem whose sole match was *shuang'e* (孀娥), a conventional reference to Chang'e, the moon goddess. Poems containing that expression together with another qualifying term remained in the sample.

The resulting 826 candidate poems were annotated at the poem level through the OpenAI API using the `gpt-5-2025-08-07` model with low reasoning effort, a fixed prompt, and structured output. A poem is classified as Positive when it praises or sympathetically portrays a widow, her fidelity, chastity, moral character, or suffering; Negative when it is critical or mocking, meaning that it attacks, satirizes, or ridicules a widow or widowhood; and Indifferent when the reference is neutral, incidental, ambiguous, or not actually about a widow. Each classification includes brief textual evidence and a confidence assessment.

I assessed the classification with a separate human-validation sample of 200 candidate poems. The sample includes all 19 poems assigned the Negative label, together with random draws of 90 poems labeled Positive and 91 labeled Indifferent, using a reproducible random

Table A.2: Human Validation of Widowhood Attitude Labels

Automated label	Reviewed	Agree	Disagree	Uncertain	Agreement rate
Positive	90	66	22	2	73.3%
Indifferent	91	87	1	3	95.6%
Negative	19	15	2	2	78.9%
Total	200	168	25	7	84.0%

Notes: The sample includes all 19 poems assigned the Negative label, plus random draws of poems assigned Positive or Indifferent labels. Agreement rate is the share of reviewed poems for which the human reviewer marked agreement with the automated label. The validation sample is stratified and should not be used to estimate unweighted corpus-wide attitude frequencies.

seed. The human reviewer agreed with the automated label in 168 cases, disagreed in 25, and marked 7 uncertain. Agreement was highest for Indifferent poems and lower for Positive poems. Among the 25 disagreements, 19 involved an automated Positive label that the reviewer judged Indifferent. The raw 84.0 percent agreement rate reflects the deliberately stratified validation sample and should not be interpreted as corpus-wide accuracy. Weighting the three strata by their frequencies in the full coded distribution (282 positive, 525 indifferent, and 19 critical-or-mocking poems) yields an estimated agreement rate of 87.6 percent across the 826 candidates, treating uncertain judgments as non-agreement.

A separate model-to-model check used a simple random sample of 300 of the 826 candidate poems, reclassified with GPT-5.6 Sol at high reasoning effort. The new labels agreed with the original GPT-5 labels in 240 cases, or 80.0 percent of the sample. Agreement was strongest for Indifferent and Positive labels; the Negative category was rare in the random draw. This comparison provides an additional robustness check on the coding procedure. The human review remains the independent assessment of classification accuracy.

Figure A.5 groups the coded poems into the broad historical periods used elsewhere in the analysis. The left panel reports the share of widow-related poems classified as positive, while the right panel reports the number of positive widow poems per 1,000 poems in the full corpus for the same period. Both measures are highest in the late imperial period studied here. The share of positive portrayals reaches 48.7 percent, while positive widow poems per 1,000 poems also reaches its maximum in this period. The first measure captures how widows were evaluated within widow-related poetry; the second captures the prevalence of favorable portrayals in the corpus as a whole. Together, they indicate that widowhood received a more favorable cultural evaluation during this period.

This measure is descriptive. Applying the same lexical rule in every period produces a consistent set of poems that refer explicitly to widowhood; I then classify those poems according to how they portray widows. The resulting series compares the treatment of widowhood

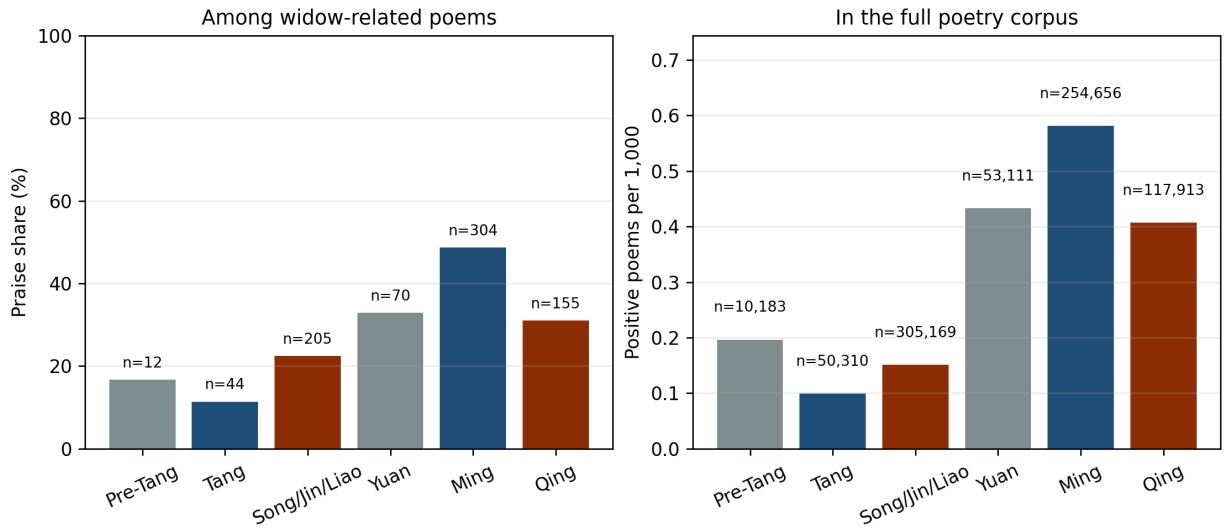


Figure A.5: Positive Portrayals of Widows Across Historical Periods

Notes: The left panel shows the share of widow-related poems classified as positive. The right panel shows positive widow poems per 1,000 poems in the full poetry corpus. The sample contains 826 candidate poems classified according to how they portray widows.

within this selected set across periods. It should therefore be interpreted as evidence on changes in the cultural portrayal of widowhood rather than as a measure of the prevalence of widowhood itself.

H Within and Between Prefecture Decomposition

Section 5 reports the cross-prefecture results and the central within-prefecture specification. Table A.3 provides a complementary decomposition of the pooled prefecture-period relationship. Column 2 omits prefecture fixed effects and uses both within- and between-prefecture variation. Column 3 separates the genealogy-recorded men-alive measure into its prefecture mean and its deviation from that mean. Both components are positive, and the within-prefecture coefficient is nearly identical to the central fixed-effects estimate.

The decomposition shows that the positive association is present in both the differences across prefectures and changes within prefectures over time. The within-prefecture estimate remains central because prefecture fixed effects absorb stable differences in settlement history, institutions, genealogy coverage, and other local characteristics.

H.1 Population Pressure as an Alternative Specification

The baseline specification uses the genealogy-recorded men-alive measure directly. As an alternative, I residualize this measure with respect to predicted local population scale, where predicted scale is constructed from land area, productive potential, terrain, and broad geography. The resulting residual measures recorded population relative to the scale predicted

Table A.3: Within- and Between-Prefecture Variation

	Prefecture FE	Pooled OLS	Within-between
	(1)	(2)	(3)
Genealogy-recorded men alive	0.110**	0.086**	
	(0.048)	(0.035)	
Within-prefecture component			0.110**
			(0.044)
Between-prefecture component			0.082**
			(0.041)
Prefecture FE	✓		
Period FE	✓	✓	✓
Prefectural characteristics	Absorbed	✓	✓
Period FE × prefectural characteristics	✓	✓	✓
Mean of Dep. Var.	0.728	0.728	0.728
Observations	642	642	642
R^2	0.681	0.395	0.395

Notes: The dependent variable is log(1 + chaste-woman records). Column 1 reproduces the 75 percent 50-year fixed-effects estimate. Column 2 omits prefecture fixed effects and uses both within- and between-prefecture variation in the genealogy-recorded men-alive measure. Column 3 enters separately the prefecture mean of the genealogy-recorded men-alive measure and the deviation from that mean. The prefectural characteristics are prefecture area, agricultural suitability, ruggedness, latitude, longitude, and logged distance to Qufu. Standard errors are clustered by prefecture and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

by these local characteristics and therefore has a more direct interpretation as population pressure in the cross section.

In the within-prefecture panel, this residualization leaves the estimated coefficient unchanged. Predicted local scale is time invariant, so subtracting it from the genealogy-recorded men-alive measure simply subtracts a prefecture-specific constant. Prefecture fixed effects absorb that constant. The period-by-characteristic interactions are included in both specifications; they allow prefectures with different fixed characteristics to follow different period-specific outcome paths but do not affect this equivalence. Table A.4 presents the two specifications side by side.

I Heroic Female Virtue Records

The source also contains heroic female virtue records. These include categories such as *liefu* and *lienu*, which more often involve violent defense of chastity, suicide, or other forms of exemplary death rather than long-term widowhood.[1] For that reason, the main dependent

[1]Related evidence from the cotton revolution finds fewer records of heroic widowhood in areas with premodern cotton textile production and interprets the pattern as lower widow suicide where women had greater means to support themselves (Xue, 2015).

Table A.4: Genealogy-Recorded Population and Population Pressure: Within-Prefecture Estimates

	(1) Genealogy-recorded men alive	(2) Population-pressure residual
Genealogy-recorded men alive	0.110**	
	(0.048)	
Population-pressure residual		0.110**
		(0.048)
Prefecture FE	✓	✓
Period FE	✓	✓
Period FE × prefectural characteristics	✓	✓
Mean of Dep. Var.	0.728	0.728
Observations	642	642
R^2	0.681	0.681

Notes: The dependent variable is log(1 + chaste-woman records). Column 1 reproduces column 1 of Table 2. Column 2 replaces log(1 + mean genealogy-recorded men alive) with its residual after accounting for predicted local population scale, constructed from prefecture area, productive potential, terrain, and broad geography. Both columns use the 75 percent coverage sample and 50-year periods. The prefectural characteristics interacted with period fixed effects are prefecture area, logged ruggedness, agricultural suitability, latitude, longitude, and logged distance to Qufu. Standard errors clustered by prefecture are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

variable uses only *jiefu* and *jienu*.

I first estimate the main 50-year panel specification after adding the heroic categories to the dependent variable. The resulting outcome is

$$\log(1 + \text{chaste-woman records} + \text{heroic-woman records}).$$

I also estimate the specification using heroic records alone. Table A.5 compares the three outcomes. Including heroic categories in the chaste-woman outcome leaves the coefficient positive and similar in magnitude. The coefficient for heroic records alone is close to zero and statistically insignificant. Because this outcome contains only 199 records in the estimation sample, however, the comparison is relatively imprecise. The contrast suggests that the relationship is more specific to long-term widow chastity than to female-virtue commendation in general, although the smaller heroic sample limits the precision of that comparison.

Table A.5: Chaste and Heroic Female Virtue Records

Outcome definition	Coef.	SE	p-value	Mean of Dep. Var.	Records
Chaste women only	0.110**	0.048	0.022	0.728	1,347
Chaste plus heroic women	0.101**	0.050	0.044	0.798	1,546
Heroic women only	0.004	0.034	0.903	0.150	199

Notes: All rows estimate the 75 percent 50-year panel specification with the 75 percent historical-area requirement, prefecture fixed effects, period fixed effects, period interactions with prefectural characteristics, and standard errors clustered by prefecture. The predictor is the genealogy-recorded men-alive measure, defined as the log of one plus the mean number of recorded men alive across observed decades in the period. The first row is the main outcome, log(1 + chaste-woman records). The second adds heroic female virtue records before taking the log. The third uses log(1 + heroic female virtue records). All specifications use 642 prefecture-period cells from 107 prefectures. The heroic outcome contains 199 records, so the comparison with the chaste-woman result is relatively imprecise. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

J Related Demographic Evidence

The genealogy records permit several additional comparisons relevant to the preventive-check interpretation. I first examine whether the genealogy-recorded men-alive measure is associated with the timing of marriage or entry into childbearing. Table A.6 reports estimates for mean observed marriage age, assigning women by either their husband's birthplace or their own birthplace, and for mean age at first linked childbirth. The unweighted and weighted estimates are all statistically indistinguishable from zero. The recorded population measure therefore has no detectable association with these two forms of family timing in the available records.

I next examine whether the result reflects changes in the prevalence of women who already

Table A.6: Genealogy-Recorded Male Population and the Timing of Marriage and Childbearing

	Mean observed marriage age		Mean age at first
	Husband birthplace	Woman birthplace	linked childbirth
Panel A. Unweighted estimates			
Genealogy-recorded men alive	0.553	0.497	-0.009
	(0.419)	(0.367)	(0.274)
Panel B. Estimates weighted by the number of observed women			
Genealogy-recorded men alive	0.338	0.302	-0.058
	(0.261)	(0.251)	(0.211)
Mean of Dep. Var.	22.128	21.964	23.796
Observations	499	528	598

Notes: Each column reports a prefecture-period regression. The marriage-age outcomes use the mean observed age at marriage among recorded women and assign a woman by the birthplace listed for her husband in column 1 and by her own listed birthplace in column 2. Column 3 uses the mean maternal age at the first linked childbirth and assigns mothers by their own birthplace. Panel B weights observations by the number of women contributing to the corresponding cell mean. All specifications use the 75 percent 50-year sample and include prefecture fixed effects, period fixed effects, and interactions between period effects and prefecture area, agricultural suitability, ruggedness, latitude, longitude, and logged distance to Qufu. Standard errors are clustered by prefecture and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

had a son while young. Controlling for the number of women with an early son leaves the coefficient on the genealogy-recorded men-alive measure positive and statistically significant. The interaction estimates provide no evidence that its relationship with chaste-woman cases was stronger where early motherhood of sons was more prevalent. Finally, using either the count or the share of recorded women with a son by the stated age as the treatment does not produce a statistically significant relationship with chaste-woman cases. Table A.7 reports these results; the corresponding early-son outcome regressions are retained with the analysis files.

Table A.7: Early Sons, Genealogy-Recorded Male Population, and Chaste-Woman Cases

	Son by age 30	Son by age 35
Panel A. Genealogy-recorded men alive with early-son count controlled		
Genealogy-recorded men alive, controlling for early-son count	0.101**	0.099**
	(0.050)	(0.050)
Early-son count control	0.031	0.039
	(0.060)	(0.062)
Panel B. Interactions with genealogy-recorded men alive		
Genealogy-recorded men alive at mean early-son count	0.084*	0.082*
	(0.049)	(0.049)
Genealogy-recorded men alive × early-son count	0.018	0.018
	(0.025)	(0.025)
Genealogy-recorded men alive at mean early-son share	0.106**	0.107**
	(0.045)	(0.046)
Genealogy-recorded men alive × early-son share	0.126	0.123
	(0.132)	(0.131)
Panel C. Early-son measures as treatments		
Log early-son count	0.054	0.062
	(0.060)	(0.061)
Early-son share	0.115	0.098
	(0.118)	(0.124)

Notes: Early-son counts record women with at least one linked son born by the stated maternal-age cutoff. The share divides that count by the number of recorded women in the corresponding prefecture and birth-period cell. In all panels, the dependent variable is $\log(1 + \text{chaste-woman records})$. Panel B centers the early-son measure, so the coefficient on genealogy-recorded men alive is evaluated at its sample mean. All specifications use the 75 percent 50-year sample and the fixed effects, period interactions, and clustered standard errors described in Table A.6. Count specifications use 642 observations; share specifications use 615 observations because the share requires a positive denominator. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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