The Shaping of a Gender Norm:

Marriage, Labor, and Foot-binding in Historical China*

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Abstract

This paper presents a theory that explains the rise of foot-binding in historical China, in response to a gender-asymmetric social mobility shock that dispersed men's quality distribution in the marriage market. The theory characterizes the marriage market equilibrium and women's competition strategies before and after the shock. Empirical evidence using archival data corroborates the theoretical predictions, that greater men's social mobility opportunities encouraged foot-binding and that a greater cost of women's labor discouraged foot-binding. The paper thus highlights that costly gender norms can be traced back to gender asymmetry in social mobility opportunities.

JEL Codes: O15, J16, N35, Z10

Key Words: Foot-binding, Gender Norms, Social Mobility, Marriage Market, Labor

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If one has lotus feet, she will marry a Literati, eating bread with meat;

if one has large feet, she will marry a blind man, eating bran with chili.

– A ballad in Zhangde, Henan, China

1 Introduction

Costly gender norms exist widely across the globe, with profound impacts on women's well-being. The dynamics of these norms reflect the evolution of gender inequality (e.g., Jayachandran, 2015; Platteau et al., 2018). For instance, we observe female genital cutting in the Middle East and Africa (e.g., Corno et al., 2020; Poyker, 2021; Becker, forthcoming), tight-lacing in the Victorian era (Veblen, 1899), and purdah among Hindus and Muslims to ensure female seclusion. However, while the effects of costly gender norms are salient, less scholarly attention has been given to the historical context from which such norms emerged.[2]

This paper analyzes the shaping of a costly gender norm by investigating foot-binding in historical China. Foot-binding was a gender-specific practice that persisted from the 10^{th} century to the early 20^{th} century, and reshaped millions of women's feet.[3] We present a theory to understand foot-binding under a non-transferable utility framework and employ empirical evidence to test the predictions. In the theoretical framework, foot-binding is modeled as a premarital investment tool adopted by women for marriage market competition, with a key trade-off: on the one hand, foot-binding embodies feminine values appreciated by men; on the other hand, foot-binding induces women's labor cost. In the historical context, we theoretically analyze the *shift* of this trade-off and characterize the marriage market equilibrium in response to a gender asymmetric social mobility shock – the Civil Examination System consolidation in the Song dynasty (960-1276), which rocked the marriage market.

As the dominant pathway for social mobility in historical China, the civil exams triggered a social transition from family-level heredity to individual-level meritocracy. Under the system, tal-

[2]In this direction, an increasing body of literature on FGC has empirically examined the persistent effect of preindustrial pastoralism on its adoption (Becker, forthcoming), the legacy of the African slave trade on FGC (Corno et al., 2020), and that regime stability is able to affect the (non)persistence of FGC (Poyker, 2021).

[3]This number comes from Bossen and Gates (2017)'s estimation that reflects the adoption of foot-binding in the 19^{th} century, based on assumptions of sex ratio and mortality rates.

ented men – regardless of their background – could climb the social ladder through individual academic performances. In contrast, women did not have such opportunities, and their chance of obtaining higher status relied predominantly on marriage. Thus, the system generated a more heterogeneous composition of men than that of women, which escalated marriage market competition among women. The theory characterizes the marriage market equilibrium before and after the gender-asymmetric mobility shock and generates two comparative static predictions. First, in terms of cost, the theory predicts that higher opportunity costs of women's farmland labor would discourage foot-binding. Second, in terms of return, the theory predicts that greater marital incentives driven by men's exam-based quality distribution would encourage women's foot-binding.

To test the comparative static predictions, we conduct empirical analyses using cross-sectional archival data on foot-binding at the county level. First, regarding labor cost, we exploit variation in the relative suitability of rice to wheat – two major cereal crops in historical China – as a proxy for women's farmland labor cost. In particular, rice cultivation places a greater demand on the labor of women and children than wheat cultivation. Using agricultural suitability data from the GAEZ (Global Agro-Ecological Zones, the Food and Agriculture Organization), we find that greater suitability for rice relative to wheat predicts less foot-binding prevalence. In terms of magnitude, a one standard deviation increase in relative rice-wheat suitability decreases foot-binding prevalence by 5.7 percentage points.

Next, to analyze the marriage motives of foot-binding, we use cross-sectional variation in the entry-level civil exam quota as a proxy for men's quality distribution (Kun et al., 1899; Bai and Jia, 2016). To address the potential endogeneity of quota allocation, we employ the instrument variable strategy based on an administrative adjustment event in the early Qing dynasty, which generated plausible exogenous variation in quota allocation at the county level. The findings show that exam quotas predict high foot-binding prevalence, such that a one standard deviation increase in exam quotas would lead to greater foot-binding prevalence by 17 percentage points. We then conduct robustness checks and horse-race tests, by accounting for a battery of regional socioeconomic characteristics, conducting the plausibly exogeneity analysis (Conley et al., 2012), and testing two prominent alternative hypotheses in the literature. Specifically, our findings show no support for (i) the Confucianism explanation of foot-binding, that foot-binding was the consequence of Neo-Confucianism influence (e.g., Blake, 1994), or (ii) the identity explanation of foot-binding,

that Han Chinese women used foot-binding to distinguish themselves from other ethnic minorities (e.g., Ebrey, 1990). The results thus consolidate our theoretical predictions.

Our paper speaks to three strands of literature. First, this paper contributes to understanding the economic origins of gender norms. In this literature, seminal work has identified various aspects of asymmetry as deep roots of gender norms, including: (1) gender asymmetry in economic values (e.g., Boserup, 1970; Qian, 2008; Alesina et al., 2013; Carranza, 2014; Baiardi, 2018; Xue, 2020; Cheng et al., 2022); (2) gender-specific legal rights and institutional opportunities (e.g., Anderson, 2003, 2018; Ambrus et al., 2010); and (3) marriage market conditions and competition (e.g., Anderson, 2007; Mariani, 2012; Grosjean and Khattar, 2019; Teso, 2019).[4] In this vein, our study adds a new perspective by showing gender-specific social mobility institutions as another crucial engine of gender norms. Thus, the case of foot-binding highlights the salience of gender equality in social mobility opportunities.

Second, our work also contributes to understanding the effect of the marriage market structure on participants' competition behavior. In the literature, sex ratios have been the spotlight of investigation (e.g., Angrist, 2002; Abramitzky et al., 2011; Grosjean and Khattar, 2019; Knowles and Vandenbroucke, 2019; Alix-Garcia et al., 2022). Nevertheless, the distributional features of men's and women's quality in the marriage market have received less attention, except for the theoretical work by Mariani (2012) and Anderson (2003). In particular, Mariani (2012) characterized a theoretical framework to explain why the prevalence of women's virginity increases with male inequality. In the context of India, Anderson (2003) established a theoretical mechanism that the post-modernization process created a more heterogeneous composition of men and encouraged dowry escalation. In this regard, the case of foot-binding adds to the literature in three aspects. First, we study gender asymmetry in social mobility opportunities as a new determinant of candidate quality distribution in the marriage market. Second, we study the effect of gender-specific quality distribution on women's competition behavior both theoretically and empirically. Our results show that both temporal and regional variations in men's quality distribution could affect

[4]In addition to these three factors, wars (Fernández, et al., 2004; Goldin and Olivetti, 2013), technology changes (e.g., Goldin, 1990; Goldin and Katz, 2002; Greenwood et al., 2005), and other historical shocks also affect gender norms. See Jayachandran (2015) and Giuliano (2017) for summaries of the social and historical origins of gender inequality and gender norms.

women's competition in the marriage market. Third, our study also reveals that when premarital investments are made prior to marriageable ages, more high-quality men lead to greater premarital investments because of better matching prospects. Therefore, an increased supply of high-quality men may intensify women's competition instead of softening it, as in conventional marriage competitions.

Finally, this paper also contributes to the vibrant literature on foot-binding across disciplines. The literature documents its aesthetic and erotic value (e.g., Levy, 1966), seclusion and moral value to the husband's family (e.g., Cheung, 1972; Greenhalgh, 1977), status consideration (Veblen, 1899; Shepherd, 2019), sustainability through social coordination (Mackie, 1996), and association with women's participation in labor-intensive agricultural activities (Cheng et al., 2022), and with women's role in household handicraft work (e.g., Ebery, 1990; Mann, 1997; Gates, 2001; Bossen et al., 2011; Bossen and Gates, 2017), among others. However, current studies have predominately examined the decline in foot-binding around the early 20^{th} century, with little study understanding its origins. Our paper fills the gap by providing a mechanism for the rise of foot-binding, corroborated by historical evidence. Moreover, our paper also shows that the economic forces that have shaped foot-binding are temporally and regionally consistent.

The rest of this paper is organized as follows. Section 2 describes the practice of foot-binding and its folk perception regarding the values and costs. Section 3 presents our theoretical framework. Section 4 discusses the empirical analysis guided by the theory. Section 5 briefly discusses class heterogeneity of foot-binding and other gender norms across cultures. Section 6 summarizes with concluding remarks.

2 Historical Background

2.1 The Practice of Foot-binding

Foot-binding targeted girls whose feet were reshaped during early childhood. The process was often initiated and practiced by mothers or grandmothers and lasted for years as the bones and soft tissues were gradually modified. Even though the deformation was completed mostly during childhood, bound feet required lifetime maintenance.

In terms of the temporal variation of the practice, the earliest foot-binding is often considered

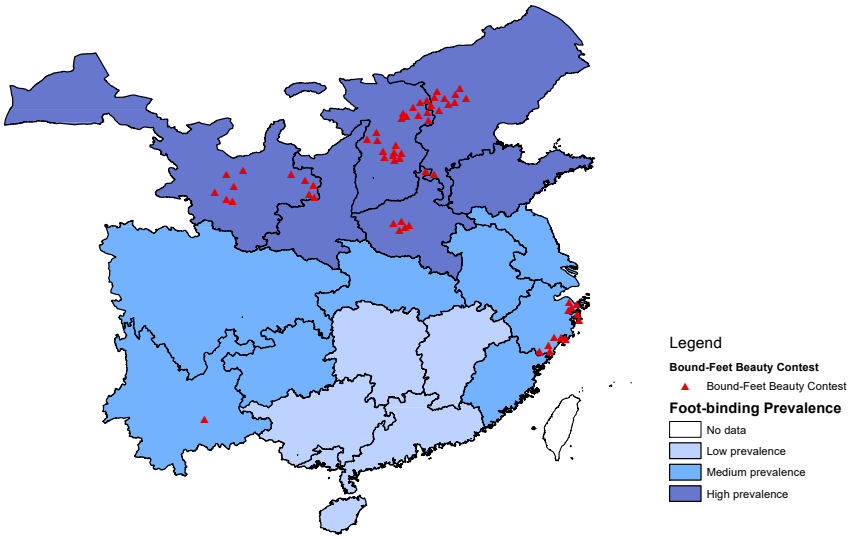
to appear in the Five Dynasties (907-960), when *Yao Niang*, a palace dancer, wrapped her feet to enhance her daintiness (e.g., Ko, 2005). In its early phase, foot-binding was often practiced by dancers and prostitutes for entertainment. However, while scattered instances of foot-binding can be found in earlier historical periods, the practice did not gain popularity until the Song dynasty (960-1279). The practice then persisted through the Ming and Qing dynasties, and declined and disappeared around the mid-20^{th} century.

In addition to temporal variation, the practice also had considerable heterogeneity across classes and regions. For class variation, foot-binding had greater popularity among upper-class women than lower-class women.[5] Moreover, among lower-class women, the prevalence of foot-binding was not universal across China, with considerable heterogeneity across regions (Qian, 1969; Davin, 1976; Xu, 1984; Turner, 1997).[6] Figure 1 shows the regional variation of foot-binding from the late 18^{th} to the early 20^{th} centuries among the 18 provinces within the Qing China proper. As illustrated by the figure, Northern regions had the highest foot-binding prevalence, while it was much less prevalent in Southern regions, especially in the Pearl River Delta.

[Figure 1 about here]

[5]The class heterogeneity can also be reflected by the size and decoration of bound feet. Women with higher social status tended to have smaller feet and finer decorations (e.g., Qian, 1969, Yao, 1941a).

[6]Another piece of evidence illustrating the regional variation in foot-binding is the presence of the Bound Feet Beauty Contest. This unique beauty contest was mainly located in the Northern regions. It was often organized in early spring or Autumn when women with delicate lotus feet gathered for the competition (Zhang, 2015; Nagao, 1973; Yao, 1934).



Notes: This figure shows foot-binding prevalence at the province level covering the 18 provinces within the Qing China proper. The counties noted by triangles are those with Bound Feet Beauty Contest (*Sai Zu Hui*, in Chinese), as recorded by Zhang (2015), Nagao (1973) and Yao (1934). The base map is from the CHGIS v5 (CHGIS, 2015).

Figure 1: Regional Variation of Foot-binding Prevalence: Province-level Variation

2.2 Foot-binding: Marriage Benefits and Labor Costs

Abundant qualitative evidence has revealed the motives for foot-binding, considering its benefits and costs. Among benefits, beauty and marriage prospects have been raised as frequent reasons for foot-binding. As revealed by anthropological work, Brown et al. (2012) discussed raw materials from face-to-face interviews with elderly food-binding women in rural China. In the interviews, the elderly women were asked why their feet had been bound, and beauty and marriage prospects were nominated as the key motives. In addition to the interviews, folkloric and oral literature also reveals the aesthetic value of foot-binding in the marriage market (Yao, 1941b; Zhang, 2015). For instance, written from a woman's perspective, a ballad in Hebei Province reads, "*The three-inch Golden Lily is fabulous, and one more inch discounts the beauty; not mentioning gentlemen, but a cowboy would turn his face away*". Regarding men's obsession with women's tiny feet, a ballad in the Hetao region in Northern China goes, "*My lover's slim waist and small feet, a better handful than dumplings; on a donkey with hanging feet, the purple lotus shoes are clear to be seen*". Last but not least, besides the folk ballads, the aesthetic values of foot-binding can be also reflected

by poems and essays (e.g., Yao, 1934, 1936a, 1936b), as well as a specific type of event during the Spring – "*the Bound Feet Beauty Contest*" (Zhang, 2015; Nagao, 1973; Yao, 1934). Given the historical and folkloric evidence, foot-binding seems to have been appreciated as a competitive dimension of women's beauty.

Despite the perceived benefits, however, foot-binding was also costly, inducing women's disutility and labor costs. In terms of disutility, a ballad in Ningbo (Zhejiang Province, southern China) revealed the associated lifetime disutility of foot-binding: "*A pair of small feet is painful, all the way from my childhood to elderly individuals; I won't do anything wrong and evil, as I'm already shackled for the rest of my life.*" Second, foot-binding was also closely related to women's labor. For instance, as observed and documented by the Jiangsu Gazetteer (Li, 1936), women did not practice foot-binding in regions where they worked predominantly on farmland, while women did bind their feet in regions where they specialized in household handicraft work.[7] Together, as shown by the qualitative evidence, foot-binding had been associated with both women's beauty in marital prosperity and costs in women's labor.

2.3 Marriage Market Changes in the Song Dynasty

Given the observed motives for foot-binding, we next discuss the historical context in which foot-binding gained popularity – the Song dynasty. The Song dynasty (960–1279) was an imperial dynasty preceded by the Five Dynasties and Ten Kingdoms period (907-979), followed by the Yuan dynasty (1271-1368). In particular, the Song dynasty not only witnessed an expanding population and economy but also experienced profound social transition and marriage market changes.

The Social Changes. We first discuss the social transition surrounding the Song dynasty, from a military-aristocratic to a scholar-bureaucratic meritocratic society. Within this transition, the Song Civil Examination System played a crucial role in changing social mobility channels.[8] In summary, before the transition, inheritable status dominated in a segregated society. After the transition, greater mobility opportunities were generated for male commoners to become elites.

[7] The detailed regional pattern is shown in Appendix Figure A8.

[8] The socioeconomic impact of the system has been discussed in a rich body of literature (e.g., Ho, 1962; Hartwell, 1982; Elman, 2000; Shiue, 2017; Chen et al., 2020). Although the civil exams had existed since the Sui dynasty (581-618), they were much more prominent in the Song dynasty. Prior to the Song dynasty, less than 10% bureaucrats were recruited through the exam system. This share climbed to more than 50% during the Song dynasty.

Several features of the exam system are worth highlighting. First, the system was gender-asymmetric with social openness. Only men were eligible to participate in the exams, regardless of family background. In the exams, composing articles in line with the Confucian classics was the key to success. Second, the structure of the exams was hierarchical, and the entry-level exams were a prerequisite for taking higher-level exams.[9] Third, the exams were meritocratic, as shown by increased procedural fairness and recruitment size, and the degree of meritocracy increased sharply during the Song dynasty (Chaffee, 1995).[10] Last, the exam was regulated by a regional quota system that quantified the number of degrees granted per exam to each region. From the 11^{th} to the early 20^{th} centuries, the elite-generation system created a sizeable literate pool beyond formal bureaucracy and reshaped social stratification.

The Marriage Market Changes. The Song dynasty civil exam system also fueled changes in the marriage market. In this regard, historians have documented the changes in two aspects. First, the dimensions for matching transitioned from single-dimensional matching (i.e., family status) to multidimensional matching (i.e., both family-level traits and individual-level traits). For men, the valued traits became both the man's family and his individual talent; for women, the valued dimensions became both the woman's family and her beauty (Zhang, 2003; Ebrey, 1993; Xu, 2009; Tao, 2001). Second, the competition among women after the Song dynasty was significantly escalated (e.g., Ebrey, 1993; Guo, 2000), including dowry escalation and a unique phenomenon during the period – the "grabbing", which refers to fathers with unmarried daughters grabbing successful candidates as sons-in-law immediately upon the release of exam results.[11]

[9]To illustrate, Appendix Figure A1 maps the exam degrees to their corresponding positions in the social hierarchy (Chang, 1955). The major layers of the exam include: (1) the Licensing Exam, (2) the Qualifying Exam, and (3) the Academy Exam. Those who passed the three levels of the exam were entitled Literati, Recommended Men, and Presented Scholar, respectively.

[10]In Appendix Figure A2 (Panel B), we quantify men's social mobility across dynasties by constructing a surname fractionalization index of upper class men using the China Biographical Database Project (CBDB), which fits the qualitative evidence.

[11]Dowries were an important component of premarital transfer in historical China, which often took the form of direct monetary transfer, in-kind transfer (including clothes and jewelry), and sometimes land transfer. Moreover, foot-binding co-existed with dowries. From the mid-11^{th} century to the Qing dynasty, dowries were an important tool of premarital competition among bridal families. Scholars have also explored the reasons for dowry escalation since the Song dynasty. For instance, Sun (2016) considers dowry escalation as a response to the social transition and

Foot-binding and the Civil Exam System. In addition to the observed marriage market changes, we also observe that foot-binding gained popularity since the Song dynasty. In this regard, the connection between women's foot-binding and men's mobility opportunities was captured not only by folklore but also by scholarly discussions.

In folklore, there is a tight association between foot-binding and the competition to win over a Literati man who had passed the entry-level exam, among the most promising men in the social mobility engine as an ideal groom. For instance, a ballad in Zhangde (Henan Province) says, "*If one has lotus feet, she will marry a Literati, eating bread with meat; if one has large feet, she will marry a blind man, eating bran with chili.*" In Yunnan Province, a ballad directly characterizes the gender-asymmetric investment strategies for boys and girls: "*The boys can write and compose articles; as long as I daily bind my feet with care, the guys will be desperate to get me.*" Similarly, a sharp contrast is presented in a ballad emphasizing education investment among boys but premarital investment through foot-binding among girls: "*Do not spoil a boy in his learning, and never spoil a girl in her feet*" (Zhang, 2015).

In addition to folklore, scholarly discussions have also linked the rise of women's foot-binding competition to men's exam opportunities during the Song dynasty. In this regard, historian Dorothy Ko discussed that "*Generally speaking, in the early years of the Tang dynasty, when aristocratic families held away in politics, marriage was a form of political alliance and pedigree was key. When politics became more democratic and officials were chosen based on merit during the Song dynasty, personal attributes became more common in selecting brides. Moral repute – signified by a pair of bound feet – later became a common requirement*"(Ko, 2001). In this process, foot-binding was "*a ladder of success for women thus mirrored the fate of the civil service exam, a similar vehicle for men*" (Ko, 2005). Thus, Ko (2001, 2005) linked the rise of foot-binding to the Civil Exam System, pointing to a mobility-marriage hypothesis. As shown, both anecdotal evidence and scholarly discussions have pointed to foot-binding as a strategic choice in the marriage market for women facing gender-asymmetric changes in social mobility. However, the lack of a theoretical analysis and empirical validation prevents such observations from going further. In the next section, we

increasing marital competition among women following the fall of heredity and the rise of the examination system: when men's individual talent became increasingly important, dowry competition among women consequently became more salient.

present a theory for analyzing the mechanisms and generating testable predictions.

3 Theoretical framework

This section provides a theory of foot-binding that incorporates two perspectives – marriage market motives and labor motives. In particular, we adopt a non-transferable utility setup and model foot-binding as a premarital investment tool in response to a structural change in the marriage market, and women used foot-binding as an individual-level quality indicator for competition.[12]

3.1 Setup

Population. The society is populated by men and women, both of a continuum of one.[13] We index individual men by i and individual women by j. Each individual is endowed with a binary level of family wealth, $F \in \{H, L\}$, indicating whether the family socioeconomic status is high or low. Each individual is also endowed with a binary level of ability, either high or low, $A \in \{H, L\}$. For the distribution of wealth and talent, the proportion of high-family-wealth individuals is μ, and the proportion of high-ability individuals is p.[14]

The quality index of a man is a combination of his natal family socioeconomic status and his individual component: $q_i = (1-\delta) F_i + \delta\phi(A_i, F_i)$. Here, $\phi(A_i, F_i)$ is the production function of

[12]While our theory is nested in the historical context, it reflects the generic theoretical insights that the relative heterogeneity and quality distribution of the two sides determine the intensity of competition (e.g., Hoppe, Moldovanu and Sela, 2009).

[13]Relaxing this assumption does not change the results qualitatively, under realistic assumptions. To see this, consider that we have men of a continuum of one and women of a continuum of $s < 1$, since son preference is a major determinant of imbalanced sex ratios. In the benchmark case in which both genders are symmetric in quality distribution, women are on the short side of the market due to the smaller population size, and there is no need to compete for men. After the marriage market shock which makes men's quality distribution more dispersed than women's, women switch to the long side of the market to compete for higher quality men as long as $p < s$, where p is the proportion of higher quality men. In reality, high-quality men are scarce in the population, $p << s$. Thus the competition was intensified on the women's side, and the main intuition remains the same.

[14]It should be noted that relaxing the two-layer society assumption does not change the results qualitatively, as men would always have one more quality indicator than that of women. Thus, the composition of men's quality is still more diversified than that of women.

men's post-natal socioeconomic status, where social mobility institution plays a role in the status and wealth-generating process, and δ is the weight of $\phi(\cdot)$. In contrast, the quality index of women depends fully on their natal family status: $q_j = F_j$, because the woman had little return to her individual ability in the status and wealth generating process (*i.e.*, in either the bureaucratic or business arenas).

Marriage. Marriage decisions are made by parents, based on both family and individual traits. Hereafter, we label the two sides as men and women for concision. We adopt a non-transferable utility (NTU) setup in marriage market matching to highlight the preferences on the two sides and the detrimental nature of foot-binding for women and its one-sided benefit to men.[15] The marital utilities for men and women have two components. The first component is the utility derived from the individual quality indices of the two sides (i.e., q_i and q_j). The second component is the utility derived from foot-binding, which incurs specific values for men while incurring physical costs for women. Combining the two components, the total marital utilities for men (V_i) and women (V_j) are as follows:

$$V_i = v(q_i, q_j) + G(B_j) - \beta \frac{B_j}{F_i}$$

$$V_j = v(q_i, q_j) - \beta \frac{B_j}{F_j}$$

Specifically, for the first component, given the quality indices on both sides, we take a tractable quality function to be $v(q_i, q_j) = q_i q_j$, that there is complementarity and symmetry regarding the socioeconomic status of spouses. The second component of premarital investment introduces foot-binding, where we consider both its values and labor costs. The benefit, $G(B_j)$, is the gain from marrying a foot-binding wife, and $B_j \in \{0, 1\}$ represents the wife's binary foot-binding status. The

[15] The existing literature has used both transferable utility (TU) setup (e.g., Lam, 1988; Chiappori, Iyigun, and Weiss, 2009) and non-transferable utility (NTU) setup (e.g., Peters and Siow, 2002; Banerjee et al., 2013) to model marriage market matching. The results in this paper would also work in a transferable utility model, which is helpful to discuss the case when the couples may redistribute the resources within the family. Here, we use the non-transferable utility setup to emphasize the preferences on the two sides, and that the practice of foot-binding places a one-sided physical cost on women, with one-sided aesthetic benefits to men.

setting captures foot-binding as a package of feminine purity and aesthetic attraction.[16] We further formalize the details of $G(B_j)$ in Assumption 3 below with historical evidence. The cost of foot-binding can be captured by the last terms in both V_i and V_j, that the practice is not only costly for a woman as a wife ($\beta\frac{B_j}{F_i}$), but also as a daughter ($\beta\frac{B_j}{F_j}$). The degree of labor distortion induced by foot-binding is represented by β. This emerges from the fact that foot-binding impedes physical mobility and the cost is decreasing in household wealth, since women in poorer households play more labor-intensive roles in production than those in richer households.

To make the analysis tractable, we formalize the following assumptions, which are grounded by historical evidence:

Assumption 1. (Class wealth gap) $H - L > L > 1$

Assumption 1 suggests a large wealth gap between the upper class and the lower class. Historically, the difference in living standards across social classes was sizable. For instance, the average annual income of the lowest-level officials was 6.62 times higher than that of commoners during the Qing dynasty (Chang, 1962).

Assumption 2. (Talent is scarce) $p < p^*$, *where* $(1-p^*)\,\delta L\,(H-L) - \frac{\beta}{L} = 0$

Assumption 2 suggests that individuals with high ability are in scarcity. Intuitively, the upper bound p^* ensures the competition incentives toward the scarce talent.[17]

Assumption 3. (The value of foot-binding) *The value of foot-binding for men is complementary to men's quality:* $G(B_j) = (q_i - q_0)\,B_j$, *where* q_0 *takes a small value that* $q_0 < L$.

Assumption 3 suggests complementarity between foot-binding and men's quality in marital production. This is shown by the multiplicative form $(q_i - q_0)\,B_j$, that the marginal benefit of a foot-binding wife is increasing in men's quality. q_0 takes a small value that $q_0 < L$, which can be considered as a reservation point of men's aesthetic and moral preferences, thus even the poorest

[16] As an alternative way to model foot-binding decisions, we may introduce incomplete information and treat foot-binding as a signal of women's unobserved virtues – docility, as in Rai and Sengupta (2013). Specifically, as foot-binding is a painful process to undertake, a pair of tiny, well-shaped bound feet could reveal personal endurance, obedience, and submissiveness. Our analysis represents a benchmark that highlights the interactions between men's upward mobility and marriage market competition, instead of incomplete information.

[17] The analysis may proceed without Assumption 2. To spell this out, we can specify the respective cutoffs of p for the upper and lower classes, to discuss competition incentives. Therefore Assumption 2 serves mainly as a simplifying and realistic assumption to make the analysis concise.

men value it positively. This assumption is consistent with historical evidence, where a stronger preference existed for foot-binding among high-quality men. In particular, foot-binding was considered a delicate form of beauty that was perceived especially by the bureaucrats (Ebrey, 1993).[18]

Equilibrium. In our model, women simultaneously make foot-binding choices first, then participate in the marriage market competition, and receive payoffs when the marriage market clears (*i.e.,* a stable matching is formed).[19] A woman's strategy, s_j, specifies her foot-binding choice, in response to the foot-binding choices of all other women. Denote the strategy profile for all women by vector $\boldsymbol{s}$, and the realized foot-binding choices as $a(\boldsymbol{s})$. After a stable matching is formed, they receive marriage payoffs (V_i, V_j). Denote a stable matching from the realized choices as $M(i, j, a(\boldsymbol{s}))$, the stable matching satisfies: (1) feasibility: All candidates in the marriage pool are paired; (2) no blocking pairs: No one in a pair has any incentive to find a better partner who also prefers the new pair. There might be multiple stable matchings. All stable matchings are selected with equal probability, and a woman evaluates the expected payoffs across all possible stable matchings in which she might end up. We only consider pure strategy equilibrium, because foot-binding is a childhood commitment and cannot be altered upon marriage. Formally, we have the following definition:

Definition. *An equilibrium in the game is a strategy profile* $\boldsymbol{s}$*, such that for every woman* $j \in J$*:*

$$\mathbb{E}_M\left[V_j\left(M\left(i,j,a\left(s_j,s_{-j}\right)\right)\right)\right] \geq \mathbb{E}_M\left[V_j\left(M\left(i,j,a\left(s_j^{'},s_{-j}\right)\right)\right)\right], \forall s_j$$

[18]Similarly, Yang (2012) described the stronger preference for foot-binding among the upper class, as revealed by the folk ballad in Songming County, Yunnan Province, that "the gentry families and renowned families valued foot-binding the most."

[19]Here we explicitly focus on the markets for wives instead of wives *and* concubines, since the markets for wives and concubines were separate and differed by nature. Furthermore, relaxing this assumption does not change the results qualitatively. Specifically, polygyny can be introduced by assuming that one upper class man can effectively marry η women, where $\eta > 1$ indicates the degree of polygyny. With the introduction of the exam system, the composition of men becomes still more heterogeneous, where upper class women compete for the scarce talented upper class men (*i.e.*, $\eta p < \mu$). Compared to the baseline model, the opportunity for women to marry up expands from p to ηp, which increases the expected payoff from foot-binding, thus the competition is intensified on the women's side, and the main intuition remains the same.

3.2 Analysis

This section proceeds to analyze how changes in social mobility channels - the Song Civil Exam System - affected the marriage market and women's premarital investment incentives. As mentioned in Section 2, before the Song exams, inheritable status dominated in a segregated society, whereas after the Song exams, it generated mobility opportunities for talented males with social openness.[20]

The Pre-Song Exam Era. In the pre-Song era, the wealth-generating process was mainly hereditary, and social mobility was rare. Mapping the context to the model, during this era, the production function of men's individual socioeconomic status is captured by $\phi(A_i, F_i) = F_i$. As a result, the individual quality index is determined purely by family status for both genders, *i.e.*, $q_i = F_i$, $q_j = F_j$. Proposition 1 characterizes the equilibrium in this case, with the matching pattern illustrated by the following table.

Table 1: Quality distribution of men and women: pre-Song Exam era

Proportions	**Family status**	**Men's quality** (q_i)	**Women's quality** (q_j)
μ	H	H	H
$1-\mu$	L	L	L

Proposition 1. *In a segregated society with inherited status, marriages are positively assortative in family status. No foot-binding is practiced in either class.*

Proof. See Appendix of proofs. □

With inherited status, the quality of both brides and grooms within each class is homogeneous. The matching pattern is endogamy, where upper-class brides are matched with upper-class grooms and lower-class brides are matched with lower-class grooms. This matching is stable since no one has the incentive to deviate or remain single. In particular, there is no incentive for women to

[20] In the baseline model, we focus on the pre-Song and the post-Song eras. A generalization of the model could capture the exams during the Sui and Tang dynasties in the early phase, by specifying varying degrees of meritocracy. Specifically, one may assume a more flexible quality function, $q_i = (1-\delta) F_i + \delta \left(\frac{A_i}{L}\right)^{\alpha} F_i$, where α resembles the degree of the meritocracy over time: In the earlier implementation of the exams, α was relatively small, whereas α increased sharply during the post-Song era.

make costly premarital investments, because practicing foot-binding cannot compensate the upper class men sufficiently to marry down, due to marital complementarity and the class wealth gap. Historically, Proposition 1 reflects the marriage market before the Song dynasty, wherein powerful clans enjoyed hereditary privileges and were interconnected through marriages, and marriages were well-sorted along the social hierarchy (Zhang, 2003; Sun, 2016).

The Post-Song Exam Era. In the post-Song era, the exam rocked the quality distribution of men. During the post-exam era, the quality composition of grooms became more heterogeneous because of the positive return to men's individual ability. This is captured by the individual status-wealth production function, $\phi(A_i, F_i) = \frac{1}{L} A_i F_i$. In $\phi(\cdot)$, family background and individual ability are complementary, as participation in the exam demands family support. The scaler $\frac{1}{L}$ ensures the lowest quality among all men as the benchmark remains unchanged in the social hierarchy. The following table exhibits the quality distribution of men and women during the post-Song exam era:

Table 2: Quality distribution of men and women: post-Song exam era

Family status	**Proportions**	**Men's quality** (q_i)	**Women's quality** (q_j)
H	μp	$q_1 = (1-\delta) H + \frac{\delta}{L} H^2$	H
	$\mu(1-p)$	$q_2 = H$	
L	$p(1-\mu)$	$q_3 = (1-\delta) L + \delta H$	L
	$(1-p)(1-\mu)$	$q_4 = L$	

As revealed by Table 2, the quality index q_i combines family endowment and individual ability, and divides men into four quality strata: (1) high talent from rich families, with quality q_1; (2) low talent from wealthy families, with quality q_2; (3) high talent from poor families, with quality q_3; and (4) low talent from poor families, with quality q_4. As a result, with rising heterogeneity among men within each family stratum, women are relatively homogeneous. Thus, the heterogeneity of men encourages relatively homogeneous women to compete in the marriage market, and the premarital investment competition among women is escalated. Denote the proportion of foot-binding among upper and lower-class women as r_H, r_L, respectively, and we summarize the results in the following proposition.

Proposition 2. *In the post-Song exam era, the proportions of women who bind feet are* $r_H^* = \min\left\{\frac{p\delta H^3\left(\frac{H}{L}-1\right)}{\beta}, 1\right\}$ *in the upper class, and* $r_L^* = \min\left\{\frac{p\delta L^3\left(\frac{H}{L}-1\right)}{\beta}, 1\right\}$ *in the lower class, where* $r_H^* \geq r_L^*$.

Proof. See Appendix of proofs. □

Proposition 2 shows that the proportion of foot-binding women is weakly increasing in marrying-up benefits, and decreasing in labor costs. In equilibrium, the proportions of women foot-binding in the upper and the lower classes are pinned down when the net expected benefit of marrying up equals the cost of foot-binding.[21] Furthermore, we observe an upper-class dominance, such that foot-binding is more pervasive in the upper class than in the lower class (*i.e.*, $r_H^* \geq r_L^*$). Two elements contribute to this result: (i) women's marrying-up gain differentials, which are generated by marital complementarity, indicating that lower-class women would always have lower benefits from marrying up than upper class women, given men's quality distribution; (ii) women's cost differentials of foot-binding across class, since lower-class women play a more labor-intensive role in household production. Proposition 2 captures the observable changes in the marriage market after the Song dynasty, when men's individual marriage quality became vital, and the competition among women intensified (Ebrey, 1993; Zhang, 2003; Xu, 2009).

3.3 Extensions

In the extensions, we highlight the flexibility of foot-binding and discuss its interactions with social conformity pressures, and with alternate marital competition tools. Regarding the flexibility of foot-binding, the historical context revealed that the appreciation of bound feet included not only the size, but also the shape, fragrance, and shoe styles (e.g., Yao, 1941b). Such flexibility indicates that considerable adjustments can be implemented even in adulthood. Consequently, foot-binding became a fine-tuned tool of premarital investment.

[21] The result in Proposition 2 characterizes an asymmetric equilibrium in a symmetric game with many players, in the sense that if we swap players, their payoffs are not affected. This equilibrium resembles an approximate outcome of playing a specific symmetric mixed-strategy equilibrium, when each woman chooses foot-binding with a probability close to the fraction of foot-binding women within her class in this asymmetric pure-strategy equilibrium. With large numbers, the *ex-ante* probability and *ex-post* frequency are approximately the same (Cabral, 1988).

Therefore, in the extension, we consider the intensive margin variation of foot-binding, which allows for foot-binding as a continuous decision, and explore the adoption of the practice in two dimensions: Horizontally, we analyze the impacts of social motives; vertically, we investigate the premarital investment competition when both foot-binding and dowries are available.

Foot-binding and Social Motives. As mentioned in women's interviews (Brown et al., 2012), men's reflections (e.g., Yao, 1934, 1941b), and folklore (e.g., Zhang, 2015), foot-binding was also considered a social norm on beauty to which women strove to conform, in addition to its role as a premarital investment. This extension thus examines the role of social conformity in shaping foot-binding decisions. The details of the extended model are presented in Appendix D.1. The extension carries some new insights. First, with continuous foot-binding, women differentiated themselves more precisely in the marriage market. Second, with social conformity, the foot-binding intensity increased over time due to the accumulation and increase of social pressures. The extension thus accounts for the historical evidence that women differentiated themselves more precisely and that the deformation increased over time.

Multiple Premarital Investment Tools. In the marriage market, multiple types of women's competition instruments may be available, including offering a higher-quality bride or offering a larger amount of dowry. Given that foot-binding embodies both aesthetic and moral values, we further consider marriage payment – dowries – as an additional competition instrument. In the literature, dowry has served as a premarital bequest to daughters (Zhang and Chan, 1999; Botticini and Siow, 2003), as a marriage payment (Becker, 1991; Rao, 1993; Anderson, 2003; 2007), and as a combination of both roles (Anderson and Bidner, 2015). Specifically, we zoom in on its marriage payment role to highlight how premarital investment decisions are shaped by gender-asymmetric mobility changes. In the extension, we introduce both foot-binding and dowries to the theory and examine the competition strategy of bridal families in equilibrium. The detailed extension is presented in Appendix D.2. We show that, with multiple investment tools, women in both classes practice foot-binding in response to a shift in the gender-asymmetric social mobility system. Also, upper-class women still have greater foot-binding intensity compared to lower-class women.

3.4 Testable Hypothesis

Based on Proposition 2, we present comparative statics in the following corollary:

Corollary 1. *The percentages of foot-binding among upper-class women r_H and lower-class women r_L are weakly increasing in the proportion of high-ability men p, and weakly decreasing in labor cost β.*

Proof. See Appendix of proofs. □

Corollary 1 shows that foot-binding prevalence increases alongside its benefits and decreases alongside its costs. On the one hand, foot-binding prevalence weakly increases alongside a higher exam recruitment rate (p), which is associated with a higher expected gain in the marriage market. On the other hand, foot-binding prevalence among lower-class women weakly decreases in labor cost (β). In the next section, we empirically test the comparative statics by using the variation in men's exam recruitment rate (p) and women's labor cost (β).

4 Empirical Evidence

4.1 Data

4.1.1 Data on Foot-binding

Next, we conduct empirical analyses to test the comparative static predictions using cross-sectional data on foot-binding prevalence.

Province-Level Data. We first compile province-level foot-binding prevalence from Yao (1934), Qian (1969), Xu (1984), and Turner (1997), capturing foot-binding during a period from the late 18^{th} to the early 20^{th} century. Table 3 shows the specific foot-binding prevalence for 18 provinces within Qing China proper. Following the sources, foot-binding prevalence among Han Chinese women can be classified into three categories: (i) foot-binding was rarely observed (=1); (ii) foot-binding was mixed, such that only a certain group of women practiced foot-binding (=2); and (iii) foot-binding was almost universal in that province (=3). The information is mapped in Figure 1. As shown by the pattern, the practice of foot-binding had considerable regional heterogeneity in terms of its observed intensity.

[Table 3 about here]

Table 3: Foot-binding Prevalence: by Province

ID.	Province	Foot-binding Practices: Categories	Sources
1	Guangdong	rare	A,B,C,D
2	Jiangxi	rare	A,C,D
3	Guangxi	rare	A,B,C,D
4	Hunan	rare	A,B,C,D
5	Jiangsu	mixed	A,B,C,D
6	Hubei	mixed	A,B,C,D
7	Anhui	mixed	A,C,D
8	Fujian	mixed	A,C,D
9	Zhejiang	mixed	A,B,C,D
10	Yunnan	mixed	A,B,C
11	Guizhou	mixed	A,B,C,D
12	Sichuan	mixed	A,C,D
13	Shaanxi	common	A,B
14	Zhili	common	A,B,C,D
15	Shanxi	common	A,B
16	Henan	common	A
17	Shandong	common	A,B,C
18	Gansu	common	A,D

Sources: A = Turner (1997). B = Qian (1969). C = Xu (1984). D = Yao (1934).

County-Level Data. Next, we introduce county-level data on foot-binding prevalence from the Republican archives stored in the Second Historical Archives of China (SHAC) in Nanjing. We collected the archival data from the SHAC, where the specific archives that we studied are stored under classification Number.12 (6) in the system (in Chinese, *Quanzonghao*), belonging to the archives owned by the Ministry of the Interior, the Republic of China.[22] The foot-binding archives are reports on local foot-binding prevalence submitted by the county-level government from 1931 to 1934, and historians have previously used this archive to study foot-binding (e.g., Yang, 2012).

The background of the archive was related to a nationwide campaign on foot-binding, when the Republican government considered foot-binding a detrimental practice for society in the early 1930s. In the report, the local county government documented both the pre-campaign intensity of the foot-binding practice and the progress of the anti-foot-binding campaign. Our focus is on the preexisting foot-binding prevalence across regions, where the specific question is: "*Describe the foot-binding prevalence among women before the implementation of the anti-foot-binding campaign.*" The question targeted women instead of girls and captured foot-binding prevalence for the birth cohorts during the late Qing period, *circa* 1862-1902. Appendix Figure A4 is an example of the report, as submitted by Yu County in Northern China.

Since the reports are mostly written in a qualitative manner, they reflected an aggregated level observation of foot-binding prevalence. We use the information from the reports for coding the regional foot-binding prevalence. In particular, foot-binding prevalence is coded with "low intensity"(=0), when it is mentioned that foot-binding was rare among women. On the other hand, foot-binding prevalence is of "high intensity" (=1) when it is mentioned that foot-binding was popular/predominant. For instance, in Yongshun County, the variable is coded zero, as "*women always work alongside men, so there was no foot-binding custom*"; in Heqing County, the variable is also coded zero, as *"there is no custom of foot-binding in our county, and women participated in agricultural work.*" On the other hand, in Yu County, the variable is coded one, as "*the foot-binding custom was exceedingly popular*"; similarly, in Yiliang County the variable is coded one, as "*foot-binding was highly popular, and women without bound feet were considered outrageous,*

[22]Please refer to the information from SHAC for detailed regulations on how to obtain access to the archives: http://shac.net.cn/cdzn/dazlkf/.

thereby affecting their marriage prospects."[23] With the coding process, our sample includes 148 counties, in four provinces (Shandong, Chahaer, Hunan, and Yunnan). Panel A of Figure 2 shows the regional distribution of foot-binding prevalence across counties. Panel B presents the number of exam quotas at the county level (Kun et al. 1899); Panel C and Panel D illustrate the crop suitability index for rice and wheat, respectively. As shown in Figure 2, the archival sample has considerable variation in foot-binding prevalence, geographic, and socioeconomic conditions. Table 4 provides descriptive statistics for the key variables of the sample.

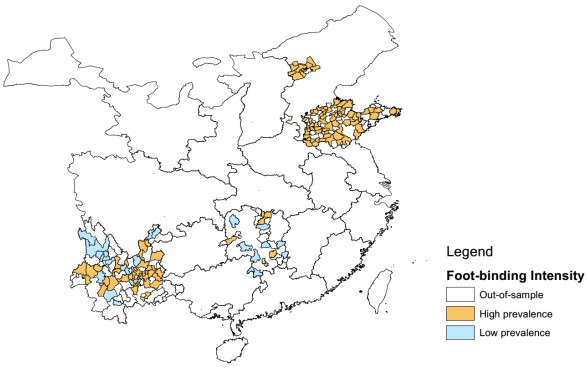
[Figure 2 about here]

[Table 4 about here]

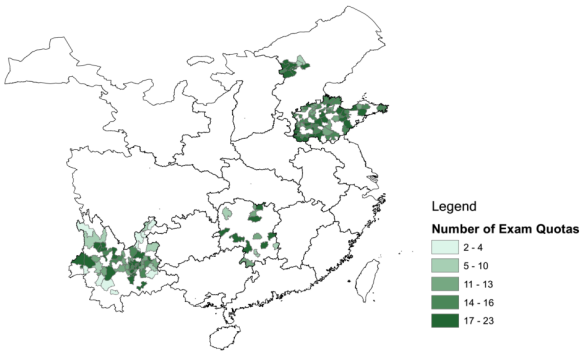
We then conduct a set of validity checks of the archival data. First, we cross-validate the regional distribution of foot-binding prevalence in the archives (Panel A, Figure 2) with alternative sources (Figure 1). As shown by the figures, the two distributions of foot-binding deliver a consistent pattern across regions at the aggregated level. Second, we examine the concern of the selective survival of the archives. To check whether the counties in and absent from the archives are systematically different, we conduct a balance check between sample counties and non-sample counties in Appendix Table A2. The results show no systematic differences regarding socioeconomic variables across the two groups. Third, we consider the possible issue of reporting bias in two scenarios: (i) If misreporting is random, the noise in data will reduce the precision of our estimation, in which case we would not find either the effects of labor cost or marital benefits to be statistically significant; and (ii) if misreporting is correlated with unobserved characteristics of the county, then we consider the omitted variable bias. Specifically, we use empirical strategies employing plausible exogenous variation in both labor and marital incentives to resolve the bias.

We further examine other qualitative features of the archives. In particular, the reports provided first-hand observations of foot-binding incentives in some localities. Among the 148 counties, 32

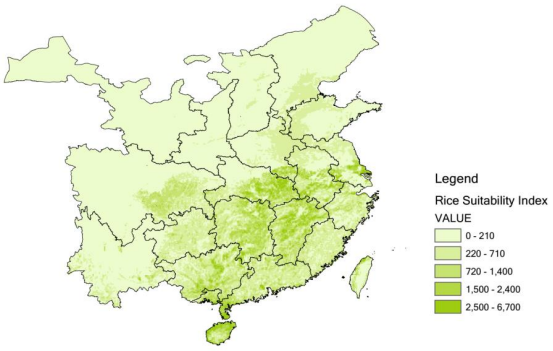
[23] Among the qualitative information, a subset of counties included information on the share of women with bound feet. To check whether the qualitative information is consistent with the shares across the binary foot-binding prevalence groups (high versus low), we find the following pattern: Among the low prevalence counties, the average share of foot-binding women is around zero (10 counties reported shares, and the average is 0.7%); among the high prevalence counties, the average share is 87.3% (34 counties reported shares).



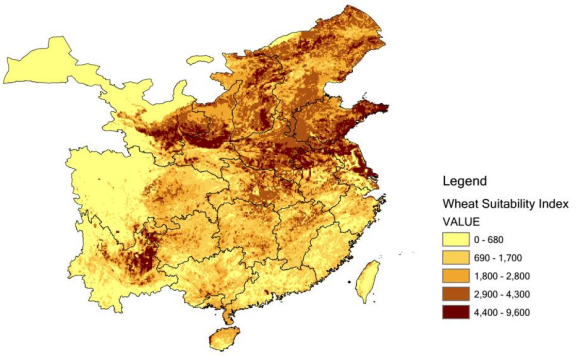
(A) Archival Counties: Prevalence of Foot-binding



(B) Archival Counties: Number of Exam Quotas



(C) Rice Suitability Index



(D) Wheat Suitability Index

Notes: Sample counties are from the Republican archives on foot-binding. Four provinces are covered by the archives: Shandong, Chahaer (now part of Hebei), Hunan, and Yunnan. Panel A shows county-level foot-binding prevalence, and Panel B illustrates the distribution of county exam quotas (Kun et al. 1899). Panel C shows the suitability index for rice and Panel D for wheat, where the data come from the crop suitability, FAOs GAEZ (Global Agro-Ecological Zones). The suitability indexes are generated under the condition of the rain-fed intermediate input level. The base map covers the 18 provinces within Qing China proper, from the CHGIS v5 (CHGIS, 2015).

Figure 2: Sample Counties: Foot-binding, Exam Quotas, and Crop Suitability

Table 4: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Sources
Province level						
Foot-binding intensity	18	2.11	0.76	1	3	A,B,C,D
Relative suitability (rice - wheat)	18	0.38	1.37	-1.66	2.32	E
Relative cultivation share (rice - wheat)	18	21.60	39.82	-34.68	86.25	F
Provincial exam quotas	18	2742.11	849.92	1393	5263	G
County level						
Foot-binding prevalence	148	0.80	0.40	0	1	H
Relative suitability (rice - wheat)	148	0.00	1.51	-4.04	5.25	E
County exam quota	148	14.76	4.82	2	23	I
ln(Quotas)	148	2.60	0.50	0.69	3.14	I
ln(County population)	148	5.12	0.82	3.33	7.22	J
Population sex ratio	148	114.55	11.02	86.16	152.34	J
Average household size	148	5.25	0.75	3.64	9.22	J
Distance to Nearest Ming Garrison(km)	148	55.83	36.39	0.95	256.09	K,L
Pop. Sparseness 1650	148	-0.07	0.05	-0.14	0.00	M
Ln(Land tax p.c. 1820)	148	-2.97	0.94	-6.76	-1.74	N
Ln(Strength of Confucianism)	148	5.03	1.05	1.39	6.48	O
Ln(Mongolian migration intensity)	148	0.39	0.44	0	1.10	P
Ln(Strengths of Clan)	148	3.27	1.67	-0.69	7.76	Q

Sources and notes: A. Turner (1997). B. Qian (1969). C. Xu (1984). D. Yao (1934). E. FAO GAEZ Crop Suitability (1965-1990). F. Buck (1937). G. Chang (1955). H. The Ministry of the Interior Archives, Republic of China. I. Kun et al. (1899). J. Yearbook of Domestic Affairs of Republican China, 1931. K. Berman (2017). L. CHGIS version 5 (CHGIS, 2015). M. Ge (2000). N. Liang (1981). O. The Jiaqing Revision of a Unified Geography (1843). P. Wu and Cao (1997). Q. Wang (2008). The strength of Confucianism is proxied by the number of chaste women at the prefecture level during the Ming and Qing dynasties, and the Mongolian migration intensity since the Yuan dynasty is calculated based on Wu and Cao (1997).

counties explicitly mentioned the reasons for (non)foot-binding in their locality. We compile the information in Appendix Table A1. Two patterns emerge from the reports: (i) Among the counties with low foot-binding prevalence, labor cost was mentioned as a predominant reason for its rareness; and (ii) Among the counties with high foot-binding prevalence, beauty, marriage, and tradition were frequently mentioned as the main considerations. This result, again, is consistent with and consolidates the trade-off of foot-binding decisions as described in Section 2. Next, we discuss the regional variation in both labor and marriage incentives for women's foot-binding in the empirical analysis.

4.1.2 Variation in Labor Cost

Regarding women's farmland labor cost, we exploit the variation in agricultural suitability (FAO, Global Agro-Ecological Zones) that drives farming labor values. Given that the package of climatic and geographic features used for constructing the data are relatively slow-moving, agricultural suitability has been considered a reasonable measure for studies of crops in historical contexts.[24] For instance, Nunn and Qian (2008) studied the effect of potatoes on population and urbanization from 1000 to 1900, and Mayshar, Moav, and Pascali (2022) examined whether the cultivation of cereal crops would contribute to the formation of states following the Neolithic Revolution.

In our analysis, we focus on two major cereal crops in China – rice and wheat.[25] The two crops differ in both the amount and type of labor used: (i) Regarding labor demand, rice is almost twice as demanding compared to wheat cultivation; and (ii) regarding the type of labor used, rice cultivation is associated with greater labor participation by women and children. Table 5 illustrates these disparities, with data from Buck (1937). As shown by the table, the average number of labor days required for the wheat region crops was 95.4, while the average number of labor days required

[24] Specifically, the FAO GAEZ project developed the agricultural suitability variables for various crops with global coverage, measured at a disaggregated geographic level, with a GIS raster map of cell's size of 5 arc-minute by 5 arc-minute. The input features used for calculation include precipitation, moisture, thermal, vapor pressure, cloud cover, sunshine, ground-frost frequency, wind speed, the slope of soils, and land characteristics. Combining this battery of climatic and geographic information with the crop-specific requirement for cultivation, the FAO then estimates the agricultural suitability of each geographic cell for different crops.

[25] As Buck (1937) documented, rice and wheat account for 65% of cereal cultivation.

in the rice region was 186.4. Regarding the type of labor used, there were larger shares of women and children involved in farmland work in the rice region than in the wheat region. The regional disparity in the crop-specific labor demand would capture differences in the opportunity cost of foot-binding for women during childhood.

[Table 5 about here]

Table 5: Labor Demand and Type on the Farm: by Crop Regions

	Amount of labor required	**Type of labor used on the farm only**		
Agricultural Region	man-labor per crop hectare	Men	Women	Children
Rice region	186.4	40.5	18.2	12.6
Wheat region	95.4	41.6	14	8.8

Source: Buck (1937). Regarding the left panel (i.e., amount of labor required), the unit of the amount of labor required is man-labor per crop hectare. Regarding the right panel (i.e., type of labor used on the farm), the number in the cells is the share of different types of labor (i.e., men, women, and children) who only participated in the farmland work.

In the empirical analysis, we use the relative agricultural suitability of rice to wheat as an exogenous variation in women's farmland labor cost defined as the difference in standardized suitability measures of rice to wheat, and we first check whether the relative crop suitability index would predict actual cropping patterns. We collect information on actual cropping patterns from Buck (1937) and calculate the relative cropping share of rice to wheat. Appendix Figure A5 shows the correlation between the relative suitability index and the cropping patterns at the province level, where a greater value of the relative suitability index of rice to wheat predicts a greater relative share of rice cultivated in the farmland.

4.1.3 Variation in Marriage Return

We then discuss the variation in the marriage motives for foot-binding that can be captured by men's exam quotas across regions. Historically, the exam quota system served as a tool to manage elite recruitment across regions (Kun et al., 1899; Shang, 2004; Liang and Zhang, 2011; Bai and Jia, 2016). At the county level, the exam quotas for the Licensing exam corresponded to the number of Literati degree holders.

We use county-level quotas for the recruitment of Literati based on the following facts. First, most of the Literati degrees were obtained during one's marriageable age (i.e., 16-25).[26] Second, the Literati degree is the prerequisite for and the entry point to obtaining upper-level degrees. Third, considering the magnitude, the Licensing exam effectively generated a larger group of men as talent reserves in counties.[27] Thus, conditional on local population size, the regional exam quotas provide a source of variation in men's mobility opportunities and their quality distribution in the locality. Panel B of Figure 2 shows the regional distribution of exam quotas at the county level of our sample.

4.1.4 Summary

With various sources of data, here we summarize the features of our data and their timing to prepare for the empirical analysis. Regarding our main analysis at the county level, both data on county-level foot-binding prevalence and exam quotas correspond to the late Qing dynasty. In addition, we also collect supplementary information on county demographic and socioeconomic characteristics. The demographic variables at the county level include county population, county population sex ratio, and average household size, from the Yearbook of Domestic Affairs of Republican China in 1931. In addition, we measure local socioeconomic conditions with land tax per capita in 1820 (Liang, 1981), the local strength of Confucianism as captured by the number of chaste women during the Ming and Qing dynasties following Kung and Ma (2014), the presence of ethnic minorities as captured by the Mongolian settlement intensity during the Yuan dynasty (Wu and Cao, 1997), and the strength of the clan measured by the average number of genealogies following Greif and Tabellini (2017). In Appendix C, we compile information including data sources, variable definitions, and a complete list of counties' foot-binding prevalence in our analysis.

[26] As documented by Chang (1955), around 63% of the Literati degrees were obtained during 16-25.

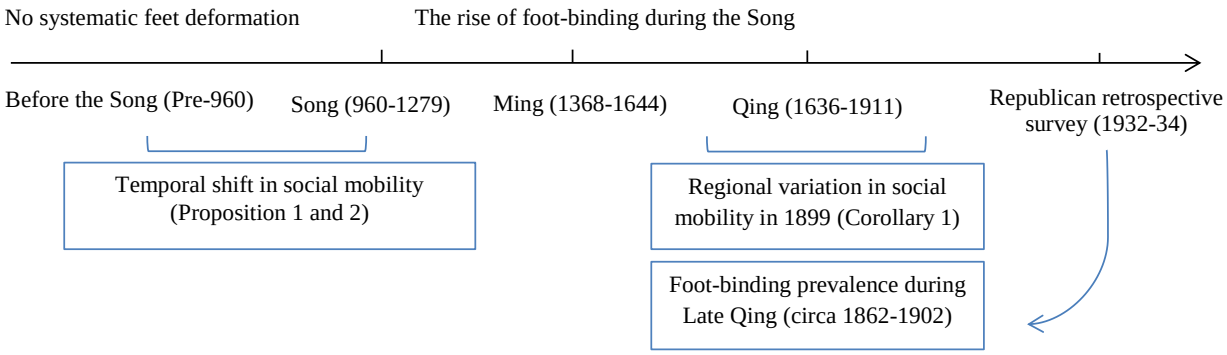
[27] The quota is a flow concept instead of a stock concept. During the late Qing dynasty, the Licensing exam was held twice every three years, and approximately two million candidates sat for each Licensing exam, where around 30,000 of them (~1.5%) were entitled to degrees (Elman, 2000).

4.2 Empirical Strategy

Next, we proceed to analyze the labor and marriage motives of foot-binding empirically. As discussed in Section 3, our main theory findings show that: First, a marriage market distributional shock encouraged foot-binding temporally (Propositions 1, 2); Second, variation in both marriage and labor motives would affect foot-binding regionally (Corollary 1). As such, the main idea of our analysis is the same: The factors shaping foot-binding, both temporally and regionally, are consistent.[28]

With the cross-sectional data on foot-binding, our empirical strategy tests Corollary 1, which provides comparative static predictions that greater marital incentives encouraged foot-binding, while greater costs in women's labor discouraged foot-binding. To illustrate the setting of our test and data, we summarize the key information in Figure 3.

[Figure 3 about here]



Notes: This figure summarizes the timeline of our main analysis. Specifically, the temporal shift in social mobility institutions and the rise of foot-binding during the Song are characterized by Propositions 1 and 2. The empirical analysis regarding regional variation is guided by Corollary 1.

Figure 3: Timeline of Analysis

[28] While we cannot conduct regression analysis to test Proposition 2, we use archaeological evidence during the Song dynasty as a source of suggestive evidence for the connection between men's exam mobility and women's foot-binding. We digitized the archaeological information of bound-feet shoes during the Song. As shown by Appendix Figure A3, all three pairs of bound-feet shoes were found in regions with a high density of exam-recruited officials.

4.2.1 OLS Regression

With the discussion of the data, our empirical specification is:

$$(1) \qquad Footbinding_{ij} = \alpha + \gamma_1 Suitability_{ij} + \gamma_2 lnQuota_{ij} + \lambda lnPop_{ij} + \delta' X_{ij} + \theta_j + \epsilon_{ij}$$

where $Footbinding_{ij}$ is a dummy variable indicating high foot-binding prevalence in county i, province j. $Suitability_{ij}$ is the relative suitability index of rice to wheat, defined as the difference in standardized suitability measures of rice to wheat. $lnQuota_{ij}$ is the logged number of quotas for the entry-level exam at the county level. $lnPop_{ij}$ is the logged county population size.[29] X_{ij} is a vector of regional characteristics as control variables. θ_j include province fixed effects, which account for province-specific observed and unobserved characteristics. ϵ_{ij} is the error term, and standard errors are clustered by the province to account for the within-province correlation of the error term. The key coefficients of interest are γ_1 and γ_2, which capture the labor cost effects and men's quality distribution's effects on foot-binding.

With an OLS regression, the crop suitability captures exogenous variation in women's labor cost of foot-binding. However, the identification of the effect of exam quotas on foot-binding requires exogenous variation, as the state's consideration of quota allocation might be correlated with foot-binding decisions generating omitted variable bias. In particular, the direction of the bias could be twofold: in one, the counties with more quotas per capita might be richer, thus making foot-binding practice more affordable; in the other, it is also possible that quota allocation served as a political stabilizer, so that disadvantaged regions would have received more quotas. Thus, the correlation between men's exam quotas and foot-binding might be confounded by unobserved heterogeneity across counties.

4.2.2 Instrumental Variable Strategy

We employ the IV strategy to address the omitted variable bias of quotas, by examining an administrative shock during the early Qing dynasty – the garrison-to-county adjustment (Mao,

[29] Since county-level population data during the late Qing dynasty are not available, we use the population measure in 1931 as the closest proxy.

2018), which generated variation in county exam quotas. Appendix Figure A7 illustrates the historical background. As shown by the figure, the regime change from the Ming to the Qing dynasties incurred an administrative adjustment to abolish Ming military garrisons. This triggered changes in county quota allocation during the early Qing dynasty that persisted until the late Qing dynasty, during which period we studied foot-binding prevalence.

The Ming Garrisons. During the Ming dynasty, the garrisons were stationary military units across the nation to oversee local stability (Gu, 1988). As a crucial part of the Ming military system, the settlement of garrisons was mainly driven by "vital military localities" (Zhang, 1974) and "the pattern of mountains and rivers" (Mao, 2001). Within the garrisons, military households were allowed to participate in the exams and were guaranteed a more generous and privileged quota allocation in the exam system (Yue, 1990; Cai, 2002; Zhang, 2007).

The Garrison-to-County Adjustment. After taking over the regime from the preceding Ming dynasty, the Qing government started administrative reforms regarding garrisons, aiming at demolishing these military settlements and transforming them into purely administrative units.[30] The transformation involved the relocation of the garrison's population and the associated exam quotas, through which the garrisons were either merged into nearby existing counties in more populated regions or established as brand new counties in sparsely populated regions (Kun et al., 1899; Gu, 1988; Mao, 2018). In terms of exam quotas, the garrison's quotas were split and incorporated into these nearby counties, or directly passed on when a new county was established.[31] Thus, the garrison-to-county adjustment generated variation in county exam quotas driven by distance to garrison and the nearby population density. The prediction is that counties closer to previous Ming garrison and in more sparsely populated regions would have more exam quotas.[32]

Using the garrison-to-counties shock as a source of IV for county-level quotas, we use the first-stage regression as follows:

[30] Among all garrisons, 93% of them were abolished during the early Qing (Mao, 2018).

[31] To illustrate the transformation process, here we use two examples as discussed by Mao (2018). The Yanqing garrison was merged into two nearby counties (i.e., Changping and Yanqing), and its previous exam quotas were split and merged into these two counties (QSL/YZ, 1741). The Chengshan garrison was transformed into the new Rongcheng County, which directly inherited the quotas from the Chengshan garrison (Kun et al., 1899).

[32] Appendix Figure A6 shows the geo-locations of the Ming garrisons and the distribution of Qing county exam quotas.

$$(2)\ lnQuota_{ij} = \alpha + \beta Dist_{ij} + \gamma Dist_{ij} \times Sparse_{ij} + \delta Sparse_{ij} + \lambda lnPop_{ij} + \boldsymbol{X_{ij}}\mu + \theta_j + \epsilon_{ij}$$

where $Dist_{ij}$ is the distance of county i in province j to its nearest Ming garrison, and $Sparse_{ij}$ is the county's neighboring population sparseness before the adjustment took place. Empirically, we use the reversed population density in 1650 at the prefecture level as a proxy. We use both $Dist_{ij}$ and $Dist_{ij} \times Sparse_{ij}$ as instruments for quotas, which capture the variation generated by the administrative adjustment event. For the first-stage analysis, we anticipate that distance to the nearest Ming garrison ($Dist_{ij}$) shall be negatively correlated with the number of quotas, and the marginal effect of distance to garrison on quotas shall increase with the neighboring population sparseness.

Next, we empirically examine the validity of the IV. Regarding the correlation condition between the IV and the endogenous variable, we use the first-stage results to document the correlation. Regarding the exclusion restriction condition, we conducted two related tests. First, we examine whether a Qing county's distance to the nearest Ming garrison is correlated with major local socioeconomic characteristics before the shock. As shown in Appendix Table A3, the relative location of the Qing counties to the Ming garrisons captures no significant predictor for local socioeconomic conditions before the adjustment. In addition, we conduct the plausible exogeneity analysis following the methodology proposed by Conley et al. (2012) in Section 4.3.2. as a sensitivity check.

4.3 Results and Robustness

4.3.1 Main Results

OLS Results. Table 6 shows the OLS results. Here we employ the full sample (N=148 counties) in Columns 1, 3, and 5. As wheat-rice cultivation is often associated with the north-south division in China, we also conducted the subsample analysis within the south in Columns 2, 4, and 6 to explore the within-south variation in agricultural suitability.[33]

[33]We are not able to conduct the sub-sample analysis in the Northern provinces due to a lack of variation in foot-binding prevalence.

In Columns 1 and 2, we first zoom in on the effect of crop suitability on foot-binding prevalence, where the results show that greater suitability of rice relative to wheat predicts less foot-binding prevalence. In Columns 3 and 4, we present the effect of the county exam quota on foot-binding prevalence, and the results reveal a positive correlation between exam quotas and women's foot-binding prevalence. Finally, in Columns 5 and 6, we include both variables capturing two sides of the trade-off, and the results show that greater suitability of rice to wheat predicts a lower prevalence of foot-binding, while men's exam quota numbers predict a higher prevalence of foot-binding.

[Table 6 about here]

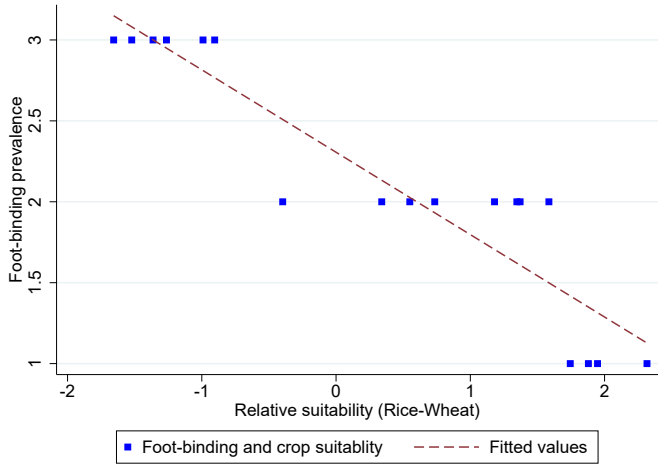
Table 6: Foot-binding, Women's Labor, and Men's Mobility: OLS Results

Dependent Variable	**Foot-binding Prevalence**					
Samples	All	Southern Prov.	All	Southern Prov.	All	Southern Prov.
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Relative Suitability (rice-wheat)	−0.064†	-0.093**			−0.055†	-0.086*
	(0.029)	(0.006)			(0.026)	(0.008)
LnQuota			0.090***	0.098*	0.062**	0.045
			(0.010)	(0.011)	(0.019)	(0.017)
LnPop			0.041	0.097	0.031	0.105
			(0.096)	(0.192)	(0.102)	(0.191)
Observations	148	72	148	72	148	72
R-squared	0.335	0.110	0.324	0.087	0.344	0.132
Prov. FE	Yes	Yes	Yes	Yes	Yes	Yes

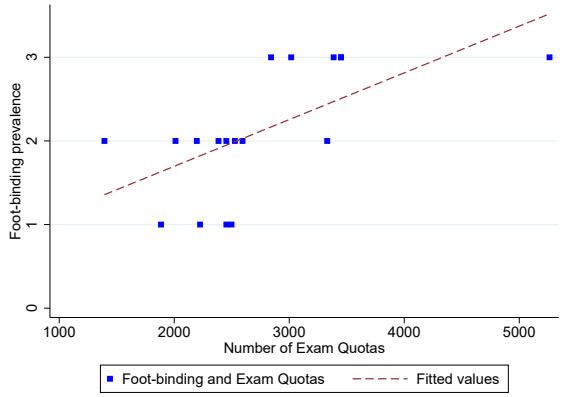
Notes: *** p<0.01, ** p<0.05, * p<0.1, † p<0.15. Standard errors clustered by province are in parentheses. The dependent variable is a dummy indicating high foot-binding prevalence in a county. The relative suitability of rice to wheat is defined as the difference between the standardized values of rice and wheat suitability. LnQuota is the logged quota for the entry-level exam at the county level. The southern sample includes the Hunan Province and Yunnan Province.

In addition to the county-level OLS regressions, we also use province-level data as another source for correlation analysis. As shown in Figure 4, regarding labor cost and foot-binding, Panel A shows a negative correlation between the relative suitability and foot-binding prevalence. Regarding men's exam quotas and foot-binding, Panel B of Figure 4 presents a positive correlation between the province-level exam quotas and foot-binding prevalence. Taken together, the results from both correlation patterns are consistent with the predictions by Corollary 1.

[Figure 4 about here]



Panel A: Foot-binding and Relative Suitability: Province level correlation



Panel B: Foot-binding and Exam Quotas: Province level correlation

Note: Panel A illustrates the correlation between provincial foot-binding prevalence and the relative suitability index (rice - wheat). Panel B illustrates the correlation between provincial foot-binding prevalence and provincial exam quotas.

Figure 4: Foot-binding Prevalence, Labor, and Quota: Province Level Correlations

Assess the Bias from Unobservables. In addition to the OLS analysis controlling for observable factors, we assess the extent of selection on unobservable factors for the entry-exam quota variable using Oster (2019). This approach provides a methodology for evaluating omitted variable bias, under the assumption that the relationship between treatment and unobservables can be recovered from the relationship between the treatment and observables. In Oster's test, we conduct two sets of regressions. In the first regression, we only explain foot-binding prevalence with county quotas and county population. In the second regression, we add control variables, including the suitability variable and the province fixed effects. By tracking the movements of both the coefficient of the quota variable and the R-square terms, the Oster (2019) methodology is able to quantify the degree of selection on unobservables. Appendix Table A4 presents Oster's δ and the movements in both the coefficient of the quota variable and the overall fitness (the R-squared). As shown by the results, Oster's δ is 1.971, which suggests that the unobservables would need to be approximately 1.97 times as important as the observables to produce a treatment effect of the quotas to be zero.

2SLS Results. We next move on to corroborate the findings with the Instrumental Variable strategy. In the analysis, we employ two samples, with the full sample in Columns 1-3 and the southern sample in Columns 4-6. Using the garrison-to-county shock as a source for identification, the IV estimates and the first-stage results are presented in Panel A and Panel B of Table 7, respectively. Regarding the first-stage results, as shown in Column 3 (i.e., the full sample, with the full set of controls), distance to Ming garrison ($Dist_{ij}$) is negatively correlated with the number of quotas, and the marginal effect of distance to garrison on quotas increases with garrison's neighboring population sparseness, as revealed by the interaction term ($Dist_{ij} \times Sparse_{ij}$). Across columns, the first-stage F-statistics shown at the bottom of Panel B are above the conventional level for weak IV tests.

The results using 2SLS are presented in Panel A, Table 7. In the analysis, we progressively add controls, including province fixed effects, county demographic characteristics (average household size and population sex ratio), and socioeconomic characteristics (land tax per capita in 1820, strength of the clan, strengths of Confucianism, Mongolian settlement intensity). As shown in Column 3 (the full sample), men's quality distribution proxied by exam quotas predicts greater foot-binding prevalence. Columns 4-6 replicate the analysis employing the southern sample, and

the effects of county quotas are consistent and quantitatively similar.

The estimated results from the 2SLS analysis in Panel A reveal the effects of the exam quota and labor cost to have both statistical and economic significance. In Column 3, Panel A of Table 7 (i.e., the analysis with the full sample with the full set of controls), we discuss and compare the magnitudes of the estimates for labor cost and exam quota variables. For the effects of men's exam quotas, the results show that a one standard deviation increase in log exam quotas would lead to greater foot-binding prevalence by 17 percentage points. The magnitude of the estimated effect is not trivial, which accounts for approximately 21.3 percent of the mean prevalence of foot-binding in the sample. For the effects of women's labor cost, we find that a one standard deviation increase in the agricultural suitability variable that is associated with a greater opportunity cost of women's labor leads to a lower probability of foot-binding prevalence by 5.7 percentage points. This effect is also economically sizeable, accounting for approximately 7.1 percent of the mean prevalence of foot-binding in the sample. Furthermore, by comparing the magnitudes of the two variables, with each variable having a one standard deviation change, we find the effect of the exam quota to be approximately three times larger than the effect of the labor cost. Taken together, the estimated results from the 2SLS analysis reveal the effects of the exam quota and labor cost to have both statistical and economic significance.

In addition to the first-stage and the second-stage IV estimates, Panel C of Table 7 shows the reduced-form results in parallel. The reduced-form results show the relationship between the instrument variables that capture administrative reform (i.e., $Dist_{ij}$ and $Dist_{ij} \times Sparse_{ij}$) and foot-binding prevalence. The correlation is consistent with the first- and second-stage IV estimates: Those counties that are closer to the garrisons and in a more sparsely populated region (and therefore associated with more quotas) are more likely to have high foot-binding prevalence. In terms of magnitude, as shown by Column 1 in Panel C, a one standard deviation increase in a county's distance to the nearest garrison would decrease the incidence of high foot-binding prevalence by 4.2 percentage points, when local population sparseness is at the mean. Taken together, the three panels of Table 7 show the results of the IV analysis, which are consistent with the theoretical predictions in terms of both labor and marriage incentives.

[Table 7 about here]

Comparing the magnitudes of the OLS and the IV estimates in Tables 6 and 7, we find that the IV estimates of the exam quota are larger than the OLS estimates. In our setting, this suggests that the raw correlation between the exam quota and foot-binding could be confounded by unobserved heterogeneity that we did not capture across counties. Moreover, the direction of bias could be downward. For instance, when quota allocation was a crucial way of allocating social mobility opportunities across the country (e.g., Bai and Jia, 2016), the number of quotas served as a political stabilizer for the counties with disadvantaged socioeconomic conditions. If foot-binding were less affordable in these disadvantaged counties, the OLS estimates would be downward biased.

4.3.2 Robustness Checks

Alternative Explanations. With the above empirical tests of our theory, we next move on to test two prominent alternative hypotheses for explanations of foot-binding in the literature. The first hypothesis that we examine is the Neo-Confucianism explanation. This explanation notes that Neo-Confucianism imposed a moral code for women to follow, making the adoption of foot-binding a manner of obedience since the Song dynasty (e.g., Blake, 1994). Despite its inconsistency with Neo-Confucianism classics,[34] we expect higher foot-binding prevalence in regions with stronger Neo-Confucianism influence if the hypothesis holds. The second hypothesis is the ethnicity identity-based explanation that Han Chinese women used foot-binding to distinguish themselves from other ethnic minorities, particularly the northern nomadic ethnic groups (e.g., Ebrey, 1990). Thus, the identity-based explanation predicts a positive correlation between foot-binding prevalence and the non-Han ethnic population.[35]

To test the two alternative explanations, we conduct a set of horse-race tests. Regarding the

[34]The Neo-Confucianism classics did not specifically advocate foot-binding, and the practice of foot-binding was controversial concerning the Classic of Filial Piety.

[35]The ethnicity identity-based explanation also encounters theoretical challenges. The theory is not clear as to why it was women – who were less socially observable, sharpened the ethnicity-specific identity. In addition, the between-ethnicity interactions had already been salient before the Song dynasty from the 4^{th} to the 6^{th} Centuries. Moreover, there existed heterogeneity regarding the ethnic minorities' foot-binding practices. For instance, while some ethnic minorities did not adopt foot-binding, some Manchurian women and some Hui people in Gansu province practiced foot-binding.

Table 7: Foot-binding, Women's Labor, and Men's Mobility: IV Results and Robustness

Panel A: 2SLS results	**Dependent Variable: Foot-binding Prevalence**					
Sample	All			Southern Prov.		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Suitability (rice-wheat)	−0.032†	-0.033*	-0.038*	-0.060***	-0.061***	-0.064***
	(0.020)	(0.019)	(0.022)	(0.006)	(0.007)	(0.008)
LnQuota	0.290***	0.293***	0.340***	0.242***	0.233***	0.243***
	(0.020)	(0.021)	(0.028)	(0.011)	(0.015)	(0.017)
LnPop	-0.006	-0.004	-0.001	0.066	0.072	0.113
	(0.085)	(0.084)	(0.086)	(0.128)	(0.121)	(0.087)
Population sex ratio		0.000	-0.001		-0.002	-0.004
		(0.002)	(0.004)		(0.003)	(0.009)
Average household size		-0.008	-0.012		0.003	-0.000
		(0.027)	(0.025)		(0.052)	(0.043)
Ln(Strength of Confucianism)			-0.071			-0.060
			(0.081)			(0.143)
Ln(Mongolian migration intensity)			-0.001			-0.026***
			(0.011)			(0.001)
Ln(Strengths of Clan)			-0.003			-0.038
			(0.033)			(0.035)
ln(Land tax pc.1820)			-0.003			0.012
			(0.094)			(0.134)
Observations	148	148	148	72	72	72
R-squared	0.277	0.276	0.265	0.073	0.079	0.093
Prov. FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: First-stage results	**Dependent variable: LnQuota**					
Distance to Nearest Ming Garrison(km)	-0.011***	-0.010***	-0.008***	-0.013***	-0.012**	-0.010**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Dist. to Garrison x Pop. Sparseness 1650	-0.093***	-0.093***	-0.079***	-0.313*	−0.326†	-0.260*
	(0.002)	(0.002)	(0.006)	(0.034)	(0.052)	(0.040)
F-statistics	129.311	146.118	118.641	375.072	197.488	217.373
R-squared	0.479	0.487	0.581	0.499	0.513	0.611
Panel C: Reduced-form results	**Dependent Variable: Foot-binding Prevalence**					
Distance to Nearest Ming Garrison(km)	-0.003***	-0.003***	-0.003***	-0.003**	-0.003**	-0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dist. to Garrison x Pop. Sparseness 1650	-0.029**	-0.029**	-0.027***	-0.047*	-0.047	-0.031
	(0.006)	(0.005)	(0.001)	(0.005)	(0.019)	(0.027)
R-squared	0.377	0.377	0.388	0.163	0.167	0.188

Notes: *** p<0.01, ** p<0.05, * p<0.1, † p<0.15. Standard errors clustered by province are in parentheses. The dependent variable is a dummy indicating high foot-binding prevalence in a county. The relative suitability of rice to wheat is defined as the difference between the standardized values of rice and wheat suitability. LnQuota is the logged quota for the entry-level exam at the county level. Population Sparseness in 1650 is measured as the reversed population density in the year 1650 ($Sparse_{ij}$), at the prefecture level. The instruments are (i) $Dist_{ij}$: a county's distance to its nearest Ming garrison(km); (ii) $Dist_{ij} \times Sparse_{ij}$: the interaction term between $Dist_{ij}$ and the garrison's neighboring population sparseness before the administrative adjustment. The Southern sample includes Hunan and Yunnan provinces. F statistics are based on the Montiel-Pflueger robust weak instrument test.

Confucianism explanation, we proximate the strength of local Confucianism by the number of chaste women at the prefecture level during the Ming and Qing dynasties, following Kung and Ma (2014). The proxy captures the intensity of Confucianism, as the moral codes stress the importance of "subordination" of a wife to her husband, and chaste women were a representative group of wives who were publicly praised for their sacrifice for their husbands. Regarding the identity-based explanation, we use data on historical nomadic presence – the Mongolian settlement intensity during the Yuan dynasty (Wu and Cao, 1997), as a proxy for the presence of the non-Han ethnic group. By the prediction of the identity-based theory, more Mongolian settlements would predict higher levels of foot-binding prevalence among Han women with identity considerations.

Table 7 presents the horse-racing results in Columns 3 and 6, for the full sample and the southern sample, respectively. As shown by the horse-race results, the effect of the local Neo-Confucianism strength is not statistically significant, which does not support the hypothesis. The effect of historical Mongolian settlement intensity is negative, which contradicts the prediction of the identity hypothesis. Moreover, the estimation of the historical nomad settlement is not robust across specifications and samples. Taken together, the results do not provide empirical support for the two alternatives, and the results are consistent with the theoretical predictions regarding both marriage and labor incentives.

Opportunity Cost of Crop Cultivation. In addition to the above two tests, we next examine another alternative interpretation of the results regarding agricultural suitability. Specifically, in addition to affecting women's labor costs, agricultural suitability may also alter the opportunity cost of participating in exams for men. If it is the case, then the effect of agricultural suitability may capture both the labor cost channel and the social mobility channel. To examine this alternative interpretation, we compare historical agricultural wages for rice and wheat cultivation areas from Buck (1941). The detailed agricultural wages are shown in Appendix Table A5.

As shown by this table, the daily wages for agricultural labor in the rice and wheat regions were largely comparable, at 0.24 and 0.25 (unit is Silver Dollars/Yuan), respectively. In addition to wages, the total subsidies (including dining subsidies and other subsidies) in the rice region and the wheat region were 0.24 and 0.19, respectively. Taken together, the total incomes of daily agricultural labor in the rice region (0.48) and wheat (0.44) region were largely comparable. Thus, considering the agricultural income by different crop regions captures the differential opportunity

cost, the comparison of agricultural incomes by crop indicates the opportunity cost difference is relatively small.

The Plausible Exogeneity Analysis. In this section, we conduct a sensitivity check for potential violations of the perfect exclusion restriction for the instrumental variable analysis. In particular, one underlying concern could be that the distance to the nearest garrison may capture certain direct effects of military units on foot-binding, and the exclusion restriction condition may not exactly hold. Here we conduct the plausible exogeneity analysis developed by Conley et al. (2012), which relaxes the assumption of the perfect exclusion restriction and allows for direct effects of instruments on the outcome variable. In this framework, we consider a generalization of our second-stage equation:

$$(3) \quad Footbinding_{ij} = \alpha + \beta_1 Suitability_{ij} + \beta_2 lnQuota_{ij} + \gamma_1 Dist_{ij} + \gamma_2 Dist_{ij} \times Sparse_{ij} + \kappa Sparse_{ij} + \delta' X_{ij} + \theta_j + \epsilon_{ij}$$

Here γ_1 and γ_2 capture the direct effects of the instruments on foot-binding. The idea of Conley et al. (2012) is that, when we have reasonable knowledge about γ_1 and γ_2, we can obtain IV estimates of β_2 with the following modified equation:

$$(4) \quad \tilde{Footbinding}_{ij} = \alpha + \beta_1 Suitability_{ij} + \beta_2 lnQuota_{ij} + \kappa Sparse_{ij} + \delta' X_{ij} + \theta_j + \epsilon_{ij},$$

$$where \quad \tilde{Footbinding}_{ij} = Footbinding_{ij} - \gamma_1 Dist_{ij} - \gamma_2 Dist_{ij} \times Sparse_{ij}.$$

The next question is how to obtain the estimates of γ_1 and γ_2.[36] In the historical context, we utilize features of the Qing military systems – the Green Standard Army (in Chinese, the *luying*),

[36] For instance, when studying the effects of the historical slave trade on contemporary trust, Nunn and Wantchekon (2011) obtained estimates of the relationship between distance from the coast (i.e., the IV for the slave trade in Africa) and trust, in countries where there was no slave trade. Thus, their strategy estimated the effect of distance to the coast on trust in Asian countries, which would be informative for capturing the direct effect of the IV on trust, under the assumption that the direct effect of distance from the coast on trust in Asia and Africa would be the same.

to study the direct effect of distance to military settlements on foot-binding. As background, after toppling the Ming dynasty in the mid-17^{th} century, the Qing government created the Green Standard Army (GSA) as a new set of military systems among the Han Chinese (Luo, 1984). The GSA took over the military obligations of the previous Ming garrisons, with its main obligation being to oversee the local security of their settlements throughout the provinces. Moreover, the Qing GSA towns remained a key military organization that did not experience the garrison-to-county reforms. Thus, the GSA towns are the closest counterfactual in the military organization compared to the Ming garrisons, and the estimated effects of distance to the GSA towns during the Qing dynasty would capture the direct effect of military units on local foot-binding.

We collect the GSA towns' list from Luo (1984), which included the 54 GSA towns in the early Qing dynasty. Using this spatial information, we calculate a county's distance to the nearest GSA town. To obtain the estimates of $\hat{\gamma_1}$ and $\hat{\gamma_2}$, we conduct a reduced-form regression where foot-binding is explained by the distance to the nearest GSA town and its interaction term with the local population sparseness. With the estimated $\hat{\gamma_1}$ and $\hat{\gamma_2}$, we then calculate the outcome variable ($\widetilde{Footbinding_{ij}}$) in equation (4) and identify β_2. The IV estimates using the plausible exogeneity framework are shown in Table 8. Here, the results regarding both the effects of agricultural suitability and exam quotas remain stable, with comparable magnitudes compared to the baseline 2SLS results. Thus, this set of analysis confirms the significant positive effect of exam quotas on foot-binding when we account for a plausible amount of imperfect exogeneity of the IVs.

[Table 8 about here]

5 Discussion

5.1 Understanding Class Heterogeneity

Given the above analysis has explored the regional variation of foot-binding, here we further examine the class variation of foot-binding following the theory. In particular, as predicted by Proposition 2, foot-binding would be more pervasive in the upper class than in the lower class (i.e., $r_H^* \geq r_L^*$). We explore qualitative historical evidence, which shows that class-specific heterogeneity in foot-binding was salient.

Table 8: Plausible Exogeneity Analysis for IV Analysis

2SLS with plausible exogeneity	**Dependent variable:** $\widetilde{Footbinding}$					
Sample	All			Southern Prov.		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Suitability (rice-wheat)	-0.059***	-0.059***	-0.062***	-0.118***	-0.121***	-0.124***
	(0.022)	(0.022)	(0.024)	(0.011)	(0.013)	(0.018)
LnQuota	0.259***	0.261***	0.305***	0.199***	0.178***	0.197***
	(0.036)	(0.033)	(0.041)	(0.042)	(0.007)	(0.030)
LnPop	-0.004	-0.002	-0.000	0.074	0.087	0.130*
	(0.090)	(0.090)	(0.091)	(0.136)	(0.126)	(0.073)
Population sex ratio		-0.000	-0.001		-0.005	-0.005
		(0.003)	(0.004)		(0.005)	(0.011)
Average household size		-0.011	-0.014		0.035	0.061
		(0.031)	(0.028)		(0.073)	(0.071)
Ln(Strength of Confucianism)			-0.059			0.014
			(0.082)			(0.091)
Ln(Mongolian migration intensity)			-0.008			-0.047***
			(0.018)			(0.014)
Ln(Strengths of Clan)			-0.001			-0.070***
			(0.032)			(0.007)
ln(Land tax pc.1820)			0.002			-0.073
			(0.096)			(0.121)
Observations	148	148	148	72	72	72
R-squared	0.567	0.567	0.542	0.386	0.444	0.517
Prov. FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1, † p<0.15. Standard errors clustered by province are in parentheses. This table conducts the plausible exogeneity analysis developed by Conley et al. (2012), which relaxes the assumption of the perfect exclusion restriction and allows for direct effects of instruments on the outcome variable. The dependent variable is $\widetilde{Footbinding}$, as shown in regression Equation (4). The specific description of the analysis is presented in Section 4.3.2.

The first set of historical evidence is provided by Gao's (1995) documentation regarding the observed heterogeneity of foot-binding prevalence by class. Specifically, Gao (1995) documented that in Shanxi, Hebei, Beijing, Tianjin, Shandong, Henan, Shaanxi, and Gansu, "*while foot-binding among the lower class was quite popular, the upper class women were the most zealous group for foot-binding*". For Jiangsu, Zhejiang, Anhui, Jiangxi, Hunan, Hubei, and Shanghai, he wrote: "*the upper class practiced foot-binding with a greater prevalence than the working class*". In southern Fujian, Gao (1995) mentioned that the renowned and rich families practiced foot-binding more than the lower-class women, reflected by a local ballad: "*the ladies have small feet, while the maids had large feet*". In the Lingnan region, Gao (1995) further denoted that the bureaucratic and renowned families practiced foot-binding, while the working class did not. In summary, the historical documentations reveal that foot-binding was more prevalent among upper-class women than among lower-class women.

In addition to Gao (1995), another collection of historical evidence by Xu (1984) examined the other side of the coin on class heterogeneity – the class heterogeneity regarding the presence of women's natural/unbound feet (in Chinese, *tianzu*). In this regard, Xu (1984) illustrated that lower-class women more commonly had natural (unbound) feet than upper-class women, driven by their roles in labor. Specifically, in provinces including Jiangsu, Anhui, Jiangxi, Zhejiang, Hubei, and Hunan, he wrote: "*women did not bind their feet, and they were involved in agricultural and horticultural works*". In Guangdong and Guangxi, he documented that "*unbound feet were prevalent, and the group of such people practiced agricultural, horticultural, fishing and other working tasks.*" Taken together, the historical evidence has revealed class-specific heterogeneity in foot-binding, which is qualitatively consistent with the theoretical prediction. Moreover, the lower-class women bound their feet to a lesser extent, driven by their roles in labor participation.

5.2 Cross-Cultural Gender Norms

In the main discussion, we have considered foot-binding as a costly beauty practice that women adopted to enhance their competitiveness in the marriage market. In this section, we extend the discussion to understand the similarities and differences between foot-binding and other gender norms across cultures.

First, in addition to foot-binding, there are other costly beauty practices for women, including

corsets, high heels, and plastic surgeries.[37] In the current literature, scholars have often considered costly forms of feminine beauty to have a physical aspect that is seen as helping to improve women's bodily attractiveness. Specifically, regarding high heels, studies have shown that high heels may help exaggerate a woman's gait (Morris et al., 2013). In terms of the historical practice of corset-wearing and tight lacing, scholars have found that corsets helped women attain a slender waist (Steele, 2001). In the case of foot-binding, scholars have also considered foot-binding to have highlighted the motion of women's gait and waist to showcase feminine beauty (Ko, 2005; Levy, 1966). Accordingly, current studies regarding feminine beauty have pointed to the physical attractiveness that women can obtain through these costly body modifications. In this paper, we have focused on how shifted marriage market conditions changed the incentives for beauty practices. To this end, our paper sheds light on the understanding of gender norms and prepares for future exploration of their deeper roots.

In addition to its role as feminine beauty, we further consider other roles of foot-binding in terms of female seclusion. In this aspect, scholars have discussed the effect of foot-binding on female seclusion, since this practice constrained women's physical movements and helped enforce women's seclusion and safeguard the premarital purity and postmarital fidelity that was particularly valued by the husband's family (Greenhalgh, 1977). In this aspect, foot-binding is similar to other practices, including female genital cutting in the Middle East and Africa for restrictions on female sexuality, and female seclusion practices that limit a woman's mobility outside her home (for instance, the Purdah system in India and Pakistan; Papanek, 1971). Foot-binding was thus associated with both aesthetic values as perceived by men and with seclusion value by enhancing women's domesticity. In the current study, while we do not endogenize the preference origins of foot-binding, our paper sheds light on the understanding of gender norms and prepares for future analysis in cross-cultural contexts.

[37] In the Middle East, the demand for women's beauty often takes the form of plastic surgeries. For instance, according to the statistics of the ISAPS (International Society of Aesthetic Plastic Surgery) International Survey on Aesthetic/Cosmetic Surgery (ISAPS, 2013), nose modification (i.e., Rhinoplasty) is a highly popular plastic surgery in Iran.

6 Concluding Remarks

This paper explains the economic motives for foot-binding in historical China by investigating its marriage market and labor incentives. The key trade-off in foot-binding decisions is between better marriage opportunities and labor value distortions in a situation in which better marriage prospects were driven by a male-specific social-mobility shock in China - the Civil Exam System - that reshaped the quality distribution of men to be more heterogeneous than that of women.[38]

Based on the theoretical framework, we corroborate the theory with qualitative historical, folkloric evidence, and empirical analysis. Our empirical analysis uses county-level archival data to show the following: Greater men's exam mobility predicts a higher incidence of foot-binding, while a greater labor-intensive cereal crop suitability predicts less foot-binding prevalence. Overall, we show that the economic forces that shaped foot-binding temporally and regionally are internally consistent. To this end, our study highlights the role of institutional and economic opportunities in shaping costly gender norms, showing that a gender-equal mobility institution is protective against cultural customs that carry high disutility for women.[39]

In the meantime, we also point to two directions for future research. First, while we do not cover the decline of foot-binding in this paper, qualitative evidence has revealed similar economic forces in line with the theory. Regarding labor costs, Bossen and Gates (2017) demonstrated that

[38]It is worth noting that our paper investigates the exam system in historical China, and cross-country comparison (e.g., with Korea or Vietnam, which also adopted the system yet with salient variations) calls for a careful examination of each country's historical and institutional backgrounds. For instance, elite recruitment in historical Vietnam remained highly connection-based, and family status was a crucial determinant. In historical Korea, the examination system was deeply shaped by its unique social structural features, especially the roles of the *yangban* class in society. Within the examination system, the *yangban* class prevailed and dominated exam opportunities (e.g., Yi, 1962; Sohn, 1963; Lee, 1993; Lee, 1996).

[39]Scholars have studied gender asymmetries in economic value, marriage market competition, and institutional opportunities. In particular, the interaction of these aspects of gender asymmetries shapes the dynamics of gender norms. Seminal examples in this regard include the new veiling movement among Muslim women during the 1970s (Carvalho, 2013), dowry escalation in postmodernization India (Anderson, 2003), the changing value and preferences of women's virtue and premarital sex (Mariani, 2012; Fernández-Villaverde et al., 2014), the economic empowerment of women (Doepke and Tertilt, 2009) and the transition of dowries in Bangladesh (Ambrus et al., 2010), among others.

the demise of foot-binding was closely related to the rise of modernized textile industries, which replaced women's sedentary labor (i.e., household handicraft production) with mechanized production, thereby lifting the opportunity cost of foot-binding. Using Taiwan census data on foot-binding in the context of an agricultural shock during the early 20^{th} century, Cheng et al. (2022) found that women unbound their feet in response to the rapid growth of sugarcane cultivation. In addition to the shifting cost aspects, during the early 20^{th} century, girls had increasingly more equalized educational and economic opportunities, and the gender asymmetry in quality distribution decreased. Under these circumstances, we would expect foot-binding to lose its popularity as the cost increased while the benefits shrank.

The second direction of future research is located at the heart of the concept of beauty.[40] While our paper does not endogenize the aesthetic preferences for foot-binding, we take our study as a step toward understanding a more general set of questions on the beauty, of its variation in standards across cultures. We leave these questions open to future scholarly exploration.

[40]There is a rich strand of literature studying the returns to beauty in the labor market and the marriage market (e.g., Hamermesh, 2013).

SUPPORTING INFORMATION

Additional supporting information may be found in the Online Appendix of the article.

Appendix A: Tables and Figures

Table A1: Reasons for Why (not) Foot-binding

Table A2: Sample Counties and Non-Sample Counties

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Figure A4: An Example from the Archive: The Yu County

Figure A5: Crop Suitability and Actual Cropping Pattern

Figure A6: Ming Garrisons and Qing Exam Quotas

Figure A7: Timeline of IV Analysis

Figure A8: Women's Labor and Foot-binding: An Example from the Jiangsu Gazetteer

Appendix B: Discussions of Historical Sources on Foot-binding

Appendix C: Data Appendix

Appendix D: Theory Extensions

Appendix E: Theory Proofs

DATA AVAILABILITY STATEMENT

The data sources used in this study are included in Online Appendix C. The usage of the archives is under the regulation of the Second Historical Archives of China (SHAC): http://shac.net.cn/cdzn/dazlkf/. The data are available as an openICPSR Project, with project number openicpsr-192501, https://www.openicpsr.org/openicpsr/.

7 Supplementary Materials

Appendix A: Tables and Figures

Table A1: Reasons for Why (not) Foot-binding

	Explaining why (or why not) foot-binding		
The Republican Archives	**Women's farm work**	**Beauty and Marriage**	**Tradition and custom**
By foot-binding prevalence:			
Counties: low foot-binding prevalence	90.91%	18.18%	0.00%
Counties: high foot-binding prevalence	4.76%	33.33%	80.95%

Notes: This table presents the qualitative reasons for why (or why not) foot-binding as shown by the Republican archive.

Table A2: Sample Counties and Non-Sample Counties

	Non-sample Counties		Sample Counties		T-test
	N1	**Mean1**	**N2**	**Mean2**	**p-value**
Shandong					
Pop. Density (1393)	17	0.701	67	1.088	0.2
Pop. Density (1580)	17	0.925	67	1.035	0.55
Pop. Density (1630)	17	0.882	67	0.943	0.72
Pop. Density (1650)	17	1.478	67	1.396	0.47
County exam quota	17	13.471	67	15.582	0.01
Hunan					
Pop. Density (1393)	41	-0.516	16	-0.353	0.09
Pop. Density (1580)	41	-0.47	16	-0.33	0.42
Pop. Density (1630)	41	-0.439	16	-0.309	0.53
Pop. Density (1650)	41	-0.62	16	-0.48	0.19
County exam quota	41	14.512	16	15.063	0.7
Chahaer					
Pop. Density (1393)	127	0.201	9	0.268	0.71
Pop. Density (1580)	127	0.264	9	0.463	0.41
Pop. Density (1630)	127	0.326	9	0.317	0.97
Pop. Density (1650)	127	0.032	9	-0.034	0.69
County exam quota	127	16.559	9	15.889	0.63
Yunnan					
Pop. Density (1393)	8	-1.029	56	-0.951	0.45
Pop. Density (1580)	8	-1.194	56	-1.089	0.4
Pop. Density (1630)	8	-1.207	56	-1.099	0.39
Pop. Density (1650)	8	-1.122	56	-1	0.41
County exam quota	8	10.75	56	13.518	0.24

Notes: This table provides a balance check for sample counties and non-sample counties, for each province covered by the Republican archives. The last column provides p-values for the t-test between the two group means. County exam quota is the number of quotas for the *Licensing* exam at the county level. Population density variables include the standardized prefecture-level population density, in the years 1393, 1580, 1630, and 1650, respectively.

Table A3: Distance to Garrison and Pre-adjustment Socioeconomic Characteristics

	Dependent variable: Pre-adjustment socioeconomic characteristics: the Ming and early Qing				
Variables (std.)	**#Households (Bianhu)**	**Pop. Density (1393)**	**Pop. Density (1580)**	**Pop. Density (1630)**	**Pop. Density (1650)**
	(1)	(2)	(3)	(4)	(5)
Distance to Garrison (std.)	0.010	-0.033	-0.009	0.001	-0.021
	(0.063)	(0.036)	(0.085)	(0.102)	(0.077)
Observations	107	148	148	148	148
R-squared	0.296	0.598	0.768	0.759	0.897
Prov. FE	Yes	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by province are in parentheses. The explanatory variable Distance to Garrison is a county's distance to its nearest Ming garrison. The dependent variables of each column are (1) the number of *registered households* (*Bianhu*) of the Ming dynasty, whose unit is one *Li*, and each *Li* includes 110 households, measured at the county level; Columns (2) to (5) are prefecture population density in the years 1393, 1580, 1630, and 1650, respectively. All variables are standardized.

Table A4: Test Selection on Unobservables, Oster(2019)

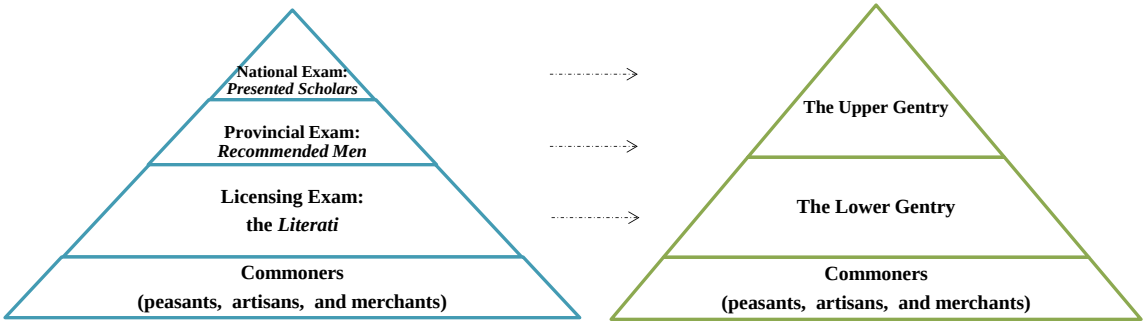
	Dependent Variable: foot-binding prevalence	
	The restricted regression	The controlled regression
	(1)	(2)
LnQuota	0.133*	0.062**
	(0.046)	(0.019)
Observations	148	148
R-squared	0.079	0.344
Controls		
Ln(county population)	Yes	Yes
Province FE.	No	Yes
Relative Suitability (rice-wheat)	No	Yes
Selection on unobservables		
Oster's δ	1.971	

Note: *** p<0.01, ** p<0.05, * p<0.1. This table shows the Oster test results (Oster, 2019) for testing selection on unobservables for the county exam quota variable, where $R_{max} = 1.3 \times R^2_{controlled}$. In Column (1), we explain the outcome variable (i.e., county-level foot-binding prevalence) with county quotas and county population only. In Column 2, we add control variables to the first, where the added control variables include the suitability variable and the province fixed effects. The movements of the coefficient of the quota variable and the R-square terms are included in this table.

Table A5: Agricultural Wages by Crop Regions

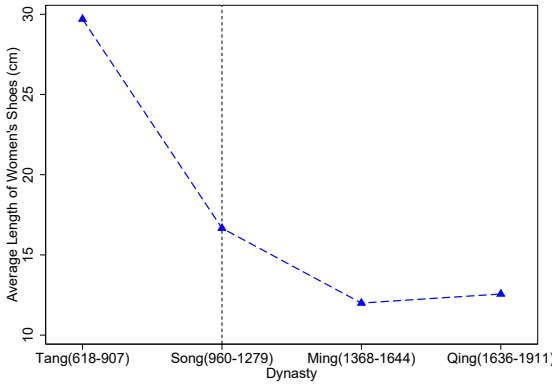
	Daily agricultural labor income			
Agricultural regions	**wages**	**dining subsidies**	**other subsidies**	**total**
Rice region	0.24	0.22	0.02	0.48
Wheat region	0.25	0.19	–	0.44

Source: Buck (1941), Table 16. This table shows daily agricultural wages and subsidies by crop region, as in agricultural surveys in twenty provinces, 155 counties, and 158 regions, from 1929 to 1933. The unit of wages and subsidies is in Silver Dollars.

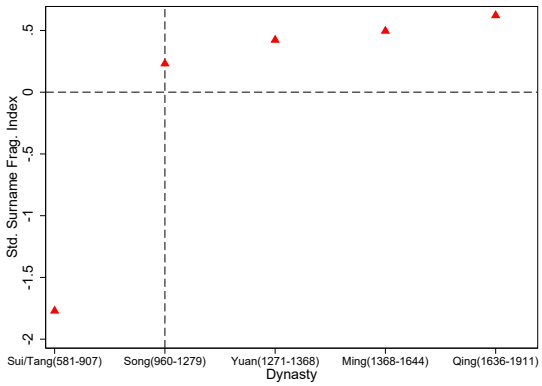


Note: Illustration based on Chang (1955).

Figure A1: The Civil Exam System and the Social Stratification



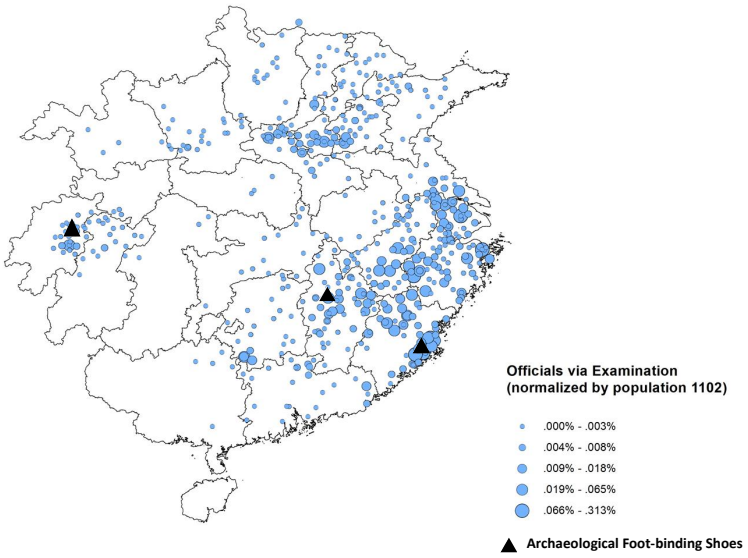
Panel A: Foot-binding: the Metrics of Women's Shoes (Sole's Length)



Panel B: Men's Social Mobility

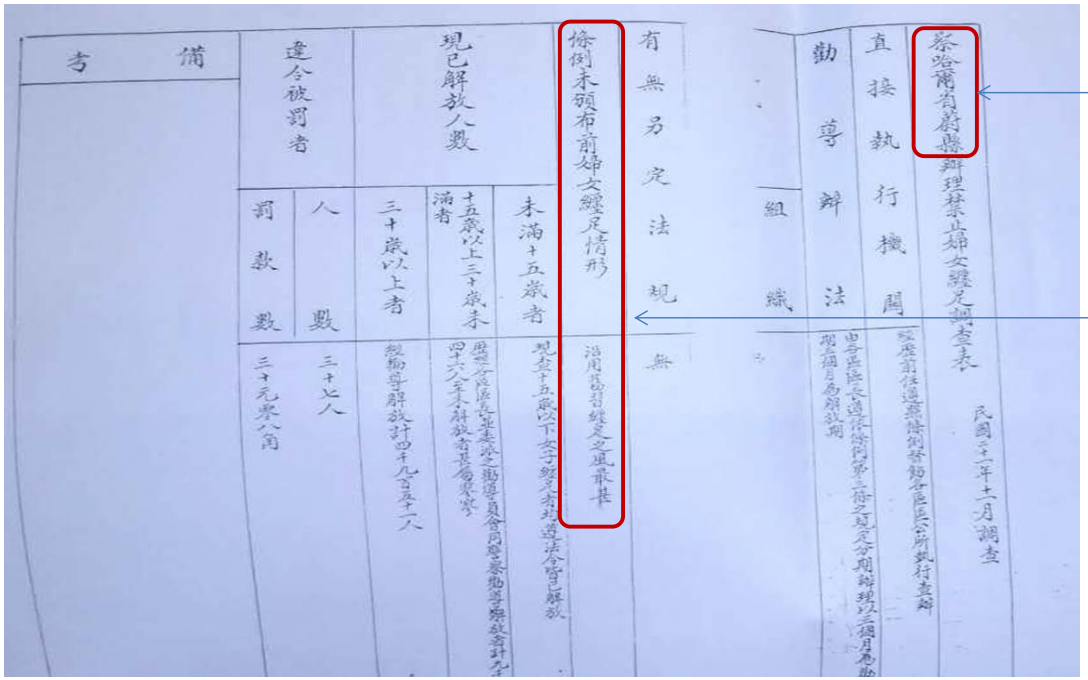
Notes: The upper panel figure illustrates, for each dynasty on the x-axis, the average sole length of women's shoes in centimeters. The information on the shoes is constructed from Ko (2001), where the number of observations in the Tang (the 8^{th} Century), the Song (the 13^{th} Century), the Ming (the 17^{th} Century), the Qing (the 19^{th} Century) dynasties are 1, 3, 1, and 11, respectively. The shoes from the 8^{th} to the 17^{th} century were from archaeological findings, which were either imperial or bureaucratic footwear. The shoes from the 19^{th} century are mostly from private collections and the Bata Shoe Museum in Toronto.
The bottom panel figure shows a dynasty-specific trend in men's social mobility, by constructing a surname fractionalization index using the China Biographical Database Project (CBDB, version 2015-03-18). The sample includes the commonly defined upper class men (i.e., officials, scholars, and other celebrities). We further restrict the sample to those with single-character surnames, as a proxy of Han Chinese ethnicity. At the surname level, a concentrated distribution of surnames captures restricted mobility. Following Alesina et al. (2003), the fractionalization index of surnames is: $Frac_d = 1 - \sum_{i=1}^{N} S_i^2$, where S_i is the share of surname group i in dynasty d.

Figure A2: Foot-binding and Men's Social Mobility



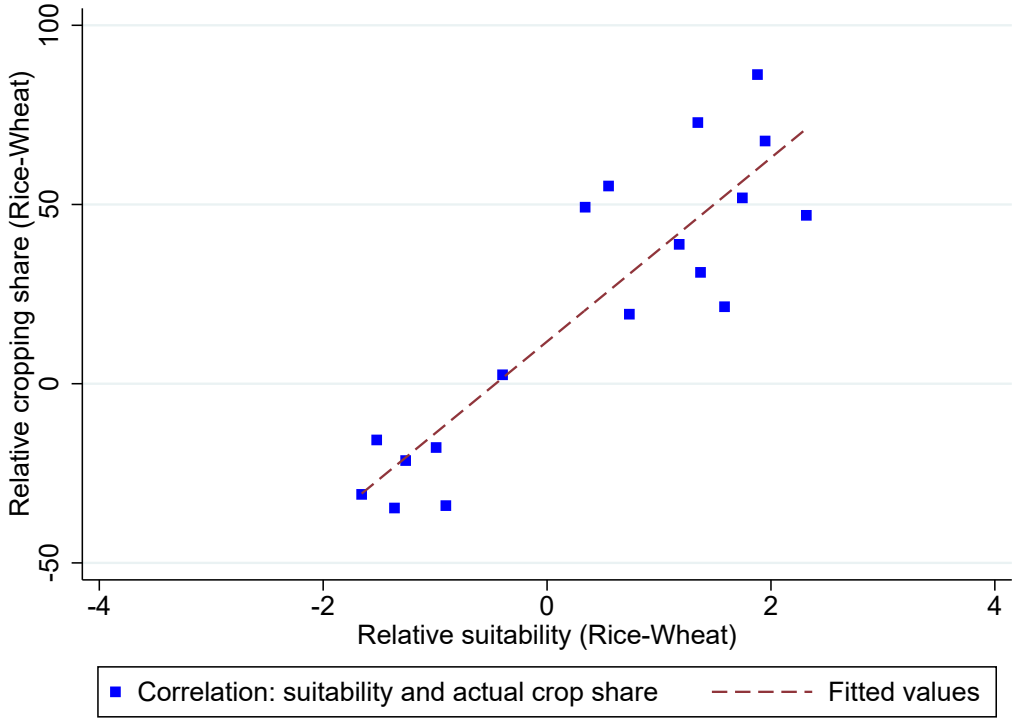
Note: In the map, black triangles denote the birthplaces of the owners of the three pairs of foot-binding shoes, as recorded by Ebrey (1993). The blue circles illustrate the distribution of the number of officials via examinations in the Northern Song dynasty, normalized by the Song dynasty population (Bielenstein, 1987). The base map is from the Harvard World Map, covering Song provinces in 1080.

Figure A3. Locations of Foot-binding Shoes: Archaeological Findings of the Song Dynasty



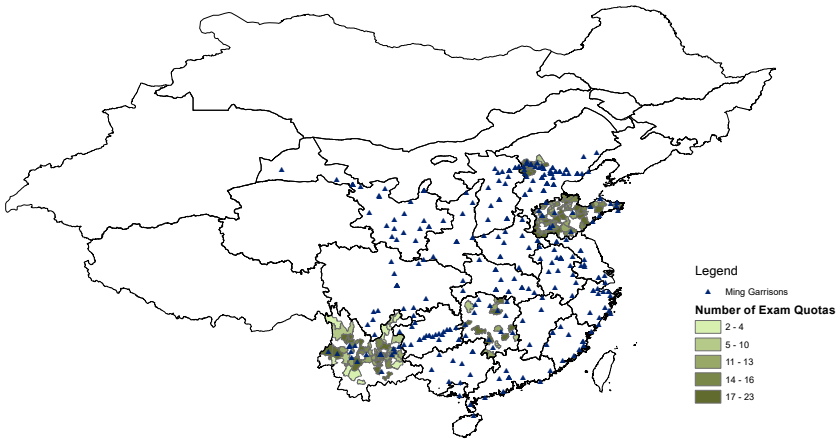
Note: This figure shows an example of the archives: Yu County in Chahaer Province (now part of Hebei Province).

Figure A4: An Example from the Archive: The Yu County



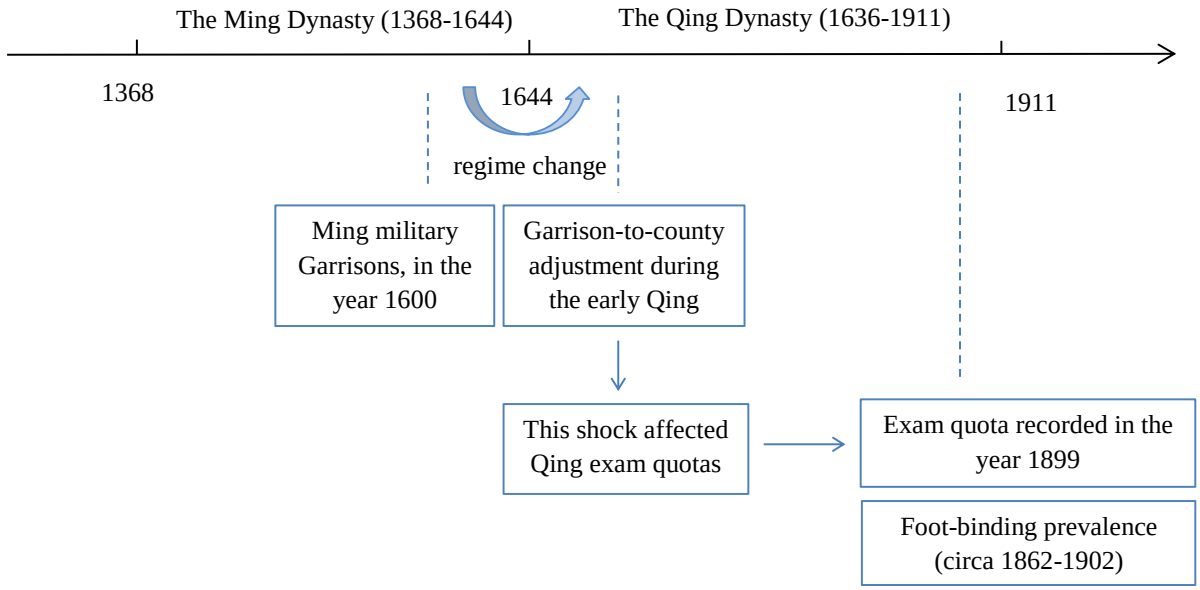
Note: This figure illustrates the correlation between the actual provincial cropping pattern (%Rice - %Wheat) and the relative suitability index (rice - wheat).

Figure A5: Crop Suitability and Actual Cropping Pattern



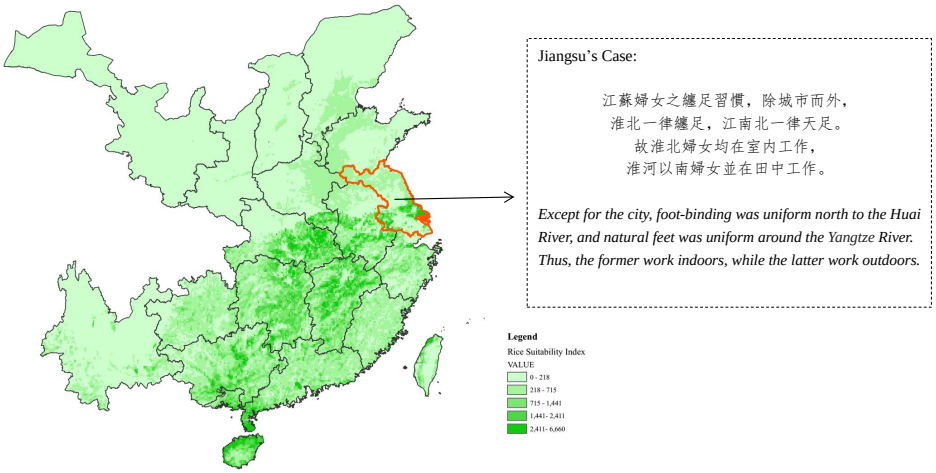
Note: The map shows the locations of the Ming garrisons (Berman, 2017) and the distribution of county exam quotas (Kun et al. 1899). The sample counties are from the Republican archives with information on foot-binding. The base map is CHGIS v5, covering provinces of the Qing dynasty.

Figure A6: Ming Garrisons and Qing Exam Quotas



Notes: This figure summarizes the timeline of the IV strategy using the Qing garrison-to-county shock.

Figure A7: Timeline of IV Analysis



Note: The map shows the geographic distribution of rice suitability from the FAOs GAEZ (Global Agro-Ecological Zones). The source of this qualitative case is the provincial gazetteer of Jiangsu province (Li, 1936). The base map is from CHGIS v4, 1911, covering certain provinces in the Qing dynasty.

Figure A8: Women's Labor and Foot-binding: An Example from the Jiangsu Gazetteer

Appendix B: Discussions of Historical Sources on Foot-binding

In this section, we discuss the features of various historical sources on foot-binding.

The first source on foot-binding we examine is the official records of the Republican government. The foot-binding archives are reports on local foot-binding prevalence submitted by the county-level government from 1931 to 1934, and historians have also used this archive to study foot-binding (e.g., Yang, 2012). This is the primary source used for the empirical analysis in this paper.

Our second historical sources on foot-binding are jottings (in Chinese, *Biji*). The authors of such works are mostly scholars, historians, and philologists (e.g., Yao, 1934; Hu, 1936; Qian, 1969; Xu, 1984). These accounts offer a wider coverage of foot-binding history in terms of temporal scope.

The third source on foot-binding that we examined is from archaeological findings and private collections of women's shoes. The information on women's shoes from private collections is from Ko (2001), which covers information on women's shoes from the 8th to the early 20th century. Regarding the archaeological sources, we digitized the archaeological information of bound-feet shoes during the Song from Ebrey (1993) and collected information about the owners.

Appendix C: Data Appendix

C.1. Variable Definitions and Data Sources

- **The archival foot-binding data:** The data source is government archives. We collected the archival data from the SHAC in July, 2016, where the specific archives that we studied are stored under classification Number.12 (6) in the system (in Chinese, Quanzonghao).[41] The foot-binding surveys that we use were conducted by the Ministry of the Interior, the Republic of China, and historians have also used this archive to study foot-binding (e.g., Yang, 2012). To digitize the information of counties, we use the input polygon map from CHGIS v5, 1911. Appendix Figure A4 shows an example from the archive: the Yu county, and the data appendix C includes the specific archival data for each county.

- **The agricultural suitability index:** The data source of this variable is the FAO GAEZ (Global Agro-Ecological Zones) dataset, and we consider the condition of the rain-fed intermediate input level. The agricultural suitability index has global coverage, measured at a disaggregated geographic level, with a GIS raster map of the cell's size of 5 arc-minute by 5 arc-minute. We calculate the average suitability index for rice and wheat for the counties in our sample, using ArcGIS. The input polygon map for counties is from CHGIS v5, and the input raster maps of the agricultural suitability index for the crops are from the GAEZ: https://gaez.fao.org/pages/data-viewer. In the empirical analysis, we use the relative agricultural suitability index of rice to wheat, which is defined as the difference in standardized suitability measures of rice to wheat.

- **Data on county exam quotas.** The data on county-level exam quotas are from Kun et al. (1899), Imperially Established Institutes and Laws of the Great Qing Dynasty (in Chinese: Da Qing Hui Dian Shi Li), specifically in Volumes 371-380.

- **The spatial information of counties:** The county-level map is from the CHGIS v5 county polygon map in 1911: https://chgis.fairbank.fas.harvard.edu/data/chgis/v5/.

[41] Please refer to the information from the SHAC for detailed regulations on how to obtain access to the archives: http://shac.net.cn/cdzn/dazlkf/.

- **The spatial information of garrisons:** The spatial information for the Ming garrisons is from Berman (2017), Harvard Dataverse, V1: https://doi.org/10.7910/DVN/5RUXK8. The spatial information for the Qing Green Standard Army towns is from Luo (1984), for which we digitize the geographic location of each town.

- **The county-level demographic variables:** The county-level demographic variables include county population, county population sex ratio, and average household size, which we collected from the Yearbook of Domestic Affairs of Republican China in 1931.

- **The prefecture-level variables:** The variables at the prefecture-level include population density in 1393, 1580, 1630, and 1650 are drawn from Ge (2000). The land tax per capita in 1820 is from Land tax p.c. 1820. The strength of the Confucianism measure follows Kung and Ma (2014), which is proxied by the number of chaste women during the Ming and Qing dynasty, where the data source is from The Jiaqing Revision of a Unified Geography (1843). The strength of clan measure follows Greif and Tabellini (2017), which is proxied by the average number of genealogies, where the data source is from Wang (2008). The Mongolian migration intensity since the Yuan dynasty is from Wu and Cao (1997).

- **Other data on foot-binding.** In Figure 1, the locations for the Bound Feet Beauty Contest (Sai Zu Hui, in Chinese) are from Zhang (2015), Nagao (1973), and Yao (1934). The province-level foot-binding prevalence is from Yao (1934), Qian (1969), Xu (1984), and Turner (1997). In Appendix Figure A2, the metric of Women's Shoes (Sole Length) is from Ko (2001). In Appendix Figure A3, the archaeological location (i.e., birthplaces of the owners) of the three pairs of foot-binding shoes are from Ebrey (1993).

- **Calculation of surname fractionalization index.** To capture dynasty-specific trends in men's social mobility, we construct a surname fractionalization index using the China Biographical Database Project (CBDB, version 2015-03-18). The sample includes the commonly defined upper class men (i.e., officials, scholars, and other celebrities). We restrict the sample to those with single-character surnames, as a proxy of Han Chinese ethnicity. Following Alesina et al. (2003), the fractionalization index of surnames is:

$Frac_d = 1 - \sum_{i=1}^{N} S_i^2$, where S_i is the share of surname group i in dynasty d.

C.2. The Archival Data Appendix

This table lists the foot-binding prevalence data covering 148 counties in our analysis.

Table C1: Data Appendix

ID	Province	County name	Foot-binding prevalence
1	Hunan	Zhijiang Xian	high prevalence
2	Hunan	Anxiang Xian	high prevalence
3	Hunan	Longyang Xian	high prevalence
4	Hunan	Huarong Xian	high prevalence
5	Hunan	You Xian	low prevalence
6	Hunan	Yiyang Xian	low prevalence
7	Hunan	Ling Xian	low prevalence
8	Hunan	Leiyang Xian	high prevalence
9	Hunan	Hengyang Xian	low prevalence
10	Hunan	Jiahe Xian	high prevalence
11	Hunan	Xintian Xian	low prevalence
12	Hunan	Jianghua Xian	low prevalence
13	Hunan	Yongming Xian	low prevalence
14	Hunan	Lingling Xian	low prevalence
15	Hunan	Wugang Zhou	low prevalence
16	Hunan	Yongshun Xian	low prevalence
17	Zhili	Xuanhua Xian	high prevalence
18	Zhili	Bao'an Zhou	high prevalence
19	Zhili	Yanqing Zhou	high prevalence
20	Zhili	Xining Xian	high prevalence
21	Zhili	Huai'an Xian	high prevalence
22	Zhili	Wei Zhou	high prevalence
23	Zhili	Wanquan Xian	high prevalence
24	Zhili	Longmen Xian	high prevalence
25	Zhili	Chicheng Xian	high prevalence
26	Shangdong	Zhangqiu Xian	high prevalence
27	Shangdong	Changshan Xian	high prevalence
28	Shangdong	Xincheng Xian	high prevalence
29	Shangdong	Qihe Xian	high prevalence
30	Shangdong	Qidong Xian	high prevalence
31	Shangdong	Yucheng Xian	high prevalence
32	Shangdong	De Zhou	high prevalence
33	Shangdong	Deping Xian	high prevalence
34	Shangdong	Linyi Xian	high prevalence
35	Shangdong	Changqing Xian	high prevalence
36	Shangdong	Ling Xian	high prevalence
37	Shangdong	Tai'an Xian	high prevalence
38	Shangdong	Dongping Zhou	high prevalence
39	Shangdong	Dong'ou Xian	high prevalence
40	Shangdong	Laiwu Xian	high prevalence
41	Shangdong	Yangxin Xian	high prevalence
42	Shangdong	Bin Zhou	high prevalence
43	Shangdong	Lijin Xian	high prevalence
44	Shangdong	Qingcheng Xian	high prevalence
45	Shangdong	Shanghe Xian	high prevalence

Table C1 (continued): Data Appendix

ID	Province	County name	Foot-binding prevalence
46	Shangdong	Ziyang Xian	high prevalence
47	Shangdong	Qufu Xian	high prevalence
48	Shangdong	Ningyang Xian	high prevalence
49	Shangdong	Zou Xian	high prevalence
50	Shangdong	Teng Xian	high prevalence
51	Shangdong	Shang Xian	high prevalence
52	Shangdong	Yanggu Xian	high prevalence
53	Shangdong	Shouzhang Xian	high prevalence
54	Shangdong	Jinxiang Xian	high prevalence
55	Shangdong	Yutai Xian	high prevalence
56	Shangdong	Lanshan Xian	high prevalence
57	Shangdong	Fei Xian	high prevalence
58	Shangdong	Mengyin Xian	high prevalence
59	Shangdong	Rizhao Xian	high prevalence
60	Shangdong	Chaocheng Xian	high prevalence
61	Shangdong	Guancheng Xian	high prevalence
62	Shangdong	Fan Xian	high prevalence
63	Shangdong	Pu Zhou	high prevalence
64	Shangdong	Chengwu Xian	high prevalence
65	Shangdong	Dan Xian	high prevalence
66	Shangdong	Tangyi Xian	high prevalence
67	Shangdong	Linzi Xian	high prevalence
68	Shangdong	Boxing Xian	high prevalence
69	Shangdong	Gaoyuan Xian	high prevalence
70	Shangdong	Shouguang Xian	high prevalence
71	Shangdong	Lin Xian	high prevalence
72	Shangdong	Anqiu Xian	high prevalence
73	Shangdong	Zhucheng Xian	high prevalence
74	Shangdong	Guantao Xian	high prevalence
75	Shangdong	En Xian	high prevalence
76	Shangdong	Wucheng Xian	high prevalence
77	Shangdong	Xiajin Xian	high prevalence
78	Shangdong	Qixia Xian	high prevalence
79	Shangdong	Zhaoyuan Xian	high prevalence
80	Shangdong	Rongcheng Xian	high prevalence
81	Shangdong	Ye Xian	high prevalence
82	Shangdong	Changle Xian	high prevalence
83	Shangdong	Wei Xian	high prevalence
84	Shangdong	Changyi Xian	high prevalence
85	Shangdong	Laiyang Xian	high prevalence
86	Shangdong	Haifeng Xian	high prevalence
87	Shangdong	Zhanhua Xian	high prevalence
88	Shangdong	Wendeng Xian	high prevalence
89	Shangdong	Qiu Xian	high prevalence
90	Shangdong	Heze Xian	high prevalence

Table C1 (continued): Data Appendix

ID	Province	County name	Foot-binding prevalence
91	Shangdong	Dingtao Xian	high prevalence
92	Shangdong	Cao Xian	high prevalence
93	Yunnan	Jingdong Xian	high prevalence
94	Yunnan	Weixi Ting	low prevalence
95	Yunnan	Jianchuan Zhou	low prevalence
96	Yunnan	Heqing Zhou	low prevalence
97	Yunnan	Yongping Xian	high prevalence
98	Yunnan	Weiyuan Ting	low prevalence
99	Yunnan	Yun Zhou	high prevalence
100	Yunnan	Shunning Xian	low prevalence
101	Yunnan	Mianning Ting	high prevalence
102	Yunnan	Zhennan Zhou	high prevalence
103	Yunnan	Yuanmou Xian	high prevalence
104	Yunnan	Anning Zhou	high prevalence
105	Yunnan	Luoci Xian	low prevalence
106	Yunnan	Fumin Xian	high prevalence
107	Yunnan	Yimen Xian	high prevalence
108	Yunnan	Xi'e Xian	low prevalence
109	Yunnan	Xinxing Zhou	high prevalence
110	Yunnan	Hexi Xian	high prevalence
111	Yunnan	Tonghai Xian	high prevalence
112	Yunnan	Shiping Zhou	high prevalence
113	Yunnan	Nan'an Zhou	high prevalence
114	Yunnan	Simao Ting	low prevalence
115	Yunnan	Xundian Zhou	high prevalence
116	Yunnan	Luquan Xian	low prevalence
117	Yunnan	Ludian Ting	high prevalence
118	Yunnan	Xuanwei Zhou	high prevalence
119	Yunnan	Nanning Xian	high prevalence
120	Yunnan	Lunan Zhou	high prevalence
121	Yunnan	Yiliang Xian	high prevalence
122	Yunnan	Chenggong Xian	high prevalence
123	Yunnan	Jinning Zhou	high prevalence
124	Yunnan	Heyang Xian	high prevalence
125	Yunnan	Jiangchuan Xian	low prevalence
126	Yunnan	Luliang Zhou	high prevalence
127	Yunnan	Shizong Xian	high prevalence
128	Yunnan	Luoping Zhou	high prevalence
129	Yunnan	Mile Xian	high prevalence
130	Yunnan	Yongshan Xian	low prevalence
131	Yunnan	Liangqiong Xian	low prevalence
132	Yunnan	Dengchuan Zhou	low prevalence
133	Yunnan	Malong Zhou	high prevalence
134	Yunnan	Binchuan Zhou	low prevalence
135	Yunnan	Kunming Xian	high prevalence
136	Yunnan	kunyang Zhou	low prevalence
137	Yunnan	Daguan Ting	low prevalence
138	Yunnan	Yao Zhou	high prevalence
139	Yunnan	Guangtong Xian	low prevalence
140	Yunnan	Dingyuan Xian	low prevalence
141	Yunnan	Mengzi Xian	high prevalence
142	Yunnan	Qiubei Xian	high prevalence
143	Yunnan	Lijiang Xian	low prevalence
144	Yunnan	Zhao Zhou	low prevalence
145	Yunnan	Qiaojia Ting	high prevalence
146	Yunnan	Baoshan Xian	high prevalence
147	Yunnan	Longling Ting	high prevalence
148	Yunnan	Tengyue Ting	high prevalence

Notes: This table presents the foot-binding data for each county in our sample. The counties correspond to the input map from CHGIS v5, 1911.

Appendix D: Theory Extensions

D.1. Extension with Social Motives

Setup. In this section, we present a more comprehensive model incorporating the social motives of foot-binding. Specifically, the first new element is the intensive margin variation of foot-binding, which relaxes the binary assumption in the baseline model and allows for foot-binding as a continuous decision. The second new element that we add is the strength of social conformity, considering the fact that foot-binding was also a strong social norm, as a customary norm to which women strove to conform. Third, we also add disutility of foot-binding to account for parental altruism towards daughters. We refrain from providing separate models which progressively add the new element for qualitatively similar results and concision.

We introduce a continuous foot-binding choice, $B_j \in \left\{0, \left[\underline{B}, \overline{B}\right]\right\}$, that delivers a foot-binding benefit up to $\overline{B} = 1$, to be consistent with the baseline model, at cost $c(B_j) = \eta B_j$.[42] The lower bound comes from the fact that bound feet are not visible unless the feet are deformed to an observable extent, so that $\underline{B} > 0$. The upper bound comes from the fact that there exists a physical limit of deformation.

Meanwhile, the adoption of foot-binding carries social motives. In particular, when foot-binding served as a norm, deviation from this norm could induce social punishment. The utility functions are as follows:

$$V_i^m = v\left(q_i, q_j\right) + \left(q_i - q_0\right) B_j - \beta \frac{B_j}{F_i}$$

$$V_j^w = v\left(q_i, q_j\right) - \beta \frac{B_j}{F_j} - \eta B_j - \underbrace{\gamma \left(\mathbb{I}_{B_j} - 1\right)^2}_{social\ \ conformity}$$

As the last term of V_j^w, γ measures the strength of social conformity, in which we adopt the following assumption. $\mathbb{I}_{B_j} = 1$ when $B_j \in \left[\underline{B}, \overline{B}\right]$, and is zero otherwise, to reflect that the social conformity enforces only the extensive margin, instead of the intensive margin, because the details of the feet are usually hard to be observed as closely by the public. To proceed with the analysis,

[42] The results are qualitatively the same, if we assume a quadratic cost function.

we still adopt Assumption 1 and Assumption 2, and introduce Assumption 3* such that marry-up through minimal foot-binding is beneficial.

Assumption 3*. $\underline{B} < \underline{B}^*$, where $\delta(1-p)(H-L)L - \frac{\beta \underline{B}^*}{L} - \eta \underline{B}^* + \gamma = 0$.

Next, we consider the pre-Song and post-Song periods, respectively. In the pre-Song era, $\gamma = 0$, and by the same reasoning of Proposition 1, there are no cross-class marriages and no foot-binding is adopted due to family-level marital complementarity.

In the post-Song era, $\gamma > 0$. With continuous foot-binding, brides differentiate themselves more precisely in the marriage market. Given the heterogeneous composition of men's quality within class, there will be a finer gradient of foot-binding choices. Specifically, for upper class women, μp choose a greater foot-binding intensity $\overline{B_H}$, and the rest $\mu(1-p)$ choose a lower intensity $\underline{B_H}$, where $\overline{B_H} \geq \underline{B_H}$. Among lower class women, $p(1-\mu)$ choose a greater intensity $\overline{B_L}$, and $(1-\mu)(1-p)$ choose a lower intensity$\underline{B_L}$, where $\overline{B_L} \geq \underline{B_L}$.[43] The mechanism that generates more foot-binding women is social conformity pressure, since certain amount of either class of women who fail to marry up also have to bind their feet, to the extent that they are indifferent between foot-binding or not. To summarize, we have the following proposition:

Proposition 3. *There are four levels of foot-binding choices. For upper class women, μp choose foot-binding intensity $\overline{B_H}$, $\mu(1-p)$ choose intensity $\underline{B_H}$, where $\overline{B_H} \geq \underline{B_H}$. For lower class women, $p(1-\mu)$ choose intensity $\overline{B_L}$, $(1-\mu)(1-p)$ choose intensity $\underline{B_L}$, where $\overline{B_L} \geq \underline{B_L}$. When social conformity is sufficiently strong, that is, when $\gamma \geq \overline{\gamma}$, foot-binding intensities are sorted top-down: $\overline{B_H} \geq \underline{B_H} \geq \overline{B_L} \geq \underline{B_L} \geq 0$.*

Proof. See Appendix of proofs. □

To compare the extended model with the baseline, we have the following corollary:

Corollary 2. *The average foot-binding intensity is weakly increasing in the proportion of high-ability men p, weakly decreasing in β, and weakly increasing in γ.*

Proof. See Appendix of proofs. □

[43] In both classes, we assume when a woman is indifferent between binding her feet or not, she breaks the tie by binding her feet.

As Corollary 2 shows, the results from the baseline model remain robust in the extension. Foot-binding is pervasive and is positive-assortative in social classes, when social pressure is high. Moreover, Corollary 2 delivers two additional insights. First, since the Song dynasty, the Confucian doctrine enforced stricter restrictions on individual behavior, especially on women's obedience and conformity to social norms (e.g., Blake, 1994). As predicted by the comparative statics of γ, when social pressure on foot-binding increased over time, foot-binding also intensified. This is consistent with the historical evidence that the deformation practice increased over time. Second, the comparative statics of β point to higher foot-binding intensity when labor distortions are more moderate. Again, this echoes the historical case of the increasing value of women's handicraft work. Specifically, cotton handicraft products had high economic value since the 14^{th} century (e.g., Xue, 2020), and the estimated ratios of female handicraft labor to male contract agricultural labor were high, as estimated to be 80% by Li (1996) and 130% by Wang (1988). The cotton shock lowered the opportunity cost of foot-binding (i.e., a smaller β), which could also have contributed to pervasive foot-binding among the lower class.

In summary, Corollary 2 shows that, with social conformity, foot-binding intensifies due to increased social pressures and decreased labor distortions. The extension thus accounts for the historical evidence that women differentiated themselves more precisely and that the deformation increased over time.

D.2: Extension with Multiple Competition Tools

In this section, we further explore the case of multiple investment tools, including offering a higher-quality bride and offering a larger amount of marriage payments.[44] As discussed in the paper, foot-binding has helped to enhance women's attraction in the marriage market, indicating a higher quality of the bride in feminine values. At the same time, if we consider the marriage payment as an additional type of competition instrument, the dowries the wealth transfers from the bride's family to the post-marital household had been salient in historical China. In the literature, there have been two natures of the dowry, where it has served as a premortem bequest to daughters (Zhang and Chan, 1999; Botticini and Siow, 2003) and as a marriage payment

[44]The existing literature often employs a transferable utility framework to study dowries. However, in this section, we follow the baseline model and continue to use a non-transferable utility framework for consistency.

(Becker, 1991; Rao, 1993; Anderson, 2003, 2007). In particular, Anderson and Bidner (2015) analyzed the dual role of the dowry, and considered two instruments of the bridal parents to compete for grooms: offering a larger marriage payment and offering a higher quality bride in human capital. In this paper, given our focus is not on the dual role of the dowries, we zoom in on its marriage payment role to highlight how the premarital investment decisions, combining foot-binding and dowries, are shaped by changes in mobility asymmetry.

To begin with, as in the first extension, we introduce a continuous foot-binding choice, $B_j \in \left\{0, \left[\underline{B}, \overline{B}\right]\right\}$, that delivers a foot-binding benefit $z(B_j)$up to $\overline{B} = 1$, to be consistent with the baseline model, at the cost $c(B_j) = \eta B_j$.[45] Intuitively, $z^{'} > 0, z^{''} < 0$. The lower bound comes from the fact that bound feet are not visible unless the feet are deformed to an observable extent, so that $\underline{B} > 0$. The upper bound comes from the fact that there exists a physical limit to deformation. Moreover, the continuous choice represents the post-childhood efforts in perfecting the value of foot-binding, in terms of shoe designing, and foot-health maintenance. This allows for adjustment in the premarital investment after the early-childhood commitment, which makes foot-binding a flexible substitute for dowry, and vice versa. Therefore, when dowry payments are feasible, we revise the utility functions as follows:

$$V_i^m = v(q_i, q_j) + (q_i - q_0) z(B_j) - \beta \frac{B_j}{F_i} + u(D_j)$$

$$V_j^w = v(q_i, q_j) - \beta \frac{B_j}{F_j} - \eta B_j - D_j$$

In the expressions, D_j denotes the continuous dowry payments from the bride's family to the groom's, $D_j \geq 0$. In particular, since we highlight the marrying-up incentives for the bridal family - thus, the groom's families usually have higher social status, we assume the received dowry payments by the groom's family feature diminishing marginal returns, that $u^{'} > 0$, $u^{''} < 0$.[46] For conciseness, we consider the post-Song case only. The marriage market equilibrium under

[45] The results are qualitatively the same if we assume a quadratic cost function.

[46] The dowry payments from the bride's family are assumed to be linear. The results are qualitatively the same if we assume a more generic form. We adopt the linearity assumption to keep it concise and consistent with the linear costs of foot-binding.

multiple premarital investments specifies a set of foot-binding intensities and dowry payments $\left\{B_H^D, B_L^D, D_H^*, D_L^*\right\}$ for the upper class and the lower class, respectively, that no woman ends up in better marriage if they choose a different foot-binding-dowry pair. We, therefore, have the following proposition:

Proposition 4. *In the post-Exam era, with multiple premarital investment tools, there are two levels of investment choices. For upper class women, μp choose foot-binding intensity B_H^D and D_H^*. For lower class women, μp choose foot-binding intensity B_L^D and D_L^*. In particular, the foot-binding intensities satisfy $B_H^D \geq B_L^D \geq 0$.*

Proof. Similar to the baseline model, women's families compete in the marriage market until they are indifferent between making further investments, and there is no cross-class marriage due to marriage value complementarity. Denote the premarital investment package from a bride's family as $X\left(B_j, D_j\right) = \beta \frac{B_j}{F_j} + \eta B_j + D_j$. Since there are no cross-class marriages, for the upper class, $X_H\left(B_j, D_j\right) = \beta \frac{B_j}{H} + \eta B_j + D_j$, while the value of such investment for the groom's family is $\hat{X_H}\left(B_j, D_j\right) = \left(q_i - q_0\right) z\left(B_j\right) - \beta \frac{B_j}{H} + u\left(D_j\right)$.
In equilibrium, the bargaining on packages leads to one clustered package choice that absorbs the marry-up benefits. That is, in the upper class,

$$\underbrace{v(q_1, H) - X_H}_{marry-up} = \underbrace{v(q_2, H)}_{non-investment}$$

Therefore, for bridal families, they strive to provide the highest marriage benefits for the grooms, given the budget constraint:

$$\max_{B_H, D_H} \hat{X_H}\left(B_H, D_H\right)$$
$$s.t. X_H = v(q_1, H) - v(q_2, H)$$

Inserting the expressions of the value functions, we have:

$$\max_{B_H, D_H} Q_H(B_H) + u(D_H)$$
$$s.t. \left(\frac{\beta}{H} + \eta\right) B_H + D_H = \Delta_H$$

where $Q_H(B_H) = (q_1 - q_0) z(B_H) - \beta \frac{B_H}{H}$, and $\Delta_H = \left(\frac{H}{L} - 1\right) \delta H^2$

We focus on interior solutions, where bridal families adopt positive foot-binding and offer positive dowries in marriage competitions. In this case, the equilibrium foot-binding intensity B_H^D and equilibrium dowry D_H^* are such that the marginal benefits of either tool are equivalent. Therefore in equilibrium:

$$\frac{Q_H'\left(B_H^D\right)}{\left(\frac{\beta}{H} + \eta\right)} = u'(D_H^*)$$

$$\left(\frac{\beta}{H} + \eta\right) B_H^D + D_H^* = \Delta_H$$

Similarly, for the lower class, the equilibrium dowry, and foot-binding intensity is determined by the following optimization problem:

$$\max_{B_L, D_L} Q_L(B_L) + u(D_L)$$
$$s.t. \left(\frac{\beta}{L} + \eta\right) B_L + D_L = \Delta_L$$

where$Q_L(B_L) = (q_3 - q_0) z(B_L) - \beta \frac{B_L}{L}$, and $\Delta_L = \left(\frac{H}{L} - 1\right) \delta L^2$

Likewise, in equilibrium:

$$\frac{Q_L'\left(B_L^D\right)}{\left(\frac{\beta}{L} + \eta\right)} = u'(D_L^*)$$

$$\left(\frac{\beta}{L} + \eta\right) B_L^D + D_L^* = \Delta_L$$

To complete the proof, suppose that $B_H^D < B_L^D$. Then comparing the two binding "budget

constraints", and that $\frac{\beta}{H}+\eta<\frac{\beta}{L}+\eta$, we have: $D_H^*>D_L^*$. Next, given $u^{'}>0$, $u^{''}<0$, we have: $u^{'}\left(D_H^*\right)<u^{'}\left(D_L^*\right)$, thus $\frac{Q_H^{'}\left(B_H^D\right)}{\left(\frac{\beta}{H}+\eta\right)}<\frac{Q_L^{'}\left(B_L^D\right)}{\left(\frac{\beta}{L}+\eta\right)}$. This then gives: $Q_H^{'}\left(B_H^D\right)<Q_L^{'}\left(B_L^D\right)$. Furthermore, it breaks down to: $\left(q_1-q_0\right)z^{'}\left(B_H^D\right)-\frac{\beta}{H}<\left(q_3-q_0\right)z^{'}\left(B_L^D\right)-\frac{\beta}{L}$, from which we conclude: $z^{'}\left(B_H^D\right)<z^{'}\left(B_L^D\right)$. However, as $z^{'}>0, z^{''}<0$, we have $B_H^D>B_L^D$, which is a contradiction. Therefore, in equilibrium, $B_H^D\geq B_L^D$. □

As shown, the qualitative result of the benchmark remains the same under multiple premarital investment tools. Moreover, the results for dowry intensities depend on the shape of the value functions u and z. In particular, when the curvature of z is sufficiently large, we have $\frac{Q_H^{'}\left(B_H^D\right)}{\left(\frac{\beta}{H}+\eta\right)}<\frac{Q_L^{'}\left(B_L^D\right)}{\left(\frac{\beta}{L}+\eta\right)}$, therefore $D_H^*>D_L^*$. In the context of reality, a high curvature of z indicates a low marginal utility of foot-binding for additional decorations. In this scenario, we would observe the escalation in both foot-binding and dowry, which is also consistent with historical evidence in premarital investment during the post-Song period (e.g. Ebrey, 1993, Guo, 2000).

Appendix E: Theory Proofs

Proof for Proposition 1.

Proof. Consider a positive assortative matching in family status. An upper-class woman has no incentives to pursue marrying up because she has already married an upper class man. A lower-class woman, on the other hand, may consider foot-binding to attract an upper class man. With cross-class marriage, the marrying-down loss for an upper-class man is $H(H-L)+\frac{\beta}{H}$, while the gain by marrying a lower-class foot-binding wife is $(H-q_0)$. Based on marital complementarity and Assumption 1, it is impossible for the lower-class woman to compensate for the marriage down loss from an upper class man by foot-binding. Consequently, no one wants to deviate, and the original matching is stable.

Now consider an alternative matching that is not positive assortative. Then there exist at least two pairs of cross-class married couples. By the same reasoning as above, the upper class man and the upper-class woman in the two couples form a blocking pair. Thus all stable matchings have to be positive assortative, and unique in social classes.

□

Proof for Proposition 2.

Proof. First, we examine whether there could be any cross-class marriages. Cross-class marriages may take place when a lower-class woman with bound feet aims to marry up to men with either quality q_1 or q_2. Similar to the proof of Proposition 1, with cross-class marriage, the marrying-down loss for an upper class man with quality q_1 and q_2 is larger than the gain by marrying a lower-class foot-binding wife. Based on marital complementarity and Assumption 1, it is impossible for the lower-class woman to compensate for the marriage down loss from an upper class man by foot-binding. Consequently, there is no cross-class marriage.

Next, we solve for r_H, the proportion of foot-binding women in the upper class. Starting from the case where no one binds feet, the expected marriage payoff is $U_0^H = pH\left((1-\delta)H + \frac{\delta}{L}H^2\right) + (1-p)H^2$. Suppose someone does bind feet, she can ensure the marriage to a man with quality q_1, which gives payoff $U_1^H = H\left((1-\delta)H + \frac{\delta}{L}H^2\right) - \frac{\beta}{H}$.

$U_1^H - U_0^H = (1-p)\delta H^2\left(\frac{H}{L} - 1\right) - \frac{\beta}{H}$. Based on Assumption 2, $U_1 - U_0 > 0$, so that women retain from matching randomly, and there will be some woman who binds feet to marry up. In equilibrium, an upper class woman is indifferent between foot-binding or not:

$$\underbrace{\frac{p}{r_H}\left[v(q_1,H) - \frac{\beta}{H}\right]}_{marry-up} + \underbrace{\left(1 - \frac{p}{r_H}\right)\left[v(q_2,H) - \frac{\beta}{H}\right]}_{marry-down} = \underbrace{v(q_2,H)}_{non-FB}$$

Re-arrange the terms, we get: $r_H = \frac{\delta p H^3}{\beta}\left(\frac{H}{L} - 1\right)$. As the proportion is bounded by 1, the actual adoption rate should be $r_H^* = \min\{r_H, 1\}$.

Similarly, we solve for r_L. In equilibrium, a lower class woman is indifferent between foot-binding or not. That is,

$$\underbrace{\frac{p}{r_L}\left[v(q_3,L) - \frac{\beta}{L}\right]}_{marry-up} + \underbrace{\left(1 - \frac{p}{r_L}\right)\left[v(q_4,L) - \frac{\beta}{L}\right]}_{marry-down} = \underbrace{v(q_4,L)}_{non-FB}$$

Re-arrange the terms to get: $r_L = \frac{\delta p L^3}{\beta}\left(\frac{H}{L} - 1\right)$. Of course, the actual adoption rate should be $r_L^* = \min\{r_L, 1\}$.

□

Proof for Proposition 3.

Proof. First, we check whether cross-class marriage can take place in equilibrium. Similar to the proof of Proposition 1, with cross-class marriage, the marry-down loss for an upper class man with quality q_1 and q_2 is larger than the status gain by marrying a lower-class foot-binding wife. Based on marital complementarity and Assumption 1, it is impossible for the lower-class woman to compensate for the marriage down loss from an upper class man by foot-binding.
Consequently, cross-class marriage cannot take place in equilibrium.
We start from the bottom to construct the equilibrium. Assume all solutions are interior at the moment.
The lower-class women who marry men with quality q_4 are indifferent between foot-binding or not, that is:

$$L^2 - \beta\frac{\underline{B_L}}{L} - \eta\underline{B_L} = L^2 - \gamma$$

which we can solve $\underline{B_L} = \frac{\gamma}{\eta + \frac{\beta}{L}}$.
Next, the lower class women who marry up to men with quality q_3 are indifferent between adopting $\overline{B_L}$ and $\underline{B_L}$:

$$\left((1-\delta)L + \delta H\right)L - \beta\frac{\overline{B_L}}{L} - \eta\overline{B_L} = L^2 - \beta\frac{\underline{B_L}}{L} - \eta\underline{B_L}$$

Thus $\overline{B_L} = \underline{B_L} + \frac{\delta L^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{L}} = \frac{\gamma+\delta L^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{L}} > \underline{B_L}$.
Similarly, the upper class women that marry men with q_2 quality bind feet until they are indifferent between conforming to social norms or not, that is:

$$H^2 - \beta\frac{\underline{B_H}}{H} - \eta\underline{B_H} = H^2 - \gamma$$

which we can solve $\underline{B_H} = \frac{\gamma}{\eta+\frac{\beta}{H}}$.
Relatedly, the upper class women who marry up to q_1 men are indifferent between adopting $\overline{B_H}$ and $\underline{B_H}$:

$$\left((1-\delta)H + \frac{\delta}{L}H^2\right)H - \beta\frac{\overline{B_H}}{H} - \eta\overline{B_H} = H^2 - \beta\frac{\underline{B_H}}{H} - \eta\underline{B_H}$$

Thus $\overline{B_H} = \underline{B_H} + \frac{\delta H^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{H}} = \frac{\gamma+\delta H^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{H}} > \underline{B_H}$.

Lastly, $\underline{B_H} - \overline{B_L} = \frac{\gamma}{\eta+\frac{\beta}{H}} - \frac{\gamma+\delta L^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{L}} = \frac{\beta\left(\frac{H}{L}-1\right)}{H\left(\eta+\frac{\beta}{H}\right)\left(\eta+\frac{\beta}{L}\right)}\left(\gamma - \left(\frac{H\eta}{\beta}+1\right)\delta L^2\right)$. Therefore $\underline{B_H} \geq \overline{B_L}$ if and only if $\gamma > \overline{\gamma} = \left(\frac{H\eta}{\beta}+1\right)\delta L^2$.

To close the proof, consider that foot-binding has an upper bound of $\overline{B} = 1$, therefore:

$\underline{B_L} = \min\left\{\frac{\gamma}{\eta+\frac{\beta}{L}}, 1\right\}$; $\overline{B_L} = \min\left\{\frac{\gamma+\delta L^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{L}}, 1\right\}$; $\underline{B_H} = \min\left\{\frac{\gamma}{\eta+\frac{\beta}{H}}, 1\right\}$;

$\overline{B_H} = \min\left\{\frac{\gamma+\delta H^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{H}}, 1\right\}$.

□

Proof for Corollary 1.

Proof. From Proposition 2, $r_H^* = \min\left\{\frac{p\delta H^3\left(\frac{H}{L}-1\right)}{\beta}, 1\right\}$ in the upper class, and $r_L^* = \min\left\{\frac{p\delta L^3\left(\frac{H}{L}-1\right)}{\beta}, 1\right\}$ in the lower class. It is immediate that both r_H^* and r_L^* are weakly increasing in p, and weakly decreasing in β.

□

Proof for Corollary 2.

Proof. The average foot-binding intensity is

$B_{avg} = \mu p\overline{B_H} + \mu(1-p)\underline{B_H} + (1-\mu)p\overline{B_L} + (1-\mu)(1-p)\underline{B_L}$. By Proposition 3, $\overline{B_H} > \underline{B_H}$ and $\overline{B_L} > \underline{B_L}$. Therefore, $B_{avg} = \left[\mu\left(\overline{B_H} - \underline{B_H}\right) + (1-\mu)\left(\overline{B_L} - \underline{B_L}\right)\right]p + \mu\underline{B_H} + (1-\mu)\underline{B_L}$ is weakly increasing in p.

Meanwhile, from the proof of Proposition 3, $\underline{B_L} = \min\left\{\frac{\gamma}{\eta+\frac{\beta}{L}}, 1\right\}$; $\overline{B_L} = \min\left\{\frac{\gamma+\delta L^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{L}}, 1\right\}$; $\underline{B_H} = \min\left\{\frac{\gamma}{\eta+\frac{\beta}{H}}, 1\right\}$; $\overline{B_H} = \min\left\{\frac{\gamma+\delta H^2\left(\frac{H}{L}-1\right)}{\eta+\frac{\beta}{H}}, 1\right\}$. It is easy to check that each foot-binding intensity is weakly decreasing in β and weakly increasing in γ, thus the average intensity is also weakly decreasing in β and weaking increasing in γ.

□

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