Prioritizing Stability over Productivity: How Confucianism Facilitated Population Growth in Preindustrial China

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This paper applies a new perspective to reassess the economics of Confucianism—risk mitigation, rather than productivity as emphasized in the literature. As a conservative philosophy of life, Confucianism prioritized stability over productivity, forming tightly-knit clans with supportive norms to make intra-clan resource pooling and risk sharing credible. Such efforts effectively expanded the Malthusian limits to population growth in preindustrial China, even in the absence of productivity gains. Using historical data from 269 prefectures for the 976–1851 period, we find that prefectures with stronger Confucian clans had significantly higher population density because of clan-enhanced resilience during natural disasters.

Key words: Confucianism, clan, population growth, risk-sharing institution, China
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The Industrial Revolution has not only dramatically lifted living standards, but also made economic history scholarship decidedly productivity-focused. The literature on the economics of Confucianism offers an illustrative example. Weber (1904, 1951) observes that while Protestantism launched modern capitalist growth in the West, Confucianism stifled such development, as it was devoted to perfecting kinship institutions that hampered, rather than facilitated, productivity-improving innovations, leaving little room for impersonal institutions and non-kinship organizations to emerge. Consequently, at least over the past millennium, China has relied on the Confucian clan, whereas the West on corporate entities, to achieve interpersonal cooperation (Greif and Tabellini 2017). When one applies the productivity-only lens to assess the economic merits of Confucianism or of other traditional cultures and religions, the conclusion is bound to be negative, as China and other preindustrial societies stagnated without measurable productivity gains for millennia (Needham 1969; Maddison 2001; Landes 2006; Mokyr 2017; Bai 2019).

While the productivity-only perspective deepens our understanding of the great divergence between China and the West in modern times, it misses a fundamental point of Confucianism—its almost absolute emphasis on economic security and social stability, rather than income growth, with a focus on innovations that secured interpersonal resource pooling and risk sharing and hence improved risk mitigation, instead of innovations that enhanced productivity. To quote Confucius (551–479 BCE), "... the head of a state or a noble family worries not about scarcity but about uneven distribution, not about poverty but about insecurity. For ... where there is harmony there is no such thing as scarcity and where there is security there is no such thing as overturning" (*The Analects*, Lau 1992, p.161). A useful analogy is Markowitz's (1952) portfolio choice framework, in which the optimality of an investment portfolio must be determined based on both risk and expected return, not expected return alone; thus, a portfolio with a low expected return can still be optimal for an investor who values stability more than return, as long as it achieves the lowest risk for the given return. With the same logic, Confucius and his followers chose to pursue the lowest risk to survival, rather than the highest growth, by structuring society and prescribing supportive norms to ensure interpersonal resource pooling and sharing. Accordingly, it is incomplete to assess the economics of Confucianism purely based on how much productivity gain, if any, it brought about. After all, Confucianism must have done something right, otherwise imperial China would not have persisted for so long, with a population that grew, in the absence of technological breakthroughs, from 34 million in 1000 CE to 427 million by 1850 (Cao 2001).

To reassess Confucianism, this paper shows how much the improved interpersonal resource pooling and risk sharing afforded by the tightly institutionalized

Confucian clan allowed Chinese society to push the Malthusian limits and grow its population for centuries. At the heart of daily life at least since the Song dynasty (960–1279 CE), the Confucian clan consisted of a group of people with a common male ancestor, structured according to rigid Confucian rules and norms that centered on loyalty, solidarity, filial piety, and reciprocity. To make the clan's existence tangible and fully embed it in each member's life, the lineage typically constructed a large ancestral hall where kinsmen regularly gathered for ancestor-worship rituals and festivities, whose role was similar to that of the Church in Medieval Europe.

Economically, the clan acted as an internal financial market in which members pooled resources and shared risks among themselves or through a charitable estate, granary, and other joint organizations. For example, the clan usually owned farmland and other properties via its estate trust, collected rental income, and used it to help poor members and provide relief during times of natural disaster or war; some clans built charity houses to provide shelter for less fortunate members and medical treatment for the sick (Leung 1987). Given the high level of trust and low level of information asymmetry in the clan, kinsmen often helped each other by offering financing for business ventures (Zelin 2005; Zhang 2020). These intra-clan services improved members' ability to survive Malthusian checks, making population growth more sustainable.

We test the above hypothesis by examining the effect of Confucian clans on population density across 269 Chinese prefectures, sampled at seven time points between 976 and 1851 CE. The number of genealogy books compiled per 10,000 km^2 (alternatively, per 10,000 residents) is used as a proxy for clan strength in each prefecture, based on the notion that as written records of lineage members and clan history, genealogy books not only represented the physical presence of a Confucian clan but also contained operationalized Confucian norms and clan-specific rules and guidelines, all of which were essential to clan cohesion and solidarity.

One empirical challenge concerns reverse causality, in that a prefecture's overall clan strength might be driven by population growth. Moreover, a prefecture's genealogy compilation might be due to other unobservable local characteristics. Genealogy books are also subject to survivorship bias, because some genealogies may have disappeared in the past, although locals who cared more about their clans probably made more effort to preserve the genealogy books, so higher survivorship should indicate stronger clan culture. To alleviate these endogeneity concerns, we instrument the distribution of clans using a prefecture's shortest distance from the teaching places (academies) of the neo-Confucian master Zhu Xi (1130–1200 CE), whose writings and teaching made the Confucian clan the central focus of life in traditional China. Given the prohibitive communication costs at the time, regions closer to the Zhu Xi academies were more likely to have earlier and more intense exposure to Confucian clan culture and to exhibit more enduring devotion to clan-building. As Zhu Xi's choice of locations for his academies was largely random, and they were not in economic strongholds, a prefecture's distance to the Zhu Xi academies as our instrumental variable (IV) is arguably orthogonal to population growth at later times.

We document a significantly positive effect of Confucian clans on population density. Under our IV estimation, doubling the clan density would increase a prefecture's population density by about 10.8%. When evaluated at the sample mean, this effect translates into an increase of about 250,000 people per prefecture between 1102 and 1851 CE. This effect remains robust after controlling for the effects of technological advances (adoption of New World crops), local agricultural endowment (soil suitability for major crops, cultivated land area, and terrain ruggedness), geography and commercial opportunity (access to the coast and to political centers), land productivity (land cultivation and tax), and initial population density.

The positive effect of clan strength is mainly driven by the clan's risk mitigation functions. These included both *ex ante* mitigation, through intra-clan resource pooling to increase land ownership and grow business (to increase the clan's collective defense against risk) and *ex post* risk-sharing among members after the occurrence of a risk event. This is evidenced by our finding that the clan significantly reduced the negative impact of weather shocks (droughts) on population density. An important channel for risk mitigation is the charity houses maintained or supported by the clans. Using a unique dataset of charity houses established between 1564 and 1851, we show that prefectures with more clans had more charity houses, which in turn led to significantly higher population density. Finally, we explore a unique collection of demographic records for 50 Chinese lineages located in 26 prefectures and spanning the 1104–1935 period. For this sample, a lineage would have significantly more sons per wife, fewer heirless males, and fewer premature deaths if its home prefecture had stronger clan culture.

Our study demonstrates that once we switch from a productivity to a risk mitigation perspective, the positive historical contributions of Confucianism to Chinese society stand out, at least to the extent that the Confucian clan helped to relax the Malthusian limits to population growth in preindustrial times. In a broader sense, our findings contribute to the literature on the economics of religion and culture, which has so far shown limited evidence for the positive impact of Confucianism (see Becker, Rubin, and Woessmann [2020] for a survey). Our study also sheds light on the importance of risk-mitigation institutions for expanding the Malthusian limits to growth; thus we extend the literature that focuses almost exclusively on technological innovations and resource expansion to explain population growth (e.g., Ashraf and Galor 2011; Nunn and Qian 2011; Voigtländer and Voth 2013, Chen and Kung 2016).

1. Risk Mitigation under Confucianism

Confucianism is often viewed and studied as a cultural system or a philosophy of life. This approach misses an important aspect of that culture: it was also an economic system that served, since the Han dynasty (202 BCE–220 CE), to define property rights, pool and allocate resources, and structure Chinese society economically, socially, and politically. Confucius (551–479 BCE) lived at a time when there were more than 100 states across the land that makes up today's China; these states existed in a condition of incessant warfare and chaos. In this context, it is understandable that Confucius sought to regulate human relations by relying on biological kinship to establish a rigid social order that prioritized stability over growth. As a result, Confucianism placed little emphasis on productivity (so it was not "a culture of growth," as in Mokyr [2017]); instead, Confucianism was a culture of stability (economic, social and political), focusing on securing intra-kinship resource pooling and sharing to enhance society's collective capacity to deal with life-threatening risks. To this end, Confucius and his successors prescribed many rules and norms by fixing each person's position in a stratified social hierarchy and assigning to that position a set of rights and obligations in relation to others that remained unchanged for life.

As a property rights system, Confucianism allowed ownership at the "communal family" level but not at the individual level, so that the oldest male member (head) of the family had full control over the allocation of assets and each member's income. Among the cardinal Confucian rules, bilateral obligations between any two members in a Confucian clan were determined by their biological distance, generational gap, relative age, and gender: a closer biological link translated into a greater obligation to pool property and share income (Lang 1946; Ebrey 1991). The constancy of a person's claims on and obligations to others (enforced via norms and institutions) was what made such morality-based intertemporal resource pooling and risk sharing more secure than free will-based market exchange, although this security came at the expense of individuals' freedom of choice.

The Song dynasty was a major turning point that brought many changes in the evolution of the Confucian clan as a risk-mitigation institution. Confucian scholars during this time innovated extensively to construct and solidify the clan, with membership including all agnates of the same distant ancestor who lived in different households or communal families. One breakthrough occurred around 1050 when scholar-official Fan Zhongyan (989–1052) donated more than 1,000 *mu* of his own cultivated land to create his clan's charitable estate, with a charter detailing operational rules for managing the trust's assets and its purpose of protecting Fan clan members against negative risk shocks (Twitchett 1959). The Fan clan model was soon widely replicated. By the Ming-Qing period (1368–1911), other forms of Confucian charity had emerged. For example, charitable granaries to complement (limited) government famine relief, charity houses for homeless elderly and widows, orphanages, and charity pharmacies for medical relief during epidemics (Leung 1987, 1997; Shiue 2004). Backed by an income-earning endowment, the estate gave the Confucian clan a tangible existence, pushing risk mitigation to a new level. Calling the clan "a fundamental organizing construct in Chinese society" since the Song, Zelin (2009) says "the lineage with an endowment or trust had an important institution at its disposal for the enforcement of lineage solidarity".

In the mid-11th century, two Confucian scholars (Ou-Yang Xiu and Su Xun) introduced a simplified genealogy template for commoners to track their clan's roots and past achievements (genealogy compilation had until then been an aristocratic privilege). By the Ming dynasty (1368–1644), the genealogy not only covered the history of the clan's male lines but also included its organizational charter operationalizing Confucian principles, prescribing its code of conduct, stipulating rewards for conformity and punishment for deviation, and offering guidelines for parenting and other duties (Liu 1959). As the clan's rule book and physical record, the genealogy helped to establish group identity and strengthen solidarity, and laid the foundation for extensive resource pooling and sharing among members.

In the late 12th century, Zhu Xi called on commoner clans to build ancestral halls, thus doing away with another aristocratic privilege. The ancestral hall was not just a physical symbol but also a place where members gathered to worship ancestors at least once every quarter and during festivals and where banquets for births, weddings, and funerals took place. Such regular gatherings were important occasions for members to update their information about each other and reduce intra-clan information asymmetry to minimize free riding. Thus, the popularization of a physical space for clan gatherings and ancestor rituals was a major milestone in addressing the moral hazard problem that might arise from intra-clan resource pooling.

These innovations of the Song dynasty—the codification of rules and norms in genealogy, the physical embodiment of a clan through the ancestral hall and ancestor tablets, the ritualized practice of ancestor worship, and the spread of charitable estates—transformed Confucianism from a set of ideas into a clan-centered institution that served as the focus of daily life and enhanced the security of the Chinese people. Such formal institutionalization sets Confucianism apart from other kinship-based cultures in traditional societies.[1] Note that the risk mitigation functions played by the clan not only operated through charitable estates and lineage businesses (Twitchett 1959; Zelin 2005) but, equally importantly and more often, through mutual assistance, cross-lending in cash or in kind (Chen et al. 2021) and relief conducted directly between clan members, for which purpose clan solidarity was essential.

Based on the above review, it is clear that the Confucian clan was central to the Chinese society's ability to mitigate risks and accommodate higher population growth.

2. Data Description

2.1. Population

The outcome variable is the prefectural population for each of China's 269 prefectures at seven year-end points: 976, 1102, 1393, 1580, 1680, 1776, and 1851. Population data for 976 and 1102 are obtained from Le (1936). The data for the subsequent periods are obtained from Cao (2001, 2017).[2] The prefectural boundaries changed over time from 976 to 1851. To maintain consistency, we adjust and match the relevant data to conform with the 269 prefectures as of 1820 based on CHGIS (Version 6). We exclude all years after 1851 to ensure relative homogeneity in the underlying Malthusian regime, given that the Taiping Rebellion (1851–1862) wiped out more than 30 million people in southeastern China (Cao 2001) and the country began to modernize itself thereafter.

Prefectural land area varied strikingly, ranging from 924 km^2 to 198,269 km^2. To control for this variance, we normalize each prefecture's population by its land area (in km^2) and take its natural logarithm to mitigate the impact of outliers. The prefectural distribution of the population by period is shown in Figure 1. The average population size grew from a trivial figure in 976 to 1.59 million per prefecture by 1851. The northern Central Plains were the most populous up to the 11th century, but the center of gravity then moved to the south and southeast.

2.2. Confucian clans

[1] Kinship group formation for resource pooling was not unique to China (e.g., Laslett 1988), but what makes the Confucian clan different lies in the level of formal institutionalization. Hypotheses about the clan's resource-pooling role in China have been proposed by, for example, Skinner (1997) and Faure (2007), though not empirically tested.

[2] Historians have made attempts to estimate regional populations of historical periods, with Cao (2001, 2017) being the most widely used (Chen and Kung 2016, among others).

As reviewed in Section 1, the genealogy was a physical record of a clan's past and present as well as its rulebook and operational guide, serving to solidify group identity and establish trust among members. The genealogy data are obtained from Shanghai Library (2009), which includes all surviving genealogies of up to 52,306 clans, involving more than 700 surnames across 283 prefectures. Based on each book's locational information and initial year of compilation, we trace back the number of genealogy books compiled in each prefecture by year.

Survivorship bias is a major concern in using genealogy data. Some genealogies may have disappeared or been destroyed before 2009, causing misestimation of the clan effect on population density. However, survivorship bias may also strengthen our use of this proxy for Confucian clan influence, because genealogies were more likely to survive in prefectures with a strong Confucian ethos (as these locals would go out of their way to protect the books). Finally, sampling errors in genealogy can be mitigated by the IV approach introduced shortly.

As cross-validation, Figure 1 shows that the evolution of surviving genealogy books is consistent with historical facts: before the late 11^{th} century, there were few genealogy books as genealogy was an aristocratic privilege. Following the 11^{th}-12^{th} century efforts by scholar-officials and the Ming emperor's adoption of Zhu Xi's version of Confucianism after 1368, genealogy compilation began to permeate commoners at an unprecedented rate. Regional genealogy distribution also coincides with historical accounts (Ebrey 1986; Chow 1994; Bol 2008): southern and southeastern China had more clan organizations than other regions. Though sometimes triggered by major events (e.g., success in the national civil examination), the decision to compile a genealogy was more often driven by clan members' seriousness about Confucianism and clan solidarity.

For our exercise, unless otherwise indicated, a prefecture's *clan density* is proxied by taking the logarithm of 0.01 plus its number of genealogy books compiled up to each time point divided by its land area (per 10,000 km^2), to allow for zero genealogy prefectures. Summary statistics for the main variables are reported in Appendix Table A1.

3. Clan Strength and Population Density

To test whether the Confucian clan enabled population growth, we estimate the following specification in a prefecture-period panel setting:

$$Pop_{it} = a + \beta \times Clan_{it} + \gamma \times \mathbf{X}_{it} + Prefecture_i + Year_t + \varepsilon_{it} \quad (1)$$

where Pop_{it} is the logarithm of the population density of prefecture i at time t between 976 and 1851; $Clan_{it}$ is the variable of interest, indicating clan density in prefecture i In year t; $\mathbf{X}_{it}$ is a vector of controls (discussed below); $Prefecture_i$ controls for all time-invariant prefecture fixed effects on $Pop_{it,}$ including its annual averages of temperature and precipitation and general law-and-order conditions; $Year_t$ captures period-specific common shocks.

3.1. Baseline Results

The fixed-effects ordinary least squares (OLS) results are reported in Table 1. The effect of $Clan_{it}$ on Pop_{it} is positive and statistically significant: doubling clan density would increase population density by 5.1% in about a century (column 1).

Although prefecture and year fixed effects are controlled, some productivity-related innovations that helped to expand Malthusian limits to growth are not included. One example is the New World crops (Nunn and Qian 2011), as maize and sweet potatoes transplanted from the late 16th century onward reduced survival risk and promoted population growth in China (Jia 2014; Chen and Kung 2016). Therefore, in column 2 of Table 1, we include a period dummy indicating whether a prefecture adopted maize or sweet potato in a given period. The clan effect remains significant, although its magnitude becomes 14% smaller.

Reverse causality may also be at play: population growth could have driven the increase in clan density. To address this concern, we redefine clan density by normalizing a prefecture's number of genealogy books by its population (per million) at the previous time point, instead of its land area. Moreover, we control for the preceding period's population density as the lagged density may affect subsequent population growth and clan building. With this treatment, the clan effect still holds (column 3).

The growth of population and clans may also be driven by a common (increasing) time trend in each prefecture. To address this concern, we control for the prefecture-specific linear time trend in column 4 and find the clan effect still significant.

Finally, we control for the interaction terms between the year dummies and a set of geographic factors (distance to the coast, distance to provincial and national capitals, soil suitability for planting rice and wheat, and terrain ruggedness) and the initial population density (in 1102), reasoning that these prefectural factors may bear on both clan and population growth, and their effects may vary across time periods. Again, this does not change the clan effect on population density (column 5).[3]

[3] In addition, population changes might also be shaped by other factors such as war deaths and migration. However, the relevant historical data are not available at the prefectural level.

3.2. The Instrumented Results

The above OLS results cannot yet be interpreted as causal conclusions. First, reverse causality may still remain even after the above treatment, as a larger population with limited resources would compete more fiercely for a livelihood, increasing the demand for clan solidarity and resource pooling. Second, both clan strength and population density may be simultaneously determined by omitted variables, such as local governance quality, migration, fertility customs, and healthcare tradition. In addition, genealogy books may not fully gauge clan strength, as the latter may manifest through clan property ownership, clan trusts, and even political and social networks. However, historical regional data on these dimensions are not available.

For these reasons, we introduce an IV that shaped the geography of the Confucian clan but had no direct impact on population density: each prefecture's shortest distance to the nearest Zhu Xi academy in the Southern Song dynasty (1127–1279).

The diffusion of Zhu Xi's version of Confucianism gained momentum in the mid-12th century when he taught at the Yuelu Academy in Changsha, Hanquan Academy in Jianyang, and Bailudong Academy in Jiujiang (Figure 1). We refer to these three schools as Zhu Xi academies, where he synthesized neo-Confucian philosophy, completing two classics—*Ji Li* (Rituals of Ancestral Worship) and *Jia Li* (Rituals of the Family, which was later adopted by the Ming and Qing imperial court as the bible for the organization and operations of the Confucian clan). By teaching students and inviting Confucian scholars to lecture, Zhu Xi made these academies well-known centers of Confucian learning from the mid-12th century onward, popularizing his model of the Confucian clan widely (Liu 2003).

Between 1150 and 1200 CE, 448 disciples from 58 surrounding prefectures studied under Zhu Xi at these schools (Chan 1982). Upon return to their hometowns, the disciples not only spread Zhu Xi's clan philosophy geographically but also vertically from generation to generation. Before the emergence of modern transportation and communication, these were the most important ways to broaden his influence and ensure its endurance. Even in the 18th and 19th centuries, regions closer to these academies still sold more of his works, especially *Rituals of the Family.*[4]

Table 2 (Panel A) formally tests the correlation between distance to the Zhu Xi academies and clan density, during 976–1851. Before the Zhu Xi era (i.e., 976 and

[4] See Appendix Table A2 for a significantly negative correlation between the distance to the Zhu Xi academies and the number of disciples (by birthplace) or published copies of his works in this prefecture. The latter two metrics significantly predict clan density.

1102), this distance variable shows little predictability of clan distribution, suggesting no unusual presence of clan culture in regions around these academies before Zhu Xi's birth. In the post-Zhu Xi era (1393–1851 in our sample), the nearby prefectures developed significantly more clans than more distant regions, indicating his strong influence.

A prefecture's distance to the academies should be orthogonal to population growth. First, Zhu Xi did not choose to teach in the three academies but was there either because he was assigned to an official post by the imperial court (i.e., Yuelu and Bailudong) or to fulfill a mourning ritual requirement (Hanquan). Second, the home prefectures of the academies were initially not economic centers. For instance, the distance variable is not correlated with prefectural urbanization rate in 1580, *jinshi* degree (highest qualification for senior official appointment) density during 1371–1851, civil exam quotas, or cultivated land ratio in 1820 (columns 1–4, Appendix Table A3). This means that our IV does not capture preindustrial China's economic conditions.[5]

The IV is correlated with geographic factors (ruggedness index, distance to the coast, and soil suitability for rice and wheat) that may have affected population growth (columns 6–10, Appendix Table A3). These should not be serious concerns, as there is no reason to believe that their effects on population density changed significantly after Zhu Xi's time. We also control for these factors in the following IV estimations.

To add more empirical credibility to the exclusion restriction of our IV, we conduct a placebo test in Table 2 (Panel B). We regress a prefecture's population density in each period on its distance to the Zhu Xi academies by year. If this distance is correlated with population or economic growth factors net of clan impact, it should have a significantly negative effect on population density before the Zhu Xi era (that is, in 976 and 1102). However, the results do not support this. The locations of the academies did not play a role in population growth until after the Zhu Xi era.

Moreover, when we include clan density together with distance to the academies (Panel C of Table 2), the significance of the distance effect on population density disappears, suggesting that our IV affects population density mainly through promoting the Confucian clan. Of course, these results should be interpreted as suggestive rather than conclusive, as we cannot rule out all possible omitted factors.

Table 3 reports the two-stage least squares (2SLS) estimates. Given that the IV is time-invariant, we first apply cross-sectional estimation at the prefecture level for 1851 (results for the years between 1393-1776 are similar but not reported, to save space). Specifically, we regress each prefecture's population density on clan density that is instrumented by distance to the Zhu Xi academies, while controlling for initial population density in 1102 (a time before Zhu Xi's birth). This allows us to examine

[5] See Chen et al. (2021) for more historical background on the Zhu Xi academies.

the extent to which prefectural population growth was driven by its Confucian clan strength shaped by proximity to the academies.

The IV results support our claim of a positive clan effect on population density in the post-Zhu Xi era. On average, doubling clan density would increase prefectural population density in 1851 by 17.7% (column 1 of Table 3), which is about 17% higher than the corresponding OLS estimate. Controlling for the same set of geographic factors as those used in Table 1 does not change the clan effect (column 2). We further control for (endogenous) land productivity variables in column 3, including adoption of maize or sweet potatoes, cultivated land ratio, and land tax, in which case the clan effect is reduced to 10.8% but remains significantly positive.

For robustness, we conduct additional IV estimations using a panel regression setting (columns 4 and 5 of Table 3). Given that distance to the academies is time invariant but the endogenous clan density is time varying, we use the distance variable multiplied by a linear post-Zhu Xi time trend as the IV. Specifically, we code the time trend for the two time points before Zhu Xi as zero and those for the five time points after Zhu Xi as 1 to 5, respectively, based on the fact that his doctrine was increasingly heavily promoted as the imperial orthodoxy during 1368-1911. Accordingly, the academies as the fountainhead of clan culture became increasingly more prominent in propagating the Confucian clan over time, as evidenced in Table 2 (Panel A) where the magnitude of the distance coefficient in predicting clan density grows steadily bigger over time. The panel IV results in columns 4 and 5 of Table 3 confirm the baseline cross-sectional results (where data for cultivated land and land tax are not available for earlier years and hence not controlled for).

4. Manifestations of Risk Mitigation

Having established that more Confucian clans led to higher population density, we want to prove next that risk mitigation was the main mechanism.

4.1. Weather shocks

If risk mitigation by the Confucian clan was at work, we should find that population losses during times of disasters were significantly lower in areas with higher clan density. Famines in historical China were mostly caused by output shortages resulting from drought and other calamities; but if clan-facilitated resource pooling provided *ex ante* risk mitigation by making members richer and preemptively accumulating resources in the clan estate and storing goods in the clan granary, its members would be in a good position to cope with the challenge; they could share with others whatever they had in their own storage, to achieve *ex post* risk-sharing. The State Meteorological Society (1981) publishes climate data by tracing historical drought and flood events across 205 weather stations for each year from 1470 to 1970.[6] Based on these data, we count the number of drought events, denoted by *droughts*, by prefecture during 1470–1851 and interact it with clan density in 1851. We also control for the initial population density in 1393.

As shown in Table 4, droughts led to significant population losses: an additional drought incident would reduce population density by 0.4% (column 1).[7] However, if we interact droughts with clan density, the negative effect of drought would be offset by 1/3 (column 2), substantiating the contribution by the clan to sustaining population growth. The mitigating effect of the clan remains robust when we instrument clan density (and its interaction with droughts) by distance to the academies in column 3, where clan density cuts the drought-caused population loss by ½.[8]

4.2. Charity

To further probe the risk mitigation channel, we offer evidence of the link between the Confucian clan and a region's provision of charity, with the understanding that charity was one of the many ways that the clan facilitated risk mitigation through resource pooling and sharing.[9] Leung (1997) investigates over 2,000 local gazetteers, from which she collects information on 2,215 charity houses (*shantang*), established between 1564-1918. Nearly half of them were homes for foundlings, which attenuated the risk of infant mortality. The remaining charity houses included general-purpose houses, and special-purpose houses for hospice and burial services and for chaste widows.

We count the total number of charity houses in each prefecture between 1564 and 1851. As we only have data on the year of establishment of a charity but no information on its duration of existence, we do not know the actual number of houses in operation at each given time. Therefore, we cross-sectionally regress each

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[6] For prefectures without a weather station, we use the average of their surrounding prefectures as a proxy. This is reasonable as weather shocks usually hit a large area affecting a number of prefectures (see also Jia 2014 for similar treatment).

[7] We do not find an effect of floods, possibly because flood's impact was usually short-lived.

[8] This IV result is suggestive as the F statistic for the first stage is only 4.57.

[9] See Chen et al. (2021) for intra-clan bridge loans as a way for members to live through distress and Chen et al. (2018) for evidence on intra-clan mutual assistance. Twitchett (1959) provides detailed case studies on these. Zelin (2005) shows how resource pooling made clan members richer and hence more risk-resilient.

prefecture's total number of charity houses on its pre-1851 clan density.[10] As 43% of the prefectures had no charity house, we use Tobit estimation.

Columns 4 and 5 of Table 4 show the positive and statistically significant clan effect on the level of charity in a prefecture. Doubling clan density would increase the number of charity houses by 50% (column 4). This effect is twice as high when we instrument clan density using distance to the academies (column 5).

4.3. Fertility and Mortality

If Confucian clans effectively attenuated survival risks in a Malthusian society, we expect to see lower mortality rates, especially among children, in regions with more clans. We find fertility and mortality records spanning the 1104–1935 period for 50 Chinese lineages in Liu (1992), who studies the complete genealogical records of the lineages over 29 generations and compiles detailed information on their 147,956 male members. Most men were born in the 18th and 19th centuries, which is consistent with China's overall demographic trends. Admittedly, located in 26 prefectures in eastern China, these 50 lineages constitute a small and highly selective sample. As they kept complete genealogical records, it is likely that these were sophisticated clans. However, as they were located across different prefectures and must have been embedded in their local clan culture, there was still much variation among them.

To explore this sample cross-sectionally (as no bigger sample is available), we measure the clan strength by using each prefecture's number of genealogy books compiled before 1935 in the prefectures where the 50 lineages were located. Liu (1992) provides each lineage's fertility rate by dividing the total number of sons by the total number of wives and concubines (aged 15 to 49). In addition, we use the share of heirless men for each lineage as a composite measure of fertility and mortality.[11]

The cross-lineage results are reported in columns 6-9 of Table 4. For the IV results, we again use each prefecture's distance to the academies to instrument its clan density. In prefectures with more clans, the lineages had significantly more sons per wife and fewer heirless males. Doubling clan density would increase the average number of sons per wife by 0.129 (column 7), which is substantial considering that the average number is 2.65 sons in the sample. Likewise, there were fewer premature deaths among sons in prefectures with stronger clan presence (column 9), supporting our claim.

[10] We also use the pre-1564 clan density to mitigate the possible feedback effect of charity on clans. The results are similar (not reported).

[11] Liu (1992) and others note the difficulty in obtaining accurate fertility and mortality rates due to underreporting of premature son deaths in the genealogies. But the statistics on heirless men are more accurate.

5. Conclusion

As a dominant social institution in historical China, the Confucian clan performed risk mitigation by acting as an internal financial market for and offering relief to members in times of hardship. This mitigation, both *ex ante* and *ex post*, alleviated a significant amount of survival risks and hence accommodated higher population growth in a Malthusian economy before the mid-19th century. Our empirical results suggest that the growth and widespread formation of Confucian clans is likely to have facilitated and sustained the population growth trajectory of China since the 12th century, as it decreased the effect of Malthusian checks.

By applying the risk-mitigation perspective to explain China's cross-prefectural variation in population, this study not only contributes to the economics of Confucianism but, more importantly, highlights the incompleteness of the productivity-only perspective typical of the current economic history literature. Thus, similar to efforts to go "beyond GDP" in assessing the well-being of people in a country (Jones and Klenow 2016), we believe that any framework for addressing the Great Divergence and other questions of economic history should combine both productivity and risk mitigation metrics.

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Figures and Tables

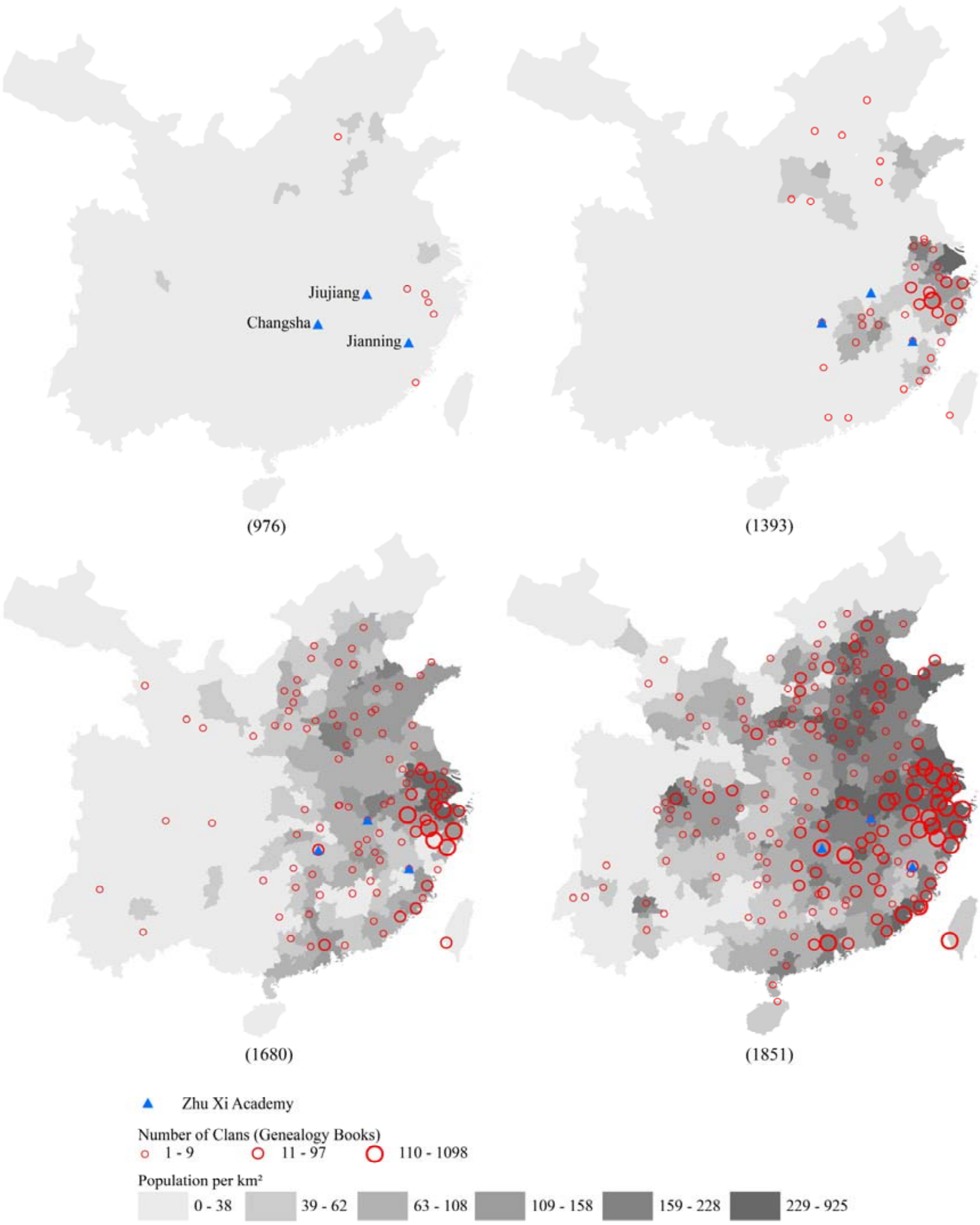

Figure 1. Distribution of Clans and Population Density

Notes: Clans are measured by the number of genealogy books compiled before each given year, based on the records kept in the Shanghai Library (2009). Population figures in 976 are obtained from *Taiping Huanyu Ji* and population figures for 1393–1851 are from Cao (2001). The map is based on the Qing administrative units of 1820 as in the CHGIS, Version 6.

Table 1. Panel Regression Results of Population Density on Clan Strength

	Dependent variable: Population density (log)				
	Main results	Main results	Alternative measure: clan/ population (t-1)	Additional controls: prefecture-specific time trend	Additional controls: prefecture factors × year fixed effects
	1	2	3	4	5
Clan density (log)	0.051***	0.044***	0.022**	0.062***	0.046***
	(0.015)	(0.014)	(0.011)	(0.018)	(0.012)
Population density (t-1, log)			0.298***		
			(0.031)		
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
New World crops		Yes	Yes	Yes	Yes
Prefecture FE × Time trend				Yes	
Year FE × Distance to coast					Yes
Year FE × Distance to political center					Yes
Year FE × Terrain ruggedness					Yes
Year FE × Wheat suitability					Yes
Year FE × Rice suitability					Yes
Year FE × Population density 1102					Yes
Observations	1,804	1,804	1,535	1,804	1,602
R-squared	0.631	0.634	0.605	0.776	0.783
Number of prefectures	269	269	269	269	229

Notes: All columns report fixed effects OLS estimates. The panel regressions cover seven time points: 976, 1102, 1393, 1580, 1680, 1776, and 1851. Clan density is the logarithm of the number of genealogy books compiled before each given time in the prefecture, plus 0.01. We normalize the number of genealogy books by land area (per 10,000 km^2) in all but column 3. New World crops stand for two dummies—maize and sweet potatoes—whose value equals 1 if a prefecture had adopted it by each time point and 0 otherwise, respectively. All standard errors in brackets are clustered at the prefecture level; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2. Impact of a Prefecture's Distance to the Zhu Xi Academies (IV) on Clan Density and Population Density by Time Point

	Pre-Zhu Xi period		Post-Zhu Xi period				
Year	976	1102	1393	1580	1680	1776	1851
	Panel A. First stage: dependent variable is clan density (log)						
IV	-0.074	-0.174*	-0.726***	-0.995***	-1.203***	-1.392***	-1.469***
	(0.053)	(0.102)	(0.180)	(0.256)	(0.227)	(0.281)	(0.322)
	Panel B. Reduced form: dependent variable is population density (log)						
IV	0.055	-0.060	-0.251***	-0.209***	-0.300***	-0.205***	-0.188***
	(0.061)	(0.057)	(0.096)	(0.079)	(0.101)	(0.073)	(0.070)
	Panel C. Horse race: dependent variable is population density (log)						
IV	0.052	-0.048	-0.123	-0.080	-0.116	-0.044	-0.030
	(0.061)	(0.056)	(0.078)	(0.058)	(0.077)	(0.050)	(0.046)
Clan density (log)	-0.041	0.067*	0.189***	0.144***	0.182***	0.149***	0.148***
	(0.072)	(0.040)	(0.021)	(0.018)	(0.023)	(0.017)	(0.021)

Notes: The table shows the cross-sectional OLS estimates at the prefecture level by time point. The IV, distance to the Zhu Xi academies, refers to the logarithm of the shortest great-circle distance from a prefecture to the nearest Zhu Xi academy (in km). Clan density is measured by the logarithm of the number of genealogy books per 10,000 km^2. There are 269 prefectures in Panel A (230 for 976 and 1102) and 230 prefectures in Panels B and C. Panels B and C control for population in 1102 in the regressions of the subsequent years. Robust standard errors are reported in brackets; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Population Density and Clan Strength: Second-Stage IV Results

	Cross-sectional estimation. Dependent variable is population density in 1851 (log)			Panel estimation. Dependent variable is population density in 976-1851 (log)	
	1	2	3	4	5
Clan density (log)	0.177***	0.142**	0.108**	0.125***	0.107**
	(0.044)	(0.059)	(0.053)	(0.044)	(0.049)
Population density 1102 (log)	Yes	Yes	Yes		
Geographic controls		Yes	Yes		
Cultivated land ratio			Yes		
Land tax			Yes		
New World crops			Yes		Yes
Prefecture FE				Yes	Yes
Year FE				Yes	Yes
Observations	230	229	223	1,804	1,804
R-squared	0.417	0.683	0.727	0.619	0.626
F statistic in first stage	15.74	9.36	8.37	23.13	19.51
Corresponding OLS estimates of clan density	0.151***	0.085***	0.072***	0.051***	0.044***
	(0.021)	(0.014)	(0.012)	(0.015)	(0.014)

Notes: Columns 1 to 3 report the 2SLS estimates of the Confucian clan effect on population density in 1851 at the cross-prefectural level, in which clan density is measured by the number of genealogy books compiled before 1851 (per 10,000 km^2) and is instrumented by the logarithm of a prefecture's distance to the Zhu Xi academies. Columns 4 and 5 report the fixed-effects 2SLS panel estimates of the Confucian clan on population density over seven time points (976, 1102, 1393, 1580, 1680, 1776, and 1851); clan density is measured by the number of genealogy books compiled up to each time point (per 10,000 km^2) and is instrumented by the logarithm of a prefecture's distance to the Zhu Xi academies multiplied by a linear post-Zhu Xi time trend. Geographic controls include the logarithm of the distance to the coast, logarithm of the distance to the political center, logarithm of the terrain ruggedness index, soil suitability for rice, and soil suitability for wheat. Robust standard errors are reported in brackets in columns 1-3, and standard errors clustered at the prefectural level are reported in brackets in columns 4 and 5; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Risk Mitigation by the Confucian Clan

	Dependent variable is population density in 1851 (log)			Dependent variable is charity houses (log)		Dependent variable is lineage fertility or mortality, measured by:			
						Number of sons per wife	Number of sons per wife	Share of heirless men (*100)	Share of heirless men (*100)
	OLS	OLS	2SLS	Tobit	IV-Tobit	OLS	2SLS	OLS	2SLS
	1	2	3	4	5	6	7	8	9
Droughts	-0.004**	-0.003**	-0.004						
	(0.002)	(0.002)	(0.002)						
Clan density (log)	0.045***	-0.068	-0.118	0.512***	1.343***	0.038	0.129**	-1.587**	-4.193***
	(0.015)	(0.043)	(0.105)	(0.108)	(0.294)	(0.031)	(0.054)	(0.607)	(1.174)
Droughts × Clan density (log)		0.001***	0.002***						
		(0.000)	(0.001)						
Population density 1393 (log)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	269	261	261	223	223	50	50	48	48
R-squared	0.640	0.798	0.799			0.451	0.281	0.256	-0.227
F statistic in first stage			4.57				21.93		18.28

Notes: Estimations in this table are cross-sectional. Columns 1-3 examine whether the clan helped cut population losses from drought (famine) events. Droughts is the total number of drought events in each prefecture between 1470 and 1851. Columns 4 and 5 examine the risk-mitigation effect of the clan by using the total number of charity houses in each prefecture between 1564 and 1851 as the dependent variable. Columns 6-9 investigate the clan culture effect on fertility and mortality for the 50 lineages recorded in Liu (1992). Clan density (per 10,000 km^2) is determined by the genealogy books compiled up to 1851 for columns 1-5 and prior to 1935 for columns 6-9. Clan density is instrumented by distance to the Zhu Xi academies for columns 3, 5, 7 and 9. Controls for columns 1-5 are the same as those for column 3 of Table 3. Controls for columns 6-9 include the duration (years) since a prefecture's adoption of New World crops, aggregated index of soil suitability for wheat and rice, distance to the coast, distance to national and provincial capitals, and terrain ruggedness. Robust standard errors are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Online Appendix

Table A1. Summary Statistics

Variable	Obs	Mean	SD	Min	Max
Panel data					
Population density (persons per km^2)	1,805	66.01	97.31	0	937.54
Clan dummy	1,883	0.31	0.46	0	1
Clan density	1,883	8.25	49.16	0	1,098.77
Clan density (/population)	1,535	10.69	49.58	0	803.87
Potato adoption	1,883	0.17	0.38	0	1
Maize adoption	1,883	0.23	0.42	0	1
Cross-sectional data					
Population density in 1851	269	144.04	147.13	0.47	925.39
Clan density in 1851 (/land area)	269	32.04	109.26	0	1,098.77
Clan density in 1851 (/population)	230	122.62	487.10	0	6,297.86
Distance to Zhu Xi academy (in km)	269	663.63	373.35	0	2,077.50
Population density in 1102	230	34.15	25.58	0.87	126.99
Population density in 1393	269	27.92	49.17	0.03	496.54
Droughts	269	101.91	25.58	63	169
Charity houses	269	4.10	10.11	0	79
Distance to coast (in km)	269	510.84	370.48	0	1,925
Terrain ruggedness	269	233.82	182.07	4.42	972.47
Distance to political center (in km)	269	188.64	109.00	4.30	862.32
Wheat suitability	269	23.66	11.21	0.001	67.57
Rice suitability	269	10.54	10.62	0	50.42
Cultivated land ratio (*100)	267	17.24	19.65	0.0005	106.54
Land tax (silver *liang* per *mu*)	262	210.70	1,850.31	0.3	22,116.09
Zhu Xi's disciples	269	1.67	5.80	0	58
Editions of *Rituals of the Family*	269	0.19	0.66	0	5
Jinshi density (per 10,000 people)	269	1.33	1.33	0	12.13
Civil exam quota (per 10,000 people)	269	1.05	0.86	0	9.13

Table A2. Distance to the Zhu Xi Academies (IV) and the Diffusion of Zhu Xi's Philosophy

	Zhu Xi's disciples	Zhu Xi's disciples	Editions of *Rituals of the Family* published	Editions of *Rituals of the Family* published	Clan density (log)
	OLS	Poisson	OLS	Poisson	OLS
	1	2	3	4	5
IV	-3.292***	-0.547***	-0.096***	-0.280***	
	(1.245)	(0.076)	(0.033)	(0.064)	
Zhu Xi's disciples					0.142***
					(0.051)
Editions of *Rituals of the Family* published					1.308***
					(0.224)
Observations	269	269	269	269	269
R-squared	0.281		0.018		0.167

Notes: Clan density is measured by the number of genealogy books compiled before 1851, normalized by the land area (in 10,000 km^2) of each prefecture. Editions of *Rituals of the Family* is the number of editions of Zhu Xi's book published in each prefecture between 1286 and 1808. Robust standard errors are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A3. Correlation between a Prefecture's Distance to the Zhu Xi Academies (IV) and Prefectural Characteristics

	Urbanization rate in 1580	*Jinshi* density 1371–1851 (log)	Civil exam quotas (log)	Cultivated land ratio in 1820	Land tax in 1820 (log)
	1	2	3	4	5
IV	-0.379	-0.128	-0.041	1.516	-0.157**
	(0.463)	(0.083)	(0.066)	(0.924)	(0.071)
Geographic controls	Yes	Yes	Yes	Yes	Yes
	249	268	268	266	261
	0.180	0.356	0.030	0.567	0.090

	Distance to coast (log)	Terrain ruggedness index (log)	Distance to political center (log)	Wheat suitability	Rice suitability
	6	7	8	9	10
IV	0.195**	0.206***	0.162***	1.269**	-6.384***
	(0.077)	(0.072)	(0.049)	(0.616)	(1.405)
Observations	268	269	269	269	269
R-squared	0.026	0.026	0.044	0.011	0.315

Notes: Urbanization rate refers to the share of urban population in a prefecture's total population. *Jinshi* density refers to the total number of exam-takers receiving the highest degree in civil examinations between 1371 and 1851 (Chen et al. 2020), normalized by the average population between 1393 and 1851 (in 10,000 people). Civil exam quotas refer to the number of quotas allocated to each prefecture for the entry-level civil examination in the Qing dynasty (before 1851), normalized by the prefecture's average Qing population (in 10,000 people). Cultivated land ratio refers to the share of cultivated land in the total prefectural land area (*100). Distance to political center refers to a prefecture's shortest distance to the nearest provincial or national capital that ever existed between 1200 and 1851. Geographic controls include the logarithm of the terrain ruggedness index, logarithm of the distance to the coast, log distance to the political center, soil suitability indices for wheat and rice, and adoption dummies for maize and sweet potatoes.