JOURNAL OF ASIAN SOCIOLOGY
Volume 53 | Number 3 | September 2024, 225-248
DOI 10.21588/dns.2024.53.3.002 **Article**

Land, Education, and Reproduction: Changing Socioeconomic Differentials in a Rural Korean Village*

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This study investigates socioeconomic differentials in marriage and fertility during the Korean fertility transition in a rural village. These differentials have significant implications for understanding historical fertility patterns and the drivers of fertility decline. By analyzing population registers linked to land rosters and school records, we examine how land ownership and educational attainment were associated with fertility levels and the timing of marriage and fertility, and how these associations evolved across birth cohorts. We attempt to examine the changing relationships between two distinct measures of socioeconomic status—land ownership and education—and marriage and fertility. This approach provides critical insights into family formation patterns during the Korean demographic transition. The analyses reveal that fertility levels and timing were influenced by land ownership but not by educational attainment. Individuals whose husbands owned farmland tended to marry earlier and have more children compared to their landless counterparts with similar characteristics. This relationship remained consistent across birth cohorts. We discuss the implications of these findings, acknowledge the study's limitations, and propose directions for future research.

Keywords: *fertility transition, historical demography, fertility differentials, Korea*

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*This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2020S1A5A2A01041134).

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Introduction

This study investigates the associations between landholding, education, marriage, and fertility during the Korean fertility transition. We utilize individual-level longitudinal data linking population registers, land rosters, and school records from a rural village. Socioeconomic differentials in marriage and fertility have long been a central theme in demographic research, crucial for understanding both historical fertility patterns and the fertility transition process. The relationship between economic resources and reproduction in historical populations has been extensively examined, often through the lens of Malthusian preventive checks (Malthus 1953). At the macro level, real income has been shown to correlate with reproduction rates (Wrigley and Schofield 1981). Micro-level studies have demonstrated that nuptiality and marital fertility were dependent on socioeconomic status such as occupations (Knodel 1988). Recent advances in historical demography have revealed that Malthusian preventive checks operated not only in Western Europe but also in the East, albeit with regional variations (Lundh et al. 2014; Tsuya et al. 2010). These studies showed that marriage and marital fertility depended on socioeconomic status in the East as well as in the West, suggesting that preventive checks were also working in the East.

In the 20th century, fertility decline typically progressed in tandem with educational expansion (Bongaarts 2003). Improvements in women's education have been identified as a key driver of fertility decline in developing countries. Highly educated women tend to marry later and have fewer children due to various factors, including economic independence (Becker 1974), delayed entry into the marriage market due to prolonged school enrollment (Mare and Winship 1991), and extended spouse search periods (Oppenheimer 1988). These findings underscore the importance of educational differentials in marriage and fertility for understanding the dynamics of fertility decline.

Our study contributes to this body of research by examining how both landholding and education—two distinct measures of socioeconomic status—were associated with marriage and fertility patterns during Korea's demographic transition. By linking population registers with land rosters and elementary school graduate directories in a rural village, we can examine how both education and land ownership were associated with the timing of marriage and fertility and the level of fertility. This approach allows us to explore the implications of two key measures of socioeconomic status, prominent at different stages of societal development, for demographic

changes. Farmland ownership was a crucial element of social stratification in peasant societies, while educational attainment became increasingly important in determining individuals' socioeconomic success as industrialization progressed. Due to their significance, both landholding and education have been widely used to examine socioeconomic differentials in reproduction, often in different historical contexts. Landholding has typically been used to measure socioeconomic status in studies of pre-transitional societies, reflecting the predominantly agrarian nature of these populations. Studies of contemporary developing countries usually rely on education as a measure of socioeconomic status, given its increasing importance in determining life chances in modern societies. However, examining either factor alone is insufficient to fully understand how socioeconomic differentials in fertility changed before, during, and after the fertility transition. To comprehensively analyze family formation patterns during fundamental demographic and socioeconomic transformations, it is crucial to consider both factors simultaneously. While most previous studies have focused on either land ownership or education due to data limitations, our research uniquely allows us to examine both factors concurrently. This comprehensive approach enables us to track the changing importance of traditional (land) and modern (education) forms of socioeconomic status over time. By analyzing these dual measures of socioeconomic status, we aim to offer a more complete picture of the complex relationships between socioeconomic status and reproductive behaviors during a period of rapid societal change.

Literature review

Landholding and reproduction in the past

The relationship between landholding and reproduction in agrarian societies has been extensively examined, as land was the primary means of production. This relationship forms the foundation of Malthusian preventive checks in the West, operating at both macro and micro levels. At the macro level, the Malthusian model posits that couples needed to accumulate sufficient economic resources, primarily land, before marriage. This necessity, coupled with the requirement to establish neo-local residences, led to late and non-universal marriage patterns in the West (Hajnal 1965). The contrast in marriage timing between the West and East confirmed that the Malthusian

preventive checks through landholding were primarily operational in Western societies. Wrigley and Schofield (1981) also provided macro-level evidence for a strong relationship between economic circumstances and reproduction in England, showing that better economic conditions correlated with higher reproduction rates. This economic-demographic dynamic contributed to the prevalence of nuclear families in England, as couples left their parental homes to establish independent households upon marriage (Laslett 1972). The resulting European marriage patterns (Hajnal 1965) became widespread in Western Europe, laying the foundation for distinct family formation patterns compared to other regions (e.g., China). This unique family system has been linked to several key societal characteristics including strong individualism (McFarlane 1986), egalitarian gender and intergenerational relationships (De Moor and van Zanden 2010), and property ownership structure (Van Bavel 2002). The positive association between land ownership and reproduction is crucial for understanding why economic conditions and population growth in the West proceeded in tandem at the macro level. This relationship underpins the complex interplay between economic resources, social structures, and demographic behaviors that characterized Western European societies during the pre-industrial and early industrial periods.

At the micro level, high status groups tended to marry earlier and give birth sooner and in greater quantities than their low status counterparts in historical populations. This pattern was observed in both Western and Eastern societies, although notable regional differences existed (Lundh et al. 2014; Tsuya et al. 2010). Despite the overall later timing of marriage in the West compared to the East (due to reasons discussed earlier), similar socioeconomic differentials in marriage timing were evident across regions. Dribe et al. (2014) examined the sequence of key life events—leaving the parental home, first marriage, and first birth—across various regions in Eurasia. Their findings revealed similarities in the relationship between socioeconomic status and the timing of family formation across the continent, suggesting some universality in these patterns despite cultural and economic differences. A comparative analysis of first marriage timing in various areas of the Eurasian continent during the 19th century provided further evidence for socioeconomic differentials in reproduction. Bengtsson (2014) found that rising grain prices had a more significant impact on lower-status families compared to higher-status families, with some regional variations. This finding suggests that the resources available to families moderated the influence of economic fluctuations on reproductive decisions

to some extent.

Education and fertility transition

The positive association between socioeconomic status and reproduction weakened or disappeared during and after the fertility transition. This shift was closely linked to broader societal changes, including industrialization, the development of individualism, and, most notably, improvements in education. Education not only contributed to overall fertility decline but also emerged as a crucial determinant of individual status attainment, becoming negatively associated with reproduction (Bongaarts 2003). Several factors contribute to the negative relationship between education and reproduction in post-transitional societies. Highly educated women often face higher opportunity costs upon marriage and childbearing, leading them to delay or forgo family formation (Becker 1974). For instance, in South Korea, the negative association between education and reproduction strengthened across birth cohorts (Hwang 2023; Kye 2008). There are also behavioral constraints associated longer schooling. Extended school enrollment periods can directly conflict with family formation timing (Mare and Winship 1991). A changing spouse selection process also contributes to educational differentials in the timing of marriage. Educated women may spend more time searching for partners due to higher "reservation wages" for potential spouses, as their economic independence reduces the necessity for marriage (Oppenheimer 1988). These changes have led to later marriage among highly educated individuals, effectively reversing the socioeconomic differentials in nuptiality and marital fertility observed in pre-transitional societies.

Taken together, the relationship between socioeconomic status and reproductive behaviors has undergone a significant transformation, shifting from positive to negative over time (Skirbekk 2008). However, examining this evolving association presents two primary challenges. Firstly, there are data limitations. Historical demographic studies typically analyze data from population registers dating to the 19th century or earlier, when fertility transition was either non-existent or in its nascent stages. Consequently, most research has focused on the relationship between socioeconomic status and reproduction in pre-transitional societies, leaving the changing association largely unexplored. Secondly, measures of socioeconomic status were inconsistent. The indicators used to assess socioeconomic status vary across time periods and studies. Historical population studies often link population registers to land rosters, analyzing the relationship between landholding and

reproduction. In contrast, research on fertility transition in developing countries frequently employs educational attainment as a socioeconomic status measure. This discrepancy in measures may partially account for the observed changes in the relationship between socioeconomic status and reproduction noted in previous literature (Skirbekk 2008). The lack of consistent measures across studies poses a significant challenge in producing coherent evidence regarding the evolving relationship between socioeconomic status and reproduction. Most studies do not simultaneously incorporate both land ownership and education measures, further complicating the analysis of this changing dynamic.

To address these limitations, the present study utilizes a unique dataset that combines multiple sources. We analyze population registers linked to land rosters and elementary school graduate directories from a rural village in Korea. This comprehensive approach allows us to examine both traditional (land ownership) and modern (education) measures of socioeconomic status concurrently and to track changes in the relationship between socioeconomic status and reproduction over time using consistent measures. This will allow us for a more coherent evaluation of how the association between socioeconomic status and reproductive behaviors evolved during Korea's demographic transition.

Data and Methods

Previous research suggests that socioeconomic status differentials in reproduction transitioned from a positive to a negative association during the fertility transition (Skirbekk 2008). This shift indicates that human reproduction became less dependent on resource availability and male-dominant family systems, and more influenced by factors such as self-realization and gender-egalitarian family structures (Lesthaeghe 1977, 1995; van de Kaa 1986). To detect this fundamental change in reproduction patterns, data must satisfy two key conditions. First, it should span a long-term period, as fertility transition is a protracted process often extending over many decades or even a century (Mason 1997). Second, it should include both landholding and education measures to assess socioeconomic status before, during, and after the fertility transition. Most demographic studies of pre-transition periods typically use landholding as a status measure, while studies of fertility decline in developing countries rely on education but lack economic variables like landholding, making these measures incomparable.

The current study satisfies both conditions: our data cover the period from the 1920s to the 1970s, encompassing the critical period of the Korean fertility transition that began in the 1960s (Kye 2012; Kye and Park 2016), and include key measures of socioeconomic status relevant to both pre- and post-transition periods: landholding and education. This comprehensive approach allows for a more nuanced examination of the changing relationship between socioeconomic status and reproductive behaviors throughout the fertility transition process.

Data

This study links the *Unyang* population registers to land rosters and elementary school graduate directories to create a comprehensive dataset. The *Unyang* population registers, serving as the baseline data, contain individual records of births, marriages, divorces, and deaths in the rural village from 1909 to 1977. The population registration system in Korea has a long history dating back to the Joseon Dynasty (1392-1910). Initially based on resident-based enumeration, it underwent significant changes in the early 20th century (Son 2005). In 1909, the Japanese family registration system (*minjeok*) was introduced, shifting focus from residence-based to family lineage-based records. This system, which included demographic events and was continuously updated, remains active with modifications. The current study utilizes "removal records" (*jejeokbu*) and "live records"; (*jaejebu*) from the *Unyang* family registers to examine marriage and fertility. These records became available upon the death of a family head or long-distance moves in the case of removal records, and were later reorganized by the Korean government between 1975 and 1977 in the case of live records. It is important to note that these registers recorded de jure population, not de facto population, meaning that listed individuals were not necessarily *Unyang* residents (Kye and Park 2016; Park et al. 2018).

The land rosters provide information on landholders' names, addresses, and land types in *Unyang*. Given the primary economic value of farmland during the studied period, we focused on farmland ownership, classifying women based on their husbands' farmland ownership status. Although the socioeconomic status of a woman's family of origin also mattered for reproductive behaviors, the husband's characteristics were likely to be more influential than the family of origin given the patriarchal socioeconomic structure. Thus, we used the husband's land ownership status instead of that of the family of origin.

The *Unyang* Elementary School graduate directory offers data on alumni's birth year, graduation date, and parent names, allowing us to categorize individuals into two educational groups: less than elementary school graduation and higher. Unlike land ownership, we use women's own educational attainment as the measure. Two issues should be noted regarding this classification. Firstly, the meaning of elementary school was likely to change because it became compulsory in 1948. While attending elementary school was a signal of higher status during the colonial period, this was no longer the case after 1948. Nonetheless, elementary school education was not still universal after 1948 and depended on family circumstances. Thus, we use this classification throughout the period. Secondly, graduating elementary school itself may not affect the timing of marriage. This suggests that differences in marriage and fertility between elementary school graduates and non-graduates may not be heavily affected by a longer stay in school. Thus, differences in reproduction between elementary school graduates and non-graduates, if any, may not be heavily affected by school enrollment (Mare and Winship 1991).

By matching these land rosters and graduate directories to the *Unyang* registers, we construct our analytic dataset, which integrates crucial socioeconomic indicators (land ownership and education) with detailed demographic information, enabling an examination of the relationship between socioeconomic status and reproductive behaviors over time. The data matching process encountered several limitations that merit consideration. Firstly, the land ownership classification may contain non-negligible measurement errors due to two factors: (a) not all land in *Unyang* was owned by *Unyang* residents, resulting in unmatched records from land rosters, and (b) "landless families" in our data may include those who owned land elsewhere. Secondly, similar issues arise with educational attainment classification due to the presence of two other elementary schools in the area. Consequently, some individuals who graduated from schools other than *Unyang* Elementary School may be misclassified as having no elementary education. More critically, the information available for matching across the three data sources was limited. Population registers provided individuals' names and birth dates, school graduate directories included names and birth years, while land rosters only contained the names of the landowners. This paucity of identifying information rendered perfect matching impossible in cases where multiple individuals shared the same name. These limitations in data matching introduce potential biases and uncertainties into our analyses, which should be considered when interpreting the results and drawing

conclusions about the relationship between socioeconomic status and reproductive behaviors in this historical context.

The issue of identical names, while challenging, does not present an insurmountable obstacle in our data matching process. The study focuses on a small rural village with a total population of approximately 15,000 in 1975 (Park et al. 2018). In such settings, it was common for extended patriarchal kin groups sharing the same family name to cluster in close proximity. This pattern is evident in *Unyang*, as households with identical family names are frequently listed in close succession in the raw data. Moreover, Korean naming traditions typically discouraged the use of identical given names among extended kin, resulting in a high diversity of full name combinations despite the prevalence of common family names. Consequently, the *Unyang* population registers exhibit numerous shared family names but relatively few duplicate full name combinations. Nevertheless, some instances of common names do exist in the data, and we cannot achieve absolute certainty in matching individuals across the three datasets due to limited identifying information. It is worth noting that school records are comparatively easier to match than land ownership data, as they include birth years as an additional identifier. These characteristics of the data and local naming practices enhance our confidence in the matching process, although some degree of uncertainty remains and should be acknowledged in subsequent analyses.

In the process of matching the three data sources, we applied the following assumptions: First, individuals in the school graduate directory were matched to population registers if both name and birth year corresponded, allowing for a three-year discrepancy due to potential age reporting inconsistencies in both sources. Second, individuals in land rosters were matched to population registers and school records if names matched and the year of land registration was at least 10 years after the birth year. While this 10-year rule eliminates many implausible matches, it may still result in some misclassifications where individuals are erroneously identified as landowners due to name similarities. To mitigate this issue, we conducted a closer examination of land ownership history. This examination revealed that most land transfers occurred between family members, typically through inheritance. We considered matches to be highly probable when (1) two individuals were associated with the same land, and (2) individuals sharing the same name were registered in population registers as fathers and sons. The majority of cases satisfied these conditions. However, our analysis also includes cases that did not meet these criteria, as we cannot definitively rule out the possibility of a genuine match. Given these methodological

limitations and potential for misclassification, the results presented in this study warrant cautious interpretation. Future research may benefit from more refined matching techniques or additional identifying information to further improve the accuracy of socioeconomic status classifications.

Despite the limitations in our data, we can assess socioeconomic status differentials in reproduction by comparing matched and unmatched individuals. The unmatched group comprises a heterogeneous mix, potentially including both landless individuals and landowners whose properties were registered elsewhere, as well as those with less than an elementary education and graduates of other elementary schools. While the matched group may also include some misclassified individuals, such errors are likely less prevalent due to the rarity of identical names in this small village setting. This asymmetry in potential misclassification suggests that our analysis is more likely to underestimate rather than overestimate socioeconomic differentials in reproduction. Consequently, any significant differences observed between the matched and unmatched groups would provide strong evidence for genuine socioeconomic differentials in reproductive behaviors. This conservative approach to interpreting our results enhances the reliability of our findings, albeit within the constraints of our data limitations.

Methods

To examine socioeconomic status differentials in the timing of marriage and fertility, we apply the Cox proportional hazards model (Allison 2014). In addition, we estimate Poisson regression models to investigate socioeconomic status differentials in fertility levels. This approach allows us to capture both the timing and quantum aspects of reproductive behaviors, providing a comprehensive understanding of how socioeconomic status was associated with family formation patterns. By employing these complementary methods, we can robustly assess the relationships between our socioeconomic status indicators (land ownership and education) and various dimensions of marriage and fertility outcomes.

Hypotheses

Based on the preceding discussion, we propose to test the following hypotheses using the linked data from population registers, land rosters, and

graduate directories in *Unyang*.

Hypothesis 1. The changing relationship between land ownership and reproduction
- H1-1: Land ownership was associated with earlier marriage and childbearing.
- H1-2: Land ownership was positively associated with fertility levels.
- H1-3: These associations became weaker for more recent birth cohorts.

Hypothesis 2. The changing relationship between education and reproduction
- H2-1: Higher educational attainment led to later marriage and childbearing.
- H2-2: Education was negatively associated with fertility levels.
- H2-3: This association became stronger for more recent birth cohorts.

These hypotheses collectively aim to capture the dynamic interplay between socioeconomic status indicators and reproductive behaviors during the period of demographic transition. By testing these hypotheses, we seek to elucidate how the influences of traditional (land ownership) and modern (education) forms of socioeconomic status on family formation patterns evolved over time in this rural Korean setting.

Results

Descriptive results

Table 1 presents descriptive statistics by birth cohorts, revealing key trends in family formation across birth cohorts. Firstly, we observe a delay in the timing of marriage and childbearing. Women's mean age at first marriage increased from 19.2 years among the oldest cohort (1895-1909) to 22.8 years for the youngest (1940-60), with a similar pattern for men. Notably, this delay was not linear, with significant changes occurring for the 1930-39 cohort. The variation in age at first marriage and childbearing is consistently larger for men across all cohorts, indicating more diverse family formation timing for males than females. Secondly, we note a decrease in the number of children ever born across cohorts, particularly from the 1930s cohort onward. This pattern, coinciding with the onset of marriage delay, aligns with

Table 1
Descriptive statistics by birth cohort

	1895-1909		1910-19		1920-29		1930-39		1940-60		All	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
# of births	5.1	2.6	5.3	2.5	4.8	2.3	3.9	1.7	2.8	1.3	4.3	2.3
Age at (first) marriage, wife	19.2	3.9	19.5	3.3	18.7	4.1	22.3	4.2	22.8	2.8	20.6	4.1
Age at (first) birth, wife	24.7	6.5	25.4	6.0	25.2	6.1	27.5	5.5	27.9	3.5	26.2	5.7
Age at (first) marriage, husband	21.4	3.9	20.8	3.4	20.2	3.4	22.0	3.2	22.6	2.9	21.4	3.4
Age at (first) birth, husband	26.8	6.3	26.7	5.9	26.7	5.3	27.2	4.4	27.8	3.4	27.0	5.1
Duration	21.0	10.0	22.8	9.6	22.3	9.7	15.6	7.0	8.0	4.3	17.7	10.0
Infant mortality (%)	37.9	-	30.4	-	17.1	-	3.3	-	1.5	-	16.9	-
Child mortality (%)	50.7	-	47.0	-	28.2	-	8.4	-	3.0	-	25.9	-
Land own (%)	73.9	-	56.1	-	42.0	-	34.1	-	26.2	-	45.2	-
ES graduate (%)	0.8	-	3.5	-	5.8	-	13.3	-	22.9	-	9.7	-
N	839		851		948		1,135		921		4,694	

* Child and infant mortality measures present the percentage of women who lost at least one of their children before age 1 or age 5.

previous studies on Korean fertility transition, suggesting that the decline was initially driven by delayed marriage and commenced in the 1960s (Kwon 1993; Kye 2012). However, interpretation requires caution due to right-censoring of later cohorts, which we address in subsequent Poisson regression analyses by controlling for age at censoring. Third, there is a clear decline in infant and child mortality across cohorts, with the percentage of women having deceased children before the fifth birthday dropping from over 50 percent in the earliest cohort to 3.0 percent in the youngest. This mortality decline preceded the fertility decline, consistent with the classic demographic transition theory (Notestein 1945). Finally, we observe contrasting trends in socioeconomic status measures: the percentage of husbands owning farmland decreased across cohorts, while the proportion of elementary school graduates increased, reflecting Korea's transition from an agrarian to an industrial society and the expansion of education. Declining

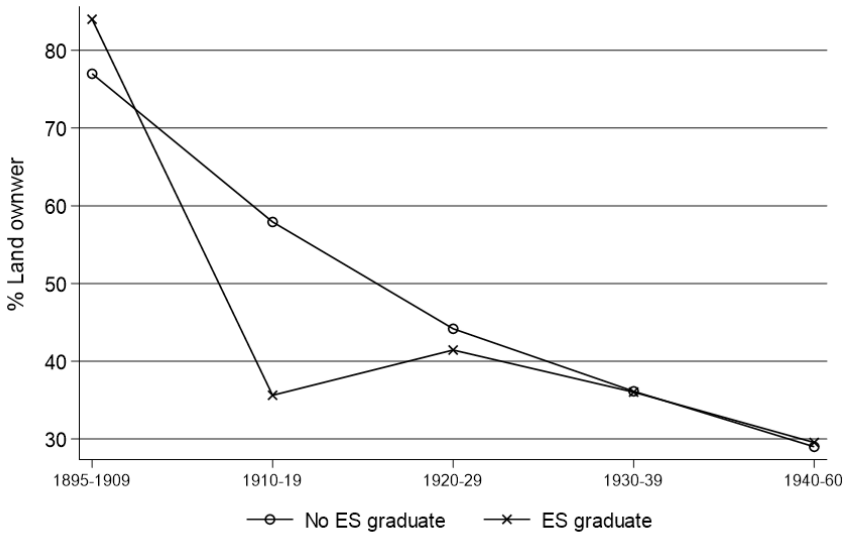

Fig. 1.—Changing relationship between education and land ownership

land ownership reflected changes in ownership during the colonial period and industrialization afterwards. For example, decline of ownership from cohort 1 (1895-1909) to cohort 2 (1910-19) may show declining land ownership among peasants during the colonial period. The decline in ownership for later cohorts may reflect a transformation of the industrial structure from a predominantly agricultural one to a modern one. Changes for recent birth cohorts may also reflect migration to urban places because data are based on de jure, not de facto, population.

Figure 1 shows how the land ownership difference between elementary school graduates and non-graduates changed across birth cohorts. Except for the cohort born in the 1910s, no difference was found. Even the difference for this cohort is not statistically significant. This suggests that two measures of socioeconomic status were not correlated with each other throughout period considered in the current study.

Table 2 shows socioeconomic status differentials in fertility levels, timing of family formation, and infant and child mortality. Clear patterns emerge: individuals whose husbands owned farmland married and bore children earlier, and had more children compared to those without land ownership. Conversely, elementary school graduates exhibited later marriage and childbearing, with fewer children than their less-educated counterparts.

Table 2
Descriptive statistics by land owning and ES graduate

	Land owning				ES graduate				All	
	Yes		No		Yes		No			
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
# of births	4.9	2.4	3.9	2.1	3.6	1.9	4.4	2.3	4.3	2.3
Age at (first) marriage, wife	19.9	3.7	21.2	4.3	22.0	3.8	20.5	4.1	20.6	4.1
Age at (first) birth, wife	25.7	5.9	26.7	5.5	26.9	4.3	26.2	5.8	26.2	5.7
Age at (first) marriage, husband	21.2	3.5	21.6	3.4	22.1	3.2	21.3	3.5	21.4	3.4
Age at (first) birth, husband	27.0	5.5	27.0	4.7	27.0	3.8	27.1	5.2	27.0	5.1
Duration	20.1	9.7	15.8	9.7	13.3	8.8	18.2	10.0	17.7	10.0
Infant mortality (%)	23.6	-	11.3	-	6.2	-	18.0	-	16.9	-
Child mortality (%)	34.8	-	18.6	-	11.0	-	27.5	-	25.9	-
N	2,123		2,571		454		4,240		4,694	

* Child and infant mortality measures present the percentage of women who lost at least one of their children before age 1 or age 5.

These findings suggest that landholding was associated with higher fertility, while education had an inverse effect, aligning with previous research (Bongaarts 2003; Hwang 2023; Kim and Park 2009; Kye 2008). However, this interpretation requires caution due to the significant changes in land ownership and educational attainment across birth cohorts, as evidenced in Table 1. The comparison of infant and child mortality rates between groups further underscores this point; farmland owners were more likely to experience child loss, likely reflecting the secular trend of mortality decline and the contraction of the agricultural sector. Consequently, the socioeconomic differentials in fertility presented in Table 2 may partially reflect broader secular trends of delayed marriage, later childbearing, and fertility decline. To address these confounding factors and provide more robust evidence for testing socioeconomic differentials in reproductive behaviors, we employ multivariate analyses such as the Poisson regression and Cox proportional hazards models. These analyses will better account for

cohort differences and other potential confounders, offering a better understanding of the relationship between socioeconomic status and reproductive outcomes during this period of demographic transition.

Poisson regression models: The level of fertility

Table 3 presents Poisson regression results for the number of children, with Model 1 excluding interaction terms and Model 2 incorporating an interaction between birth cohort and farmland ownership. Notably, the educational differentials in fertility levels observed in Table 2 are no longer significant after controlling for other covariates. This suggests that the apparent lower fertility among elementary school graduates is primarily attributable to differences in other characteristics such as birth cohort, farmland ownership, age at censoring, and children's survival, rather than education itself. The disappearance of educational differentials likely reflects the secular trend of fertility decline, given the increasing proportion of

Table 3
Poisson regression analysis of the number of children (N = 4,694)

	Model 1			Model 2		
Variables	*b*	SE	exp(*b*)	*b*	SE	exp(*b*)
Birth cohort (Reference = 1895-1909)						
1910-1919	0.016	0.022	1.016	**0.080**	**0.040**	**1.084**
1920-1929	0.009	0.022	1.009	0.051	0.038	1.052
1930-1939	0.014	0.024	1.014	0.066	0.038	1.068
1940-1960	**-0.086**	**0.030**	**0.918**	-0.050	0.043	0.951
ES graduate	0.006	0.027	1.006	0.006	0.027	1.006
Land own	**0.069**	**0.015**	**1.071**	**0.126**	**0.037**	**1.134**
Birth cohort *Land own (Reference = 1895-1909)						
1910-1919*Land own	-	-	-	-0.092	0.047	0.912
1920-1929*Land own	-	-	-	-0.053	0.047	0.949
1930-1939*Land own	-	-	-	-0.080	0.048	0.923
1940-1960*Land own	-	-	-	-0.030	0.057	0.970
Age at exit	**0.031**	**0.001**	**1.032**	**0.031**	**0.001**	**1.032**
Infant mortality	0.013	0.025	1.013	0.014	0.025	1.014
Child mortality	**0.277**	**0.023**	**1.319**	**0.276**	**0.023**	**1.317**
Intercept	**0.096**	**0.048**	**1.101**	0.053	0.055	1.055

Bold: $p < 0.05$

elementary school graduates across birth cohorts (as shown in Table 1). In contrast, farmland ownership remains a significant predictor of fertility even after controlling for other variables. Landowners had 7.1 percent more children than their landless counterparts with comparable characteristics, a statistically significant difference. Thus, while the seemingly negative relationship between education and fertility levels appears spurious, the positive association between land ownership and fertility persists. These findings underscore the importance of considering secular trends and potential confounding factors when interpreting socioeconomic differentials in fertility, and highlight the enduring influence of land ownership on reproductive outcomes during this period of demographic transition.

Model 2 in Table 3 investigates the temporal change of the relationship between farmland ownership and fertility levels by incorporating interaction terms. While the point estimates of these interactions suggest a decreasing trend, indicating potentially weaker cohort differences in the association over time, these changes do not reach statistical significance.

Taken together, these results provide mixed evidence for our hypotheses. Consistent with our expectations, land ownership demonstrates a positive association with fertility levels, and this relationship shows some indication of weakening across cohorts, albeit not statistically significantly. Conversely, educational differentials in fertility prove insignificant after controlling for other factors. This shows that land ownership mattered for fertility level, showing that demographic behaviors in a Korean rural village were dependent on socioeconomic circumstances. These findings suggest that Malthusian preventive checks, characteristic of pre-transitional societies, were operational in the rural village of *Unyang* during the fertility transition, but their influence may have diminished to some extent over time.

Cox proportional hazards models: Timing of first marriage and first birth

Figures 2 and 3 present Kaplan-Meier survival estimates for first marriage and first birth, stratified by farmland ownership and elementary school graduation status. These analyses corroborate the findings presented in Table 2, revealing distinct patterns in the timing of family formation events across socioeconomic groups. Individuals from households owning farmland exhibit accelerated transitions to both marriage and childbearing compared to their landless counterparts. Conversely, elementary school graduates demonstrate delayed entry into marriage and motherhood relative to those with lower educational attainment. Notably, the disparities between these

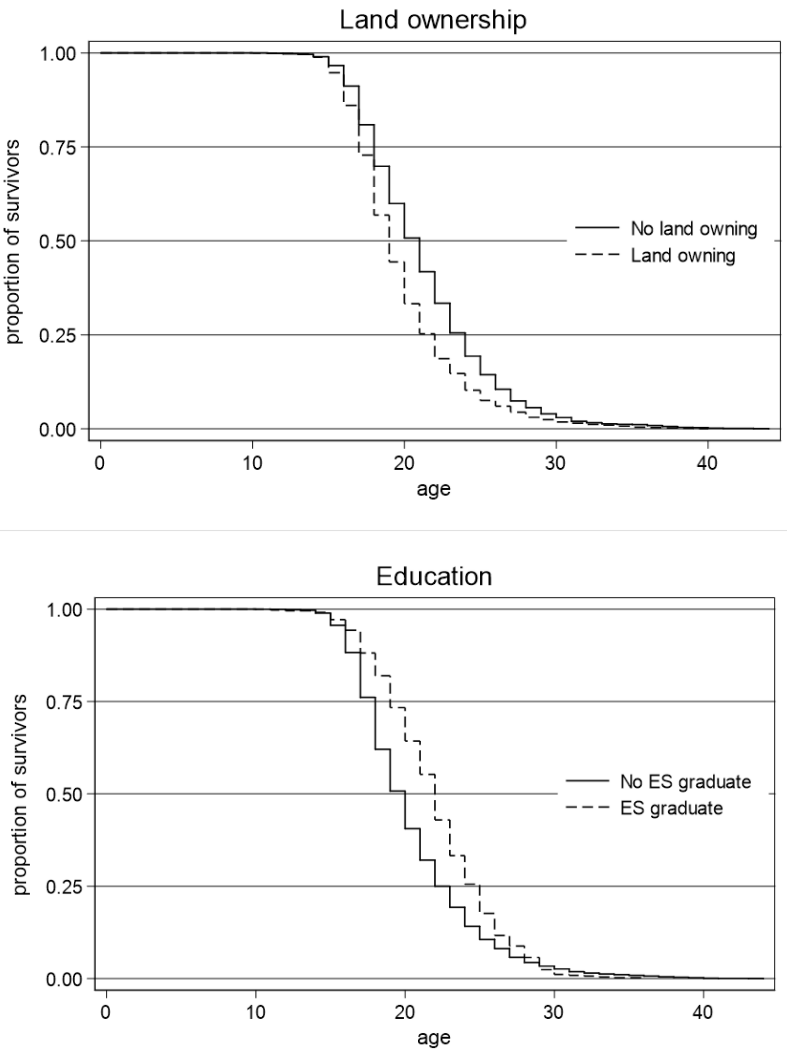

Fig. 2.—Kaplan-Meir survival estimates for age at (first) marriage, by landholding and education

socioeconomic groups are more pronounced for the timing of marriage than for the timing of first birth. The more substantial differences observed in marriage timing suggest that socioeconomic factors may exert their strongest influence on the initial stages of family formation, with potentially cascading effects on subsequent reproductive outcomes.

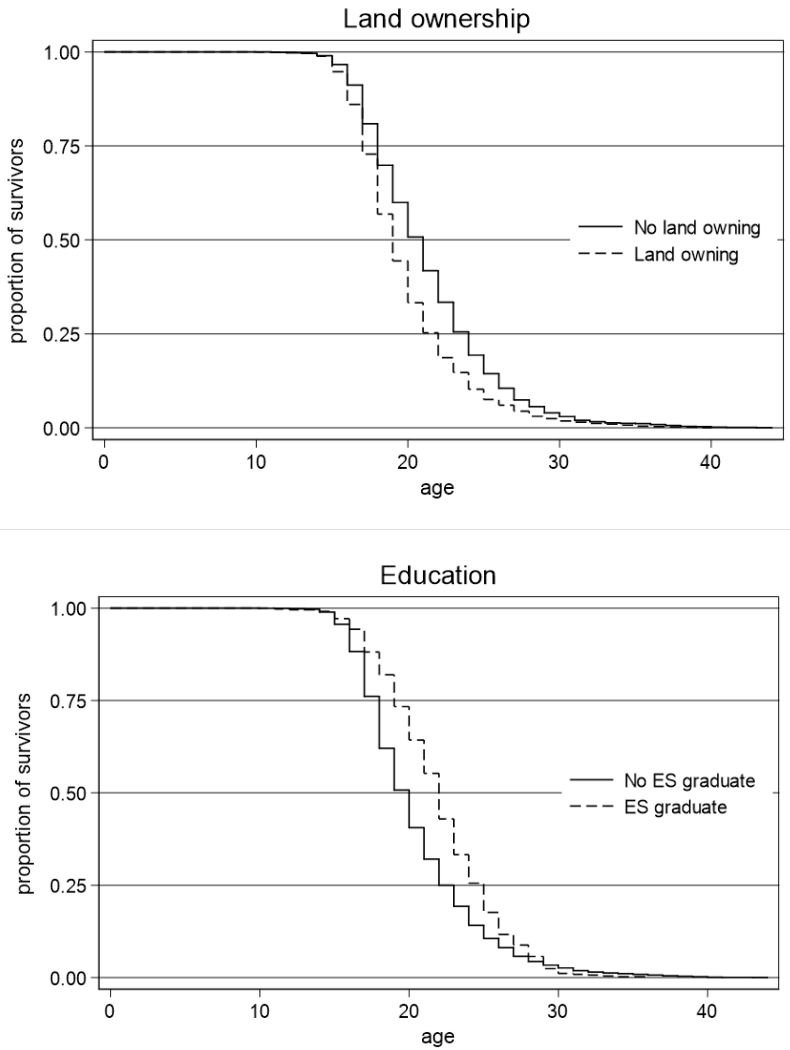

Fig. 3.—Kaplan-Meir survival estimates for age at (first) birth, by landholding and education

Tables 4 and 5 present Cox proportional hazards regression estimates for age at first marriage and age at first birth, respectively. The findings for marriage timing (Table 4) align with the fertility level analysis reported in Table 3. Land ownership emerges as a significant predictor of marriage timing, while educational differentials do not reach statistical significance

Table 4
Survival analysis of age at (first) marriage (N = 4,694)

	Model 1			Model 2		
Variables	*b*	SE	exp(*b*)	*b*	SE	exp(*b*)
Birth cohort (Reference = 1895-1909)						
1910-1919	-0.013	0.049	0.987	-0.005	0.085	0.995
1920-1929	**0.177**	**0.048**	**1.194**	**0.195**	**0.080**	**1.215**
1930-1939	**-0.612**	**0.048**	**0.542**	**-0.654**	**0.077**	**0.520**
1940-1960	**-0.677**	**0.052**	**0.508**	**-0.660**	**0.079**	**0.517**
ES graduate	-0.034	0.051	0.966	-0.037	0.052	0.963
Land own	**0.134**	**0.031**	**1.143**	0.129	0.079	1.138
Birth cohort *Land own (Reference = 1895-1909)						
1910-1919*Land own	-	-	-	-0.015	0.105	0.986
1920-1929*Land own	-	-	-	-0.043	0.103	0.957
1930-1939*Land own	-	-	-	0.121	0.101	1.128
1940-1960*Land own	-	-	-	-0.068	0.109	0.934

Bold: $p < 0.05$

Table 5
Survival analysis of age at (first) birth (N = 4,694)

	Model 1			Model 2		
Variables	*b*	SE	exp(*b*)	*b*	SE	exp(*b*)
Birth cohort (Reference = 1895-1909)						
1910-1919	**0.177**	**0.049**	**1.194**	**0.225**	**0.085**	**1.252**
1920-1929	**0.327**	**0.049**	**1.387**	**0.362**	**0.080**	**1.436**
1930-1939	**-0.122**	**0.048**	**0.885**	-0.131	0.077	0.877
1940-1960	**-0.271**	**0.052**	**0.763**	**-0.237**	**0.079**	**0.789**
ES graduate	-0.022	0.052	0.979	-0.022	0.052	0.978
Land own	0.047	0.031	1.048	0.075	0.079	1.077
Birth cohort *Land own (Reference = 1895-1909)						
1910-1919*Land own	-	-	-	-0.076	0.105	0.927
1920-1929*Land own	-	-	-	-0.061	0.103	0.940
1930-1939*Land own	-	-	-	0.062	0.101	1.064
1940-1960*Land own	-	-	-	-0.077	0.109	0.926

Bold: $p < 0.05$

(Model 1). Specifically, the risk of first marriage for farmland owners is 14.3 percent higher than for their landless counterparts with comparable characteristics. Notably, this association remains consistent across birth cohorts, indicating a stable relationship between land ownership and marriage timing throughout the period studied. In contrast, the analysis of age at first birth (Table 5) reveals that neither education nor farmland ownership significantly influences the timing of first birth. While there are significant changes in the timing of first birth across cohorts, socioeconomic status differentials in the timing of first birth are not evident.

Summary and discussion

This study investigates the associations between socioeconomic status and both the level and timing of reproduction in a rural Korean village during the fertility transition. Utilizing uniquely linked population register data with land rosters and school directories, we examine the roles of land ownership and educational attainment in shaping changing fertility patterns. Despite certain limitations in data construction, our analysis reveals noteworthy patterns. Firstly, land ownership emerges as a significant factor influencing fertility levels, while education shows no significant effect after controlling for other covariates. Although bivariate relationships are observed for both socioeconomic indicators, the association between education and reproduction disappears in multivariate analyses. Conversely, farmland ownership maintains a significant positive association with fertility levels and earlier marriage timing, even after controlling for other factors. This suggests that economic resources, particularly in the form of land ownership, continued to play a fertility-enhancing role during the Korean fertility transition. Secondly, the association between land ownership and reproduction remains relatively stable across birth cohorts, with no statistically significant changes observed. This persistence underscores the enduring influence of land ownership on reproductive behaviors, even amidst rapidly changing demographic patterns. These findings contribute to our understanding of the complex interplay between socioeconomic factors and fertility during demographic transitions, highlighting the sustained importance of traditional economic resources in shaping reproductive outcomes in rural Korea during this period.

This study, while offering valuable insights, has several limitations that warrant acknowledgment and suggest avenues for future research. Firstly, the

data linkage process is incomplete, as discussed in the methodology section. The null association between education and reproduction may be attributable to misclassification of educational attainment due to matching errors. Future studies could address this by including data from other elementary schools, potentially reducing this issue. Additionally, the binary classification of educational attainment (elementary school graduates vs. non-graduates) may obscure non-linear relationships between education and reproductive behaviors. While this categorization may be appropriate given the generally low educational attainment among the cohorts studied, it potentially masks more complex educational effects. For instance, if schooling up to middle school positively influences reproduction while high school education leads to delayed marriage and fertility, our current analysis would be unable to capture such nuances. Secondly, the observed positive association between land ownership and reproduction may reflect factors beyond simple status differentials. While this association likely represents higher reproduction among higher-status families for earlier birth cohorts, consistent with previous studies (Bengtsson 2014; Kim and Park 2009), its interpretation for later cohorts is less straightforward. The inclusion of non-*Unyang* residents in the data, some of whom may have resided in urban areas, complicates the analysis. Given the substantial rural-to-urban migration in Korea since the 1960s, many individuals from recent birth cohorts, particularly those without land, may have moved to urban areas. The strong urban-rural fertility differential could thus be driving the observed patterns, rather than socioeconomic status per se.

Despite these limitations, this study contributes significantly to our understanding of changing socioeconomic differentials in reproduction during Korea's rapid fertility transition. It highlights the complex interplay between traditional economic resources, education, and reproductive behaviors in a transitioning society. Future research should aim to address these limitations by incorporating more comprehensive data on educational attainment, refining the classification of urban and rural residents, and potentially employing more sophisticated statistical techniques to disentangle the various factors influencing reproductive patterns during this critical period of demographic change.

(*Submitted*: July 18, 2024; *Revised*: September 20, 2024; *Accepted*: September 21, 2024)

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