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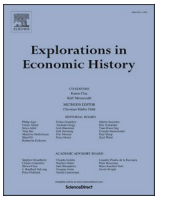

Land Inequality and Demographic Outcomes: The Relationship between Access to Land and the Demographic System in 19th-century Rural Tuscany

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ABSTRACT

In pre-industrial rural Italy, the disparities among smallholders, sharecroppers, and day laborers were starkly defined by their unequal access to land, which significantly influenced their living standards, family structures, and socioeconomic conditions. This paper uses nominative data from 1819 to 1859 to first explore how the different peasant categories adjusted their demographic behaviors according to their tie to the land, and then how they were possibly modified when short-term stressors, such as price increase and/or epidemics, altered the existing equilibrium.

The results reveal that the groups with access to land where less vulnerable and less susceptible to economic crises compared to day laborers, who relied entirely on the market for essential food supplies. During periods of high prices, day laborers experienced a rapid decline in their economic situation, leading to increased mortality, migration, and postponement of marriages. However, access to land was also associated with a demographic pattern aimed at both controlling household consumption and maximizing the male labor force. This included strict control over marriages, increased fertility, and selective mobility, all of which could intensify during crises and periods of rising prices.

These findings underscore the inadequacy of the simplistic classification of landed versus landless groups, emphasizing the necessity for a more sophisticated understanding of households based on their relationship and connections with the land.

1. Introduction

In light of Malthus's theory (1803) on the relationship between economy and demography, the concept of inequality has been central in historical-demographic literature. Inequality refers to the uneven distribution of resources and opportunities among different population segments. This can lead to economic disparities, and, in turn, to different demographic patterns and behaviors (Bengtsson and Saito, 2000). A large literature has highlighted the relevance of socioeconomic factors in population evolution and changing demographic behaviors within various demographic models of long-run population growth, especially those focusing on the transition from natural to controlled fertility (Dribe et al., 2014; Bengtsson and Ohlsson, 1994; Clark and Cummins, 2009; Easterlin, 1975).

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In the historical demography literature, inequality has been often studied through occupational status, class, or income, which suggests the potential access to resources of individuals and family groups. However, Fertig et al. (2022) and Schlumbohm (1996) studied access to resources in pre-industrial rural populations in terms of landownership. The idea is that landownership provided a buffer against short-term economic crises, enabling landed families to better withstand poor harvests or economic downturns compared to their more vulnerable landless counterparts (Bengtsson et al., 2004a).

Both earlier and recent studies on pre-industrial Italian rural areas, however, provided evidence that farmholders (landed) and sharecroppers (landless) exhibited similar family systems and household structures, and that both groups relied on a relatively high number of adult males to ensure greater labor capacity and, consequently, better economic conditions (M. Della Pina, 1990; Kertzer and Hogan 1989; Breschi et al., 2004; Doveri, 1990). This required the adoption of demographic strategies aimed at continuously adjusting household size and structure to the characteristics of the farm and changing economic situations. Given these premises, we propose that the demographic behaviors of rural social groups could be better described and more closely associated with access to land rather than with landownership.

This article explores the relationship between different forms of access to land and demographic behaviors through the analysis of a Tuscan community, Casalguidi, between 1819 and 1859. Casalguidi offers several distinctive characteristics that make it an ideal case study for the objectives outlined above. Firstly, it exemplifies a typical sharecropping community of mid-nineteenth-century Tuscany, characterized by the simultaneous presence of various social groups with differing ties to the land, such as sharecroppers, landowners, and day laborers. Secondly, the demographic indicators of Casalguidi closely align with those of Tuscany as a whole, making it representative of the region's rural areas. Thirdly, Casalguidi is one of the few Italian historical databases that cover the pre-unitary period (before 1861), based on a detailed reconstruction of the life histories of its inhabitants. Fourthly, the community has been extensively studied within the Eurasian Project on Population and Family History (EAP) (Bengtsson et al., 2004c; Tsuya et al., 2010; Lundh and Kurosu, 2014), a comparative project offering an innovative approach "to illuminate the complexities of demographic responses to exogenous stress, economic and otherwise" (Bengtsson et al., 2004b, pp. viii).

By employing event history analysis models, we can examine how different modes of access to land have impacted and shaped demographic outcomes, including mortality, fertility, nuptiality, and out-migration. Special attention has been given to how the different groups responded to short-term economic crises and epidemic outbreaks in relation to their tie to the land. The ability to withstand hard times and short-term stress is, in fact, crucial for defining the living standards of human groups (Sen, 1984; Bengtsson et al., 2004a). In this view, many studies have highlighted the positive relationship between grain prices and mortality (Lee, 1981; Galloway, 1988; Ó Gráda and Chevet, 2002; Appleby, 2010), emphasizing the lower mortality risks of the social groups at the top of the social ladder.

In this community, only smallholders and sharecroppers had direct access to land, leaving day laborers and those not engaged in agriculture without any access to land. Although differences existed between smallholders and sharecroppers, these paled in comparison to the stark contrast with the demographic model of day laborers. The insights gained from this research illuminate not only how access to land influenced the demographic patterns of these groups but also highlight its critical role in their responses to short-term crises, whether economic or health-related. The key points can be briefly summarized as follows.

- Mortality

Besides the dramatic impact of cholera on individuals and social groups alike, day laborers were the social group more exposed to mortality risks for their greater poverty and vulnerability. Furthermore, their reliance on the market for food made them also more sensitive to price increases, a situation that was especially dire for the elderly among them.

- Marriage

Access to land played a crucial role in shaping marriage patterns. Upon marriage, women typically left their family homes, regardless of their social background. In contrast, men with access to land tended to adopt a patrilocal living arrangement, while those without often opted for a neolocal arrangement. These dynamics are essential for understanding why pronounced SES differences were observed only among males. Sharecroppers and smallholders were both less likely to marry than day laborers, as they often viewed marriage as a strategic means to control household size and family consumption. On the other hand, day laborers, who were more sensitive to price fluctuations, faced a significant decline in their marriage opportunities in times of hardship.

- Fertility

While marriage was an important check to adapt the household size to family and economic conditions, fertility was vice versa essential for ensuring a future workforce for the groups with access to land. This explains why families with land access, especially sharecroppers, show higher fertility than day laborers. Unlike marriage, we found no evidence of effects of price increases on fertility.

- Out-migration

Out-migration was extremely responsive to short-term stressors, with both high prices and cholera outbreaks positively associated with individual and, to a lesser extent, household mobility. However, the relationship between access to land and out-migration is more complex than with previous events. The risk of out-migration varies along a gradient, ranging from the highly mobile day

laborers to the deeply-rooted smallholders, with sharecroppers somewhere in between. While the first, lacking access to land, often moved their entire household, sharecroppers tended to favor the out-migration of individuals as a means to preserve the balance between household size and farm size, thus preventing the risk of eviction of the entire family unit.

These findings reveals that the demands and pressures of agricultural labor have led to surprising similarities in the demographic patterns of sharecroppers and smallholders, despite their different socioeconomic backgrounds. It emerges how sharecroppers may have developed complex demographic strategies to maintain their permanence on the same farm, while smallholders implemented measures to avoid land fragmentation. Thus, this paper makes a significant contribution to the existing literature by challenging the overly simplistic division of households into landed and landless groups. It highlights the necessity for a more sophisticated classification that reflects the diverse relationships households maintain with the land. Such an approach is essential for a deeper understanding of the complexities surrounding land ownership and access to land. Furthermore, this study is pioneering in its use of a life-history perspective to explore the interplay between land access, demographic behaviors and reactions to short-term crises in an Italian rural community during the pre-unitary period. This work complements, in some way, the earlier research by Kertzer and colleagues (1989) on the population of Casalecchio di Reno in the post-unitary period (1861–1921).

This paper is structured into four sections. Following this introduction, a background section acquaints the reader with previous studies' findings concerning the relationship between rural social groups and demographic behaviors in nineteenth-century Italy, with a particular focus on Tuscany. The next section outlines the demographic and socio-economic context of the community of Casalguidi during the same period. Section four details the data sources and the methodologies employed in the analyses, while the final section presents and discusses the results.

2. Background

In discussions surrounding the demographic model of mid-nineteenth-century Tuscany, which was still pre-industrial and largely agricultural, scholars have frequently used profession or occupation as a proxy of access to land. While this approach is not incorrect in principle and the two dimensions sometimes overlap, the form of land tenure (or its absence) does not necessarily coincide with one's occupation or profession. In fact, access to land was often a more critical dimension of socioeconomic status (SES) than occupation or profession in determining the demographic behaviors of individuals and families. It significantly influenced living standards, family organization, and demographic choices. This is evidenced in various studies that contrast the household structures and the family systems of sharecroppers and day laborers, two typical landless social groups in rural Tuscany, deeply differentiated by their access to land (Kerzter and Hogan, 1989; Barbagli, 1990; Manfredini, 2017). Sharecropping was the predominant and emblematic land tenure system in Tuscany during this period, widely practiced across many regions of Central Italy (Barbagli, 1990;Poni, 1982; Giorgetti, 1974). The contract bound the entire family, renewed annually, and typically involved an equal division of expenses and harvests between the sharecropping family and the landowner (Anselmi, 1990; Biagioli, 2002; Giorgetti, 1974). A sharecropping family was allocated a plot of land that matched the structural and dimensional characteristics of its household (Doveri, 2000; Pazzagli, 1973; Fornasin et al., 2024). As a result, sharecroppers had to strictly control demographic behaviors to maintain the most suitable household structure and size for the required farming activities, or they risked eviction from the farm (Biagioli, 1987).

Marriage was the primary preventive check frequently emphasized in historical and demographic literature on sharecroppers. Numerous studies have demonstrated that marriage was either postponed or entirely avoided to limit births and, consequently, family expansion (Rettaroli, 1993; Barbagli, 1990; M. Della Pina, 1990). Additionally, the significance of working-age men in agricultural work led to the establishment of a strict patrilocal model, wherein sons typically remained within the paternal household after marriage, while daughters traditionally relocated to their husband's residence (Derosas et al., 2014). Day laborers, on the other hand, had no demographic constraint deriving from contractual norms or land ties, and their entire demographic system was shaped by indigence. Hired on short-term contracts, they moved frequently in search of job opportunities (Nani, 2012). Day laborers' primary objective was, therefore, to reduce economic pressure on the family, which was partially managed by reducing internal consumption through a neolocal marriage system, wherein both males and females left the paternal household upon marriage.

While disparities in land access and living standards between sharecroppers and day laborers have prompted numerous studies on their family systems and marriage patterns, there has been less emphasis on fertility and mortality differentials. Rosella Rettaroli and Francesco Scalone (2012) demonstrated that sharecroppers in the Emilian countryside exhibited higher marital fertility than day laborers, a finding also observed by Della Pina (1993) for the Prato countryside in Tuscany. Regarding mortality, differentials by occupation were almost exclusively estimated for the first year of life. Scalone and colleagues (2016) found no evidence of differentials in neonatal mortality between the children of sharecroppers and day laborers near Bologna, while Della Pina (1993) reported a higher infant mortality risk among day laborers in Tuscany. Unfortunately, in-depth analyses of socioeconomic status (SES) differentials in mortality and reproductive patterns, such as mortality at older ages and potential mechanisms of birth control, remain notably rare (M. Manfredini and Breschi, 2013). Demographic studies of other significant social groups in the Tuscan countryside, such as landowners, are even more scarce (Fornasin et al., 2024). As previously mentioned, some analyses have focused on the marriage and family systems of landowners, highlighting their adherence to a patrilocal marriage system, which underscores the pivotal role of adult males also within their households. Beyond their essential contribution to agricultural activities, as seen with sharecroppers, for landowners, ensuring at least one married male member was crucial for facilitating intergenerational property succession within the family. The substantial lack of studies on landowners has hindered a comprehensive understanding of the relationship between land access and demographic behaviors. The literature on nineteenth-century Tuscany is not clear whether groups with different living standards had heterogeneous demographic responses to short-run crises (Malanima and Breschi, 2003). Significant insights have been gleaned from the Eurasian Project, particularly through the analysis of the population of Casalguidi as representative of a typical Tuscan

sharecropping society during the pre-unitary period. Notably, in EAP studies of Casalguidi, socioeconomic status was often proxied through family tax for the purpose of comparison, rather than occupation or land access. We have found evidence that wealthier households had higher fertility and higher marriage rates (Breschi et al., 2010; Derosas et al., 2014), while the poorest ones experienced higher mortality and were more vulnerable to short-term crises and market price fluctuations (Campbell et al., 2004; Breschi et al., 2004). The literature usually explains mortality in terms of access to resources, while the higher fertility of sharecroppers was likely driven by the need to secure future workforce, thereby reducing the risk of eviction from the farm. On the other hand, nuptiality differentials were found associated with inheritance practices and homeownership (Barbagli, 1990).

The application of event-history models to the reconstructed population of Casalguidi has also shed light on migration, a relatively less explored demographic event in pre-unitary Italy due to the lack of specific sources and data. The analysis has revealed that homeowners were less prone to household out-migration than non-homeowners, and that sharecroppers relied not only on nuptiality but also on individual mobility to adjust household size according to work demands and farm size. (Manfredini, 2003; Breschi et al., 2011).

From the discussion of the literature above, it is evident that a coherent and comprehensive analysis of the impact of land access on the demographic patterns of the different social groups is still missing. Further and more in-depth analyses are therefore warranted, which should include landowners (smallholders in the case of Casalguidi) and examine how different social groups responded to short-term crises based on their tie to the land.

3. Setting: Casalguidi, a typical sharecropping society of mid-19th century Tuscany

Between 1819 and 1859, Casalguidi, a large community in the province of Pistoia near Florence, witnessed a steady population growth from 1906 to 2690 inhabitants (+41.1 %). This increase was interrupted only by a significant decline of 3.6 % during the cholera outbreak of 1854–55 (Fig. 1).

Extensive exploration of Casalguidi's demographic system during this period has revealed strong evidence of a pre-transitional demographic model, characterized by recurrent waves of epidemics and short-term economic crises. Life expectancy at birth was approximately 35 years, heavily impacted by high infant mortality rates of around 200 per thousand, while fertility rates averaged about 5 children per woman (Breschi et al., 2004, 2010 and M. 2013; Derosas et al., 2014). These findings are consistent with various other studies that have examined the demographic system of mid-nineteenth-century Tuscany (Bandettini, 1960; Del Panta, 1974 and 2021).

During this timeframe, Casalguidi endured a severe cholera epidemic in 1854–55, which saw the death rate peaking at 77 per thousand, resulting in a 131 % excess mortality compared to the average for that period. No other short-term crisis between 1819 and 1859 led to such a dramatic rise in mortality (Fig. 2).

The cholera epidemic overlapped with a significant surge in grain prices, which reached over 30 £ per quintal, the highest recorded in the period 1819–59. Grain prices had already been on the rise since 1851 (17.5 £/q), leading to an 87.7 % increase between 1851 and 1854, which had severely affected the economic stability of the entire community. A far less impactful short-term crisis was observed in 1833, this time without any association with increase in grain prices. Overall, the average grain price during 1819–59 was 21.9£ per quintal, with a peak of 32.8 £/q in 1854. This positive association between prices and mortality has been a distinctive trait of Tuscany throughout the nineteenth century (Malanima and Breschi, 2003).

Moreover, Casalguidi reflects the social stratification and land tenure systems typical of much of the regional countryside during the mid-nineteenth century. At that time, the dominant land tenure system in this area was the typical Tuscan sharecropping model, accounting for 48.6 % of all peasant households. However, the sharecropping system in Casalguidi was distinct from other parts of Tuscany, primarily due to the smaller average farm size−5.9 hectares in 1835 compared to the regional average of 14.2 hectares. This smaller scale required less labor and resulted in smaller households than those found in other rural areas (Detti, 2000; Martinelli, 2016). If we consider that day laborers represented 14.3 % of the population, a large majority−approximately 63 %−were landless, while a minority of landowners, mainly smallholders, constituted 13 %. Overall, the agricultural sector engaged around 76 % of the village's families, with approximately 17 % involved in non-agricultural activities, particularly craftsmanship.[1] This social stratification led to marked differences in the demographic patterns among the various social groups, largely shaped by living standards, socioeconomic conditions, and household composition (Manfredini and Breschi, 2008 and M. 2013; Breschi et al., 2009).

4. Data and methods

The analyses were conducted using a longitudinal database based on both individual and household-level data, previously used within the Eurasian Project and various studies investigating the demographic behaviors and family systems of Italian populations (Breschi et al., 2004 and 2010; Manfredini and Breschi, 2008; Derosas et al., 2014). It includes the life histories of residents from Casalguidi, meticulously reconstructed by integrating information from parish registers of baptism, marriage, and burials with a parish census called Status Animarum. Each year, the priest recorded this register during his pastoral visits to families, allowing for the tracking of household changes from 1819 to 1859. The Stati Animarum from Casalguidi are particularly detailed and rich, providing consistent data over the studied period, with just one missing year over four decades. The priest recorded details for each household

[1] For about 7 % of households, no information on profession was available on parish registers.

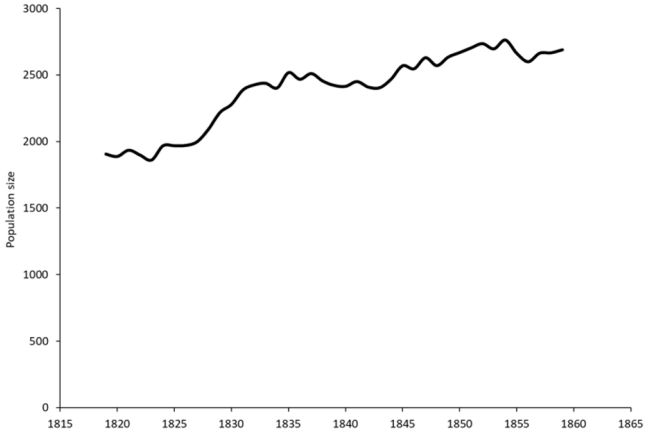

Fig. 1. Population size. Casalguidi, 1819–59.

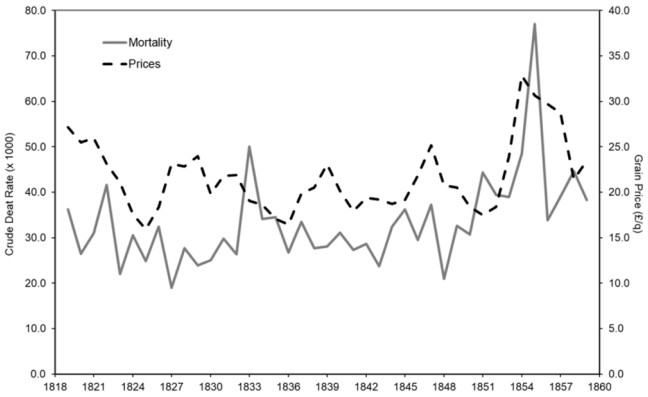

Fig. 2. CDR (x 1000) and grain price (£/q) in Casalguidi, 1819–59.

member, such as name, surname, age, sex, and their relationship to the household head (Manfredini, 1996). Furthermore, the occupation of the household head and homeownership were carefully noted, offering a profound insight into the demographic and social characteristics of the community.

We carried out an event-history analysis in discrete time to assess the impacts of occupation and short-term crises on mortality, fertility, nuptiality, and out-migration (Table 1). This approach was chosen for two main reasons. First, Status Animarum are inherently annual in nature. Second, accurately dating certain events, such as marriages occurring in the wife's parish or specific deaths, poses a challenge. These events can only be reliably attributed to a specific year rather than an exact date.

This analysis is commonly approached with a logistic regression, where the dependent variable is the probability $p_{i,t}$ that an individual i will die, give birth, or marry in year t. It takes the form

$$\frac{p_{i,t}}{1-p_{i,t}} = exp(\beta_{i,j} \cdot \mathbf{X}_{i,j,t})$$

where $p_{i,t}/(1\text{-}p_{i,t})$ is the odds of experiencing a specific event according to a set of j potential determinants, here indicated by $\mathbf{X}_{i,j,t}$, the vector of explanatory variables with their corresponding coefficients $\beta_{i,j}$. The determinants include always the age and sex of each person i, the household head's occupation (SES), the logged grain price, the cholera epidemic of 1854–55, and the interaction between occupation and price (see tab. 1A in the Appendix for descriptive statistics). Moreover, each model was integrated with specific control variables, indicated below the tables. We classified the household head's occupation according to the different modes of access to land, dividing them into four distinct groups: day laborers (the reference category), sharecroppers, smallholders and landowners, and a category for non-agricultural activities, which primarily includes poor artisans alongside some wealthy people. For grain prices, we used a series of mean annual wheat prices from the Florence city market, measured in Lire per quintal (Bandettini, 1957; Bengtsson et al., 2004a; Breschi et al., 2004). The data were first logged and subsequently filtered using the Hodrick-Prescott filter to determine the deviations from the price trend (Hodrick and Prescott, 1997). Although a smoothing parameter of 6.25 is typically recommended for yearly data (Ravn and Uhlig, 2002), it proved unsuitable for our series. Therefore, we opted for a smoothing parameter of 100 (see fig. 1A in the Appendix). The effects of prices on demographic responses were analyzed using different time lags. For mortality and

Table 1
Sample features of each analysis.

	N° of unique individuals	N° of person-years	Average person-years	N° of events
Mortality	14,218	96,061	6.8	2542
0 years	3775	3775	1.0	735
1–14 years	4212	26,692	6.3	698
15–49 years	4588	49,001	10.7	434
50+ years	1643	16,610	10.1	675
First Marriage	2432	14,167	5.8	1075
M_{20-44}	1302	7872	6.0	509
F_{20-44}	1085	5892	5.4	566
Fertility (F_{15-49})	484	6087	12.6	2076
Out-migration[1]		17,618		590

[1] Analysis of out-migration was based on households, thus the number refers to household-years and the number of events to household out-migration

out-migration, we considered the price of the current year (lag0),[2] while for fertility and nuptiality, we also added the price of the previous year (lag1).[3] The coefficients of prices were then converted in elasticities, indicating the percent change in the odds of specific events associated with a 10 percent increase in the deviation from the price trend.[4] The cholera outbreak of 1854–55, the most important epidemic short-term crisis in the period considered, was expressed as a dichotomous variable. Lastly, we included the year of birth to account and control for a linear trend over time, with the exception of the out-migration model, where we opted for the calendar year.[5] Typically, this variable serves as a predictor of the secular trend, but in this case−spanning 41 years in the mid-nineteenth century−it rather reflects potential shifts in demographic rates over a shorter time frame.

Interaction models were ultimately run to explore potential differential effects of prices on demographic outcomes by profession. We evaluated improvements in model fit using the Likelihood Ratio test and will discuss solely statistically significant results. The complete interaction models can be found in the Appendix (tabb. 3A-6A).

For the mortality analysis, we estimated four distinct models stratified by age: infants (0 years), children (1–14 years), adults (15–49), and the elderly (50+). This age segmentation accounts for varying social roles, positions within the household, and different nutritional needs in relation to work activities. The outcome variable is dichotomous, indicating whether or not an individual died within a specific year. In the nuptiality model, acknowledging the distinct marriage patterns between genders, we estimated two separate models for men and women aged 20–44 years. Regarding fertility, the model estimates the odds of having a child for married women 15–49 years, focusing exclusively on those whose marital histories have been reconstructed starting from marriage. This requirement was crucial to tackle the pervasive issue of missing data across multiple variables, particularly concerning the reproductive histories of women who were already married upon their arrival in Casalguidi. Although this condition limits the number of women included in the model (Table 1), it significantly improves the quality of information and data used in our analysis.

The analysis of out-migration employed a competing risk model, with the household as the primary unit of the analysis. This methodology was designed to differentiate between two distinct forms of out-migration: household out-migration and individual (or group) out-migration. Understanding this distinction is crucial, as each type carries different implications. Household out-migration often suggests forced migration scenarios, such as when landlords evict entire families from the farm. In contrast, individual or group out-migration may reflect a strategic decision aimed at reducing family consumption. This model does not consider one-person households or individual out-migration that occurs upon marriage.

While the dataset may not be extremely large, we deem it to be reliable and representative, as its demographic indicators align closely with those of the whole region. However, to address potential limitations in robustness related to small sample sizes, we adopted an α level of $p < 0.10$. Furthermore, all models were estimated using a robust variance estimator to correct standard errors for heteroscedasticity issues (White, 1980).

5. The relationship between access to land and demographic outcomes

The results of logistic regression models for the various demographic events are detailed in Tables 2-5. Regarding mortality (Table 2), the findings reveal significant differential risks by household head's occupation, especially for the most vulnerable age groups, infants and individuals aged 50+ years.

Infants living in households headed by sharecroppers and smallholders show a 32 % and 37 % lower risk of dying, respectively, when compared to infants from households of day laborers. Among the elderly, we found evidence of a significant 26 % lower risk among sharecroppers. These findings suggest that sharecropping families may have a better capacity to protect their most fragile

[2] Landless families typically left the farm at the end of the agrarian contract on November 11th, which supports the use of prices at time *t* in the out-migration model.

[3] Fertility is generally associated with prices at time *t-1*, except during mortality crises, when it could respond quickly to changing conditions (Bengtsson and Dribe, 2006).

[4] Being *b* the original coefficient, the risk associated with a 10% increase in grain prices is calculated as $100 \cdot \left(e^{b \cdot \log(1.1)} - 1\right)$.

[5] The out-migration model is based on household-level data, which makes the year of birth meaningless.

Table 2
Logistic regression. Effects of occupation and short-term crises on mortality. individuals 0 years, 1–14, 15–49, and 50+ years. Casalguidi, 1819–59.

	0 years[1]		1–14 years[2]		15–49 years[3]	
	Variables	OR	*p*-value	OR	*p*-value	OR
Logged grain price (lag 0)	0.653	0.217	1.434	0.349	3.164	0.005
Year of birth	1.001	0.954	1.047	<0.001	0.996	0.218
Cholera epidemic (ref. No)	1.716	0.007	2.309	<0.001	2.605	<0.001
Profession (ref. Day Laborers)	1.000		1.000		1.000	
Sharecroppers & tenants	0.679	0.002	0.852	0.430	1.074	0.701
Farmholders	0.626	0.003	0.916	0.733	0.959	0.869
Non-agric. occupations	0.825	0.167	1.600	0.026	1.061	0.798
Unknown	1.156	0.572	1.479	0.021	2.383	<0.001
Log-likelihood	-1822.0		-1700.7		2405.3	
Wald test (chi2)	68.4, p<0.001		159.8, p<0.001		173.0, p<0.001	
	50+ years[3]					
Variables	OR	*p*-value				
Logged grain price (lag 0)	1.064	0.855				
Year of birth	0.986	<0.001				
Cholera epidemic (ref. No)	3.055	<0.001				
Profession (ref. Day Laborers)	1.000					
Sharecroppers & tenants	0.741	0.049				
Farmholders	1.175	0.369				
Non-agric. occupations	0.868	0.440				
Unknown	1.935	<0.001				
Log-likelihood	-2641.3					
Wald test (chi2)	350.1, p<0.001					

[1] This model also controls for sex, mother's age at birth, birth order, presence/absence of parents, and household size
[2] This model also controls for sex and household size
[3] These models also control for sex, marital status, and household size

members, likely due to their household structure and organization rather than solely economic factors. In contrast, the risk patterns among children aged 1–14 years and adults aged 15–49 years are more homogeneous, with no significant differential risks across different social groups. The only exception is observed in children from non-farming families, who face a 60 % higher risk compared to children of day laborers.

When examining short-term crises, the findings reveal that changes in mortality were significantly more associated with the cholera epidemic than with fluctuations in grain prices. During the cholera years, all the age groups experienced a significant rise in the risk of death, with mortality nearly doubling for everyone. Grain prices impacted only adult mortality, where a 10 % increase in the deviation from price trend led to a significant 11.6 % rise in the risk of death. However, disentangling the effects of grain prices and the cholera epidemic on mortality is challenging. In fact, prices had been on the rise since 1853 (see Fig. 2), which may have exacerbated the effects of cholera due to the food shortage and the consequent organic decay experienced during that period.

The interaction between prices and profession was found to be statistically significant only among the elderly (LR = 9.9, *p*-value = 0.042), while no significant interaction was observed for the other age groups (LR = 2.4, *p*-value = 0.664 for infants 0 years, LR = 4.2, *p*-value = 0.380 for children 1–14, and LR = 5.8, *p*-value = 0.213 for adults 15–49, see tab. 3A in the Appendix). For individuals aged 50+ years, day laborers and those not engaged in farm activities show a positive 15–20 % increase in mortality associated with a 10 % rise in grain prices, with this effect being statistically significant only for day laborers (Fig. 3), likely due to their reliance on the market for sustenance. Conversely, sharecroppers and smallholders, who could rely on self-produced food, exhibited a less pronounced mortality response to price increases.

Coming to fertility (Table 3), the model considers all live births from married women 15–49 years and includes grain prices at both lag0 and lag1. Much like mortality, fertility was strongly impacted by the cholera epidemic, with a significant 28 % decline in 1854–55, but it remained unaffected by price fluctuations, regardless of the lag period considered. All social groups show higher odds of having a child compared to day laborers, although statistically significant coefficients were only found for women not engaged in farming activities (+15 %) and sharecroppers (+13 %). For sharecroppers, this may reflect a concern to secure a reliable future workforce for the household, a hypothesis that could be further supported by the practice of testing a future daughter-in-law's fertility through the approval and encouragement of premarital sexual activity.

No significant interaction between occupation and grain prices at both lags was found (LR = 5.2, *p*-value = 0.270 for lag0; LR = 1.5, *p*-value = 0.819 for lag1, see tab. 4A in the Appendix for details). However, we observe signs of a reduction in fertility at lag0 during economic hardship among groups with access to land, farmholders in particular. This seems suggesting that these groups quickly responded to rising prices, likely through a reduction in the risk of marriage (see below).

Fertility in pre-transitional populations was closely associated with marriage. The institution of marriage played a crucial role not only in ensuring the biological continuity of families and communities but also in shaping family economies, forging alliances, and influencing social mobility. In Casalguidi, marriage was also closely tied to access to land, which determined the type of living arrangement after marriage. For men, neolocal marriages, common among day laborers, necessitated the accumulation of sufficient resources to establish a new household. In contrast, patrilocal marriages, prevalent among sharecroppers and farmholders, relied on

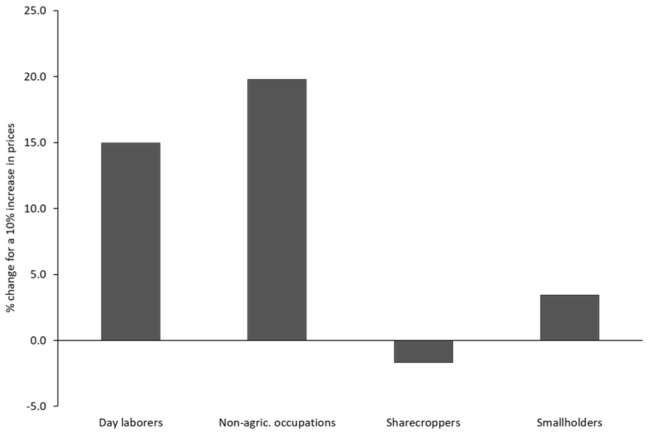

Fig. 3. Logistic regression. Mortality response to a 10 % increase in prices by occupation. Individuals 50+ years. Casalguidi, 1819–59.

Table 3
Logistic regression. Effects of occupation and short-term crises on marital fertility. Married women 15–49 years, all live births. Casalguidi, 1819–59[1].

Variables	OR	*p*-value
Logged grain price (lag 0)	0.871	0.598
Logged grain price (lag 1)	0.983	0.944
Year of birth	1.003	0.329
Cholera	0.718	0.012
Profession (ref. Day Laborers)	1.000	
Sharecroppers & tenants	1.130	0.091
Farmholders	1.160	0.121
Non-agric. occupations	1.149	0.025
Unknown	1.155	0.171
Log-likelihood	-3792.8	
Wald test (chi2)	392.3, p<0.001	

[1] The model also controls for mother's age at marriage and household size

having adequate family resources to support the new couple and any future children within the paternal home. Women, on the other hand, always left the paternal house upon marriage, with the only requirement being that the bride's family provided a dowry to the groom's family, where she would then reside.

The analysis focuses exclusively on first marriages (Table 4). The results reveal significant risk variations across occupational categories only among men. Specifically, sharecroppers and smallholders were found to be 25 % less likely to marry compared to day laborers. This differential can be better understood within the context of the patrilocal system typical of these social groups. In this framework, marriage served as a preventive check aimed at controlling household growth, ensuring a balance between family consumption and available resources (Manfredini and Breschi, 2008). Contrarily, the lack of substantial variations in female marriage patterns across different social groups may explain the homogeneity in nuptiality risks faced by women. While cholera does not seem to

Table 4
Logistic regression. Effects of occupation and short-term crises on first marriage. Never-married men and women 20–44 years. Casalguidi, 1819–58[1].

Variables	Men		Women	
	OR	*p*-value	OR	*p*-value
Logged grain price (Lag 0)	0.561	0.179	0.799	0.605
Logged grain price (Lag 1)	0.940	0.886	0.588	0.192
Year of birth	0.997	0.590	1.008	0.057
Cholera	1.111	0.662	1.170	0.480
Profession (ref. Day Laborers)	1.000		1.000	
Sharecroppers & tenants	0.747	0.016	1.041	0.737
Farmholders	0.753	0.097	1.227	0.200
Non-agric. Occupations	0.848	0.282	1.008	0.955
Unknown	0.310	0.001	0.312	<0.001
Log-likelihood	-1847.6		-1842.4	
Wald test (chi2)	74.3, p<0.001		41.1, p<0.001	

[1] This model also controls for household size and immigration in the previous 3 yrs.

have a significant impact on the odds of marrying for either gender, grain prices show a differential impact by occupation.

The interaction between grain prices and occupation (see tab. 5A in the appendix) shows a significant improvement in model fit for both sexes at both time lags, except for women at lag0 (LR = 15.3, *p*-val = 0.004 and LR = 6.5, *p*-val = 0.168 for men and women at lag0; LR = 10.3, *p*-val = 0.035 and LR = 9.2, *p*-val = 0.056 for men and women at lag1).

Fig. 4 shows that occupational groups without direct access to land (i.e. day laborers and individuals engaged in non-farming activities) faced a general decline in nuptiality for both sexes in times of high prices, although this was statistically significant only for men at lag0. This suggests a heightened vulnerability to economic stress among these groups, particularly men. In a neolocal family formation context, they often lacked sufficient savings or economic resources to establish a new household whenever the general economic conditions deteriorated.

Sharecroppers were more sensitive to price variations at lag0 than lag1, with opposite responses from men and women: high prices discouraged men from marrying while simultaneously encouraging women. In a patrilocal marriage system, these contrasting reactions may reflect once again the need to manage household growth during short-term economic crises. Opposite responses between men and women were observed also among farmholders, but in this case, men were more likely to marry during economic hardship, while women less likely to do so.

Lastly, we explored out-migration patterns from the parish of Casalguidi. Since Stati Animarum were compiled on Easter, we can track the movements in and out of the parish by comparing two successive registers. Since vital parish registers do not explicitly document the mobility of parishioners, we had to infer this information. Out-migration was defined as the absence of an individual (or entire household) in the Status Animarum at year $t + 1$, given they were present in the Status Animarum at year t and were not listed in the death register.

In the multinomial logistic model used to analyze out-migration, individual out-migration is defined as the departure of either single individuals or groups of people (aged 15+ years) from a family unit, while household out-migration the simultaneous departure of all the members of a household.

The results highlight the diverse effects of short-term stressors (Table 5). On one hand, increases in grain prices were found to positively affect the odds of both forms of out-migration, although this association was statistically significant only for individual mobility, which saw a 13.2 % increase for every 10 % rise in grain prices. On the other hand, the cholera outbreak led to a remarkable 71 % increase in the odds of household out-migration, without affecting individual out-migration.

This pattern of mobility may indicate that the substantial losses suffered by numerous families made them incapable of sustaining their farming activities, ultimately driving them to leave. Socioeconomic status (SES) had a profound impact on mobility. Household out-migration was particularly high among day laborers, while all the other social groups experienced lower odds (-77 % for farmholders, -31 % for sharecroppers, and -28 % for households not engaged in agricultural labor). However, the pattern for individual out-migration reveals a more homogeneous picture, with only sharecroppers showing a significant effect, being 17 % more likely to emigrate individually compared to day laborers.

Despite the lack of a significant improvement in model fit for the interaction model between grain prices and occupation (LR = 3.5, *p*-value = 0.482 for individual out-migration, LR = 4.5, *p*-value = 0.344 for household out-migration), the results presented in table 6A in the Appendix reinforce the preceding arguments. In times of high prices, farmholders and sharecroppers responded to short-term crises with increased individual out-migration, while day laborers experienced higher mobility for both individuals and family groups. These observations suggest that out-migration was relatively uncommon among social groups with deep territorial ties, such as homeowners. Conversely, it was a common experience for day laborers and sharecroppers. The former social group, lacking homeownership and access to land, was somehow forced to relocate the entire family group in search of work opportunities. Faced with pressure from landowners to maintain a balance between household composition and farm size, sharecroppers appear to use individual out-migration (and immigration when necessary) as a strategy to adjust household size and the consumer-to-producer ratio, thus averting the risk of eviction of the entire household.[6] This may clarify why sharecroppers had higher levels of individual out-migration while exhibiting lower levels of household out-migration compared to day laborers.

6. Conclusions

The research outlined in this paper challenges the conventional division of farmers into landless and landed categories, asserting that access to land potentially may have a more substantial impact on demographic behaviors than actual landownership within rural social groups. A detailed analysis of the 19th-century Tuscan community of Casalguidi reveals that landless sharecroppers shared greater demographic commonalities with farmholders than with day laborers. The literature highlights that both sharecroppers and farmholders lived in large and complex households, which were foundational to a family-oriented work structure heavily reliant on a predominantly male labor force. Understanding the key role of the household in the demographic systems of these groups can help us in interpreting the results of our analysis. Our results indicate that sharecroppers and smallholders faced lower risks of marriage for males, with sharecroppers also showing higher fertility and higher individual mobility compared to day laborers. The first finding suggests that both groups strategically managed access to marriage, and, consequently, household size, within the context of a patrilocal living arrangement. The other findings may reflect demographic adaptations to the strict limitations imposed by sharecropping contracts on household size and structure, serving as a sort of demographic strategy to prevent eviction. The higher fertility rates likely

[6] Among sharecroppers, networks of related households often engaged in the practice of exchanging members to meet varying household needs, such as addressing a shortage of male members or reducing household size and consumption rates.

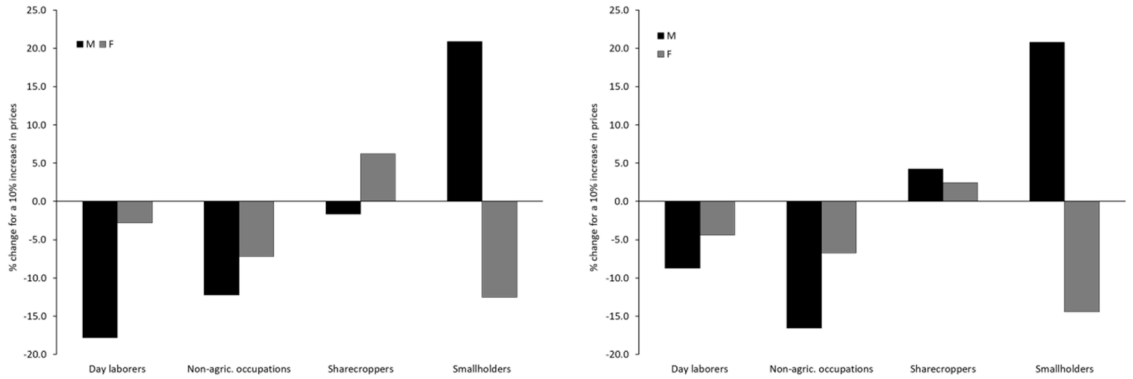

Fig. 4. Logistic regression. Nuptiality response to a 10 % increase in prices by occupation, sex, and time lag. Casalguidi, 1819–59[1].
[1]The figure includes also the interaction *Females x Lag0* although it did not result statistically significant.

Table 5
Multinomial logistic regression. Effects of occupation and short-term crises on out-migration. Household and individual out-migration. Casalguidi, 1819–58[1].

Variables	Individual		Household	
	OR	*p*-value	OR	*p*-value
Logged grain price (Lag 0)	3.680	<0.001	1.607	0.229
Time (in years)	0.983	<0.001	0.997	0.470
Cholera	1.089	0.503	1.707	0.010
Profession (ref. Day Laborers)	1.000		1.000	
Sharecroppers & tenants	1.168	0.068	0.687	0.010
Farmholders	0.931	0.500	0.231	<0.001
Non-agric. Occupations	1.060	0.577	0.716	0.049
Unknown	1.182	0.061	6.529	<0.001
Log-likelihood	-7126.8			
Wald test (chi2)	580.9, p<0.001			

[1] The model also controls for household head's age, sex, marital status, and presence of kindred households.

aimed to ensure a reliable male workforce capable of fulfilling both family and landlord crop production demands, while effective management of individual departures from the household was vital to control excessive growth.

Sharecroppers and farmholders were also much less reliant on the market for staple food. This autonomy, combined with their ability to adopt family and demographic strategies, likely explains why these groups not only faced lower mortality risks than day laborers but also showed greater resilience to short-term crises and economic hardships.

In contrast, day laborers, being landless and facing more considerable economic pressure, represent the most vulnerable segment of the society. They experienced higher mortality and higher mobility due to their reliance on the market for food and sustenance, making them particularly exposed to economic crises that could worsen their living conditions in periods of high prices. Furthermore, rising prices could impact their strict neolocal marriage behavior by limiting their capacity to accumulate sufficient resources to marry and establish a household during tough times.

In summary, while day laborers had limited options for demographic adaptation in response to external stressors, sharecroppers and farmholders may have had a range of effective demographic strategies that served them well during both routine and adverse situations. These well-organized demographic models were rooted in the goal of passing down land to future generations, whether as an undivided estate for smallholders or an "immaterial" estate for sharecroppers, highlighting the essential household features instrumental in ensuring stability and long-term residence on the same farm.

CRediT authorship contribution statement

M. Manfredini: Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **A. Fornasin:** Investigation, Conceptualization. **M. Breschi:** Supervision, Resources, Investigation, Data curation, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eeh.2025.101668.

Data availability

The authors do not have permission to share data.

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