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Access to Land, the Agriculture Trap, and Literacy: Evidence from Late Nineteenth-Century Greece

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ABSTRACT

Many growth analysts have argued that more equal patterns of landownership and the supremacy of industry over agriculture were associated with the rise of mass public education systems during the late eighteenth and early nineteenth centuries. The theoretical framework of this argument relies mainly on the so-called capital-skill complementarity hypothesis that agricultural land and industrial capital are characterized by different levels of complementarity with human skills. Thus, landowning elites were often reluctant to promote and support public education, while rising capitalists were much more in favour of a better-educated workforce and promoted major educational reforms. This paper seeks to provide some of the first empirical evidence of a significant positive relationship between more equitable distribution of landholdings and the development of literacy in late nineteenth-century Greece, using data from the Censuses of 1870 and 1879. Our estimates largely confirm previous findings of a positive and significant linkage between people's access to land and literacy rates. On the contrary, labour concentration in the farm sector (the agriculture trap) has been found to be negatively and significantly related to literacy. These results remain robust after controlling for such other socioeconomic factors as marital status, family size, urbanization, ethnicity, religion, students' attainment and teachers' availability.

1. Introduction

The main focus of regional growth studies was long the so-

called geography hypothesis, which holds that climatic and geographical conditions are responsible for the significant variations in economic performance between countries and regions (Bloom & Sachs, 1998; Diamond, 1997; Machiavelli, 1519; Montesquieu, 1748; Mydral, 1968; Sachs, 2001). However, this approach could not always explain why some initially resource-rich areas have suffered from low growth rates, while others, much poorer in natural resource endowments, have enjoyed higher levels of economic development and prosperity (Acemoglu et al., 2001). This gave rise to a modern approach for better understanding regional disparities, highlighting the important role of different-quality institutions in generating widely divergent national and regional paths of economic development (Acemoglu et al., 2005; Engerman & Sokoloff, 1997; Hall & Jones, 1999; North, 2005).

Along this institutional line of thought, a good number of scholars have documented a negative relationship between inequality and growth (Aghion et al., 1999; Alesina & Perotti, 1996; Barro, 2000; Kuznets, 1955; Stiglitz, 1969). In the same vein, others have reported significant negative associations between the distribution of landholdings and economic growth (Alesina & Rodrik, 1994; Deininger & Olinto, 2000; Easterly, 2007; Frankema, 2010; Keefer & Knack, 2002; Lipton, 1974). Still others have further expanded the literature to show the adverse effects of landownership concentration on the development of human capital (Cinnirella & Hornung, 2016; Goni, 2013; Ramcharan, 2010; Tapia & Martinez-Galarraga, 2015; Vollrath, 2013). Within this context, a society's transition from the agrarian to the modern industrial mode of production may offer the best opportunity to test the so-called capital-skill complementarity hypothesis (Galor & Moav, 2006; Galor, Moav & Vollrath, 2009). According to this hypothesis (sometimes called the GMV approach), powerful landowning elites generally exploited poor, landless peasants, mainly through sharecropping relations of production. Thus, from the landlord's point of view, greater access for poor people to education could be expected to result in greater mobility from the countryside to cities, increasing wage demands and lowering land

exploitation rates. Early capitalists, by contrast, had strong incentives to promote and support mass public education, as they were favoured by the high degree of complementarity between the productivity of physical capital in manufacturing and human skills (Galor, 2011; Galor & Moav, 2006).

However, late nineteenth-century Greece remains almost totally unexplored in the empirical literature and so offers an opportunity to re-test the GMV hypothesis in a very different institutional domain. Historically, Greece never experienced the full feudalism that marked Western Europe (Mouzelis, 1990, 1983; Ricks & Magdalino, 1998), and Byzantine and Ottoman land-grant institutions were both limited to a specific period of time, revocable, and not transferable (Imber, 2002; Papademetriou, 2015; Papastathes, 1998). Moreover, unlike most Western European societies, the vast majority of landholdings in the Greek territories remained strictly state-controlled, at least until the late sixteenth century (Laiou, 2002; Bartusis, 2012; Tucker, 2010). It was not until the late seventeenth century that the decline of the Ottoman Empire allowed the transformation of the land-grant institutions into a system of private ownership of land, the so-called chifliks (Mouzelis, 1978). In any event, in the years following the Greek War of Independence (1821-1828) the agrarian question became an issue of major importance among the liberated Greeks. Immediately after the Revolution, the First National Assembly of Epidaurus (1822) declared that all former Muslim lands had to be radically transformed into national lands, under the direct control of the newly founded Greek state (Davis and Pereira, 2003; Milios, 2018; Mouzelis, 1978; Petropoulos, 1985). In this sense, major redistributive land reforms were carried out in Greece between 1828 and 1871, such as Kapodistrias's efforts for land reform, King Otto's reform and the first large-scale redistribution of lands by Koumoundouro's government. However, these efforts did not affect the entire country equally. On the one hand, the Southern Greek areas (the Peloponnese) were found to be associated with the mass expropriation of former Muslim lands that were later redistributed among landless Greek peasants (Aroni-Tsichli, 2002). On the other

hand, the Treaty of Constantinople (1832) granted Muslim individuals mainly located in Central Greece (Sterea Ellada and Euboea) some exceptional rights to dispose of their lands through sale (Bantekas, 2015; Katsikas et al., 2012). In fact, these lands were purchased by wealthy Greeks, who became a new class of landowners in Central Greece (Petmezas, 2003). Consequently, a highly diversified structure of landownership emerged in late nineteenth-century Greece, family farms prevailing in almost all of Southern Greece while large landed estates and semi-feudal relations of production remained dominant in Central Greece (Evangelinides, 1980; Mouzelis, 1990). At the same time, Greek modernization was accompanied by important educational changes, such as the introduction of free elementary education for all Greeks, the Primary and Communal Education Law, and the foundation of the Pedagogical Institute of Athens, leading to a significant increase in the numbers of schools and students throughout the country during the second half of the nineteenth century.

This paper provides some new empirical evidence of a positive and significant linkage between people's access to land and literacy levels in late nineteenth-century Greece. For this purpose, a new dataset has been constructed, using the Greek Population Censuses of 1870 and 1879. This dataset includes various socioeconomic and demographic indicators for 350 Greek municipalities in those years, including literacy rates, students' attainment, the availability of teachers, people's access to land, family size, the agriculture trap, marital status, urbanization, gender ratio, ethnic differences and religious affiliation. Our estimates would appear to be consistent with earlier findings, indicating a positive and significant linkage between access to land and literacy. By contrast, the supremacy of agriculture over industry (the agriculture trap) can be seen to have had significant adverse effects on the growth of literacy. These results remain robust after controlling for all the other factors that might potentially affect literacy rates.

The rest of the paper is organized as follows. Section 2 discusses the relevant literature and presents the theoretical background. Sec-

tion 3 offers an introduction and outline of landownership patterns in medieval and early modern Greece. Section 4 describes the data and presents the main descriptive statistics, Section 5 analyzes the methods and models used in this paper, and Section 6 reports the empirical results. The conclusions are presented in Section 7.

2. Literature Review

Contrary to the traditional approach to the theory of economic growth, many scholars have reported low-quality institutions as the main factor in increasing disparities between countries and regions (Acemoglu & Robinson, 2008; Acemoglu et al., 2005, 2013; Landes, 1999; North, 1981). Along these lines, a good number of other scholars have provided evidence that inequality in land ownership adversely affects economic growth (Alesina & Rodrik, 1994, Fort & Ruben, 2006; Frankema, 2010; Keefer & Knack, 2002; & Lipton, 1974). In the same vein, Engerman and Sokoloff's distributional approach to institutions further expanded the literature, with the thesis that unequal distribution of landholdings in Latin America had a direct negative impact on the public provision of education (Engerman & Sokoloff, 1997; 2005). Similarly, studies of the United States in the late nineteenth and early twentieth centuries have also found negative associations between land inequality and the rise of mass public education (Easterly, 2007; Go & Lindert, 2010; Ramcharan, 2010; Vollrath, 2013). In addition, Cinnirella and Hornung (2016) have shown that extreme landownership concentration in nineteenth-century Prussia was negatively correlated with school enrollment rates, while Tapia and Martinez-Galarraga (2015) have identified a significant negative association between the fraction of farm labourers and literacy rates in mid-nineteenth century Spain. Goni (2013) and Lindert (2004) have indicated that high levels of land ownership concentration in nineteenth-century England and Wales appear to be correlated with the underfunding of public education, while Chaudhary (2009) has demonstrated that uneven distribution of lands in

nineteenth-century British India had negative impacts on the provision of public education.

In a much more detailed analysis, Galor, Moav and Vollrath have provided further evidence of the negative link between unequal land distribution and the spread of mass public education (Galor, Moav & Vollrath, 2009). In GMV's analysis, the society's transition from the agrarian to the modern industrial mode of production expanded and deepened the class conflict between the owners of land and the owners of industrial capital, factors of production characterized by different complementarities with human skills (Galor & Moav, 2006). Thus, on the one hand landowning elites did not benefit so much from the massive expansion of the public school system, while on the other the rising capitalists had stronger incentives to support and promote mass public education, mainly because the productivity of physical capital in manufacturing was enhanced by increased inputs of human skills (Acemoglu & Robinson, 2000; Galor et al., 2004; Galor, Moav & Vollrath, 2009). Similarly, the important role played by industrialization in the rise of mass public education systems has also been pointed out by Berman, Bound and Machin (1998), Deininger (2003), Federman & Levine (2005), Goldin & Katz (1998), Hippe & Baten (2012), Jacod (1997) and Ruly (2002). Lastly, Bowles & Gintis (2002), Brockliss & Sheldon (2012), Green (2013) and Lindert (2004, 2000) have argued that what lay behind the rise of modern educational systems was the capitalist class's need to control working-class children; and the role of public schools as agents of social reproduction has been examined by Apple (2001), Drebeen (1967), Gaffield (1986), Jackson (1968), Parsons (1959) and Willis (1976).

3. The Case of Greece

Historians have long known that the economic, social, and political structure of medieval and early modern Greece differed greatly from Western European feudalism (Geanakoplos, 1984; Mouzelis, 1983, 1990; Ricks & Magdalino, 1998; Milios, 1999). Both

the Byzantine and the Ottoman land tenure systems were strictly characterized by large state-owned landholdings, with some small independent peasant communities still present in the Greek territories until the late eleventh century (Bartusis, 2012; Hathaway, 2008; Islamoglu-Inan, 1987; Kaser, 2011; Laiou, 2002). And both the Byzantine and the Ottoman land-grant institutions were lifetime, revocable and not transferable or hereditary (Imber, 2002; Papademetriou, 2015; Papastathes, 1998). By the late tenth or early eleventh century, however, some of the free small peasants in Greek territories began to sell their lands to the powerful, forfeiting their independence and so becoming a sort of serf on large landed estates (Kaser, 2011; Setton, 1976). This tendency continued until the late sixteenth century, when the decline in Ottoman power led to the transformation of the *timar* and *miri* lands into a system of latifundia, the so-called *chiftliks* (Mouzelis, 1978). Unlike the previous landownership institutions, these large inheritable *chiftlik* properties could be leased or transferred to private stewards and effective owners, who gradually developed into a new class of landlords, the *chiftlik-sahibi* (Karakasidou, 2009; McGonan, 1981).

The early nineteenth century found the vast majority of the Greek population engaged in agriculture, while most Greek peasant families were still landless (Koliopoulos & Veremis, 2010). Nevertheless, after the War of Independence (1821-1828) an issue of prime importance for Greece was what to do with the over 1 million hectares of land that had belonged to the Ottoman State, Muslim individuals and charitable institutions (Mouzelis, 1976). As the First National Assembly of Epidaurus declared (1822), all these former Ottoman-owned lands had to be transformed into state land and later redistributed among landless and poor Greek peasants (Strong, 1842). Following the achievement of Independence, Ioannis Kapodistrias, the first governor of the Greek state (1828-1831) as well as the Bavarian King Otto (1832-1862) tried to pass a series of reforms needed to promote land redistribution and protect the rights of small landowners. A law enacted in 1830 granted a plot of 1 *stremma* (1,000 square metres) to all Greeks so they could build a

house with a yard (Tzinieri, 2015). King Otto's land reform (the Donation Law of 1835) also helped thousands of small, poor Greek farmers by granting low-cost loans (Aroni-Tsichli, 2002). All family heads (including war widows) were entitled to buy land at public auction with 2,000-drachma promissory notes issued to them by the government, repayable in 36 annual instalments, each equal to 6% of the principal (Franghiadis, 1990). No one could acquire more than four hectares of national land (Gallant, 2015).

In practice, these efforts at land redistribution were often blocked by the powerful landowning elites or met with indifference on the part of the peasantry (Frary, 2015). Up until 1871, a mere 35,000 hectares of planted and cultivated lands was effectively distributed (Franghiadis, 1990). The nineteenth century witnessed a series of important socioeconomic and political upheavals: the Revolution of September 3rd (1843), the promulgation of Greece's first constitution (1844), the Revolution of 1862 with the dethronement of King Otto, which eventually led to Greece's first large-scale redistribution of national lands, in 1871. Unlike its predecessors, the 1871 law aimed chiefly to give land to the landless and enable very small landowners to expand their holdings (Gallant, 2015). Learning from the mistakes of the earlier schemes, the parcels were not purchased at auction (with the risk of prices going too high for the peasants to afford), but at prices set by government assessors (Franghiadis, 1990; Gallant, 2015). The outcome is readily summarized: 265,000 hectares of former Ottoman land was distributed in 357,217 individual plots, which suggests – given that the rural population was no more than 254,000 households in 1879 – that practically all Greek farmers became owners of land (Fraghiadis, 1993; Gritsopoulos, 1955; Hadjimichalis, 1986; Mouzelis, 1976; Petmezas, 1991).

In addition to altering the country's production profile by strengthening small-scale family farming, the Revolution also brought significant change to the educational system. Before Independence, local elementary schools in the Greek areas were organized, operated and controlled by the Greek Orthodox Church,

under a self-ruling institution conceded by the Sultan, the so-called *millet* (Braude, 1982; Hatzopoulos, 1991; Mackridge, 2009; Zervas, 2017). Although following the Revolution of 1821 the newly founded Greek state proclaimed free elementary education for all Greek citizens (1822), there were essentially no modern schools in Greece until the end of the 1830s (Antoniou, 2002; Zervas, 2016). It was only with the so-called Bavarian Plan (King Otto's educational reform of 1834-36) that Greece's education system was truly re-established, producing massive expansion in numbers of schools and students enrolled in primary and secondary education (Antoniou, 2002; Bouzakis, 2009). The Primary and Communal Education Law went into force in 1834, establishing compulsory education for all children aged five to twelve (Bouzakis, 2005). The Pedagogical Institute of Athens was founded that year, with the mission of training elementary school teachers to be assigned throughout the country (Bouzakis, 2011; Zervas, 2017). Public elementary schools in Greece grew even more in number and enrollments during the second half of the nineteenth century, and eventually more than a quarter of all peasant children and almost half of all boys attended school (Tsoukalas, 1977).

4. Data Analysis and Descriptive Statistics

In order to examine a hypothesized positive relationship between the peasantry's access to land and literacy rates in late nineteenth-century Greece, we have constructed a new dataset based on the Greek Population Censuses of 1870 and 1879. These years were selected for a number of reasons:

1. data on literacy levels are not available in the censuses prior to 1870;
2. the first large-scale redistribution of land came during the period (the land reform of 1871);
3. specific data referring to class relations in agricultural production are not available after the 1879 census; and
4. the period 1870-1879 did not see any major social, political, or

economic changes, such as the annexation of new provinces (1881, 1913, 1920 and 1923), the currant crash (1890), the financial default under Trikoupis' prime ministership (1893), the Greco-Ottoman War (1897), the Goudi Coup (1909) and the arrival of the Greek refugees from Asia Minor (1922).

Our dataset contains a wide set of socioeconomic and demographic indicators: literacy levels, educational enrolment, access to land, relative importance of agriculture in the economy, marital status, family size, gender ratio, urbanization, ethnic differences, religious affiliation, etc., covering 350 municipalities and 41 provinces in the years 1870 and 1879. Table 1 defines the variables and Table 2 presents the main descriptive statistics.

4.1 Literacy Rates

As Table 2 shows, literacy rates rose significantly between 1870 and 1879. More specifically, total literacy increased by 1.90 percentage points, male literacy by 2.74 points, and female literacy by just 0.60 points. Over the same period, the gender gap in literacy was substantially narrowed, by 1.92 percentage points, though it remained quite broad. However, there were considerable regional and gender differences in literacy levels in the Greek territories, with some change in the pattern between our two observation years (Maps 1-8; see also Appendix Figures 1-6). In 1870, the highest male literacy rates were reported in Attica (46.52%), Kynouria (39.55%), Kalamata (38.48%), Aigio (38.41%) and Nafplio (38.27%), the lowest in Istiea (12.08%), Valtos (12.98%), Livadia (13.94%) and Megalopoli (14.33%). In the same year, the highest levels of female literacy were found in Attica (19.08%), Hydra-Troizinia (22.24%), Patra (12.71%) and Nafplio (12.50%), the lowest in Dorida (0.43%), Itilo (0.46%), Valtos (0.46%), Vonitsa-Xiromero (0.58%) and Megalopoli (0.60%). Turning to 1879, we find the highest male literacy rates in Attica (48.21%), Helia (44.51%), Aegina (41.97%), Nafplio (41.95%) and Kynouria (41.18%), the lowest in Megalopoli (13.58%), Pylos (16.10%), Istiea (16.12%), Thiva (17.41%) and Kalavryta (18.18%). That same year,

TABLE 1
Definition of the variables

Literacy Development		
Total Literacy (%)	=	Literate People/Total Population
Male Literacy (%)	=	Literate Males/Total Male Population
Female Literacy (%)	=	Literate Females/Total Female Population
Gender Gap in Literacy	=	Literate Males/Literate Females
Educational enrolment		
Total enrolment (%)	=	Total Number of Students/Total Population
Boys' enrolment (%)	=	Male Students/Total Male Population
Girls' enrolment (%)	=	Female Students/Total Female Population
More Equal Patterns of Landownership		
People's Access to Land (%)	=	Landowners/Total Agricultural Population[1]
Supremacy of Agriculture over Modern Occupations		
Agriculture trap	=	People Working in Agricultural Activities/People Working in Modern Occupations[2]
Marriage Patterns		
Married-Single Ratio (Total Population)	=	Married People/Single People
Married-Single Ratio (Male Population)	=	Married Males/Single Males
Married-Single Ratio (Female Population)	=	Married Females/Single Females
Women's Social Position		
Student Participation Rate	=	Female Students/Male Students
Teaching Participation Rate	=	Female Teachers/Male Teachers
Labour Force Participation	=	Female Workers/Male Workers
Other Factors		
Gender Ratio	=	Males/Females
Urbanization (%)	=	Municipal Population/Population
Non-Greeks (%)	=	Non-Greeks/Total Population
Family Size	=	Total Population/Number of Families
Workers (%)	=	Number of Workers/Total Labour Force
Merchants (%)	=	Number of Merchants/Total Labour Force
Priests (%)	=	Number of Priests/Total Population
Housing Development	=	Number of Houses/Number of Families
Widows (%)	=	Widows/Total Female Population

[1] Total Agricultural Population = (Landowners + Farmers).
[2] People Working in Agricultural Activities = (Landowners + Farmers + Livestock Keepers). People Working in Modern Occupations = (Owners of Manufacturing Firms + Workers + Merchants).

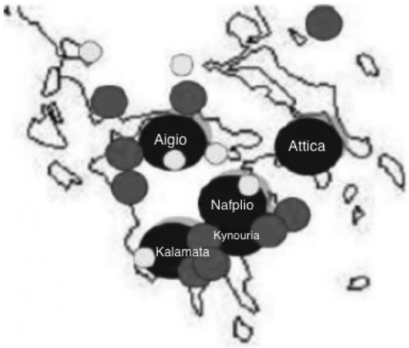
TABLE 2
Descriptive Statistics (municipal-level data)

	1870					1879				
	Mean	Max	Min	Std.Dev.	Obs.	Mean	Max	Min	Std.Dev.	Obs.
Literacy Development										
Total Literacy	14.42%	46.49%	1.99%	0.08	350	16.32%	50.50%	0.71%	0.08	350
Male Literacy	25.04%	77.68%	3.27%	0.11	350	27.78%	66.09%	1.37%	0.12	350
Female Literacy	3.61%	42.53%	0.00%	0.06	350	4.21%	39.40%	0.00%	0.06	350
Gender Gap in Literacy	38.67	367.00	0.61	59.14	350	36.75	635.50	0.74	61.41	350
Students' enrolment										
Total enrolment	4.63%	17.93%	0.41%	0.02	350	4.45%	24.34%	0.03%	0.02	350
Boys' enrolment	8.18%	23.52%	0.69%	0.04	350	7.77%	31.95%	0.06%	0.04	350
Girls' enrolment	1.08%	13.60%	0.00%	0.01	350	0.97%	18.92%	0.00%	0.01	350
More Equal Patterns of Landownership										
People's Access to Land	14.82%	95.48%	0.00%	0.18	350	14.92%	93.16%	0.00%	0.18	350
Supremacy of Agriculture over Modern Occupations										
Agriculture trap	16.44	219.50	0.01	25.53	350	12.92	317.50	0.02	29.01	350
Marriage Patterns										
Married–to–Single rt. (total)	0.58	0.92	0.25	0.07	350	0.58	1.30	0.37	0.09	350
Married–to–Single rt. (males)	0.53	0.88	0.16	0.07	350	0.53	1.28	0.21	0.09	350
Married–to–Single rt. (females)	0.66	2.02	0.43	0.11	350	0.66	1.16	0.33	0.09	350
Women's Social Position										
Female Students Participation	0.11	0.78	0.00	0.16	350	0.09	0.83	0.00	0.15	350
Female Teachers Participation	0.16	7.00	0.00	0.45	350	0.14	12.00	0.00	0.72	350
Female Workers Participation	0.89	90.05	0.00	6.84	350	0.25	16.50	0.00	1.38	350
Other Factors										
Gender Ratio	1.03	1.88	0.52	0.12	350	1.06	2.44	0.51	0.14	350
Urbanization	0.28%	3.35%	0.02%	0.00	350	0.28%	4.31%	0.02%	0.00	350
Non-Greeks	0.88%	31.70%	0.00%	0.02	350	1.13%	36.59%	0.00%	0.03	350
Family Size	4.44	9.22	1.75	0.71	350	4.74	10.25	1.29	1.19	350
Workers	5.76%	62.94%	0.00%	0.09	350	9.35%	73.58%	0.00%	0.11	350
Merchants	3.68%	25.89%	0.00%	0.04	350	6.27%	37.01%	0.00%	0.06	350
Priests	0.49%	3.10%	0.00%	0.00	350	0.51%	3.51%	0.00%	0.00	350
Housing Development	0.99	4.18	0.19	0.38	350	1.02	1.94	0.30	0.22	350
Widows	11.46%	25.55%	2.86%	0.02	350	10.85%	31.36%	4.91%	0.02	350

Attica (26.46%), Hydra-Troizinia (16.28%), Spetses-Ermioni (15.40%), Nafplio (13.51%) and Aegina (13.28%) had the highest literacy rates for women, while the lowest were registered in Megalopoli (0.23%), Sparta (0.26%) and Dorida (0.36%).

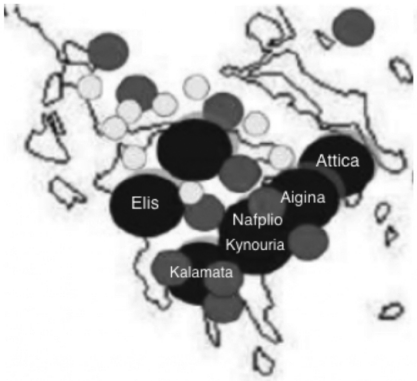
Maps 1-4
Male Literacy, provincial-level data

1. Highest Male Literacy Rates (1870)



2. Lowest Male Literacy Rates (1870)

3. Highest Male Literacy Rates (1879)

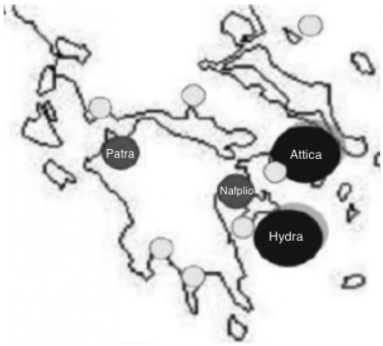


4. Lowest Male Literacy Rates (1879)

Male literacy rate > 38%
38% > Male literacy rate > 30%
30% > Male literacy rate > 25%
25% > Male literacy rate > 20%
20% > Male literacy rate > 15%
Male literacy rate < 15%

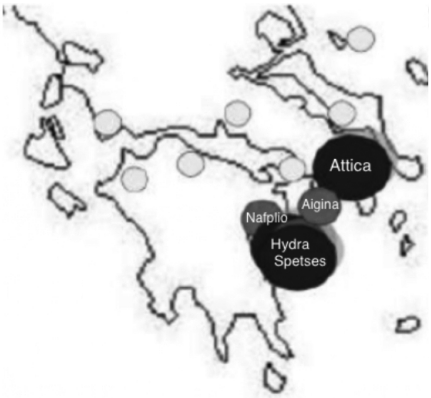
MAPS 5-8
Female Literacy, provincial-level data

5. Highest Female Literacy Rates (1870)



6. Lowest Female Literacy Rates (1870)

7. Highest Female Literacy Rates (1879)



8. Lowest Female Literacy Rates (1879)

Female literacy rate > 15%
15% > Female literacy rate > 10%
10% > Female literacy rate > 5%
5% > Female literacy rate > 2%
2% > Female literacy rate > 1%
Female literacy rate < 1%

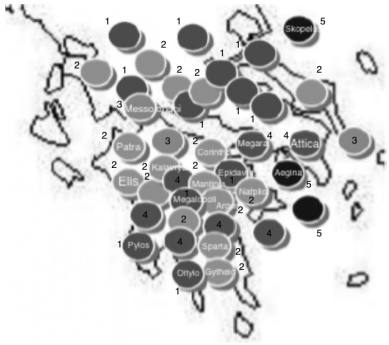
4.2 Access to Land and the Agriculture Trap

Although the censuses of 1870 and 1879 covered many different population characteristics, they did not include any specific information on the distribution of agricultural landholdings according to

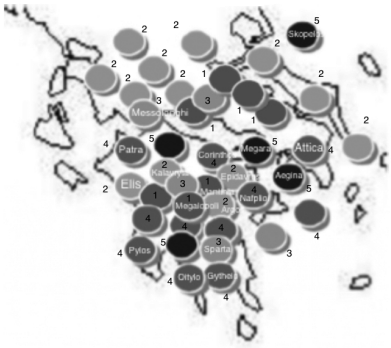
size and district. The best way to measure access to land is therefore the ratio of landowners (*ktimaties*) to the total agricultural population. A low ratio clearly implies greater concentration of landownership in a few hands, higher values indicating more equal distribution of landholdings across the population. In fact, as we see in Table 2, the landholding ratio edged up by 0.39 percentage points between 1870 and 1879. At provincial level, however, one readily perceives the co-existence of two highly divergent patterns of landownership (see Maps 9-11; see also Appendix Figures 7-10).

Maps 9-11
Access to Land

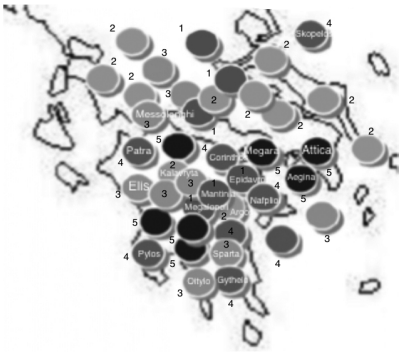
9. Access to Land (1861)



10. Access to Land (1870)



11. Access to Land (1879)



1. Access to land < 5%
2. 10% > Access to land > 5%
3. 15% > Access to land > 10%
4. 30% > Access to land > 15%
5. Access to land > 30%

Specifically, most of the Central areas were characterized by a high degree of land ownership concentration (a land access ratio of less than 10%) for the entire period from 1861 to 1879. There were, however, some notable exceptions, such as Attica, Megara, Messolonghi, Aegina, and Skopelos, where land ownership was far more egalitarian than in neighboring areas. By contrast, the vast majority of Southern areas had higher levels of access to land than those of Central Greece. Indeed, between 1861 and 1879 most of these Southern areas were almost totally transformed, from marked inequality in land ownership to more equitable distribution (see the provinces of Patra, Helia, Nafplio, Corinthos, Githio, Pylos, Messini, Olympia, Sparta and Oitylo). By the late 1870s, only a few parts of Southern Greece still had high levels of land ownership concentration (Argos, Kalavryta, Epidavros, Megalopoli and Mantinia).

Table 2 further shows that the rate of entrapment in agriculture decreased remarkably between 1870 and 1879 (-3.52 percentage points). At the same time, the percentage of workers and merchants both increased considerably (+3.59 and +2.59 percentage points, respectively).

4.3 Other Factors

Table 2 also reports trends in marriage patterns in later nineteenth-century Greece. Although there were no significant differences in marriage rates from 1870 to 1879, some significant gender differences can be observed. More specifically, the marriage rate for women significantly exceeded that of men in both years. Gender indices reflect the social position of Greek women in those years: the ratios of female to male students, teachers and workers all came down between 1870 and 1879, indicating worsening gender inequality within Greek society. Lastly, educational enrolment ratios display a small decrease, non-Greek population a significant increase, while such indicators as gender ratio, family size and number of priests (%) all rose slightly.

4.4 Correlation Analysis

A preliminary analysis of our municipal-level data provides some evidence of a positive relation between people's access to land and literacy levels in late nineteenth-century Greece (see Figures 1 and 2). Figures 3 and 4 illustrate a strong negative association be-

FIGURE 1-2
Access to Land

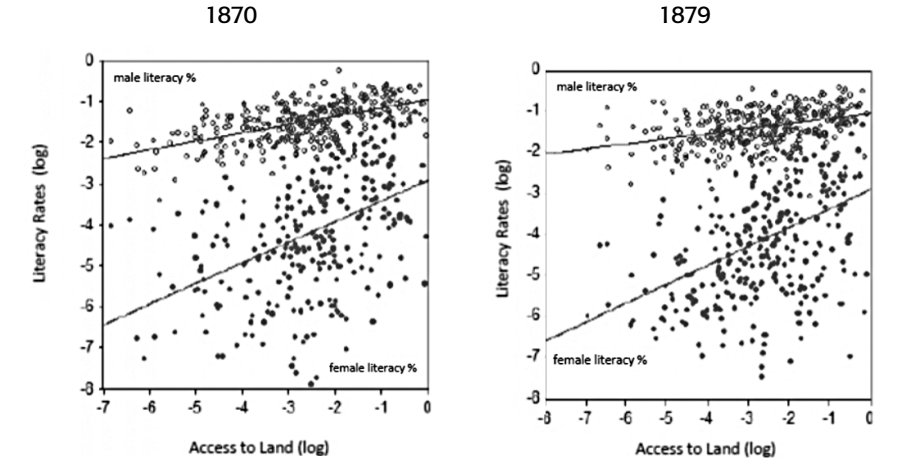


FIGURE 3-4
Agriculture trap

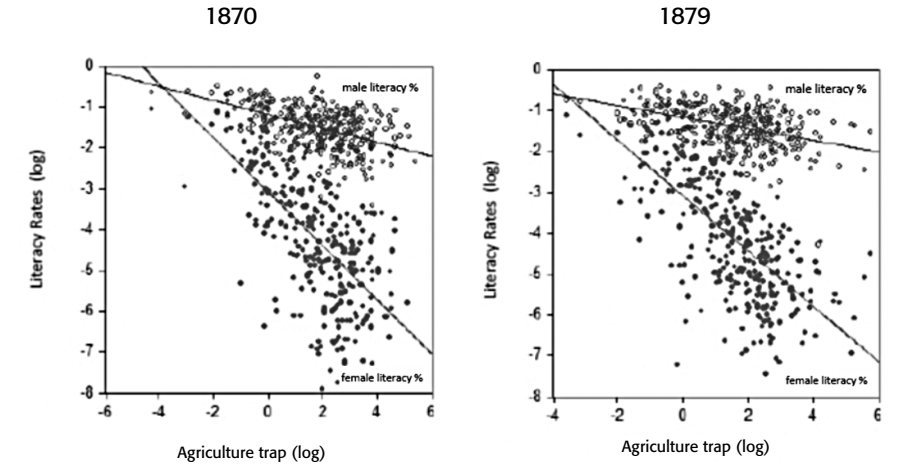


TABLE 3
Correlation Coefficients (municipal-level data)

	1870		1879	
	Male Literacy %	Female Literacy %	Male Literacy %	Female Literacy %
Access to Land (%)	+0.47	+0.38	+0.37	+0.37
Workers (%)	+0.34	+0.42	+0.22	+0.35
Merchants (%)	+0.52	+0.67	+0.54	+0.71
Male Students (%)	+0.65	+0.39	+0.69	+0.54
Female Students (%)	+0.51	+0.81	+0.46	+0.88
Urbanization (%)	+0.29	+0.45	+0.25	+0.41
Widows (%)	+0.31	+0.19	+0.32	+0.24
Non-Greeks (%)	+0.10	+0.23	+0.09	+0.19
Priests (%)	+0.05	+0.11	+0.01	+0.11
Agriculture trap	-0.28	-0.27	-0.19	-0.20
Workers in Agricultural Activities (%)	-0.56	-0.72	-0.46	-0.68
Farm Size	-0.30	-0.15	-0.16	-0.17
Married Males (%)	-0.07	-0.07	-0.00	-0.02
Married Females (%)	-0.24	-0.18	-0.20	-0.17
Family Size	-0.04	-0.01	-0.05	-0.27
Gender Ratio	-0.25	-0.18	-0.14	-0.23

tween the agriculture trap and literacy rates. The correlation coefficients between literacy and various other variables examined here are presented in Table 3. These findings show that factors such as access to land, percentage of workers and merchants, urbanization, educational enrolment, non-Greek population, widows and priests are all positively related to literacy rates, while such other factors as the agriculture trap, agricultural labourers, farm size, marriage, family size and gender ratio are negatively correlated.

5. Model Building

5.1 Cross-Sectional Regressions

In order to test the significance of the relations presented above

statistically, the following ordinary least squares (OLS) cross-sectional regression model has been estimated, using heteroskedasticity and autocorrelation consistent (HAC) standard errors:

$$literacy_level(i, t) = bo + b1^{*}access_to_land(i, t) + \\ + b2^{*}\ agriculture_trap(i, t) + c^{*}V'\ (i, t) + e(i, t) \quad (1)$$

where *literacy_level* represents the literacy rate in each municipality i ($i = 1, 2, ..., 350$) in year t ($t = 1870$ and 1879, respectively), bo is the constant term, *access_to_land* is the ratio of landowners to total agricultural population, $b1$ is the effect of people's access to land on literacy (we expect $b1 > 0$), *agriculture_trap* is the ratio of people working in agricultural activities to those in modern occupations, $b2$ is the effect of labour concentration in agriculture on literacy (we expect $b2 < 0$), V is a vector of control variables (marriage, family size, gender ratio, non-Greek population, urbanization, female widowhood, priests and geographical location), c is a vector of coefficients measuring the effect of covariates on literacy, and e is the error term.

5.2 Binary Probit Models

Alternatively, we have also estimated a binary probit model, analyzing the effects of access to land on female participation in education. In this case, female participation (as either students or teachers) is a binary choice variable equal to 1 if there is at least one girl or woman at a school (either as student or as teacher) in municipality i ($i = 1, 2, ..., 350$) at time t ($t = 1870$ and 1879, respectively), and 0 if not. The model is as follows:

$$Pr\ [female\ participation = 1\ \mathrm{I}\ X\ ] = F(X'\ b) \quad (2)$$

where $Pr\ [female\ participation = 1\ \mathrm{I}\ X\ ]$ is the probability of girls or women attending school (as students or teachers, respectively), F is the standard normal cumulative distribution function, X is a set of regressors, and b is a vector of estimated coefficients.

6. The results

The cross-sectional OLS regression estimates show that the coefficients both of access to land and of agriculture trap have the expected signs (positive and negative, respectively) and are always statistically significant (see Tables 4 and 5). Columns (1) to (4) report the effects of access to land and agriculture trap on literacy levels (our baseline specification), while columns (5) to (20) add all the control variables one by one. The positive and significant coefficients of access to land provide strong evidence that more equal patterns of land ownership played an important role in the spread of literacy for both genders in late nineteenth-century Greece. On the other hand, the negative coefficients for agriculture trap imply that the overall supremacy of agricultural over modern occupations had measurable adverse impact on literacy. These results are robust to controlling for various other factors that could potentially affect literacy, such as marriage, family size, gender ratio, ethnic differences, urbanization, female widowhood and religion. More specifically, female marriage was negatively related to female literacy levels (though the correlation is significant only for 1879), while male marriage rates did not significantly affect men's literacy. Family size was negatively associated with female literacy (significant in almost all regressions) and with male literacy (significantly) in 1870. The gender ratio affects male literacy negatively (though not always significantly), while the share of non-Greek population shows a positive and significant impact on female literacy, but only in 1879. Urbanization appears to have a significant positive impact on both male and female literacy rates in almost all regressions. Lastly, there is a significant positive correlation between female widowhood and male literacy; the percentage of priests in the population does not appear to affect literacy significantly.

The results from the binary probit models are shown in Tables 6 and 7. The probability of girls attending school and that of there being at least one woman teacher in a municipality were both found to have positive and significant associations with access to land, but

Table 4
OLS Estimates (HAC s.e) (dependent variable: male literacy)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879
Access to Land	+0.20***	+0.12***	+0.14***	+0.07***	+0.14***	+0.07***	+0.14***	+0.07***	+0.14***	+0.07***	+0.14***	+0.07***	+0.14***	+0.06***	+0.13***	+0.07***	+0.13***	+0.07***	+0.13***	+0.07***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Stuck in Agriculture			-0.09***	-0.09***	-0.09***	-0.09***	-0.09***	-0.09***	-0.08***	-0.09***	-0.08***	-0.09***	-0.07***	-0.08***	-0.07***	-0.07***	-0.07***	-0.07***	-0.06***	-0.07***
			(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Male Marriages					-0.01	+0.01	-0.02	+0.01	-0.10	+0.01	-0.11	+0.01	-0.10	+0.01	+0.03	+0.02	+0.04	+0.02	+0.02	+0.02
					(0.13)	(0.02)	(0.13)	(0.02)	(0.14)	(0.02)	(0.14)	(0.02)	(0.14)	(0.02)	(0.14)	(0.01)	(0.14)	(0.01)	(0.14)	(0.01)
Family Size							-0.13**	+0.08	-0.14**	+0.13	-0.13**	+0.14	-0.19***	+0.11	-0.18***	+0.02	-0.18***	+0.05	-0.18**	+0.03
							(0.06)	(0.11)	(0.06)	(0.12)	(0.06)	(0.12)	(0.06)	(0.12)	(0.06)	(0.11)	(0.06)	(0.11)	(0.07)	(0.12)
Sex Ratio									-0.36	-0.25	-0.34	-0.23	-0.40*	-0.26	-0.39**	-0.11	-0.37*	-0.10	-0.32	-0.12
									(0.22)	(0.16)	(0.22)	(0.16)	(0.22)	(0.16)	(0.20)	(0.14)	(0.20)	(0.15)	(0.20)	(0.15)
Non-Greeks (dummy)											-0.03	-0.02	-0.04	-0.03	-0.04	-0.04	-0.05	-0.04	-0.06*	-0.03
											(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Urbanization (dummy)													+0.17***	+0.08*	+0.18***	+0.08*	+0.18***	+0.07	+0.19***	+0.07
													(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.13)
Widows															+0.31***	+0.42***	+0.32***	+0.40***	+0.34***	+0.39***
															(0.08)	(0.11)	(0.09)	(0.11)	(0.09)	(0.11)
Priests																	+0.01	+0.03	+0.00	+0.04
																	(0.04)	(0.02)	(0.04)	(0.03)
Islands (dummy)																			+0.07	-0.04
																			(0.05)	(0.06)
Adj. R-Squared	0.31	0.13	0.37	0.19	0.36	0.19	0.36	0.19	0.37	0.19	0.37	0.19	0.38	0.20	0.41	0.26	0.42	0.26	0.44	0.26
Obs.	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

Note: Table 4 presents OLS estimates of equation (1) for the years 1870 and 1879. *Male Literacy* is the dependent variable. *Access to Land* is the ratio of landowners to total agricultural population. *Stuck in Agriculture* is the ratio of people engaged in agricultural activities (landowners, farmers and livestock keepers) to people engaged in modern professions (owners of manufacturing firms, workers and merchants). *Male Marriage* is the ratio of married to single men. *Family Size* is the ratio of total population to total number of families. *Sex Ratio* is the ratio of males to females. *Non-Greeks* is a dummy variable (it takes the value 1 if an area/municipality has at least one non-Greek resident, and 0 otherwise). *Urbanization* is another dummy variable (it takes the value 1 when an area's population is greater than 5000 people, and 0 otherwise). *Widows* is the percentage of widows in the total female population. *Priests* is the percentage of priests in the total population. Islands is another dummy variable (it takes the value of 1 for island areas, and 0 otherwise). All regressions are at the municipal level (n = 350). All variables are in logarithmic form (except the dummies). Newey-West HAC standard errors are reported in parentheses. For simplicity, the intercept is not reported. Significance: *** $p < 0{,}01$ ** $p < 0{,}05$ * $p < 0{,}1$.

Sources: Greek Population Censuses of 1870 and 1879.

TABLE 5
OLS Estimates (HAC s.e) (dependent variable: female literacy)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879
Access to Land	+0.50***	+0.46***	+0.16***	+0.10**	+0.16***	+0.10**	+0.18***	+0.12**	+0.19***	+0.12**	+0.19***	+0.12**	+0.19***	+0.10**	+0.20***	+0.14***	+0.20***	+0.14***	+0.21***	+0.15***
	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)
Stuck in Agriculture			-0.57***	-0.63***	-0.57***	-0.63***	-0.56***	-0.58***	-0.57***	-0.58***	-0.56***	-0.54***	-0.52***	-0.51***	-0.49***	-0.47***	-0.50***	-0.47***	-0.46***	-0.45***
			(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Female Marriages					-0.16	-1.08**	-0.22	-1.34***	-0.23	-1.38**	-0.21	-1.15**	-0.11	-1.06**	-0.17	-1.27**	-0.22	-1.17**	-0.45	-1.28**
					(0.47)	(0.49)	(0.49)	(0.51)	(0.49)	(0.54)	(0.49)	(0.54)	(0.51)	(0.53)	(0.52)	(0.51)	(0.53)	(0.52)	(0.49)	(0.52)
Family Size							-0.45	-0.99***	-0.44	-1.05***	-0.45	-1.12***	-0.56*	-1.23***	-0.53*	-1.58***	-0.55*	-1.55***	-0.51	-1.43***
							(0.31)	(0.35)	(0.31)	(0.39)	(0.31)	(0.40)	(0.33)	(0.38)	(0.32)	(0.30)	(0.33)	(0.30)	(0.32)	(0.31)
Sex Ratio									+0.45	+0.29	+0.40	+0.04	+0.23	-0.06	+0.20	+0.17	+0.22	+0.22	-0.89	+0.34
									(0.68)	(0.49)	(0.71)	(0.45)	(0.71)	(0.45)	(0.67)	(0.44)	(0.67)	(0.44)	(0.66)	(0.44)
Non-Greeks (dummy)											+0.07	+0.46***	+0.04	+0.44***	+0.08	+0.47***	+0.08	+0.51***	-0.00	+0.48***
											(0.12)	(0.11)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.11)	(0.12)
Urbanization (dummy)													+0.38**	+0.35***	+0.39**	+0.34**	+0.39**	+0.31**	+0.43**	+0.32**
													(0.17)	(0.13)	(0.17)	(0.13)	(0.17)	(0.13)	(0.18)	(0.13)
Widows															+0.35	+0.20	+0.31	+0.16	+0.49	+0.19
															(0.31)	(0.29)	(0.32)	(0.30)	(0.30)	(0.29)
Priests																	+0.08	+0.09	-0.05	+0.07
																	(0.11)	(0.07)	(0.12)	(0.07)
Islands (dummy)																			+0.79***	+0.27**
																			(0.16)	(0.13)
Adj. R-Squared	0.19	0.18	0.42	0.47	0.42	0.48	0.43	0.50	0.43	0.50	0.42	0.52	0.43	0.53	0.44	0.56	0.44	0.57	0.49	0.57
Obs.	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

Note: Table 5 presents OLS estimates of equation (1) for the years 1870 and 1879. *Female Literacy* is the dependent variable. *Access to Land* is the ratio of landowners to total agricultural population. *Stuck in Agriculture* is the ratio of people engaged in agricultural activities (landowners, farmers and livestock keepers) to people engaged in modern professions (owners of manufacturing firms, workers and merchants). *Female Marriage* is the ratio of married to single women. *Family Size* is the ratio of total population to total number of families. *Sex Ratio* is the ratio of males to females. *Non-Greeks* is a dummy variable (it takes the value 1 if an area/municipality has at least one non-Greek resident, and 0 otherwise). *Urbanization* is another dummy variable (it takes the value 1 when an area's population is greater than 5000 people, and 0 otherwise). *Widows* is the percentage of widows in the total female population. *Priests* is the percentage of priests in the total population. Islands is another dummy variable (it takes the value of 1 for island areas, and 0 otherwise). All regressions are at the municipal level (n = 350). All variables are in logarithmic form (except the dummies). Newey-West HAC standard errors are reported in parentheses. For simplicity, the intercept is not reported. Significance: *** $p < 0{,}01$ ** $p < 0{,}05$ * $p < 0{,}1$.

Sources: Greek Population Censuses of 1870 and 1879.

Table 6
Probit Model Estimates (Dependent Variable: Female Students)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879
Access to Land	**+0.41*** ** (0.05)	**+0.29*** ** (0.05)	**+0.20*** ** (0.06)	+0.07 (0.06)	**+0.19*** ** (0.06)	+0.07 (0.06)	**+0.20*** ** (0.06)	+0.08 (0.06)	**+0.21*** ** (0.07)	+0.08 (0.06)	**+0.21*** ** (0.07)	+0.07 (0.06)	**+0.22*** ** (0.07)	+0.04 (0.06)	**+0.22*** ** (0.07)	+0.04 (0.06)
Stuck in Agriculture			**-0.46*** ** (0.06)	**-0.54*** ** (0.08)	**-0.46*** ** (0.07)	**-0.54*** ** (0.08)	**-0.45*** ** (0.07)	**-0.54*** ** (0.09)	**-0.46*** ** (0.07)	**-0.54*** ** (0.09)	**-0.45*** ** (0.07)	**-0.51*** ** (0.09)	**-0.41*** ** (0.08)	**-0.48*** ** (0.09)	**-0.41*** ** (0.08)	**-0.49*** ** (0.09)
Female Marriages					-0.91 (0.58)	-0.28 (0.57)	-0.82 (0.59)	+0.00 (0.62)	-0.85 (0.60)	+0.00 (0.64)	-0.82 (0.59)	+0.14 (0.67)	-0.83 (0.62)	+0.26 (0.66)	-0.83 (0.63)	+0.32 (0.65)
Family Size							-0.20 (0.32)	+0.58 (0.38)	-0.21 (0.32)	+0.58 (0.41)	-0.22 (0.31)	+0.54 (0.42)	-0.46 (0.30)	+0.26 (0.42)	-0.46 (0.30)	+0.22 (0.43)
Sex Ratio									+0.40 (0.72)	-0.01 (0.90)	+0.28 (0.72)	-0.34 (0.92)	+0.19 (0.72)	-0.33 (0.91)	+0.19 (0.73)	-0.38 (0.90)
Non-Greeks (dummy)											+0.11 (0.14)	**+0.38** ** (0.17)	+0.07 (0.15)	**+0.37** ** (0.17)	+0.07 (0.15)	**+0.37** ** (0.18)
Urbanization (dummy)													**+0.89*** ** (0.25)	**+0.83*** ** (0.21)	**+0.89*** ** (0.25)	**+0.81*** ** (0.21)
Islands (dummy)															+0.00 (0.18)	-0.12 (0.19)
McFadden R-Squared	0.12	0.18	0.22	0.21	0.23	0.21	0.23	0.21	0.23	0.21	0.24	0.22	0.27	0.26	0.27	0.26
Obs.	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

Note: Table 6 presents OLS estimates of equation (1) for the years 1870 and 1879. *Female Students* is the dependent variable. *Access to Land* is the ratio of landowners to total agricultural population. *Stuck in Agriculture* is the ratio of people engaged in agricultural activities (landowners, farmers and livestock keepers) to people engaged in modern professions (owners of manufacturing firms, workers and merchants). *Female Marriage* is the ratio of married to single women. *Family Size* is the ratio of total population to total number of families. *Sex Ratio* is the ratio of males to females. *Non-Greeks* is a dummy variable (it takes the value 1 if an area/municipality has at least one non-Greek resident, and 0 otherwise). *Urbanization* is another dummy variable (it takes the value 1 when an area's population is greater than 5000 people, and 0 otherwise). *Widows* is the percentage of widows in the total female population. *Priests* is the percentage of priests in the total population. Islands is another dummy variable (it takes the value of 1 for island areas, and 0 otherwise). All regressions are at the municipal level (n = 350). All variables are in logarithmic form (except the dummies). Newey-West HAC standard errors are reported in parentheses. For simplicity, the intercept is not reported. Significance: *** $p < 0{,}01$ ** $p < 0{,}05$ * $p < 0{,}1$.

Sources: Greek Population Censuses of 1870 and 1879.

TABLE 7
Probit Model Estimates (Dependent Variable: Female Teachers)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879	1870	1879
Access to Land	+0.44***	+0.39***	+0.15**	+0.13*	+0.14**	+0.13*	+0.12***	+0.08	+0.14*	+0.09	+0.15*	+0.09	+0.16**	+0.06	+0.15*	+0.05
	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)
Stuck in Agriculture			-0.57***	-0.61***	-0.57***	-0.62***	-0.60***	-0.69***	-0.63***	-0.76***	-0.58***	-0.73***	-0.54***	-0.71***	-0.57***	-0.72***
			(0.08)	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)	(0.08)	(0.10)	(0.08)	(0.10)	(0.09)	(0.10)	(0.09)	(0.10)
Female Marriages					-0.23	-1.33**	-0.10	-1.42**	-0.16	-1.76***	-0.02	-1.58**	+0.07	-1.65**	+0.22	-1.60**
					(0.60)	(0.55)	(0.59)	(0.59)	(0.60)	(0.60)	(0.57)	(0.59)	(0.59)	(0.63)	(0.59)	(0.62)
Family Size							-0.36	+0.87**	-0.40	-0.46	-0.41	-0.40	-0.68**	-0.00	-0.71**	-0.07
							(0.29)	(0.38)	(0.29)	(0.40)	(0.27)	(0.40)	(0.28)	(0.41)	(0.29)	(0.42)
Sex Ratio									+1.19*	+2.21***	+0.79	+1.98**	+0.53	+1.96**	+0.20	+1.92**
									(0.75)	(0.75)	(0.75)	(0.78)	(0.70)	(0.75)	(0.73)	(0.76)
Non-Greeks (dummy)											+0.45***	+0.40**	+0.43**	+0.35*	+0.45***	+0.37**
											(0.15)	(0.18)	(0.16)	(0.19)	(0.16)	(0.19)
Urbanization (dummy)													+0.86***	+1.04***	+0.86***	+1.03***
													(0.20)	(0.19)	(0.20)	(0.19)
Islands (dummy)															-0.32	-0.11
															(0.19)	(0.21)
McFadden R-Squared	0.13	0.11	0.29	0.29	0.29	0.30	0.31	0.31	0.31	0.33	0.33	0.34	0.37	0.41	0.38	0.41
Obs.	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350

Note: Table 6 presents OLS estimates of equation (1) for the years 1870 and 1879. *Female Teachers* is the dependent variable. *Access to Land* is the ratio of landowners to total agricultural population. *Stuck in Agriculture* is the ratio of people engaged in agricultural activities (landowners, farmers and livestock keepers) to people engaged in modern professions (owners of manufacturing firms, workers and merchants). *Female Marriage* is the ratio of married to single women. *Family Size* is the ratio of total population to total number of families. *Sex Ratio* is the ratio of males to females. *Non-Greeks* is a dummy variable (it takes the value 1 if an area/municipality has at least one non-Greek resident, and 0 otherwise). *Urbanization* is another dummy variable (it takes the value 1 when an area's population is greater than 5000 people, and 0 otherwise). *Widows* is the percentage of widows in the total female population. *Priests* is the percentage of priests in the total population. Islands is another dummy variable (it takes the value of 1 for island areas, and 0 otherwise). All regressions are at the municipal level (n = 350). All variables are in logarithmic form (except the dummies). Newey-West HAC standard errors are reported in parentheses. For simplicity, the intercept is not reported. Significance: *** $p < 0{,}01$ ** $p < 0{,}05$ * $p < 0{,}1$.

Sources: Greek Population Censuses of 1870 and 1879.

only in 1870. By contrast, agriculture trap has a negative and significant correlation with female participation in education. Moreover, factors such as female marriage, family size and gender ratio display no significant effects on female enrolment in school, but they do appear to have some significant impact on female teacher availability. Finally, the non-Greek population share and urbanization register positive and significant relationships with female participation in education.

7. Conclusion

This paper is the first empirical exploration of the possible linkages between people's access to land and the growth of literacy in late nineteenth-century Greece. It exploits information drawn from the Greek Population Censuses of 1870 and 1879. Our newly created dataset includes a broad range of socioeconomic and demographic indicators: literacy levels, educational enrolment, teacher availability, access to land, the agriculture trap, marital status, family size, gender ratio, urbanization, ethnic differences and religious affiliation. It covers 350 Greek municipalities for the two census years. The resulting empirical estimates turn out to be consistent with previous findings in the literature, indicating a positive and significant relationship between access to land and literacy rates. On the other hand, the prevalence of agriculture over modern professions (the agriculture trap) proves to be negatively related to literacy. The results are robust to controls for a selection of other variables that could potentially affect literacy. Our estimates also indicate significant negative associations between marriage and literacy rates, and family size is identified as another important factor adversely affecting literacy. Urbanization is found to have positive effects on literacy. The gender ratio registers a negative, though not always significant, relationship with male literacy, while the share of non-Greek population appears to have a positive effect on female literacy. Lastly, the number of female widows is found to be positively related to male

literacy rates, while the prevalence of religion (gauged by number of priests) shows no significant effect on the expansion of literacy.

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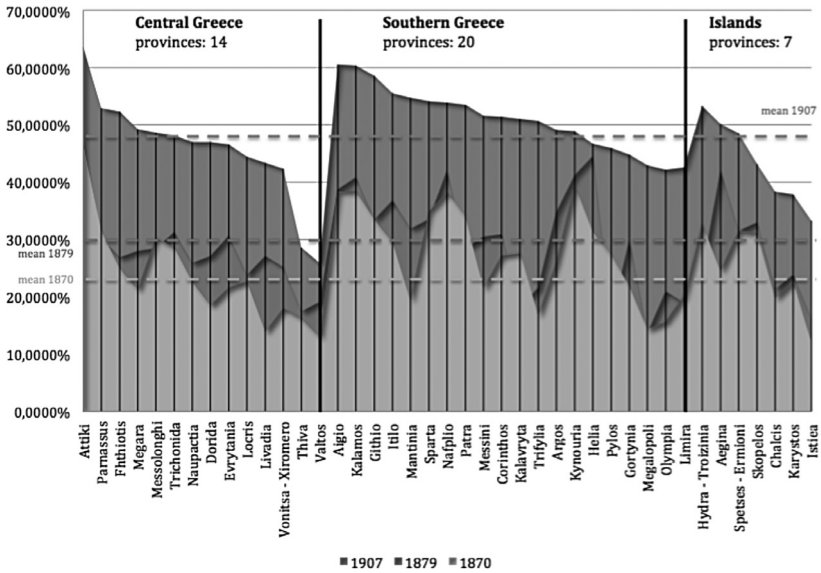
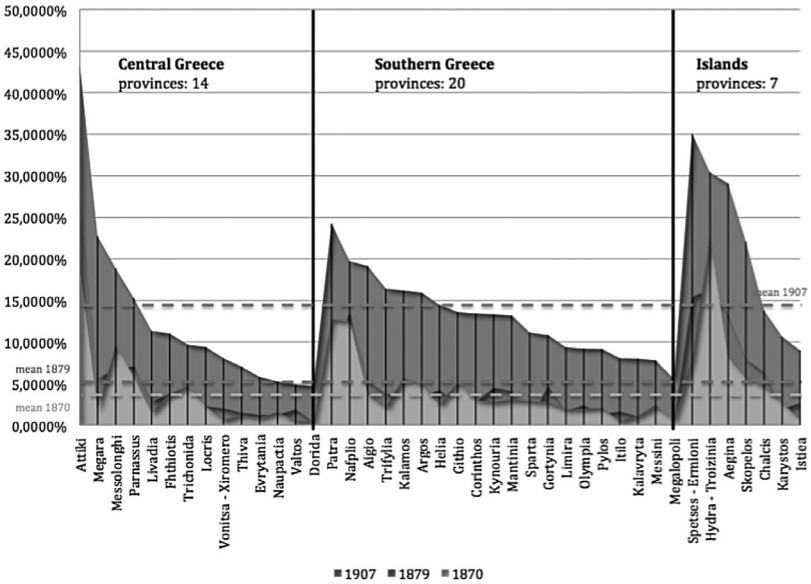
Appendix

FIGURE 1
Male Literacy (1870, 1879 and 1907) (provincial-level data)



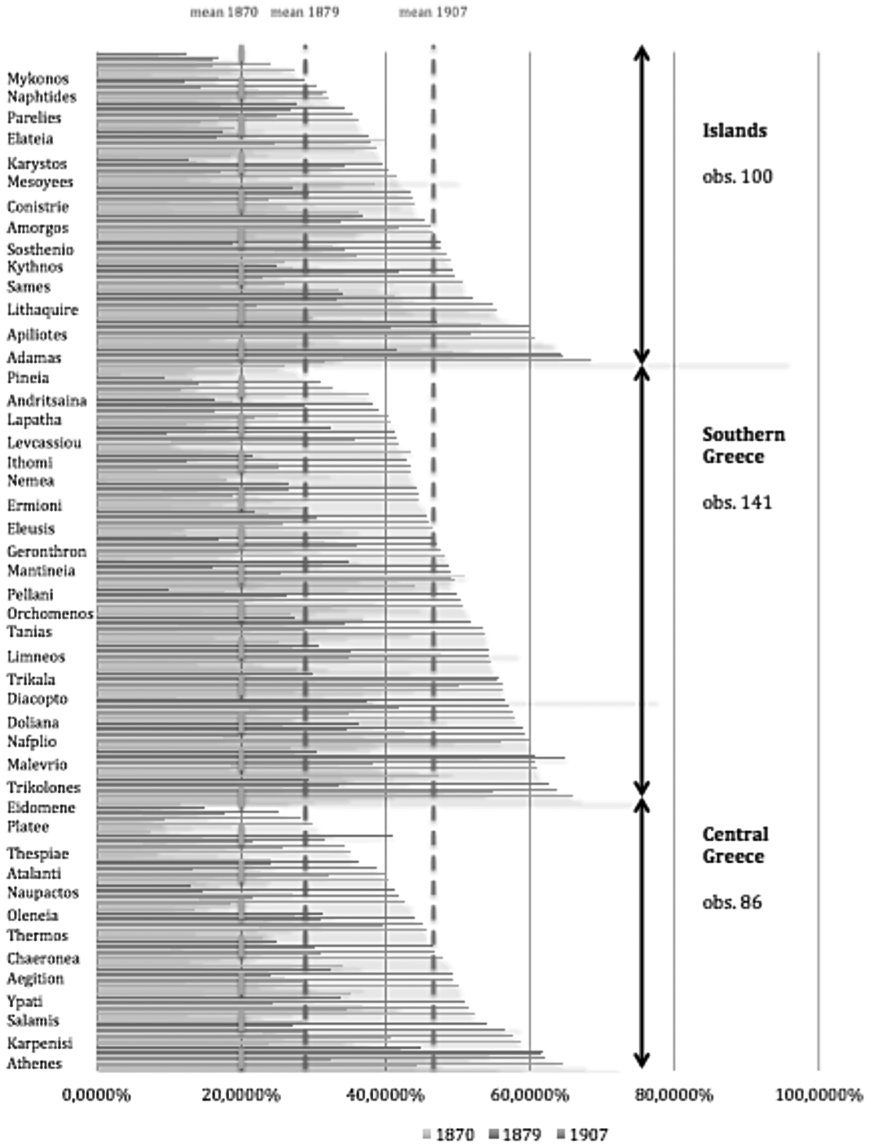
Note: Figure 1 shows literacy rates for men in Greece during the period 1870-1907. Newly annexed territories (Ionian Islands and the Northern lands) as well as the Aegean Islands are excluded. Provinces ranked by the maximun levels of 1907.

FIGURE 2
Female Literacy (1870, 1879 and 1907) (provincial-level data)



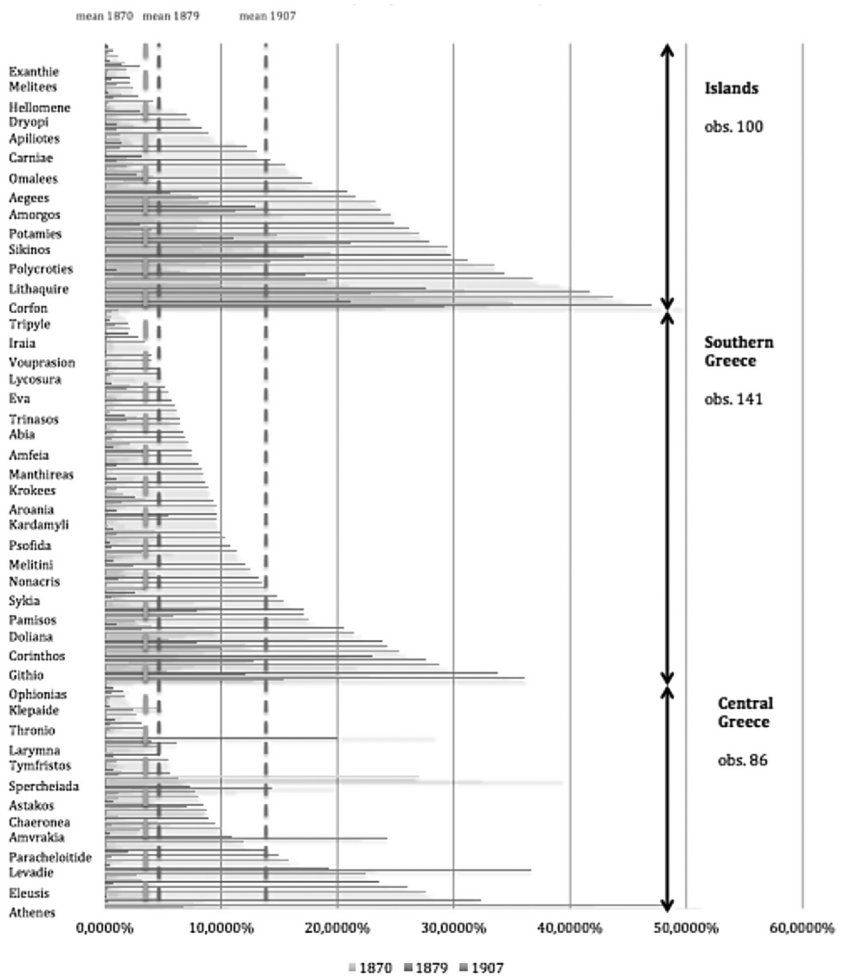
Note: Figure 2 shows literacy rates for women in Greece during the period 1870-1907. Newly annexed territories (Ionian Islands and the Northern lands) as well as the Aegean Islands are excluded. Provinces ranked by the maximun levels of 1907.

FIGURE 3
Male Literacy, municipal-level data (1870, 1879 and 1907)



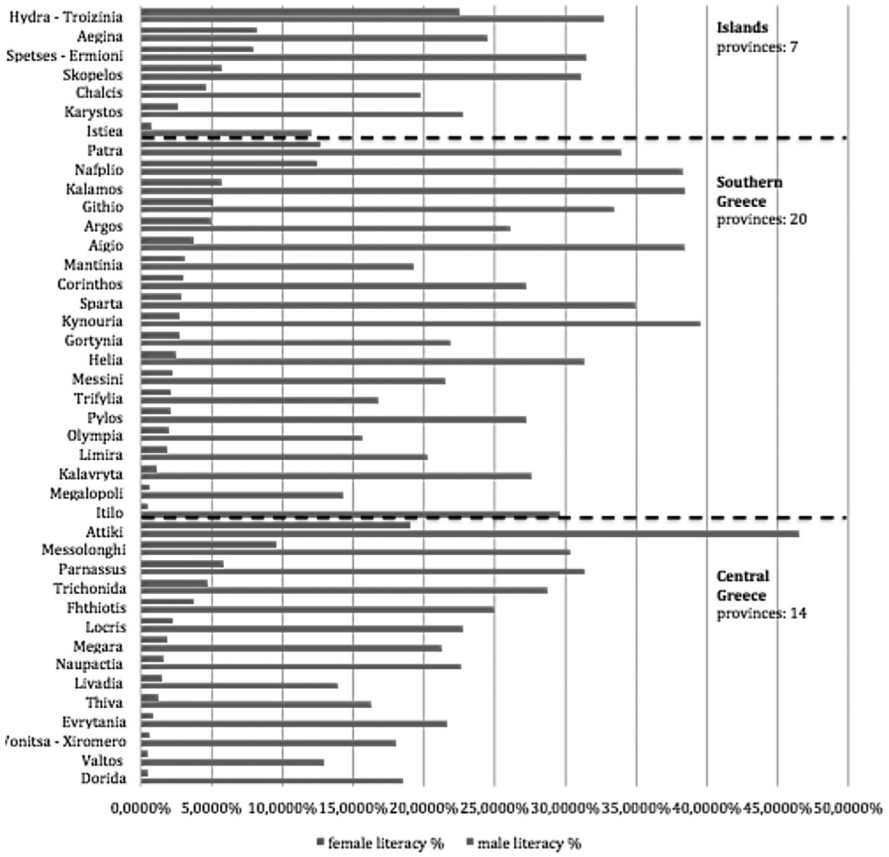
Note: Figure 3 shows literacy rates for men in Greece during the period 1870-1907. The Northern lands are excluded. Municipalities ranked by the maximun levels of 1907.

Figure 4
Female Literacy, municipal-level data (1870, 1879 and 1907)



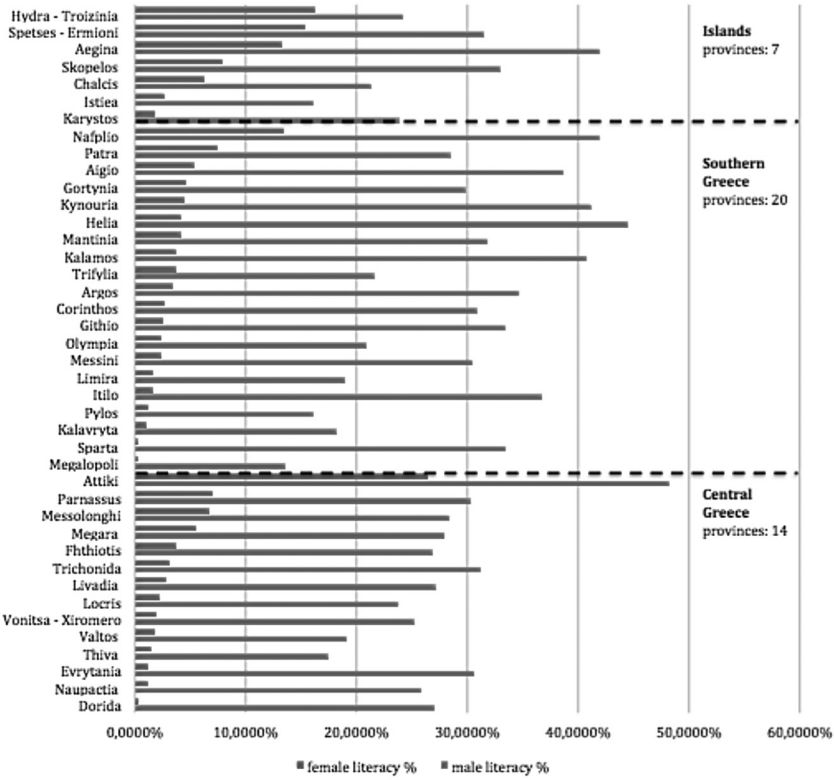
Note: Figure 4 shows literacy rates for women in Greece during the period 1870-1907. The Northern lands are excluded. Municipalities ranked by the maximun levels of 1907.

FIGURE 5
Gender Gap in Literacy (1870) (provincial-level data)



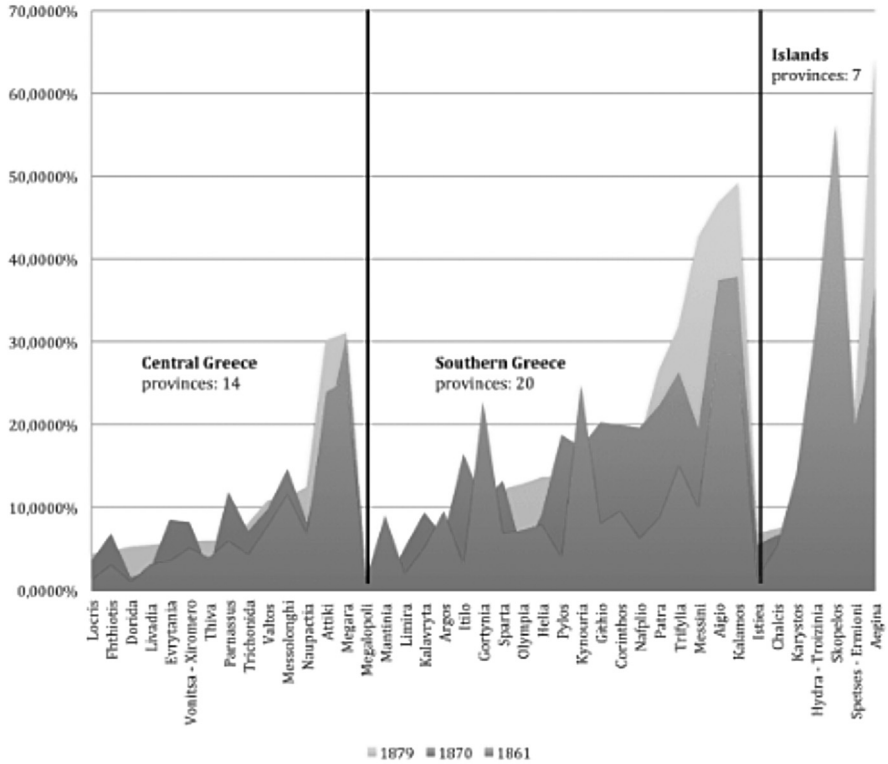
Note: Figure 5 shows the gender gap in literacy in Greece in 1870. Newly annexed territories (Ionian Islands and the Northern lands) as well the Aegean Islands are excluded. Provinces ranked by the maximun levels of female literacy.

Figure 6
Gender Gap in Literacy (1879) (provincial-level data)



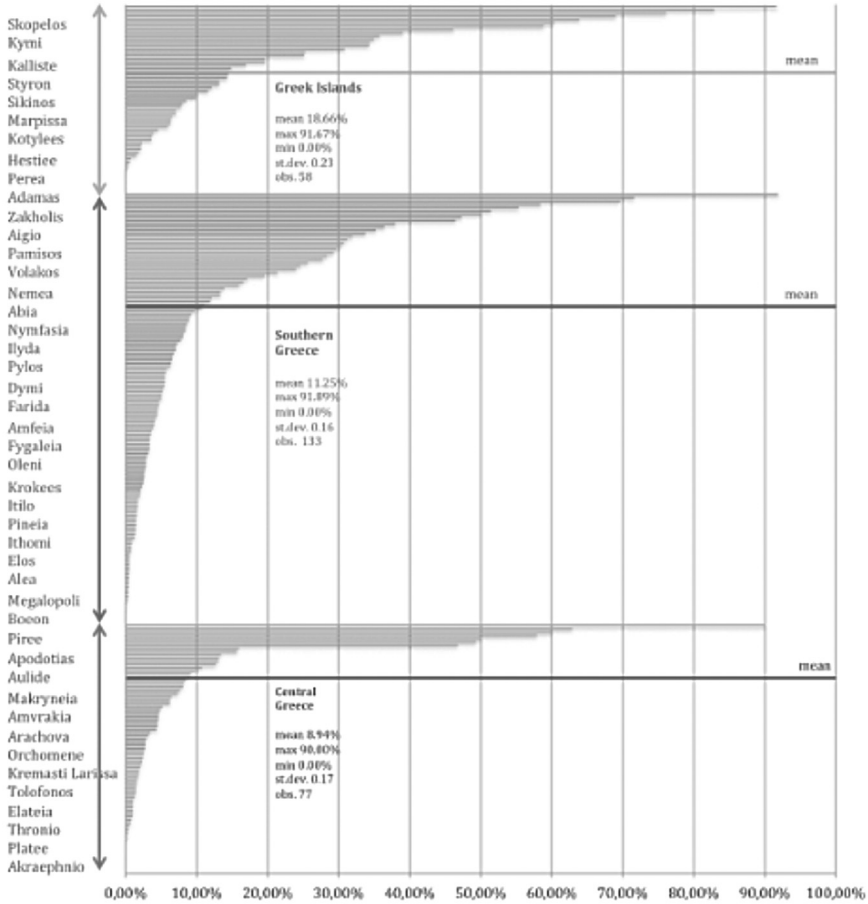
Note: Figure 6 shows the gender gap in literacy in Greece in 1879. Newly annexed territories (Ionian Islands and the Northern lands) as well as the Aegean Islands excluded. Provinces ranked by the maximum levels of female literacy.

FIGURE 7
Access to Land (1861, 1870 and 1879) (provincial-level data)



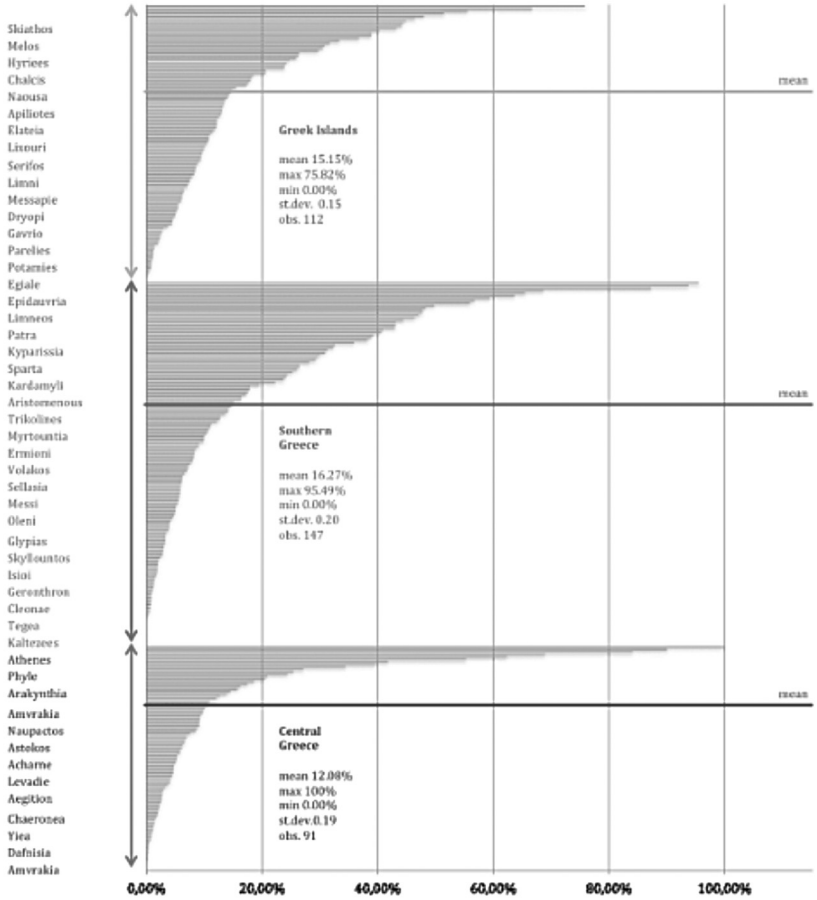
Note: Figure 7 shows the rate of access to land in Greece during the period 1861-1879. Newly annexed territories (Ionian Islands and the Northern lands) as well as the Aegean Islands are excluded. Provinces ranked by the maximun levels of 1879.

FIGURE 8
Access to Land (1861) (municipal-level data)



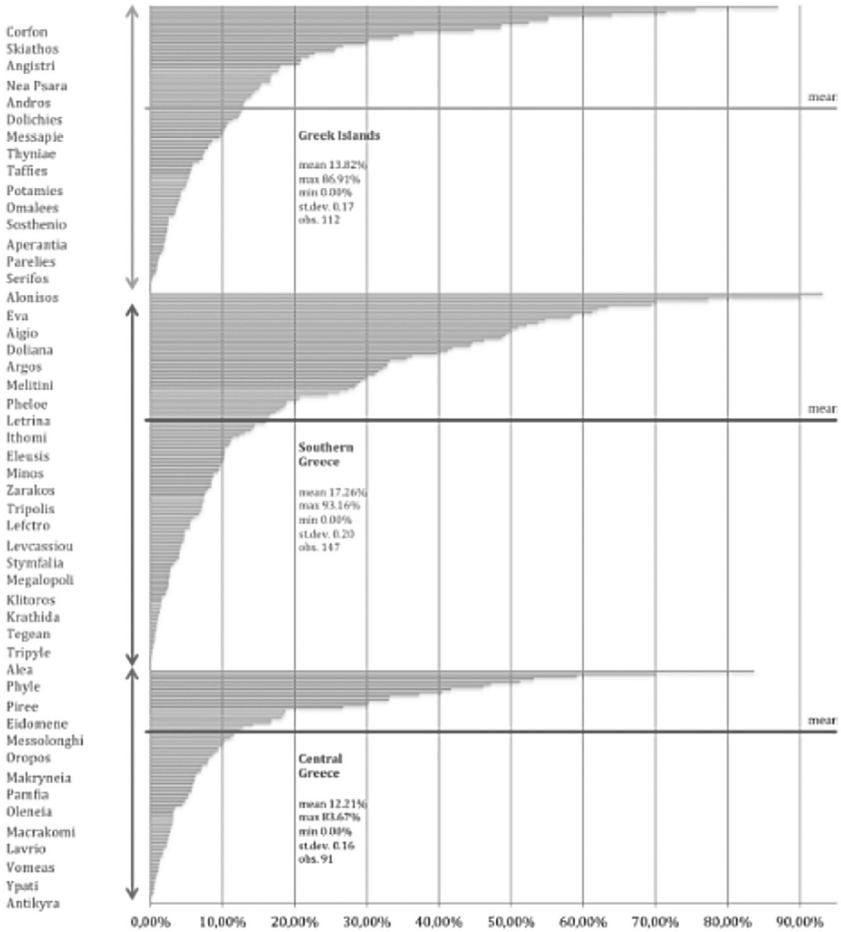
Note: Figure 8 shows the rate of access to land in Greece in 1861. The Northern lands are excluded. Municipalities ranked by the maximun levels.

FIGURE 9
Access to Land (1870) (municipal-level data)



Note: Figure 9 shows the rate of access to land in Greece in 1870. The Northern lands are excluded. Municipalities ranked by the maximun levels.

FIGURE 10
Access to Land (1879) (municipal-level data)



Note: Figure 10 shows the rate of access to land in Greece in 1879. The Northern lands are excluded. Municipalities ranked by the maximun levels.