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Essays on culture, human capital development and economic history

by

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Abstract

The current thesis presents three empirical studies, motivated by the historical impact of agriculture on aspects of development, such as cultural attitudes, formation of human capital and regional development.

The initial chapter explores the impact of land ownership inequality on beliefs towards gender equality. Using a combination of cross-country land inequality data and individual level data on attitudes towards the role of women in society, I find that higher shares of historical land inequality have a negative impact on beliefs in favor of gender equality. Looking into the mechanism behind this transmission, specifically at second-generation immigrants, it appears that these cultural attitudes are predominately shaped from the mother's country of origin.

The following chapter focuses on an agrarian economy during earlier stages of development. It exploits how the increased cultivation of currants affected human capital formation in the Greek economy during the 19th century, following an exogenous shock related with international trade. I show that regions that were able to respond to the increased demand for currants faster, were less likely to invest towards education. The evidence is consistent with the idea that gains from international trade in agrarian economies may reduce incentives for human capital accumulation, and instead exacerbate the specialization in the production of low-skill nonindustrial goods.

The final chapter investigates how land relations affected regional development of the same economy, at the local level. Following the annexation of Thessaly to Greece, the transition of communities out of feudal relations towards different forms of private ownership had an significant impact on regional development. Communities that transitioned towards small private ownership, experienced higher rates of population growth. In terms of the underlying mechanism, I provide evidence that municipalities with higher shares of small ownership have higher shares of married and illiterate households, thus settled down households increased their agricultural efforts rather than increasing their demand for human capital.

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Chapter 1

Introduction

1.1 Motivation and Aims

This thesis is motivated by the impact of agriculture on comparative development. It examines how certain attributes that play an important role in development, such as beliefs, human capital formation and land relations, were shaped by historical realities and events. While initially starting from a general perspective examining how agriculture affected beliefs related to gender equality, it evolves into a within country examination of historical events that had a profound effect on human capital formation and regional development of the agrarian economy of Greece during the 19th and early 20th century.

The first attribute related with development are beliefs towards gender equality, and how they have been partially shaped by historical realities. Societies characterized by higher levels of land ownership inequality have been associated with a slower transition out of the agricultural phase and into industrial and post-industrial stages of the economy. Similarly, differences in methods of cultivation in pre-industrial agricultural societies have been shown to negatively impact beliefs towards gender equality. For instance, societies that experienced predominately plough agriculture, which required upper body strength and short bursts of power, tended to accept that men were primarily expected to work in the fields, while women

were instead allocated in house-related activities (Boserup, 1970).

With this as motivation, this chapter aims to examine how land ownership inequality affected contemporary beliefs towards gender equality, specifically women's participation in the labour market, higher education, and politics. Historically, inequality in land ownership has been the result of geographical characteristics affecting the type of agricultural production that was implemented across regions (Sokoloff and Engerman, 2000). Agricultural societies were less likely to provide economic opportunities for women, prioritizing existing structures favoring male economic independence, negatively affecting female labour market participation, and limiting female economic autonomy. Existing literature has focused on differences in production (Alesina et al., 2013) without considering the role of other factors such as inequality in land ownership. In this chapter, I combine aggregate measurements of cross-country land ownership inequality from Vollrath and Erickson (2007) with global survey measurements of beliefs towards gender equality from the World Values Survey. I explore whether beliefs towards gender equality were partially shaped by these differences. Moreover, I study the persistent effect of historical land inequality on contemporary beliefs of second-generation immigrants, using the European Social Survey.

The second attribute related with development is human capital formation in an agrarian economy. The motivation behind the examination of Greece as a case study lies in historical events transforming the agricultural sector of the country. During the late 19th century, the increasing popularity of pudding in England, along with the outbreak of phylloxera plague in French vineyards had an unintended effect in the agrarian economy of Greece. These events escalated the international demand and production of currants in Greece during the 1870s, causing an unprecedented shock that was transmitted through trade in the agricultural population. In particular, the increased international demand for currant cultivation led to a significant increase in production, as well as triggered a process of internal agricultural colonization. The spread of currant viticulture became feasible through in-migration and permanent settlement of peasant families, from highlands to fertile coastal plains where

currants could be produced.

The aim of this chapter is to empirically test how human capital formation in earlier stages of development was affected by this shock in agricultural demand. Previous research has argued that during the second phase of the industrial revolution, trade affected industrial and nonindustrial economies differently (Galor and Mountford, 2008). In industrial economies, trade enhanced specialization towards skill-intensive goods, causing increased demand for skilled labour, subsequently increasing incentives towards human capital accumulation. By contrast, in non-industrial economies trade generated incentives towards the specialization of labour-intensive unskilled nonindustrial goods, reducing incentives for human capital accumulation. Case studies of industrialized economies during this era have documented how changes in agricultural production affected educational outcomes (Bignon and Garcia-Peñalosa, 2018). In this chapter I provide a case study of non-industrialized economy, by creating a novel dataset from historical archives. Using that, I examine the shock from international demand of currants and its effect on formation of human capital.

The final attribute is focused on land distribution and regional development of an agrarian economy, after a change in land relations. A historical event, specifically the annexation of Thessaly in Greece from the Ottoman empire, motivates this chapter. During the Ottoman period, most communities of this region followed a feudal semi-cooperative system, in which large estates would share aspects of risk and profits between owners and workers, while other communities followed a communal way of social and political life. Following the cession of the region in the 1880s, agricultural estates that relied on customary Ottoman law were recognized by the Greek state as private properties. This legal change acknowledged rights of use as full ownership rights, while denying existing rights of cultivation. As a result, Thessaly was transformed into a region dominated by forms of large ownership based on formalized rights of use, and forms of small ownership created in the aftermath of repudiated rights of cultivation.

This final chapter aims to examine how these changes in land relations affected agricul-

tural development in the region. Historical studies have demonstrated the importance of land distribution in formation of human capital and subsequent economic development (Galor et al., 2009). The negative effect of land concentration on education and development has been highlighted for countries characterized by conflicting interests between landed and industrial elites, such as 19th century Prussia (Cinnirella and Hornung, 2016). However, recent studies point towards the conditional nature of land distribution as a function of existing historical realities that may affect human capital formation (Andersson and Berger, 2019). For instance, changes in land relations, such as labour emancipation, may affect the underlying choices towards education and development (Ashraf et al., 2020). In this chapter I provide a case study of the impact that changes in land relations have on regional development, as proxied by population growth. Furthermore, I investigate the mechanism behind this transition, specifically whether it affected the underlying trade-off faced by emancipated former cultivators between increasing long-term settlement or investing towards human capital, as proxied by marriages and literacy rates.

1.1.1 Overview of chapter 2

This chapter explores the role of historical differences in land ownership, contributing to the understanding of formation and transmission of gender equality beliefs. The first objective is to examine the impact of land ownership inequality on beliefs towards gender equality. The second objective is to establish if the effect of historical land inequality can be traced in the beliefs of second-generation immigrants.

To explore whether land inequality affected beliefs towards gender equality, cross-country data from various sources such as the Food and Agriculture Organization of the United Nations, and the World Values Survey, were combined. The former was used to construct land Gini indexes during the 1960s and 1970s across countries, while the latter to create gender equality scales across countries for the period between the 1970s and 2000s, using survey answers on questions regarding attitudes towards female labour participation, female

political representativeness, and female education importance. The empirical approach of cross-country comparisons included the use of terrain ruggedness as an instrumental variable, to consider how geographical factors had shaped different levels of land ownership inequality across countries. In line with theoretical arguments about the limited economic opportunities for women in societies characterized inequality in land ownership, there is a negative association between higher land inequality and beliefs in favour of gender equality.

To further scrutinize how contemporary beliefs towards gender equality may have been partially shaped by land ownership inequality, methodologies from the cultural transmission literature are employed. Individual level data from the European Social Survey measuring beliefs of second-generation immigrants are combined with average levels of historical land inequality from the parental country of origin. Higher shares of land inequality during earlier periods in the country of origin, appear to have a negative effect on contemporary beliefs of second-generation immigrants towards female labour market participation. Consistent with findings from cultural transmission literature, the mother's country of origin appears to drive the effect.

1.1.2 Overview of chapter 3

Chapter 3 provides an empirical study of a non-industrialized agrarian economy, namely Greece, and investigates how formation of human capital was affected by the exogenous shock in currant demand. As one of the first historical empirical studies of the relevant literature, it contributes to the understanding of human capital formation in agrarian economies.

To evaluate how the demand for currants transformed the economy, novel data from historical archives are digitized, such as population and agricultural censuses between 1860 and 1880. Using advanced methodologies ranging from optical character recognition to geospatial mapping software, a historical dataset for late 19th century Greece is constructed, containing information for aspects of the agricultural population (number of students, farmers, landowners etc.) at the municipality level, and agricultural land used for various crops at the county

level, along with other relevant variables. The empirical approach compares changes in the agricultural population in regions with different shares of land dedicated to currant production. The logic is that counties with a higher share of the country's overall currant landsize prior to the shock, had the natural endowment to respond more intensively in the increased international demand for currants, through their agricultural populations.

Consistent with expectations, in an agrarian economy that specializes in unskilled labour-intensive agricultural goods, the shock had a negative effect on human capital formation. Municipalities with higher shares of land dedicated to currant production, and increased agricultural population before and after the shock, experienced to a decreased focus on the formation of human capital, as measured by student ratios. It seems that following the specialization of the economy towards the production of an unskilled agricultural product, incentives of households to invest towards education were lessened. While the historical aspects of this event may be exclusive to Greece, this case study highlights how shocks from international trade may affect human capital formation in agricultural economies.

1.1.3 Overview of chapter 4

The last chapter exploits a historical event related to changes in land relations in early 20th century Greece, analyzing how it affected regional development. By examining an exogenous legal change in property rights, it contributes to the literature focused on pre-industrial economies and development.

To explain how the change in ownership status affected regional development between 1880 and 1910, historical data on the community level for property rights and population were digitized from historical archives and combined with municipality level information about marriages and literacy from population censuses. To empirically assess how the change in ownership status affected development, a treatment indicator for communities that transitioned towards small ownership regimes is utilized. The intuition is that emancipated former cultivators that became landowners in these areas, were more likely to increase their long-

term settlement and agricultural investment in their newly acquired private estates rather than increase their demand towards education, thereby increasing population density in the long run.

The empirical findings confirm that these abrupt changes in ownership had a positive effect on regional development. Communities that transitioned towards small ownership experienced a higher rate of population growth between the 1880s and 1910s, following the annexation. These findings are further reinforced when focusing on the underlying mechanism of the emancipated former cultivators that became landowners, using marriages and literacy ratios. In municipalities with higher share of treatment, there was a positive effect on the shares of married and illiterates, in other words individuals were more likely to increase their long-term settlement in the area, and less likely to search for out-of-farm opportunities.

1.2 Organization of Thesis

The following chapters employ modern econometric techniques and state-of-the-art identification strategies to examine the effect of interest. The data varies between chapters, starting with cross-country and individual level for chapter 2, then using regional level data for chapters 3 and 4, with different levels of aggregation. The remainder of the thesis is organized in the following way.

Chapter 2 begins by introducing literature related with the development and persistence of culture, and then focuses on the role of agriculture with beliefs towards gender equality in the following subsection. The next section sketches out the theoretical arguments connecting inequality in land ownership with gender equality beliefs. The proceeding section describes data sources and definitions of variables used in the empirical analysis, starting with measurements of beliefs towards gender equality, and moving to land inequality measures in the next subsection. Following this, I detail the empirical strategy for both OLS and instrumental variables in the cross-country sample, describe the main results of both models,

and discuss the instrument relevance. Then I conduct a series of robustness checks using alternative measurements of land ownership inequality and extending the control variables included in the regressions. In the second to last section, I outline the empirical strategy at the individual level and establish that the baseline results are similar at the individual level. In the next subsections I describe the complimentary dataset for second generation immigrants, analyze the empirical methodology from the relevant literature and describe the results. The final section of this chapter concludes.

Chapter 3 starts off by outlining the importance of human capital formation and how historical events related with international trade have shaped this process for a small agrarian economy. The idea is that by giving a solid analysis of the relevant literature in which the case study of 19th century Greece fits, it provides vital context through which the rest of the chapter is interpreted. The next section digs deeper in the historical background of the shock in demand for currants, how it affected the agricultural specialization of Greece, and its connection with comparative development and human capital formation. Following this, I present the digitized data from the archives and create variables for the econometric analysis. In the proceeding section I describe the main difference-in-differences methodology used to examine the effect of the demand shock on student ratios, comparing regions with varying production capability as well as changes in their respective agricultural population. I then outline the baseline results and their connection with findings from relevant literature and explore whether there was a differential effect depending on the gender of students. In the last subsection of the results, I employ a battery of robustness checks, ranging from placebo tests using alternative crops and expanding the sample to all counties of the country, to exploring whether assumptions such as parallel trends or selective migration influence the results, while also examining alternative variables and different subsamples. The final section provides a summary of findings and their contribution to the relevant literature.

In Chapter 4 I begin by connecting literature from land distribution and its effect on human capital formation and development with the historical case study. Like the previous

chapter, the intuition is to provide the context through which the change in land relations in a part of early 20th century Greece affected regional development. The next section provides a historical background of land relations in Greece and focuses further on changes in property rights in Thessaly before and after the annexation. In the following section, I describe the data used from historical archives and explain how the main variables of interest are constructed. The proceeding section is comprised of four subsections. First, I outline the empirical methodology used to compare the difference in development, as proxied by population density, between communities that transitioned towards small ownership, compared to the other communities. Second, I present the baseline results, analyze how they relate to existing literature and identify potential threats to the identification. Third, I provide a battery of robustness checks, such as a contiguous border test, an omitted variables test, an examination of the presence of the baseline effect on population growth during earlier years, and finally repeat the analysis with different subsamples. Fourth, in the final subsection I move on a higher level of aggregation, namely municipalities instead of communities, to establish that the same effect is present. In the second to last section, I explore the mechanism behind the main results in two different ways. One, I use municipality level data on marriage and literacy rates, to analyze how the changes in land relations altered the underlying mechanism affecting choices related with potential mobility of individuals, using both an OLS and instrumental variable approach. Two, I use data at the same aggregation for births, deaths, marriages, and outsiders to exclude the possibility of different trajectories. The final section of the chapter concludes.

The thesis concludes in chapter 5, where I summarize the thesis for social scientists, economists, and the public society. First, I present the main findings of each chapter and provide an interpretation of the main result of interest. Following that, I discuss implications, limitations, and potential future research. For the second chapter, I note the increasing salience of gender equality and the need to understand it through a historical perspective. For the third chapter, I highlight the recent developments in tools for archival research,

that will significantly enhance future research. And for the fourth chapter, I outline the main strengths and limitations of the study, while highlighting the importance of historical framework in both future research and policy making decisions.

Finally, it should be noted that chapters 3 and 4 are written in the format of papers suitable for publication in peer-review journals. The contribution of my supervisors in these two papers was in the research design process, as well as providing detailed feedback on every stage of the project. Chapter 3 is currently under review from a peer-review journal, while chapter 4 will be submitted for publication in the near future. An abridged version of Chapter 2 is planned for future submission as well. All materials contained in this thesis are derived from original research undertaken by myself, during my time in the Department of Economics.

Chapter 2

Land inequality and gender equality beliefs

The first empirical chapter is motivated by the role of agriculture in formation of beliefs. Societies characterized by high levels of land inequality experience slower transitions from agricultural to industrial an d post-industrial stages of the economy. The economic autonomy of women is comparatively lower in these societies. Using this as a backdrop, I ask whether land inequality, an important agricultural factor, has partially affected formation of beliefs towards gender equality.

2.1 Introduction

Cultural norms are increasingly gaining the attention of economists (Bowles, 1998; Akerlof and Kranton, 2000; Guiso et al., 2006). While traditionally, due to its vague nature, culture is understood by economists as an interesting but complicated matter, the undeniable effects it has on most outcomes of organized economic activity has reinvigorated attempts to incorporate it in economic frameworks (Bisin and Verdier, 2001; Alesina and Angeletos, 2005). Whether it is understood as an autonomous system of ideas, in the Weberian sense of protestant work ethic that shaped modern capitalism (Weber, 1930; Becker and Woess-

mann, 2009), or as an optimal response to environmental factors that are then systematized by each society (Piketty, 1995; Bénabou and Tirole, 2006), economists agree that there is an important effect of culture (Gorodnichenko and Roland, 2011; Nunn, 2012).

Ideas such as equality are certainly not foreign to economists, and are central in policy debates regarding taxation and redistribution, as well as its effects on long term growth. Nonetheless, equality is related to moral rather than normative principles, thus different societies have given different weight and definitions to it. Nowdays, equality is becoming increasingly associated with gender equality, and the perspectives towards women in general. Specifically, attitudes towards the role of women in activities such as participating in the workforce, in politics or attending higher education, characterize the dominant culture of a society. While there are many aspects of social life that may define perceptions on such beliefs, in this chapter I will concentrate on understanding the effect that historical economic factors have on shaping these cultural norms.

My focus will be centered on inequality in land ownership and how it may have affected beliefs towards gender equality. Historically, land was one of the main means of earning a livelihood, at least until industrialization. Post-industrialization naturally has lessened the importance of land agriculture, however the effect of land ownership inequality – in earlier stages of development – may have shaped attitudes towards the role and position of women in different societies, due to its effect on economic autonomy of women. In this chapter I will try to determine whether earlier land inequality played a role in shaping such cultural attitudes, and if traces of this historical economic factor can be found on contemporary beliefs.

The rest of the chapter is organized as follows: Section 2.2 goes through literature related to culture and development, then focuses on gender equality beliefs and land inequality. Section 2.3 elaborates on the relevant literature and provides the theoretical argument. Section 2.4 presents and describes the main data used. Section 2.5 includes the cross-country analysis, with the empirical strategy and findings. Section 2.6 extends the baseline analysis to

the individual level, and checks whether the effect of historical land inequality can be found in second generation immigrants. Section 2.7 concludes.

2.2 Literature Overview

2.2.1 Development and persistence of Culture

The historical determinants of culture, its persistence, and effects on development are increasingly being studied by economists (Nunn, 2012). While usually culture as a concept is still debated among economists, there is a growing consensus pointing to the direction of an evolutionary process, as those "decision making heuristics, which typically manifest themselves as values, beliefs and social norms" [page 1 (Nunn, 2012)]. Following literature from anthropologists, culture is defined essentially as those "rules of thumb" that evolved over time to help individuals make decisions in uncertain environment, if acquiring information is costly or imperfect (Richerson and Boyd, 1985, 2005). The benefits of employing such "fast-and-frugal" heuristics often outweigh costs of imprecision in many environments (Gigerenzer and Goldstein, 1996).

Historical events, and more generally history, played a role shaping cultural traits and long term development. For instance, Transatlantic and Indian Ocean slave trade routes had a long-term impact on distrust levels amongst individuals in Africa (Nunn and Wantchekon, 2011). Individuals whose ancestors belonged to ethnic groups residing closer to those routes, which were heavily raided by slave traders, are less trusting today even though these events took place more than 400 years ago. In a European historical context, Italian city states that became independent during the 12th century developed a higher level of social capital and trust that can be traced even today (Guiso et al., 2016). These cities had a form of participatory democracy which generated a feeling of belonging to the polity, guaranteeing property rights as well as public goods provision, ending up creating a deep sense of civic and cooperative behaviour (Putnam et al., 1993). Similarly, comparisons of medieval European

populations, such as the Genoese and Maghribis, reveal that their collectivist or individualist culture was shaped by different strategies undertaken (by their ancestors) to prevent opportunistic behavior (Greif, 1993). Depending on whether a punishment was enforced collectively or not among merchants engaged with long-distance trade, the respectable cultural trajectories of each society differed, creating different cultural traits that persisted over the long run (Greif, 1994).

Historical migrations within different parts of the U.S. provide further evidence regarding the persistence of culture. The "culture of honour" that still exists in parts of Southern U.S., where one's honour and reputation is highly valued and defended even by violent means, can be explained by different histories of settlements between the North and South U.S. (Nisbett and Cohen, 1996). While the North was settled primarily by groups with a farming background, where protection of property rights was a primary concern, the South was mainly settled by Celts, which historically organized in herding cultures, thus characterized by low population densities and weaker protection of property. Hence, a culture of aggressiveness prevailed and persists even today, as relevant studies have shown (Cohen et al., 1996). Furthermore, while the identity of the settlement group may have been important, the prevalence or not of cultural traits depended on the interaction between culture and institutions. For example, counties in the U.S. South with more Scottish and Irish immigration prior to the 1800s, have higher homicide rates today compared to similar neighbouring counties (Grosjean, 2014). Nevertheless, this relation only exists in the South, highlighting the presence of weaker enforcement of the rule of law and in general weaker formal institutions. In the North, stronger formal institutions made this culture of honour detrimental, therefore this trait did not persist.

The interaction between the organizational forms of every society (i.e. institutions) and its prevalent culture have shaped different societies accordingly. The most well-known example is the colonial origins hypothesis examining the prevalence of European settlements in different regions around the world during the Age of Exploration (15th to 18th century).

The mortality rates of early settlers affected the type of institutions that were implemented in different regions, setting up inclusive institutions that provided rule of law and protection of property rights where mortality rates were low, and extractive institutions otherwise (Acemoglu et al., 2001). These European settlers did not just established such growth-promoting institutions though, they also brought "themselves, their know-how and human capital", or in other words their cultural traits (Glaeser et al., 2004). Similar examples can be found by comparing early migration waves of different religious groups to North America, such as the Puritans, the Cavaliers or the Quakers (Fischer, 1989). For instance, the Cavaliers believed that inequality was a natural outcome that should be maintained in society, thus focused on existing hierarchies. Hence, they emphasized institutions providing limited education, lower taxes and an informal judicial system based on such hierarchical structures.

The role of historical events and organizational forms of every society on cultural traits is therefore significant. Nonetheless, in order to better understand the persistence of historical factors on cultural traits across societies, comparisons between societies have to go beyond analysing specific historic instances and their effect on cultural traits, and focus on the relation of historical phases with cultural traits. In general, cross-country comparisons of cultural characteristics originated from cross-cultural psychology, and specifically from studies of Hofstede in the 1980s, with thousands of interviews that took place across IBM employees in thirty countries (Hofstede, 2001). The individual responses on a range of questions, were used to create different dimensions of culture across countries (Heine, 2008), and have been used by economists interested in culture and its effects. For instance, the dichotomy between individualism and collectivism has been used to explain long-term growth (Gorodnichenko and Roland, 2017). However, this literature focuses on comparisons without analysing the role of history determining cultural traits. Since this could be a complicated matter, I will only focus on a specific cultural trait (gender equality), and analyse the role of historical economic factors related to it.

Attitudes regarding gender equality have been used in order to understand the reasons

behind the cultural differences across societies. Measuring gender equality can be a multidimensional phenomenon (Baxter, 1997), and feminist philosophy has deep divisions amongst socialist, liberal and cultural strands of thought (Maynard, 1995). Specific attitudes regarding the importance of equal participation in activities relating to the public sphere (right to work, education, vote) are usually the focus of such measurements (Fischer et al., 2000). Coming from an extensive social psychology literature, reliable multidimensional scales measuring attitudes towards the division of sex roles both in home and workplace have been created already from the 1970s and 1980s (Downing and Roush, 1985; Gerstmann and Kramer, 1997; Frieze and McHugh, 1998). However, these scales were quite comprehensive, and therefore usually only tested on smaller samples of college students, primarily in the United States (Bargad and Hyde, 1991; Liss et al., 2001). In order to make cross-national comparisons of such attitudes more appropriate, measurements from various sources started to be used by political scientists, like the Eurobarometer and the International Social Survey Programme (Wilcox, 1991; Banaszak and Plutzer, 1993). The creation of the World Values Survey (WVS) in the 1980s (and European Values Survey in the 1990s), provided an important tool for those interested in social attitudes across different countries and has been used extensively among social scientists during the last twenty years (e.g. Alesina and Angeletos, 2005; Bénabou and Tirole, 2006; Guiso et al., 2006). While the WVS takes place every few years and has an evolving design, the core battery of questions regarding attitudes towards gender equality is usually present. By combining some of the most focused questions regarding attitudes towards female labour participation, female political representativeness and female education importance, gender equality scales have been used to analyze determinants of culture across and within countries due to industrialization and post-industrialization (Inglehart and Norris, 2003).

2.2.2 Agriculture and Beliefs

In societies transitioning from agricultural to industrialized, a notable shift occurred in cultural norms and values related to gender equality, and has been even more pronounced in post-industrial societies (Iversen and Rosenbluth, 2011). A major factor explaining this shift has been the impact of economic growth on the type of labour – and human capital – typically found in those societies. For instance, in agricultural societies there is a lower demand for high-skilled workers, therefore a lower need for human capital development (i.e. through education) which has been documented extensively (e.g. Galor et al., 2009). In such societies, one of the main responsibilities allocated to women is childbearing, ensuring that a higher number of healthy children will assist – either as adults or as children – in agricultural production. Accordingly, food production and preparation is allocated to women, and jobs are usually predominately male (Nanda, 2000).

By contrast, in industrial societies, there are increasing opportunities for women to join the labour force and supplement the family income (Geddes and Lueck, 2002), even though this effect is stronger for later phases of industrialization rather than the early stages due to the nature of early industrial jobs (Goldin, 1988). Similarly, the earlier phases of industrialization required lower levels of human capital, compared to the later phases in which specialization became more prevalent, allowing for the creation of different types of occupations. Post-industrial societies expand these opportunities even further, due to the increasing "availability of general skills jobs not characterized by increasing returns to specific human capital, and that therefore do not penalize women for career interruption on account of child bearing and rearing" [page 36 (Iversen and Rosenbluth, 2011)]. In these societies, gender roles have converged in female labour participation, educational opportunities and characteristics of the family structure in general (Pasternak et al., 1997; Bonvillain, 1998), leading to a transformation from "male breadwinner" to "dual earning" families (Blossfeld and Drobnic, 2003).

The impact of different types of labour on beliefs regarding the role of women in soci-

ety, is not an exclusively recent concern. One of the seminal works from Boserup (1970), argued that the type of technology that could be used in different types of agricultural land, ultimately laid the foundations for the role of women in each society. The main difference she pointed out was the type of agriculture practiced across societies, specifically whether they used plough or shifting agriculture. Shifting agriculture is labour-intensive and requires women to actively participate in farm work. Plough agriculture is more capital-intensive and requires upper body strength (along with grip strength and burst of power), needed to pull the plough or control the animals pulling it. Furthermore, plough agricultures' difficulty to practice simultaneous childcare led to women exclusively assuming that responsibility. These differences in type of agriculture generated different norms about the natural role of women in society (Giuliano, 2015), which are observed across countries with similar institutions or economic development (Giuliano, 2017) and include beliefs towards labor market participation, entrepreneurship, politics, education, polygamy, and marital payments (Aberle, 1961; Goody, 1976), and actual female labour force participation (Alesina, Giuliano, and Nunn, 2013).

Changes in the agricultural production can affect gender differences in the short-term as well. Agricultural policy reforms in China during the late 1970s affected gender differences, through their impact on labour productivity (Qian, 2008). In the Maoist era, central planning focused on achieving production targets. However, a series of reforms during the early reform era (1978-1980), increased the returns on various cash crops, including tea and orchards. Women and men had a comparative advantage on different types of those crops. Men – due to height and strength – could pick fruit easier from trees, while women had a comparative advantage in picking tea leaves, a more delicate procedure. Comparing regions affected by these reforms, tea-growing regions showed an increase in average female earnings, which was translated in higher weight in household decision making, measured by fewer sex-selective abortions, less infanticide of girls, and better educational outcomes for girls.

Studies on the impact of variations of agricultural production, and their compatibility

with specific crops, have showcased that there are important factors connecting gender beliefs with land agriculture and land ownership. Differences in characteristics of the soil (e.g. slope and depth) or the amount of land required for cultivation, affected agricultural productivity and the distribution of land ownership (Sokoloff and Engerman, 2000). For instance, depending on the type of crop that could be cultivated, there is evidence that plough agriculture had an impact on the formation on beliefs about gender equality, even after accounting for geographic and environmental characteristics (e.g. terrain slope, soil depth, average temperature and precipitation) (Pryor, 1985). Empirically, this effect was documented after separating plough positive (i.e. cultivation benefits greatly from the plough) and plough negative (cultivation benefits less from the plough), and analyzing the impact of different agricultural methods (Pryor, 1985).

Variations on the type of agricultural methods and specific crops that could be grown in different regions have been linked to differences in land inequality and subsequent different levels of economic growth, institutional outcomes, and in general different organizational forms of each society (Sokoloff and Engerman, 2000). Specifically, cash crops (e.g. sugar, tobacco, coffee, rubber and bananas) were subject to economies of scale, while the production of food crops (wheat, maize), at least in the pre-modern period, was subject to constant returns of scale. The latter crop types were generally best suited for temperate climates, while the former for tropical areas (Easterly, 2007; Frankema, 2010). These differences had an impact on the type of crop selected by farmers, while at the same time had an impact on the average farm size and more generally land inequality (Cinnirella and Hornung, 2016). In regions characterized by economies of scale, land ownership concentration was higher, while regions where agriculture was only subject to constant returns of scale had lower levels of land inequality (Easterly, 2007). For instance, societies with a legacy of wheat agriculture (a crop from the latter category) tend to have weaker family ties, hence a more egalitarian distribution of household work (Ang and Fredriksson, 2017). Accordingly, societies characherized by weaker family ties, have higher levels of female labour participation

(Alesina and Giuliano, 2010). Overall, the type of agricultural production had a significant effect on the distribution of land holdings, female labour force pariticipation, as well as gender beliefs, leaving open the possibility that these different effects can be connected.

2.3 Theoretical Mechanism

The previous section described the determinants of culture and their interplay with organizational forms of society (i.e. institutions). It focused on how beliefs towards gender equality have been linked to variations in the type of society (agricultural, industrial, post-industrial), primarily due to their disparate effect on labour productivity of women, and therefore their economic autonomy. Moreover, it analysed how agriculture affects beliefs towards gender equality, and how variations in agricultural production are linked to land ownership inequality and female labour force participation. I argue that these separate effects can be connected, and proceed to analyse the effect of land inequality on contemporary beliefs towards gender equality.

The main argument can be summarized as follows. Societies characterized by higher levels of earlier land inequality, were less likely to move early towards industrialization, due to higher returns on land productivity, thus making a late transition towards an industrialized economy. Land inequality is usually higher in agricultural societies[1] and, apart from historical instances of abrupt reforms (e.g. after revolutions), changes relatively slowly over time.[2] Industrialized and post-industrial economies tend to have higher levels of human capital and female labour force participation, as well as more favourable attitudes towards gender equality, compared to agricultural (Inglehart and Norris, 2003). The main reason for these different attitudes is the economic independence of women, which was greatly enhanced as

[1] For instance, the correlation between land inequality around 1960 and the contemporaneous share of population working in the agricultural sector is relatively strong (around 0.4)

[2] For example, correlations between values of land inequality from the 1960s and 1970s, with measures prior to 1950 are high (around 0.65).

an outcome of this process. This argument follows the mechanism outlined in Galor et al. (2009), however I am more interested in the direct effect that different types of agricultural production had, on female labour force participation. In other words, increasing the economic autonomy of women should have a direct effect on beliefs towards gender equality regardless of the type of society. This is in line with arguments from Qian (2008) who argues that when women in regions of China were given a comparative advantage in agriculture related field (tea picking), this led to "higher weight in household decision making" i.e. higher autonomy. Similarly, Iversen and Rosenbluth (2011), have argued that womens' skills in agricultural societies were not transferable to other sectors of the economy. This made them less able to control their own livelihood, compared to post-industrial societies where their increased participation in different sectors of the economy allowed them to aquire transferable skills, leading to higher autonomy.

The historical presence of wheat agriculture and its long run effects, highlights the importance that differences in agricultural production can have on female labour force participation and beliefs towards gender equality. Wheat production historically required lower labour input requirements compared to other food crops (e.g. rice). Furthermore, it did not require as much coordination with neighbouring farms, since it did not depend on irrigation networks, but mainly relied on natural rainfall (Talhelm et al., 2014). Apart from periods of sowing and harvesting, the growing season was relatively short (spring to fall), which led to periods of extended absence for the male members of a household. Hence, women were (and most of the time required to be) able to cultivate the crops themselves, since men would spend a seasonal nomadic life, in order to take care of the cattle – securing food and access to water for it (Bates and Lees, 1977; Moran, 1982). Wheat agriculture did not require a large amount of manpower (apart from sowing and harvesting), therefore families in societies with wheat agriculture were not highly dependent to each other (Ang and Fredriksson, 2017) and used to be more egalitarian in their allocation of household tasks. This allowed smaller families to be able to produce enough food on their own, since food crops (such as wheat) in general

were subject to constant returns of scale, and such regions (with constant returns of scale) were characterized by lower levels of land inequality (Easterly, 2007). Similarly, food crops were best suited for temperate climates, and such regions were characterized by lower land inequality (Frankema, 2010). Combining the effects that differences in agricultural production had on land ownership inequality, with the effect that such inequality had on female labour productivity, one can argue that differences in agricultural production played a significant role on the economic independence of women, leading to higher female labour force participation, as well as relative beliefs in favour of such participation (Alesina and Giuliano, 2010).

The transition from agricultural to industrial and mainly post-industrial societies dramatically increased the ability of women to join the labour force, and become economically independent. Hence, societies characterized by lower levels of historical land inequality should have a more favorable view towards gender equality beliefs, since women were more likely to become economically independent from an earlier stage. On the other hand, in societies with higher levels of historical land inequality that industrialized on a later stage, views towards gender equality should be less favorable, due to the relevant – or entire – absence of jobs available for women (outside of the household) that provided economic independency. Overall, I expect that higher levels of historical land inequality have a negative effect on beliefs towards gender equality, even after agriculture ceases to be the main driving force of economic growth, in line with arguments made by both economists Nunn (2012) and anthropologists (Richerson and Boyd, 2005) defining culture as a – mostly – slowly changing variable.

The indirect effect that historical land inequality had on gender equality through education and human capital, should be mentioned as well. Societies that experienced higher levels of land inequality, were less likely to invest earlier in education, due to lower demand for high productivity workers. In other words, industrialization and early investment in education were positively correlated (Galor and Tsiddon, 1997), thus societies with lower

levels of land inequality – therefore lower amount of land elites able to influence educational reforms – were able to invest earlier in education, since they were not depended as much on land productivity. This early investment in education has been linked to early development of human capital promoting institutions (Galor et al., 2009), leading to a divergence between societies and their growth path. For instance, in regions where land ownership concentration was higher, enrollment rates historically have been lower, in other words the expansion of primary schooling provided by the state took longer, and empirical findings document this result either across countries (Kourtellos et al., 2013) or counties in nineteenth-century Prussia (Cinnirella and Hornung, 2016). The need for a larger number of educated workers, in an increasingly diversified number of sectors, allowed the higher participation of women in the labour force, thereby strengething their economic autonomy, and consequently shifting beliefs towards gender equality in the long run.

To sum up, historical differences in agricultural production played an important role determining female labour participation and beliefs towards gender equality. Depending on geographical determinants, such as the type of crops that could be cultivated and whether only constant returns of scale could be implemented, regions were characterized by different levels of land (ownership) inequality. These differences in agricultural production affected female labour force participation and their economic independence, specifically by increasing such participation in regions with constant returns of scale (and lower land inequality). Earlier land inequality affected the transition from agricultural to industrial societies, a transition that increased the opportunities for women's economic independency either directly, due to the shift in the type and number of occupations available to them, or indirectly, through the increased investment in education resulting to higher levels of human capital. Therefore, one would expect that higher levels of historical land inequality should have a negative effect on contemporaneous beliefs towards gender equality, across different societies.

2.4 Data Description

2.4.1 Beliefs about Gender Equality

The data used for gender equality beliefs comes from the World Values Survey Longitudinal data (WVS, 2014), and includes information from the fourth wave (1999) until the 6th wave (2014). The sample includes 40 countries from the 4th wave, 58 from the 5th wave, and 60 countries for the 6th, for a total of 99 different countries. The main variable of interest is the equality sub-index index (Y022), a variable created by averaging three variables related to gender equality. The three variables measure beliefs towards female labour market participation (C001), female political participation (D059), and female higher education (D060). In cases of either one missing, the equality variable is a linear transformation of the two available components. The exact formula is obtained by regressing the average of the three components on the other two. A more detailed description of the formula can be found on the WVS database site.[3]

For all questions, respondents are asked whether they (strongly) agree or disagree with a given following statement. The questions are worded in such a way, that the more someone disagrees with the statement, the higher the response scores in the gender equality index. Analytical definitions are provided in the appendix (Table 10).

The first variable related to gender equality (C001) is concerned with attitudes towards female labour market participation. Specifically, respondents have to state whether they agree/disagree with the following statement: *"When jobs are scarce, men should have more right to a job than women."*. Higher values of the variable C001, indicate higher levels of beliefs in favour of gender equality related to labour market participation.

The second variable related to gender equality (D059) is concerned with attitudes towards female political participation. Similarly, respondents have to state whether they agree/disagree with the following statement: *"On the whole, men make better political lead-*

[3] Link for further details: http://www.worldvaluessurvey.org/WVSContents.jsp

ers than women do.". Higher values of the variable D059, indicate higher levels of beliefs in favour of gender equality related to political participation.

The third variable related to gender equality (D060) is concerned with attitudes towards female education. Specifically, respondents have to state whether they agree/disagree with the following statement: *"A university education is more important for a boy than for a girl."*. Higher values of the variable D060, indicate higher levels of beliefs in favour of gender equality related to education.

For all questions, I average the responses by country, for all available waves (4 to 6). The original weight provided by each survey was used, and negative or null scores (indicating whether the question was not asked or unwillingness of individual to respond), were not taken into account. The final scale for each of the three variables (C001, D059, D060) is a ratio (i.e. from 0 to 1), describing the percentage of population supporting a view in favor of gender equality. The correlation between these three variables that create the Gender Equality Scale (Y022), is strongly positive and very high (above 0.8 and 0.9 as can be seen in Table 10 of the appendix.[4]

A global mapping of beliefs towards gender equality is reported in Figure 1. Higher values are coded in deep red, while lower values have a less pronounced colour. Similar to findings from the relevant literature, it is evident that a high degree of variation regarding gender equality beliefs exists across countries. For instance, countries in Western Europe and Scandinavia (e.g. Norway), along with North American ones (e.g. Canada) and Australia score higher in their respective beliefs towards gender equality. The next section explores whether land gini scores are related to this variation.

[4] Other correlations are reported in the appendix as well, for instance Table 11 reports correlations between main variables over waves, and Table 12 only between different waves.

2.4.2 Land Inequality

The measurement of land ownership concentration (i.e. land inequality) is of central importance to understand whether this form of inequality led to different beliefs about gender equality that can be traced even after the transition from agricultural to industrial and post-industrial societies. One of the first detailed datasets used in growth literature, comes from Deininger and Squire (1998) (hereafter, DS), who employ data taken from The Food and Agriculture Organization (FAO), a specialized agency of the United Nations focused on defeating hunger globally. In general, FAO data are based on official 'Agricultural Censuses', conducted at the beginning of each decade. Their dataset is based on the statistical Yearbook for the 1990 World Census (FAO, 1997) and contains information about the distribution of land holdings. The focus on land holdings is due to their ability to determine an individual's productive capacity as well as ability to invest, mainly in agricultural economies where land ownership is a major asset. Similar measurements of land holdings defined as *"all agricultural land assigned to a holder, that is one or two persons, rather than a group, community, state, or distinct management unit (in other words a farm)"* (Frankema, 2010), have been used by economic historians. The data sources include both FAO reports on world census (with data from 1950 to 1990), as well as the Institut International d' Agriculture (IIA)'s International yearbook (IIA, 1936).

In these datasets (DS & Frankema), land is measured in size (either acres or hectares), and the total agricultural area measured includes *"all land that is part of a holding, i.e. arable land, land under permanent crops, land under permanent meadows and pastures, wood and forest land, and other land"* (Table A1, Frankema, 2010). However, there is no correction for the quality or type of land. Other shortcomings of these datasets, such as referring only to operational rather than ownership distribution of the land, or not taking into account landlessness, should be taken into account when it comes to the measurement of land ownership inequality.

An important contribution regarding the measurement of land ownership inequality

comes from (Erickson and Vollrath, 2004). While other measurements focused on inequality within the group of landowners for each country (Deininger and Squire, 1998), they proposed a new measurement, accounting for factors affecting agricultural productivity, and focused on the inequality within the landholders as well as across the general population. Combining data from DS and FAO, this "modified" land Gini *"uses information on the size of the economically active agricultural population and the total number of holdings"* (page 11, Vollrath, 2008). By taking into account both inequality within land owners and across the agricultural population, this measurement provides a more nuanced description of land ownership inequality and has been used extensively in the relevant literature (e.g. Vollrath and Erickson, 2007; Vollrath, 2008; Galor et al., 2009).

The main variable used for the analysis is the "modified" Land Gini (Vollrath_Land_Gini), measuring the inequality in land ownership, similar to the gini coeffiecient used to describe income inequality across 99 countries, primarily from 1960s and 1970s (up to 1990), taken from Vollrath and Erickson (2007). Hence, for higher values of Land Gini, there is a less equal distribution of land holdings in each country (i.e. inequality). The final measurement used contains values from 0 to 1, similar to income Gini measurements. It should be noted that the vast majority of values is higher than 0.6, due to certain methodologies followed by the authors.[5] A global mapping of land inequality is reported in Figure 2. Higher scores of land inequality are coloured in deep blue, while lower scores are coloured in ligher shades. Apart from the variation, one can observe the mismatch between data available for gender beliefs, and data for land inequality.

The variation of beliefs towards gender equality across countries from the Vollrath sample is reported in Figure 3. While both samples before merge happen to have 99 different countries, the overlap between the two samples is not as significant as one would expect, leading to a final sample of 55 countries. Only countries with available information from both

[5] More information regarding the exact methodology can be found in Vollrath (2007), or in the following link: https://sites.google.com/site/dietrichvollrath/landdistfinance

the WVS and the Land Gini measurement from Vollrath and Erickson (2007) are reported. Once again, a high degree of variation exists across countries. For instance, Saudi Arabia and Yemen have the lowest scores on the Gender Equality Scale (below 0.4), while countries like Sweden or Norway are at the top of the distribution with scores above 0.8.

The correlations between Vollrath_Land_Gini and Gender Equality variables are reported in Figure 4. The upper left panel describes the relationship between the Gender Equality Scale (Y022) from WVS and Land Gini. As described earlier, the Gender Equality Scale consists of three variables measuring beliefs towards female labour participation (C001), female political participation (D059), and female educational attainment (D060). The relationship of each of those variables is reported in the other three diagrams. The upper right panel describes the relationship between the belief in female labour participation (C001) and land inequality, the bottom left between the belief in female political participation (D059) and land inequality, and the bottom right between belief in female educational attainment (D060) and land inequality. The relationship between each of the variables measuring beliefs towards Gender Equality and Land Inequality is negative, indicating that for higher levels of land inequality during the earlier years (1960-1970), a lower level of support towards gender equality beliefs exists in latter periods (1990-2014). To further analyze this relationship, other factors should be taken into account, which is done in the next section.

Before that however, two additional measurements of land inequality are described below, to be used for robustness checks later on. The first is once again a land gini (Frank_Land_Gini), which comes from Frankema (2010), and includes data on land holdings from 1950 to 1990 for a few more countries (101). While this variable has a few more observations and is very similar to the main variable (Vollrath_Land_Gini), the land inequality measured is only focused on within land owners rather than across the population. Hence, it is not reflecting inequality in the distribution of land holdings as well as the main variable, but similar effects should be expected on beliefs towards gender equality.

The second complimentary measurement, comes from the extensive work of Vanhanen

(2009) on measurements of Democracy. This dataset includes a variable measuring the percentage of family farms in different countries. On the one hand, it includes data that goes all the way back to the 1850s, and for later years (1950+), there are more countries (177) in this sample from the FAO data. On the other hand, the measurement comes from combining evidence from country censuses accounting for ownership by family, rather than farm size i.e. depending on the size of the country, the median family farm size differs. This contrasts the data from FAO, which measure actual size of the land holdings, in detailed censuses focused exclusively on agricultural measurements. The measurement is weaker than the land gini measurements analyzed earlier for a couple of reasons. First, the information is obtained from general censuses that had a broad focus measuring variables unrelated to land agriculture (e.g. political institutions across time) therefore measurement errors are more likely. Second, it compares average farm size across different countries, instead of taking into account inequality within them, in other words reports whether fewer family farms existed in a country, rather than how the land size was distributed (like in the land gini measurements).

Overall, percentage of family farms is included as an additional complimentary proxy of land ownership inequality, along with the main measurement from Vollrath (Vollrath_Land_Gini - Land Gini accounting for landlessness) and the additional from Frankema (Frank_Land_Gini - Land holdings Gini). Higher values of this variable (Family_Farms) indicate a higher level of equality (i.e. less inequality). Like the other land inequality variables, it takes values from 0 to 1. Even if this measurement may not be as consistent as land gini measures, it's conceptual similarity provides an additional proxy for land inequality nonetheless.

2.5 Empirical Analysis - Macro Sample

2.5.1 Empirical Strategy

This section analyzes the empirical strategy used to describe the relationship between historical Land Inequality and contemporary beliefs towards Gender Equality. In order to

further explore the relationship, the following ordinary least squares empirical specification is estimated:

$$Belief_i = \beta_1 Vollrath\_Gini_i + \beta_2 Plow_i + \beta_3 GDP_i + \beta_4 X_i + \epsilon_i \tag{2.1}$$

where $Belief_i$ is one of the four measurements of Gender Equality taken from the World Values Survey (i.e. Belief in Gender Equality, Belief towards female labour force participation, higher education attendance, political participation), in country i, averaged for the period between 1999-2014. $Vollrath\_Gini_i$ is the Gini coefficient measuring Land ownership concentration in country i, and is taken from Vollrath and Erickson (2007). Following their approach, only the earliest value of each country's Land Gini is used, and for the vast majority of countries the Gini coefficient is from the 1960s and 1970s. A negative sign of the coefficient β_1 should be expected, indicating that for higher values of historical Land Inequality (in the 1960s and 70s), there is a lower average contemporary belief in favor of Gender Equality in country i.

The main control variables are historical usage of plough agriculture and GDP per capita. Plough measurements are taken from Alesina, Giuliano, and Nunn (2013), and originally come from the Ethnographic Atlas, an ethnicity-level database containing information for 1265 ethnic groups around the world, which was subsequently simplified in order to provide cultural measurements for 186 cultural provinces, referred to as the Standard Cross-Cultural Sample (Murdock, 1967).[6] The measurement used is constructed by assigning the value of 1 if plough agriculture was exercised during the time that an ethnic group was firstly observed, and zero otherwise. Afterwards, the scores from each ethnic group are matched with corresponding presence of the groups in modern countries. The final $Plow_i$ variable takes values from 0 to 1, where a higher score indicates earlier historical usage of plough from ethnic groups present in country i. Results from relevant literature (Alesina, Giuliano, and Nunn, 2013), indicate that the presence of historical plough agriculture had a negative effect

[6] More information about the atlas can be found on: http://eclectic.ss.uci.edu/ drwhite/worldcul/atlas.html

on beliefs towards gender equality. Controlling for it will ensure that such effects have been taken into account. GDP per capita measurements are taken from the Quality of Governance 2018 database (QOG et al., 2018). The GDP_i variable is averaging for the period 1990 to 2014, for country i, and is measured in gross domestic product converted to International Dollars using purchasing power parity rates, for constant prices of 2011 International Dollars. GDP per capita has a positive effect on beliefs towards gender equality (Inglehart and Norris, 2003), at least on average, hence controlling for it is necessary. Continental and geographical controls are included, such as whether a country is landlocked, taken from Michalopoulos (2012), originally from the Global Development Network Growth Database, and information on latitude and longtitude is taken from Nunn (2012).

Table 1 summarizes the information for countries used in the baseline analysis, from the Vollrath dataset. Information relevant to subsequent analysis (i.e. instrumental variables and complimentary measurements of land inequality), is included as well. The five columns report the number of observations, the mean of the variable, the standard deviation, as well as the minimum and maximum value of each.

One can observe, that while land Gini measurements from Vollrath are available for 99 countries, only 55 of those countries match with data from the World Values Survey. The variables measuring beliefs towards Gender Equality are named after their respective descriptions. For the belief relating to female labour participation (i.e. question on whether when jobs are scarce men should be given priority over women), the variable is named JSC (original WVS code in parenthesis - C001). The belief related to political participation (i.e. question on whether men make better political leaders than women), the variable is named WPL (original WVS code in parenthesis - D059). Finally, the belief related to university attainment (i.e. question on whether a university education is more important for a boy than a girl) the variable is named UIG (original WVS code in parenthesis - D060).

2.5.2 Baseline Results

The baseline effect of Land Inequality on contemporary beliefs towards Gender Equality across countries is reported in Table 3. Only the β_1 coefficient of interest is reported for each case, in order to fit all results in one table. Each line reports the effect of the same independent variable (i.e. Vollrath_Gini), on a different belief towards Gender Equality. The first line is the Gender Equality Index that is computed as an average of the other three variables. The second line is the belief towards female labour force participation, namely the variable JSC. The third line is the belief towards female political participation, namely the variable WPL. The fourth line is the belief towards female higher education attendance, namely the variable UIG. Column (1) shows the negative effect of Land Ownership Inequality on all 4 contemporary beliefs towards Gender Equality, after controlling for continental fixed effects. Specifically, for the first line of column (1), an increase of one standard deviation of Vollrath Land Gini coefficient (i.e. an historical presence of higher land inequality), results in a roughly 0.56 standard deviation decrease in the average belief in favor of Gender Equality, and is significant at the 1% level. Similar results across all three variables are reported in the second, third and fourth line of column (1), documenting the negative effect of historical Land inequality on contemporary beliefs towards Gender Equality - variables JSC, WPL and UIG respectively.

Column (2) adds controls for Geographical characteristics of each country. In particular, dummies for being landlocked, and the absolute longtitude and latitude are added alongside the Continental controls. The effect of Land Inequality on all beliefs towards Gender Equality remains negative and statistically significant on the 1% level, after taking into account geographical characteristics. All three remaining variables measuring beliefs towards Gender Equality (i.e. JSC, WPL and UIG) are affected by the additional controls in the same way, thus a small decrease in magnitude of the effect, but no change in statistical significance.

Column (3) adds GDP per capita measurements as an additional control. This is an important control since it has been shown in political science literature (Inglehart and Norris,

2003) that there is a positive correlation between GDP per capita and beliefs in favour of Gender Equality, therefore it is important to see whether controlling for GDP affects the results. Reassuringly, the effect of Land Inequality on beliefs towards Gender Equality remains negative and statistically significant at the 1% level, while being very similar in magnitude. The effect is the same for the rest of the three variables, as all remain negative and statistically significant at the 1% level.

Finally, column (4) adds the historical presence of plough agriculture to the list of controls. The effect of Land Inequality on beliefs towards Gender Equality remains similarly negative and statistically significant at the 1% level, even though the magnitude decreases slightly. An increase of one standard deviation of the Gini coeffiecient, results in a 0.51 standard deviation decrease in the average belief in favor of Gender Equality. The other three variables (JSC, WPL and UIG) are affected in the same way, but all remain negative and statistically significant at the 1% level.[7]

Overall, the effect of historical Land Inequality (land ownership concentration) on contemporary beliefs in favour of Gender Equality, appears to be negative. Since there is a time gap between the measurements of Land Inequality across countries (early 1960s and 1970s), and the data from the World Values Survey (after 1980s and until early 2010s), one may argue that reverse causality concerns are mitigated. Nonetheless, I proceed by exploiting a possible instrument, in order to establish that Land Inequality has a direct effect on beliefs about Gender Equality, and that this effect is more than a correlation.

2.5.3 Baseline Results - Instrumental Variable Approach

Geographical factors have been used in relevant literature, in order to analyze the impact of agricultural factors on cultural norms. For instance, (Alesina, Giuliano, and Nunn, 2013),

[7] I checked for Income Inequality by adding the Gini coefficient from the World Bank Indicators as an additional control, and the results remain significant. However, since its inclusion severely limits the sample from 55 to 41 countries, it is excluded from the reported results.

use a distinction between the type of crops suitable for plough agriculture. They document the effect of a change on cultural norms (e.g. belief towards female labour participation) due to the usage of plough agriculture, through an exogenous environmental determinant that satisfies the exclusion restriction (i.e. plough-positive soil only affects the cultural norms through its impact on the adoptation of plough agriculture in a society).

Following a similar approach, I use terrain ruggedness and specifically the average slope of the each country as an instrument. My interest lies in its adverse effects on cultivation, specifically through the effect of ruggedness on irrigation (FAO, 1993), as well as increasing transportation costs (Bryant et al., 2005). One recent study by Baten and Hippe (2018) finds a positive, though weak, effect of ruggedness on land ownership concentration, for regional Europe in the early 1900s. However, studies have shown that terrain ruggedness may have disparate effects, depending on regional and historical factors. For instance Nunn and Puga (2012), find that while terrain ruggedness has a negative direct effect on income for most countries around the world, when analyzing development in African countries there is positive effect on income, due to historical events.[8] In a similar manner, analyzing the effect of different levels of terrain ruggedness within regions, may be different than comparing the average level within countries, and their effect on land inequality. Finally, it seems like a reasonable assumption – in line with the exclusion restriction – that ruggedness affects agriculture directly, and is not connected with contemporary beliefs, other than through its effect on Land Inequality.

The data on terrain ruggedness is taken from Nunn (2008), originally from the US (1996) Geological Survey and Riley et al. (1999). It comprises of the average grid cells in a country and the difference in altitude with corresponding neighbouring 30-arc-second cells.[9] The

[8] Specifically, the presence of many hills, caves and cliff walls provided hiding places for those fleeing from slave traders.

[9] The calculation averages the distance from 8 different grid cells (and their altitude), and takes the square root of all differences to create the measurement for each cell. The distance between two adjacent grid points is half a nautical mile or 926 meters.

final measurement for each country averages all cells within the country, taking into account only those not covered in water, to create a comparable cross country variable.

Table 4 summarizes the results from the IV model. The controls are added in the same order as in the OLS model.[10] Column (1) controls for continental effects. Column (2) adds geographical effects. Column (3) adds GDP per capita measurements, and finally, column (4) adds historical usage of plough agriculture. The results are similar with the OLS model, at least for the effect of Land Gini on the average belief towards Gender Equality, reported in the first line. The effect of Land Gini on beliefs towards Gender Equality is negative and statistically significant on the 1% level, with a larger effect than the OLS estimation. The effect is similar on the other two beliefs towards female political participation (WPL) and belief towards female higher education attendance (UIG). As reported in the third and fourth line, the effect is negative and statistically significant at the 1% level. The only exception comes from the effect of Land Gini on the belief towards female labour participation (JSC), where the effect remains negative throught all specifications, albeit now statistically significant at the 10% level.

The first stage estimates are reported on the lower part of Table 4. Terrain ruggedness, in particular the average slope index measurements, has a negative effect on the Land Gini coefficient. This may seem counterintuitive at first, but going back to findings from literature may provide an argument explaining this finding. Rather than comparing regions of a few countries as in Baten and Hippe (2018), the unit of comparison here is countries, and terrain ruggedness has been shown to have different effects depending on historical differences Nunn and Puga (2012).[11] Certain geographical constraints, such as the frequent presence of mountains and hills, made the practical aspects of organizing and implementing economies of scale harder (e.g. irrigation networks), thus leading to lower levels of land inequality distribution.

[10] Regressions with additional controls can be found in the appendix, Table 13.

[11] Another aspect that should be taken into account is that the correlation of terrain ruggedness and Land Gini (while always negative) varies significantly amongst different continents.

Concerning the statistical significance of the instrument, the F-test value is reported for all columns, in the first line of the lower part of the table. While in the first column it starts around 7, it moves above 10 for the rest of the specifications, and remains above 10, even after adding historical usage of plough agriculture as a control in column (4). This satisfies the criteria of relevance of the instrument, meaning that terrain ruggedness (slope) is an relatively strong instrument for the effect of Land Gini on beliefs towards Gender Equality. In conclusion, terrain ruggedness appears to be a viable instrument connecting the negative effect of land inequality on beliefs towards gender equality. To further strengthen the baseline findings, I employ alternative measurements of land inequality in the next section, to further analyze its effect on beliefs towards gender equality.

2.5.4 Robustness Analysis - Alternative measurements

In this section I provide results from complimentary measurements of Land Inequality. Specifically, I employ measurements of land gini from Frankema (2010), and family farms from Vanhanen (2009), and analyze their impact on beliefs towards Gender Equality.

Table 5 reports the results for the Frankema Land Gini measurement. Like Vollrath Gini, this variable measures the land inequality within each country in terms of land ownership of arable land, but focuses only on the inequality amongst landowners. Each column adds the same controls as with the baseline results, and each row describes the effect of land inequality on a different variable of beliefs towards gender equality. The order of the rows describing beliefs is the following: index of Beliefs regarding Gender Equality, beliefs towards female labour participation, beliefs towards female political participation, and beliefs towards female higher education attendance. The four columns add controls in the same way as in the baseline measurement, hence column (1) for continental controls, column (2) for geographical controls, column (3) for GDP per capita, and column (4) adds the historical presence of plough agriculture as a control variable. For all specifications and all variables (apart from beliefs towards female higher education attendance - UIG), the effect of Land Inequality

on beliefs towards Gender Equality is negative and statistically significant at the 5% level. These findings are in line with the baseline results reported in the previous section, describing a negative effect of land inequality on beliefs towards Gender Equality.

Table 6 reports the results for the complimetary measurement of family farms from Vanhanen (2009). This measurement differs from the land gini utilized earlier, in the sense that higher values of family farms indicate lower levels of land inequality. Hence, a reverse (positive) effect of family farms on beliefs towards Gender Equality is expected. The order of the results is identical to the previous measurement (and baseline results), with each row reporting a different belief (index of Gender Equality, beliefs towards female labour participation, female political participation and female higher education attendance), and each column adding an additional control (continental, geographical, GDP, and historical plough usage) to each specification. As reported earlier, data for family farms are available for more countries, increasing the total sample to 88 countries. The effect of higher percentage of family farms on beliefs towards Gender Equality (as well as each other belief), is positive and statistically significant on the 1% level. This result further reinforces the baseline findings, showing that even alternative measurements of land distribution appear to have an effect on beliefs towards Gender Equality.

2.5.5 Robustness Analysis - OLS extended

In this section I provide further robustness checks, to see how the baseline results are affected when more controls are added in the OLS specification. Table 7 summarizes the results from this process.[12] Columns (1) and (2) repeat the analysis in the baseline macro sample, using the same Continental and Geographical controls respectively. Column (3) now adds the religious fractionalization of a country as an additional control. In general, more tolerant and free societies have a higher score of religious fractionalization (Alesina et al., 2003), which may affect beliefs towards Gender Equality, and alter the robustness of

[12]Regressions for the equality index with all control variables can be found in the appendix, Table 14.

the baseline specification. The measurement is taken from (Michalopoulos, 2012), and does not match the total sample perfectly, leading to a decline from 55 to 53 countries, hence the reason why this is not included in the baseline sample. However, the results are still similar with the earlier columns, showing a negative efffect of Land Gini on the average beliefs towards Gender Equality (reported in the first line), and statistically significant at the 1% level. An increase of one standard deviation in the Land Gini coefficient, results in a 0.53 standard deviation decrease in the average belief towards Gender Equality. The same negative effect remains for the rest of the beliefs regarding female labour force participation (JSC), female political participation (WPL), and female higher education attendance (UIG), which are all negative and statistically significant at the 1% level.

Column (4) adds Legal origins of the country as an additional control. Arguably, the legal norms that characterize each country, have an effect on social norms and are important determinants of cultural beliefs (Nunn, 2012). The measurements are taken from (Nunn, 2012), and include whether a country has a history of French, Socialist, German or Scandinavian law origin, keeping English law as the reference point. Adding Legal origins affects the strength of the results, even though the effect of Land Gini on beliefs towards Gender Equality (first line), remain negative and statistically significant at the 1% level. An increase of one standard deviation in the Gini coefficient, leads to a 0.40 standard deviation decrease in the average beliefs towards Gender Equality score. Furthermore, the other three variables measuring the effect of Land Gini on specific beliefs towards Gender Equality, have a more pronounced effect after the inclusion of Legal origins. For one, regarding the belief towards female labour force participation (JSC), the variable of Land Gini is now only significant on the 10% level, and the magnitude of the effect is almost reduced in half. The effect on the belief towards female political participation (WPL), is significant at the 5% level, while the effect on the belief towards female higher education attainment is the only one that remains statistically significant on the 1% level. Overall, the inclusion of Legal origins weakens the effect, even though the main variable (belief towards Gender Equality) remains negative and

statistically significant in the 1% level.

Column (5) adds Colonial origins of the country as an additional control, to take into account the effect of colonial rule in institutional settings of different societies, which have been central in the development of institutions (Acemoglu et al., 2001). The interplay between institutions and cultural norms has been established in relevant literature as well (Nunn, 2012). Hence, measurements regarding the colonial origins of each country are included, in order to ensure that the results are not driven by such factors. Specifically, controls measuring British, French, Portuguese and other European colonial rule are added, keeping Spanish colonial rule as a reference point. The effect of Land Gini on average beliefs towards Gender Equality remains negative and statistically significant at the 1% level, while the magnitude slightly increases. An increase of one standard deviation in the Gini coefficient now leads to a 0.46 standard deviation decrease of the average beliefs towards Gender Equality. Similar slight readjustments take place on the other three variables measuring Gender Equality. Specifically, the effect on the belief towards female labour participation (JSC) is now significant on the 5% level, while the effect on the belief towards female political participation is significant on the 1% level. Finally, the effect on the belief towards higher education attainment (UIG), is now significant at the 5% level, while maintaining a similar magnitude to prior specifications.

Column (6) and (7) add the same controls used in the baseline model's columns (3) and (4), i.e. GDP and historical Plough agricultural usage. The effect of Land Gini on average beliefs towards Gender Equality (first line) remain almost identical to the previous column, at least for the inclusion of GDP per capita in column (6). The only exception is the effect of Land Gini on the belief towards female labour participation (JSC), which is now statistically significant only on the 10% level. The effect on the other two beliefs (WPL and UIG), remain statistically significant on the 5% level. However, the inclusion of historical Plough usage in agriculture (column 7), has a more pronounced impact on the results. Now the effect of Land Gini on the average beliefs towards Gender Equality is still negative and statistically

significant, but only on the 5% level. The magnitude of the effect is decreased as well, since now am increase of one standard deviation of Land Gini leads to a 0.36 standard deviation decrease in average belief towards Gender Equality. Moreover, the effect of Land Gini on the other beliefs towards gender equality are weakened as well. The effect of Land Gini on the belief towards female labour participation now becomes statistically not significant (albeit very close to the 10% level). The effect on the other two variables (WPL and UIG), remains statistically significant on the 5% level, though the magnitude of the effect is decreased. Overall, the inclusion of historical Plough agriculture has a bigger effect in the full controls specification, but the main result remains significant at the 5% level.

2.6 Empirical Analysis - Individual Level

2.6.1 World Values Survey - Empirical Strategy

I now take a complimentary approach, investigating whether the macroeconomic effects that were analyzed in the previous section can be traced in individual level beliefs towards Gender Equality. The same hypothesis, that Land Gini has an effect on the beliefs towards Gender Equality, is reexamined, only now the analysis will not just include country controls, but add individual level controls, such as age, gender, and education.

For this section, I utilize the same dataset from the previous section (World Values Survey Longditutional Dataset, 1999-2014), only now the individual beliefs are not averaged in order to be compared with country scores, rather the average score of each country is assigned to every individual as an additional control. The analysis takes place with 119.309 individuals from the 55 countries of the baseline sample reported in section 5.2. The empirical specification is given by the following equation:

$$Belief_{ijt} = \beta_1 \overline{\text{Vollrath\_Gini}}_i + \beta_2 \overline{\text{Plow}}_i + \beta_3 \overline{\text{GDP}}_i + \beta_4 X_i + \beta_5 Z_{ijt} + \epsilon_{ijt} \tag{2.2}$$

where, like before, $Belief_{ijt}$ is one of the four measurements of Gender Equality taken

from the World Values Survey (i.e. Belief in Gender Equality, Belief towards female labour force participation, higher education attendance, political participation), only now for an individual j from country i, for the period t between 1999-2014 [13]. $Vollrath\_Gini_i$ is the Gini coeffiecient measuring Land ownership concentration in country i but is now assigned to every individual j from that country. Data for this variable is again taken from Vollrath and Erickson (2007), with only the earliest value of each country's Land Gini being used, and for the majority of individuals (from the 55 countries) the Gini coefficient is from the 1960s and 1970s. The two main controls from before are matched for each individual j in the same way, thus $Plow_i$ is the average historical usage in the country i assigned to every individual j from that country, and GDP_i is the relevant GDP per capita, matched to every individual j from country i. X_i is a vector of continental and geographic controls, similar to the ones in the previous section (continental fixed effects, latitude, longtitude, landlocked). Z_{ijt} is a set of individual level controls that are established in relevant literature (Fernández and Fogli, 2009; Luttmer and Singhal, 2011). Specifically, the controls include age, age squared, gender, highest education, employment status, and current income. All the specifications have been weighted using the original weights provided from the WVS database. Like before, a negative sign of the coefficient β_1 is expected, indicating that for higher values of historical Land Inequality (in the 1960s and 70s), individuals j have lower average contemporary beliefs in favor of Gender Equality.

2.6.2 World Values Survey - Results

Table 8 summarizes the results from the individual level analysis. The format is the same as in the baseline results from section 5.2. The first line reports the effect of Land Gini on the individual's belief in favour of Gender Equality. The second, third and fourth lines

[13] It should be noted that the time subscription is not entirely accurate, given the fact that these are not the observations of the same individuals over this period. Rather, they are repeated cross-section datasets, from the same countries.

report the effect of Land Gini on the individuals' belief towards female labour participation (JSC), female political participation (WPL), and female higher education attendance (UIG), respectively.[14]

Column (1) includes both the individual level controls (age, age squared, gender, education, employment, and income), along the country continental fixed effects. The effect of Land Gini on the beliefs of the individual in favour of Gender Equality is negative, and statistically significant on the 1% level, in accordance with the findings from the macro analysis. However, the effect seems to be mainly driven by the last belief (UIG). Specifically, only the effect of Land Gini on the belief towards female higher education attendance (UIG) remains both negative and statistically significant at the 1% level. The effect of Land Gini on the belief towards female political participation (WPL) is negative, but not statistically significant, and the same holds for the effect of Land Gini on the belief towards female labour participation (JSC), which again is negative and not statistically significant (even though very close to the 10% level).

The rest of the columns (2-4) add the controls in the same way as in the baseline results, i.e. column (2) Geographical, column (3) GDP per capita and column (4) historical plough usage in agriculture. For each specification the individual controls are always included. Focusing on the final column (4), one can observe that the effect of Land Gini on belief in favour of Gender Equality remains negative and statistically significant in the 5% level. Similar to the first column, the effect is driven by the two last beliefs. Specifically, the effect of Land Gini on the belief towards female higher education attendance (UIG) and the belief towards female political participation (WPL) is negative and statistically significant on the 5% and 10% level respectively, while the effect of Land Gini on the beliefs towards female labour participation is negative but not statistically significant (even though once again it is close to the 10% level).

[14]Regressions with all variables are reported in the appendix, Tables 15.

2.6.3 2nd Generation Immigrants - European Social Survey

Certain issues exist with the methodology and results outlined in sections 6.1 and 6.2. To begin with, there is the problem that since the data are pseudo-panel (i.e. not same individuals in all waves), it is hard to argue that the effect of Land Gini on beliefs in favour of Gender Equality is captured successfully. The main reason is that the dependent variable (beliefs) changes over time - albeit slowly - due to other unobservable factors (e.g. institutions). Furthermore, the time period (1999 to 2014), is approximately 15 years[15], making comparisons between individuals from different generations even harder. Focusing on a different sample, as well as methodology, could provide a reasonable alternative.

There is a strand of literature trying to establish economic effects on cultural norms, by focusing on immigrants. The main reason for using samples of immigrants, to understand how cultural norms are affected by economic factors, is due to the fact that it's an easier way to capture the differences clearly. Whether it is for investigating how the fertility rates affect beliefs of second generation women in the U.S. (Fernández and Fogli, 2009), or how redistribution levels in the home country affect the beliefs towards redistribution and political behavior of second generation immigrants (Luttmer and Singhal, 2011), the use of second generation immigrants allows a better disentaglement of what can be attributed on the persistance and trasmission cultural norms. The approach I follow is similar with Michalopoulos (2012), and closer to Litina (2016), where she uses the land suitability of the country of origin, to show its effect on the trust levels of immigrants. My approach is focused solely on the second generation of immigrants, in order to bypass issues of selective migration that may influence the decision for the country of destination.

Since the longitudinal dataset from WVS does not provide enough information for this exercise, I turn on data from the European Social Survey (ESS, 2016). Unfortunately, only one of the questions measuring beliefs towards Gender Equality has been asked in this survey, and it is identitical to the question from the World Values Survey regarding female labour

[15]Regressions including additional waves are reported in Table 16.

participation. Specifically, the question asked was: *"When jobs are scarce, men should have more right to a job than women."*, which I already have coded earlier as JSC. Once again, higher values of this variable indicate positive view towards Gender Equality. By combining this dataset with the information on the historical Land Inequality, I try to establish the effect of Land Gini on contemporary beliefs towards female labour participation in the next section.

2.6.4 2nd Generation Immigrants - Empirical Methodology

The data on second generation immigrants comes from the 8th wave of the European Social Survey, and took place in 2016, across 23 European countries. My interest lies on the country of origin of the parents, for those who were born in the current country of residence (and can be considered natives). In other words, I focus only on second generation immigrants, and analyze how the historical Land Inequality in the country of origin of their parents may have affected their beliefs towards female labour participation.

Ideally, it would be preferable to use a measure that went further back in time, i.e. before the 1950s, since that would be closely related to the relevant literature. The land gini measurements utilized are primarily from the 1960s and 1970s, while the data for beliefs of individuals are from 2016. The main concern is whether the ancestors of the second generation immigrants resided in their respective country of origin during that period. Since the survey only includes adults, even the youngest respondent was born prior to 2000. Land inequality is a slowly changing variable, and the correlation between values from the 1960s and 1970s, going into the 1990s is very high (above 0.8). The same applies for periods earlier than the 1960s, as correlations for either one of the alternative measurements (Frankema Gini or Family Farms) between measurements from 1960s and prior to 1950 are high as well (around 0.8). Hence, even in extreme cases such as parents moving into the country in the early 1950s (i.e. second generation immigrants older than or around 65 years old), the land inequality in their country of origin was not substantially different than the measurement

from the 1960s and 1970s.

Similarly, second generation immigrants born in late 1990s, had parents that were likely born in the their country of origin during the 1970s. Anecdotally, the author himself happens to be a second generation immigrant (even though not currently residing in either country of origin or country of birth), whose parents were born during the 1960s in their country of origin, before moving to a different country during the 1980s. Overall, in both cases (very young or very old respondents), I argue that parents of second generation immigrants likely resided in their respective country of origin during a period with similar characteristics (regarding land inequality) with the measurements from the 1960s and 1970s.

I split the sample of second generation immigrants to three different but overlapping samples. Those who only their mother is a first generation immigrant, only father immigrant, and either one of their parents is a first generation immigrant. The reason for this is to distinguish whether there is a difference, in accordance to findings from relevant literature [Fernández and Fogli (2009); Luttmer and Singhal (2011) etc.] showing that such transmission effects usually can be attributed to the mother's side. Unsurprisingly, the sample of either parents being an immigrant is larger, and consists of 2075 individuals. The other two samples are smaler, and consist of 1312 individuals for the father's effect, and 1299 for the mother's effect. Information on countries of birth and ancestral origin, as well as the percentages of each in the relevant samples, are reported in the appendix (Table 17).[16]

The empirical specification analyzing the impact of historical land inequality on the contemporary beliefs of second generation immigrants, is given from the following equation:

$$Belief_{ij} = \beta_1 \overline{\text{Vollrath\_Gini}}_i + \beta_2 \overline{\text{Plow}}_i + \beta_3 \overline{\text{GDP}}_i + \beta_4 X_k + \beta_5 Z_{ij} + \epsilon_{ij} \tag{2.3}$$

where $Belief_{ij}$ is the belief towards female labour force participation (JSC), for an second

[16]The final sample is reduced further by the availability of control variables in the sample, leaving a total of 1747 individuals with either parent as immigrant, followed by 1097 for the father's side and 1082 for the mother's side of the effect.

generation immigrant individual j, from parent's country of origin i. $Vollrath\_Gini_i$ is the Gini coefficient measuring Land ownership concentration in country of ancestral origin i and is assigned to every individual j depending on the country of origin of the parent. Data for this variable is taken from Vollrath and Erickson (2007), with only the earliest value of each country's Land Gini is used (from the 1960s and 1970s).

The two main controls from the country-level analysis are matched for each individual j in the same way, thus $Plow_i$ is the average historical usage in the country of origin i of the parent and assigned to every individual j responding to the survey. GDP_i is the relevant GDP per capita, matched to every individual j again according to the ancestral country of origin i. X_k is a vector of country fixed effects for country of residence k. Z_{ij} is a set of individual level controls and include age, age squared, gender, highest education, employment status, religion and current income. All the specifications have been weighted using the original weights provided from the ESS database, and the standard errors are clustered at the respective country of origin level. Like before, a negative sign of the coefficient β_1 is expected, indicating that for higher values of historical Land Inequality in the parental country of origin (in the 1960s and 70s), individuals j have lower contemporary beliefs in favor of Gender Equality.

2.6.5 2nd Generation Immigrants - Results

The results for the 2nd Generation Immigrants for the European Social Survey are reported at Table 9. The only belief regarding Gender Equality is towards the female labour participation, JSC, which is identical to the one previously used in the World Values Survey sample. Three subsamples are reported, on different lines. Specifically, the first line reports the results for the sample of 2nd Generation immigrants that have either a father or mother who was a 1st Generation immigrant, but were born in the country of current residence (where the survey took place). The second line reports just the effect of the father's country of origin, while the third line reports the effect of Land Gini in the country of mother's side,

on the beliefs towards female labour participation of 2nd Generation immigrants. While overlapping, these samples are not the summary of each others, since it is possible that a second generation immigrant may only have one immigrant parent. However, in order to distinguish the effects between the ancestral country of origin, this sampling took place.

Column (1) is the baseline specification, and includes all controls from the baseline macro sample, specifically continental and geographical controls, the GDP per capita as well as the presence of plough agriculture in the country of origin and finally country fixed effects. The effect of historical Land Gini in the ancestral country of origin appears to have no on contemporary beliefs towards female labour participation.However, if we focus on the different side of the effect, the effect from the father's side appears to be positive and statistically significant at the 5% level, while the effect of Land Gini in the mother's country of origin, is only significant at the 10% level. Hence, individuals that are descended by mothers from countries experiencing higher levels of land inequality in the early 1960s and 1970s are less likely to be in favour of female labour participation, while there is an opposite effect from the father's side.

To scrutinize closer this opposing effect, and take into account the different level of analysis, the rest of the table adds individual controls using a different structure. Column (2) adds personal characteristics such as age, age squared and gender as controls. Column (3) adds the employment characteristics of individuals, specifically whether they are employed or searching for a job. Column (4) adds various questions regarding religion in all the specifications. Specifically, the questions asked are the following three: *"How religious are you?" "How often do you attend religious services apart from special occasions?" "How often do you pray apart from at religious services?"*. As with the cross-country sample, measuring the importance of religion attributes towards a cultural norm is imporant, in order to be certain that such choices are not affected by these factors. The opposing effect from the father and mother's side remains after the addition of all these variables.

However, after column (5) adds higher education as a control variable, this is no longer the

case. This addition makes the effect from the father's side statistically not significant, while the effect from the mother's side still remains negative and statistically significant at the 10% level. Finally, column (6) adds self reported level of income as a control variable, with no further change on the results. Apparently, the addition of higher education diminishes the effect from the father's side, however does not affect the mother's side.

To sum up, this section analyzed the impact that Land Inequality in the ancestral country of origin has in contemporary beliefs of second generation immigrants. While in the beginning it appeared that either side of the parents influence the development of this specific belief, adding a series of personal and ancestral country controls showcased that the effect is primarily driven by the mother's country of origin. This finding is in line with relevant literature (Luttmer and Singhal, 2011), that cultural transmission through generations is dominated by the mother's side of the effect.

2.7 Conclusion

The determinants of cultural norms are still a relatively new interest to economists. Beliefs towards Gender Equality are increasingly receiving more attention in both the public sphere and research. In this chapter I tried to add to this growing literature by examining one factor that has shaped societies, namely the distribution of land holdings in each country. I show that on average, countries that have experienced higher levels of land inequality in the past, are less likely to be characterized by favourable views towards Gender Equality. In other words, land inequality in the past, had a negative effect to contemporary beliefs in favour of Gender Equality, such as views regarding female labour participation, higher education attendance and political participation. Using a measurement of terrain ruggedness (average slope of each country) as an instrument I argued that this relationship is more than a simple correlation. To further strengthen the baseline results, I showed that similar effects can be found when other measurements of land inequality are utilized.

Moving beyond cross-country comparisons, the effect of land inequality can be traced in

individuals as well. Using individual level data from the latest wave of the European Social Survey, I showed that historical land inequality may have been a determinant factor shaping beliefs of second generation immigrants. The effect appears to be driven by the mother's country of origin, in line with relevant findings from cultural transmission literature.

In conclusion, the importance of historical economic factors in determining cultural norms, is a promising field of research. While it's undeniable that culture is shaped by various social and anthropological circumstances, the role of history and past economic realities should be highlighted, in order to understand better the role of culture in economics.

Chapter Appendices

2.A Chapter 2 Tables

Table 1: *Descriptive Statistics for Macro Sample (Vollrath Dataset)*

	n	mean	sd	min	max
Equality - (Y022)	55	0.583	0.159	0.283	0.858
JSC - (C001)	55	0.552	0.221	0.140	0.948
WPL - (D059)	55	0.521	0.163	0.165	0.807
UIG - (D060)	55	0.672	0.114	0.377	0.900
Vollrath_Gini	99	0.832	0.130	0.229	0.996
Frank_Land_Gini	101	0.601	0.152	0.291	0.865
Family_Farms	177	0.409	0.221	0.002	0.934
Plough	96	0.549	0.471	0.000	1.000
Landlocked	91	0.165	0.373	0.000	1.000
Latitude	97	19.133	24.427	-41.806	64.481
Longitude	97	7.297	66.616	-112.982	171.478
Log_GDP	92	9.457	1.172	6.512	11.406
Terrain_Rugged_Slope	97	3.826	3.414	0.108	17.595

Notes: Descriptive statistics of variables used in the macro sample. Definitions and sources are provided in Table 2

Table 2: *Definition of variables*

C001 - When Jobs are scarce (JSC)	The exact wording of the question is as follows: *"When jobs are scarce, men should have more right to a job than women."* The original coding in the WVS database, has three answers. For agreeing, the response is coded as 1, disagreeing is coded as 2, and for neither agreeing nor disagreeing the response is coded as 3. Following the logic used to create the equality sub-index, this variable is re-coded in order to make the three main variables similar. Questions for which an respondent agrees with the statement, are re-coded as 0. Questions for which an respondent disagrees, are re-coded as 1. Finally, questions for which an respondent neither agrees nor disagrees, are re-coded as 0.5. Higher values indicate beliefs in favour of gender equality.
D059 - Women as Political Leaders (WPL)	The exact wording of the question is as follows: *"On the whole, men make better political leaders than women do."* The original coding in the WVS database, has four answers. When a respondent strongly agrees with the statement, the response is coded as 1, if the respondent only agrees it is coded as 2. When a respondent strongly disagrees with the statement is coded as 4, while disagreement is coded as 3, and no answer is coded as -1. Following a similar process with variable C001, this variable is re-coded in order to measure whether a response is in favour of gender equality. Higher values indicate beliefs in favour of gender equality.
D060 - University is Important for a Girl (UIG)	The exact wording of the question is as follows: *"A university education is more important for a boy than for a girl."* The original coding in the WVS database, has four answers, and is identical to variable (D059). When a respondent strongly agrees with the statement, the response is coded as 1, if the respondent only agrees it is coded as 2. When a respondent strongly disagrees with the statement is coded as 4, while disagreement is coded as 3, and no answer is coded as -1. Following a similar process with variable C001, this variable is re-coded in order to measure whether a response is in favour of gender equality. Higher values indicate beliefs in favour of gender equality.
Vollrath_Gini	Land Gini Measurements from Vollrath and Erickson (2007), measuring Land inequality, taking into account Landlessness. Originally taken from FAO database (Food and Agricultural Organization of the United Nations), and measure Land Holdings by size in acres.
Frank_Land_Gini	Land Gini from Frankema (2010), measuring Land inequality.
Family_Farms	Ratio of family farms in each country, taken from Vanhanen (2009).
Plough	Degree of historical plough usage across countries, taken from Alesina, Giuliano, and Nunn (2013).
Landlocked	Indicators of whether a country is landlocked, taken from Michalopoulos (2012).
Geographical variables	Latitude and Longtitude variables, taken from Nunn (2012), Continetal Dummies, taken from Galor et al. (2009).
Log_GDP	GDP per Capita, ppp (constant 2011 international U.S. Dollars), taken from Quality of Governance database (QOG et al., 2018).
Terrain_Rugged_Slope	Terrain ruggedness (average slope, %) for each country, taken from Nunn (2012).
Fractionalization	Fractionalization of a given country, taken from Michalopoulos (2012)
Legal origins	Indicator of the legal tradition that influenced a given country (e.g. British, French, Socialist etc.), taken from Nunn (2012).
Colonial origins	Indicator of colonial tradition that influenced a given country (e.g. Spanish, British etc.), taken from Acemoglu et al. (2001).

Table 3: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - Macro Sample*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Vollrath_Gini	-0.564***	-0.533***	-0.536***	-0.511***
	(-5.86)	(-4.45)	(-4.44)	(-4.05)
Adjusted R^2	0.743	0.764	0.760	0.760
		JSC (C001)		
Vollrath_Gini	-0.682***	-0.606***	-0.613***	-0.582***
	(-4.72)	(-3.08)	(-3.13)	(-2.90)
Adjusted R^2	0.658	0.664	0.659	0.656
		WPL (D059)		
Vollrath_Gini	-0.594***	-0.567***	-0.573***	-0.564***
	(-5.47)	(-4.52)	(-4.44)	(-4.17)
Adjusted R^2	0.721	0.769	0.767	0.762
		UIG (D060)		
Vollrath_Gini	-0.486***	-0.484***	-0.481***	-0.443***
	(-4.59)	(-3.66)	(-3.55)	(-3.25)
Adjusted R^2	0.664	0.659	0.653	0.671
Observations	55	55	55	55
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: Vollrath Gini is a ratio measuring the Inequality in Land ownership. The dependent variables are beliefs towards gender equality, as detailed in Table 1. Column (1) includes continetal fixed effects. Column (2) includes geographical variables (Landlock indicators, Latitude and Longtitude variables). Column (3) includes log GDP per capita, ppp (constant 2011 international U.S. Dollars). Column (4) includes the degree of historical Plough usage. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 4: *IV Estimates of Land Inequality on Gender Equality - Instrument is ruggedness*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Vollrath_Gini	-0.820***	-0.902***	-0.910***	-0.893***
	(-2.613)	(-2.979)	(-2.950)	(-2.903)
R^2	0.210	0.295	0.295	0.309
		JSC (C001)		
Vollrath_Gini	-0.684	-0.817*	-0.832*	-0.806*
	(-1.349)	(-1.770)	(-1.778)	(-1.712)
R^2	0.170	0.223	0.229	0.239
		WPL (D059)		
Vollrath_Gini	-1.055***	-1.149***	-1.163***	-1.167***
	(-3.240)	(-3.771)	(-3.784)	(-3.735)
R^2	0.102	0.265	0.268	0.266
		UIG (D060)		
Vollrath_Gini	-0.766***	-0.796***	-0.791***	-0.761***
	(-2.640)	(-2.870)	(-2.873)	(-2.868)
R^2	0.190	0.244	0.248	0.295
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes
First stage estimates			Vollrath_Gini	
Terrain_Rugged_Slope	-0.010***	-0.011***	-0.011***	-0.011***
	(-2.784)	(-3.617)	(-3.570)	(-3.395)
First stage F-stat	7.753	13.080	12.741	11.525
Underidentification test: Kleibergen-Paap rk LMstatistic	0.027	0.027	0.025	0.028
Observations	55	55	55	55

Notes: Terrain_Rugged_Slope is a measure of terrain ruggedness (average slope, %) for each country, and is taken from Nunn (2012). Columns (1-4) follow the same structure as Table 3. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 5: *OLS Estimates of Land Inequality (II) on Beliefs about Gender Equality WVS (Macro Sample)*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Frank_Land_Gini	-0.275**	-0.283**	-0.287**	-0.287**
	(-2.57)	(-2.18)	(-2.24)	(-2.21)
Adjusted R^2	0.675	0.695	0.689	0.683
		JSC (C001)		
Frank_Land_Gini	-0.412***	-0.465**	-0.464**	-0.464**
	(-2.71)	(-2.38)	(-2.42)	(-2.39)
Adjusted R^2	0.600	0.611	0.603	0.595
		WPL (D059)		
Frank_Land_Gini	-0.331***	-0.333**	-0.329**	-0.330**
	(-2.83)	(-2.54)	(-2.56)	(-2.53)
Adjusted R^2	0.691	0.728	0.723	0.718
		UIG (D060)		
Frank_Land_Gini	-0.105	-0.0669	-0.0809	-0.0812
	(-1.27)	(-0.68)	(-0.85)	(-0.84)
Adjusted R^2	0.541	0.544	0.555	0.546
Observations	58	58	58	58
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: Frank Land Gini is a ratio measuring the Inequality in Land owernship, for the period from 1950 to 1990, and is taken from Frankema (2010). Columns (1-4) follow the same structure as Table 3. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 6: *OLS Estimates of Family Farms on Beliefs about Gender Equality WVS (Macro Sample)*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Family Farms	0.158***	0.173***	0.171***	0.175***
	(4.09)	(4.01)	(3.78)	(3.90)
Adjusted R^2	0.586	0.597	0.592	0.590
		JSC (C001)		
Family Farms	0.156***	0.173***	0.174***	0.183***
	(2.92)	(2.86)	(2.80)	(2.97)
Adjusted R^2	0.519	0.523	0.517	0.517
		WPL (D059)		
Family Farms	0.208***	0.231***	0.236***	0.243***
	(4.86)	(4.79)	(4.53)	(4.79)
Adjusted R^2	0.570	0.601	0.597	0.600
		UIG (D060)		
Family Farms	0.121***	0.122***	0.116***	0.113***
	(3.79)	(3.62)	(3.17)	(3.05)
Adjusted R^2	0.482	0.470	0.468	0.463
Observations	88	88	88	88
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: Family Farms measurements taken from Vanhanen (2009) and measure the ratio of family farms in each country for the period 1950-1998. A higher value of the variable indicates a higher percentage of population owns property (existence of more family farms), which translates to lower inequality in land ownership. Columns (1-4) follow the same structure as Table 3. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 7: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - More Controls*

	(1) Continental	(2) Geographical	(3) Fractional	(4) Legal	(5) Colonial	(6) GDP	(7) All Controls
			Equality (Y022)				
Vollrath_Gini	-0.564***	-0.533***	-0.539***	-0.409***	-0.463***	-0.437***	-0.363**
	(-5.86)	(-4.45)	(-4.72)	(-2.79)	(-2.89)	(-2.78)	(-2.49)
Adjusted R^2	0.743	0.764	0.794	0.795	0.818	0.832	0.844
			JSC (C001)				
Vollrath_Gini	-0.682***	-0.606***	-0.597***	-0.378*	-0.459**	-0.417*	-0.310
	(-4.72)	(-3.08)	(-3.26)	(-1.82)	(-2.13)	(-1.99)	(-1.69)
Adjusted R^2	0.658	0.664	0.696	0.703	0.738	0.758	0.768
			WPL (D059)				
Vollrath_Gini	-0.594***	-0.567***	-0.596***	-0.420**	-0.484***	-0.450**	-0.392**
	(-5.47)	(-4.52)	(-4.80)	(-2.33)	(-2.83)	(-2.62)	(-2.25)
Adjusted R^2	0.721	0.769	0.781	0.777	0.833	0.862	0.868
			UIG (D060)				
Vollrath_Gini	-0.486***	-0.484***	-0.482***	-0.447***	-0.440**	-0.438**	-0.375**
	(-4.59)	(-3.66)	(-3.47)	(-2.80)	(-2.46)	(-2.43)	(-2.11)
Adjusted R^2	0.664	0.659	0.672	0.668	0.632	0.622	0.632
Observations	55	55	53	53	53	53	53
Continetal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes	Yes	Yes	Yes
Relig_Fractionalization	No	No	Yes	Yes	Yes	Yes	Yes
Legal_Origins	No	No	No	Yes	Yes	Yes	Yes
ColonialOrigins	No	No	No	No	Yes	Yes	Yes
GDP/capita	No	No	No	No	No	Yes	Yes
PloughAgriculture	No	No	No	No	No	No	Yes

Notes: Vollrath Gini is a ratio measuring the Inequality in Land ownership. The dependent variables are the same as in Table 3. Column (1) includes continetal fixed effects. Column (2) includes geographical variables (Landlock indicators, Latitude and Longtitude variables). Column (3) includes fractionalization measurements of a given country. Column (4) includes the legal tradition that influenced a given country (e.g. British, French, Socialist etc.) Column (5) includes the colonial origins of a given country. Column (6) includes log GDP per capita, ppp (constant 2011 international U.S. Dollars). Column (7) includes the degree of historical Plough usage. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 8: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - WVS (Micro Sample)*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Vollrath_Gini	-0.358***	-0.385**	-0.396***	-0.324**
	(-3.12)	(-2.61)	(-2.68)	(-2.06)
Adjusted R^2	0.299	0.307	0.307	0.310
		JSC (C001)		
Vollrath_Gini	-1.203	-1.611	-1.495	-1.045
	(-1.40)	(-1.31)	(-1.34)	(-1.33)
Adjusted R^2	0.077	0.079	0.082	0.096
		WPL (D059)		
Vollrath_Gini	-0.874	-1.145*	-1.289**	-1.208*
	(-1.66)	(-1.83)	(-2.06)	(-1.78)
Adjusted R^2	0.139	0.144	0.146	0.146
		UIG (D060)		
Vollrath_Gini	-0.777**	-1.099***	-1.098**	-0.894**
	(-2.57)	(-2.70)	(-2.68)	(-2.19)
Adjusted R^2	0.098	0.099	0.099	0.101
Observations	119309	119309	119309	119309
Individual	Yes	Yes	Yes	Yes
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: The dependent variables are the same as in Table 3, aggregated at the individual level. Columns (1-4) follow the same structure as Table 3. All specifications include Individual controls, such as age, age squared, gender, highest education, employment status, income, and are weighted using the original weights provided from the WVS database. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 9: *OLS Estimates of Land Inequality on Gender Equality Belief: When Jobs Scarce, Right to Work (C001) - ESS Sample (2nd Generation Immigrants)*

	(1) Baseline	(2) Personal	(3) Employment	(4) Religion	(5) Education	(6) Income
Either Parent Sample						
p_Vollrath_Gini	-1.093	-0.877	-0.902	-0.904	-0.867	-0.867
	(-1.10)	(-0.97)	(-0.98)	(-0.95)	(-0.98)	(-0.98)
Observations	1747	1747	1747	1747	1747	1747
Adjusted R^2	0.080	0.110	0.113	0.140	0.175	0.175
Father's Origin Sample						
fs_Vollrath_Gini	2.062**	1.914**	1.750**	1.688**	1.156	1.163
	(2.63)	(2.47)	(2.14)	(2.01)	(1.48)	(1.50)
Observations	1097	1097	1097	1097	1097	1097
Adjusted R^2	0.098	0.128	0.133	0.156	0.186	0.185
Mother's Origin Sample						
ms_Vollrath_Gini	-1.703*	-1.361*	-1.363*	-1.592**	-1.549**	-1.520**
	(-1.76)	(-1.77)	(-1.77)	(-2.08)	(-2.16)	(-2.14)
Observations	1082	1082	1082	1082	1082	1082
Adjusted R^2	0.093	0.117	0.122	0.164	0.187	0.187
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes
Personal	No	Yes	Yes	Yes	Yes	Yes
Employment	No	No	Yes	Yes	Yes	Yes
Religion	No	No	No	Yes	Yes	Yes
Education	No	No	No	No	Yes	Yes
Income	No	No	No	No	No	Yes

Notes: The dependent variable is taken from the European Social Survey (Wave 8), and matches the WVS question measuring Gender Equality: **C001** *"When jobs are scarce, men should have more right to a job than women"* (agreement coded low - higher values indicate equality). There are three subsamples, depending on the respondents: p_Vollrath_Gini captures the average Land Gini of the two parents birth country, in case either of them is an immigrant. The other two variables (fs_Vollrath_Gini and ms_Vollrath_Gini) capture the average Land Gini on the Birth Country of Father and Mother respectively (i.e. only Father's/Mother's effect). Column (1) includes all country of origin controls from Table 3, namely Continental, Geographical, log GDP per capita and the degree of historical Plough usage in country of origin. Column (2) includes personal characteristics (age, age squared, gender). Column (3) includes employment characteristics (employed or searching for job). Column (4) includes religious characteristics (religiocity, attendance rate). Column (5) includes highest education. Column (6) includes personal income. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level. All regressions are weighted using the original weights provided from the ESS database.

Table 10: *Correlations between WVS Variables - Vollrath Sample*

	(1)
Y022	
Y022	1
C001	0.978***
D059	0.970***
D060	0.908***
C001	
C001	1
D059	0.934***
D060	0.837***
D059	
D059	1
D060	0.833***
N	55

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: *Correlations between Waves over time - main variables*

	(1) Y002	(2) C001	(3) D059	(4) D060
main var. Y022	1			
wv4_Y022	0.973***			
wv5_Y022	0.988***			
wv6_Y022	0.972***			
C001		1		
wv4_C001		0.982***		
wv5_C001		0.982***		
wv6_C001		0.967***		
D059			1	
wv4_D059			0.976***	
wv5_D059			0.988***	
wv6_D059			0.974***	
D060				1
wv4_D060				0.928***
wv5_D060				0.971***
wv6_D060				0.901***
N	99	99	99	99

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: *Correlations between Waves over time - waves 4 to 6*

	(1) Y002	(2) C001	(3) D059	(4) D060
wv4_Y022				
wv4_Y022	1			
wv5_Y022	0.945***			
wv6_Y022	0.924***			
wv5_Y022				
wv5_Y022	1			
wv6_Y022	0.960***			
wv4_C001				
wv4_C001		1		
wv5_C001		0.954***		
wv6_C001		0.962***		
wv5_C001				
wv5_C001		1		
wv6_C001		0.955***		
wv4_D059				
wv4_D059			1	
wv5_D059			0.958***	
wv6_D059			0.934***	
wv5_D059				
wv5_D059			1	
wv6_D059			0.948***	
wv4_D060				
wv4_D060				1
wv5_D060				0.824***
wv6_D060				0.594**
wv5_D060				
wv5_D060				1
wv6_D060				0.847***
N	99	99	99	99

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: *IV Estimates of Land Inequality on Gender Equality - Instrument is ruggedness - Extended Controls*

	(1) Continental	(2) Geographical	(3) Religion	(4) Fractional	(5) Colonial	(6) GDP	(7) All Controls
			Equality	(Y022)			
Vollrath_Gini	-0.820***	-0.902***	-0.525***	-0.508***	-0.466***	-0.502***	-0.452***
	(-2.613)	(-2.979)	(-2.628)	(-2.591)	(-2.905)	(-2.969)	(-2.777)
R^2	0.210	0.295	0.656	0.692	0.736	0.767	0.786
			JSC	(C001)			
Vollrath_Gini	-0.684	-0.817*	-0.220	-0.172	-0.091	-0.152	-0.075
	(-1.349)	(-1.770)	(-0.790)	(-0.619)	(-0.371)	(-0.616)	(-0.286)
R^2	0.170	0.223	0.573	0.611	0.644	0.690	0.702
			WPL	(D059)			
Vollrath_Gini	-1.055***	-1.149***	-0.838***	-0.849***	-0.750***	-0.791***	-0.786***
	(-3.240)	(-3.771)	(-3.257)	(-3.275)	(-4.352)	(-4.368)	(-4.105)
R^2	0.102	0.265	0.596	0.593	0.722	0.755	0.756
			UIG	(D060)			
Vollrath_Gini	-0.766***	-0.796***	-0.568***	-0.556***	-0.599***	-0.607***	-0.543***
	(-2.640)	(-2.870)	(-2.599)	(-2.621)	(-2.767)	(-2.770)	(-2.633)
R^2	0.190	0.244	0.444	0.499	0.500	0.501	0.555
Continetal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes	Yes	Yes	Yes
Religion	No	No	Yes	Yes	Yes	Yes	Yes
Fractionalization	No	No	No	Yes	Yes	Yes	Yes
ColonialOrigins	No	No	No	No	Yes	Yes	Yes
GDP	No	No	No	No	No	Yes	Yes
PloughAgriculture	No	No	No	No	No	No	Yes
First stage estimates			Vollrath_Gini				
nunn_rugged_slope	-0.010***	-0.011***	-0.012***	-0.012***	-0.012***	-0.012***	-0.012***
	(-2.784)	(-3.617)	(-4.243)	(-3.936)	(-3.514)	(-3.496)	(-3.359)
First stage F-stat	7.753	13.080	18.002	15.492	12.350	12.221	11.284
Underidentification test	0.027	0.027	0.010	0.018	0.014	0.012	0.012
Observations	55	55	54	53	53	53	53

Notes: The table expands the results of Table 4, by including all controls from Table 7. The dependent variables are the same as in Table 3, and columns (1-7) follow the same structure. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 14: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - More Controls - All variables - Y022*

	(1) Continental	(2) Geographical	(3) Fractional	(4) Legal	(5) Colonial	(6) GDP	(7) All Controls
			Equality (Y022)				
Vollrath_Gini	-0.564***	-0.533***	-0.539***	-0.409***	-0.463***	-0.437***	-0.363**
	(-5.86)	(-4.45)	(-4.72)	(-2.79)	(-2.89)	(-2.78)	(-2.49)
Africa dummy	-0.229***	-0.0818	-0.0467	-0.0372	-0.0541	-0.154*	-0.199***
	(-3.50)	(-0.86)	(-0.51)	(-0.38)	(-0.59)	(-1.97)	(-2.75)
Europe dummy	-0.0596**	0.116	0.151**	0.152*	0.0885	0.0355	-0.0168
	(-2.45)	(1.60)	(2.11)	(1.78)	(0.95)	(0.41)	(-0.20)
Asia dummy	-0.310***	-0.212***	-0.155***	-0.144**	-0.155***	-0.210***	-0.259***
	(-16.01)	(-4.88)	(-3.38)	(-2.70)	(-2.84)	(-3.98)	(-5.25)
Americas dummy	-0.0394***	0.172*	0.165	0.184	0.126	0.0232	-0.00270
	(-2.97)	(1.71)	(1.62)	(1.48)	(0.88)	(0.17)	(-0.02)
Dummy for Landlocked		-0.0426	-0.0667*	-0.0533	-0.0494	-0.0750	-0.0562
		(-1.29)	(-1.81)	(-1.22)	(-1.11)	(-1.59)	(-1.18)
Latitude		-0.000612	-0.000907*	-0.000797	-0.000781	-0.000683	-0.000937
		(-0.90)	(-1.72)	(-1.40)	(-1.22)	(-1.09)	(-1.15)
Longitude		0.000799	0.000483	0.000600	0.000442	0.0000774	0.0000551
		(1.63)	(1.07)	(1.10)	(0.69)	(0.13)	(0.11)
Religious fragmentation			0.133***	0.171***	0.218***	0.244***	0.237***
			(3.10)	(2.86)	(4.28)	(4.68)	(4.99)
Legal origin indicator: French civil law				0.0203	-0.0162	-0.0238	-0.0352
				(0.68)	(-0.42)	(-0.70)	(-1.19)
Legal origin indicator: Socialist law				-0.00674	-0.0452	-0.0473	-0.0745
				(-0.09)	(-0.62)	(-0.66)	(-1.12)
Legal origin indicator: German civil law				0.00329	-0.0673	-0.0383	-0.0474
				(0.09)	(-1.39)	(-0.76)	(-1.07)
Legal origin indicator: Scandinavian law				0.114*	0.0737	0.0915	0.100*
				(1.88)	(1.30)	(1.47)	(1.76)
Colonial origin indicator: British					-0.0954**	-0.100***	-0.115***
					(-2.42)	(-2.78)	(-3.44)
Colonial origin indicator: French					-0.0383	-0.0471	-0.0515
					(-0.63)	(-0.91)	(-1.04)
Colonial origin indicator: Portuguese					-0.0493	-0.0464	-0.0344
					(-1.55)	(-1.55)	(-1.13)
Colonial origin indicator: Other European					-0.0783	-0.0466	-0.0594
					(-1.04)	(-0.78)	(-0.97)
Log GDP per capita, PPP (constant 2011)						-0.0312*	-0.0356**
						(-1.89)	(-2.28)
Usage of Plough Agriculture							0.0661
							(1.48)
Constant	1.217***	1.047***	1.146***	1.007***	1.077***	1.324***	1.294***
	(14.42)	(7.09)	(12.03)	(7.06)	(7.74)	(7.04)	(7.22)
Adjusted R^2	0.743	0.764	0.794	0.795	0.818	0.832	0.844
Observations	55	55	53	53	53	53	53
Continetal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes	Yes	Yes	Yes
Relig_Fractionalization	No	No	Yes	Yes	Yes	Yes	Yes
Legal_Origins	No	No	No	Yes	Yes	Yes	Yes
ColonialOrigins	No	No	No	No	Yes	Yes	Yes
GDP/capita	No	No	No	No	No	Yes	Yes
PloughAgriculture	No	No	No	No	No	No	Yes

Notes: The table provides the full results of the first row from Table 7 for all variables, and columns (1-4) follow the same structure. The dependent variable is **Y022**, the Gender Equality Index, a combined scale from the World Values Survey. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 15: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - WVS (Micro Sample) - All variables - Y022*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Vollrath_Gini	-0.358***	-0.385**	-0.396***	-0.324**
	(-3.12)	(-2.61)	(-2.68)	(-2.06)
Sex	0.0863***	0.0852***	0.0855***	0.0856***
	(11.89)	(12.02)	(12.07)	(12.09)
Age	0.00198***	0.00176***	0.00178***	0.00173***
	(3.05)	(2.89)	(3.08)	(3.08)
Age squared	-0.0000278***	-0.0000266***	-0.0000264***	-0.0000267***
	(-3.94)	(-4.13)	(-4.04)	(-4.16)
Educational level	0.0154***	0.0154***	0.0156***	0.0159***
	(8.31)	(8.77)	(10.94)	(12.56)
Employment status	-0.0000710	-0.0000208	-0.000115	-0.000143
	(-0.04)	(-0.02)	(-0.09)	(-0.11)
Scale of incomes	0.00462***	0.00440***	0.00447***	0.00410***
	(3.12)	(2.91)	(2.86)	(2.78)
Africa dummy	-0.179***	-0.0922	-0.104	-0.134*
	(-3.52)	(-1.11)	(-1.31)	(-1.71)
Europe dummy	-0.0225	0.103	0.0962	0.0713
	(-0.80)	(1.43)	(1.36)	(1.02)
Asia dummy	-0.310***	-0.239***	-0.250***	-0.291***
	(-12.92)	(-5.84)	(-5.20)	(-5.59)
Americas dummy	-0.0293*	0.127	0.117	0.130
	(-1.90)	(1.14)	(1.09)	(1.22)
Dummy for Landlocked		-0.0486*	-0.0544	-0.0474
		(-1.69)	(-1.57)	(-1.50)
Latitude		-0.000542	-0.000492	-0.000741
		(-0.67)	(-0.59)	(-0.92)
Longitude		0.000576	0.000561	0.000683
		(1.03)	(1.01)	(1.23)
Log GDP per capita			-0.00736	-0.0121
			(-0.39)	(-0.67)
Usage of Plough Agriculture				0.0684**
				(2.52)
Constant	0.617***	0.854***	0.931***	0.908***
	(4.55)	(7.09)	(3.79)	(3.85)
Adjusted R^2	0.299	0.307	0.307	0.310
Observations	119309	119309	119309	119309
Individual	Yes	Yes	Yes	Yes
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: The table provides the full results of the first row from Table 8 for all variables, and columns (1-4) follow the same structure. The dependent variable is **Y022**, the Gender Equality Index, a combined scale from the World Values Survey. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 16: *OLS Estimates of Land Inequality on Beliefs about Gender Equality - WVS (Micro Sample) - All waves*

	(1) Continental	(2) Geographical	(3) GDP	(4) All Controls
		Equality (Y022)		
Vollrath_Gini	-0.397***	-0.445***	-0.447***	-0.387**
	(-3.97)	(-3.25)	(-3.25)	(-2.64)
Adjusted R^2	0.274	0.280	0.280	0.283
		JSC (C001)		
Vollrath_Gini	-1.009	-1.376	-1.261	-0.897
	(-1.66)	(-1.52)	(-1.57)	(-1.59)
Adjusted R^2	0.077	0.079	0.082	0.092
		WPL (D059)		
Vollrath_Gini	-1.045**	-1.256**	-1.400**	-1.370**
	(-2.32)	(-2.20)	(-2.42)	(-2.19)
Adjusted R^2	0.123	0.127	0.129	0.129
		UIG (D060)		
Vollrath_Gini	-0.841***	-1.268***	-1.243***	-1.094***
	(-3.07)	(-3.45)	(-3.33)	(-2.82)
Adjusted R^2	0.088	0.091	0.091	0.092
Observations	150060	150060	150060	150060
Individual	Yes	Yes	Yes	Yes
Continetal	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
GDP/capita	No	No	Yes	Yes
PloughAgriculture	No	No	No	Yes

Notes: The table provides results from Table 8 for all waves, and columns (1-4) follow the same structure. T-stat in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

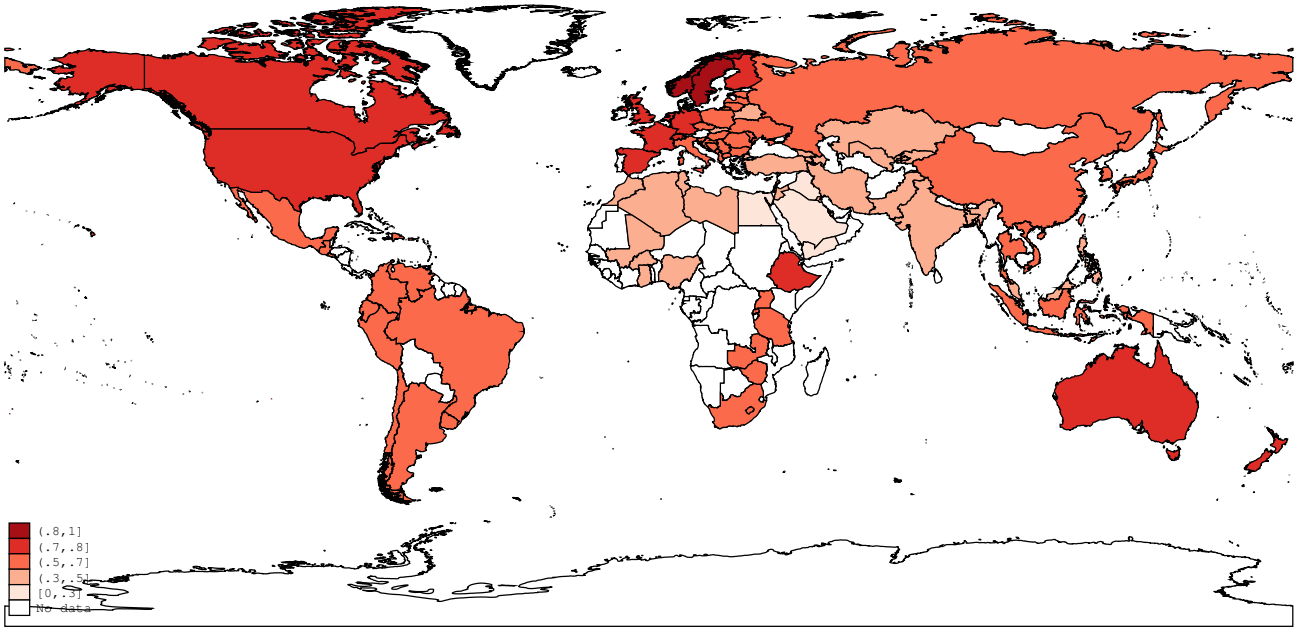
Table 17: *Second Generation Immigrant Samples - Country of Birth and Parental Origin*

Country of Birth	Number	Pct %	**Country of Origin, Mother**	Number	Pct %	**Country of Origin, Father**	Number	Pct %
Austria	126	6.1	Argentina	11	0.8	Argentina	8	0.6
Belgium	131	6.3	Australia	4	0.3	Australia	4	0.3
Czech Republic	91	4.4	Austria	32	2.5	Austria	37	2.8
Estonia	8	0.4	Bangladesh	7	0.5	Bangladesh	7	0.5
Finland	15	0.7	Belgium	18	1.4	Belgium	14	1.1
France	179	8.6	Brazil	15	1.2	Belize	1	0.1
Germany	225	10.8	Canada	7	0.5	Brazil	5	0.4
Hungary	15	0.7	Colombia	1	0.1	Brunei	1	0.1
Iceland	20	1.0	Cote d'Ivoire	1	0.1	Canada	5	0.4
Ireland	113	5.4	Cyprus	1	0.1	Congo, DR	2	0.2
Israel	506	24.4	Czech Republic	31	2.4	Cote d'Ivoire	2	0.2
Italy	19	0.9	Denmark	18	1.4	Cyprus	1	0.1
Lithuania	8	0.4	Ecuador	3	0.2	Czech Republic	38	2.9
Netherlands	114	5.5	Ethiopia	13	1.0	Denmark	23	1.8
Norway	32	1.5	Finland	35	2.7	Dominican Rep.	1	0.1
Poland	27	1.3	France	69	5.3	Ethiopia	13	1.0
Portugal	26	1.3	Germany	151	11.6	Finland	19	1.4
Russia	2	0.1	Greece	5	0.4	France	50	3.8
Slovenia	12	0.6	Hungary	30	2.3	Germany	107	8.2
Spain	29	1.4	India	32	2.5	Greece	9	0.7
Sweden	104	5.0	Indonesia	19	1.5	Honduras	1	0.1
Switzerland	162	7.8	Iran	25	1.9	Hungary	37	2.8
United Kingdom	111	5.3	Iraq	64	4.9	India	30	2.3
			Ireland	36	2.8	Indonesia	28	2.1
			Israel	1	0.1	Iran	30	2.3
			Italy	79	6.1	Iraq	69	5.3
			Jamaica	6	0.5	Ireland	35	2.7
			Japan	2	0.2	Israel	4	0.3
			Lebanon	10	0.8	Italy	103	7.9
			Libya	24	1.8	Jamaica	4	0.3
			Luxembourg	2	0.2	Kenya	1	0.1
			Madagascar	1	0.1	Lebanon	6	0.5
			Mali	2	0.2	Libya	17	1.3
			Mexico	1	0.1	Luxembourg	2	0.2
			Netherlands	14	1.1	Madagascar	3	0.2
			Norway	13	1.0	Mali	2	0.2
			Pakistan	11	0.8	Mexico	1	0.1
			Philippines	6	0.5	Netherlands	13	1.0
			Poland	135	10.4	Norway	13	1.0
			Portugal	20	1.5	Pakistan	13	1.0
			Senegal	3	0.2	Philippines	2	0.2
			South Africa	3	0.2	Poland	134	10.2
			South Korea	1	0.1	Portugal	22	1.7
			Spain	30	2.3	Senegal	3	0.2
			Sri Lanka	5	0.4	South Africa	5	0.4
			Suriname	6	0.5	South Korea	1	0.1
			Sweden	10	0.8	Spain	38	2.9
			Switzerland	8	0.6	Sri Lanka	4	0.3
			Thailand	3	0.2	Suriname	7	0.5
			Tunisia	41	3.2	Sweden	9	0.7
			Turkey	96	7.4	Switzerland	6	0.5
			United Kingdom	59	4.5	Togo	1	0.1
			United States	32	2.5	Tunisia	42	3.2
			Venezuela	1	0.1	Turkey	110	8.4
			Vietnam	5	0.4	Uganda	1	0.1
			Yemen	41	3.2	United Kingdom	75	5.7
						United States	31	2.4
						Uruguay	1	0.1
						Venezuela	2	0.2
						Vietnam	6	0.5
						Yemen	53	4.0
Total	2075	100.0	**Total**	1299	100.0	**Total**	1312	100.0
Sample size	2,075		**Sample size**	1,299		**Sample size**	1,312	

Source: ESS Wave 8 (2016)

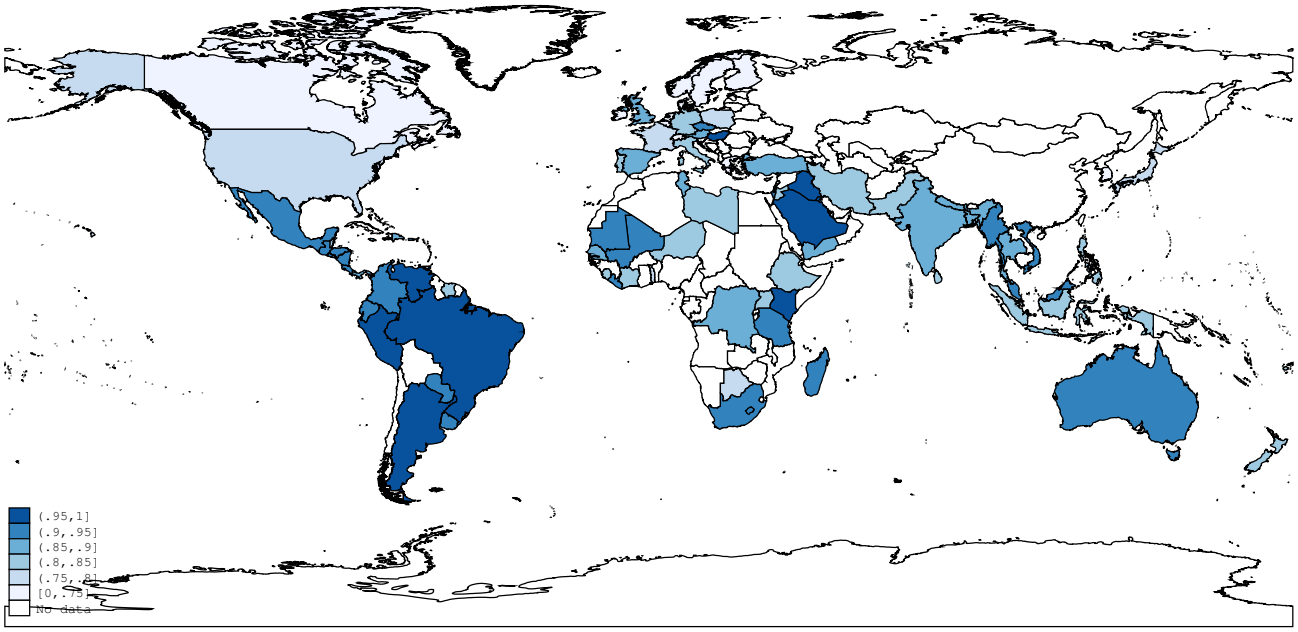
2.B Chapter 2 Figures

Figure 1: *Gender Equality around the World*



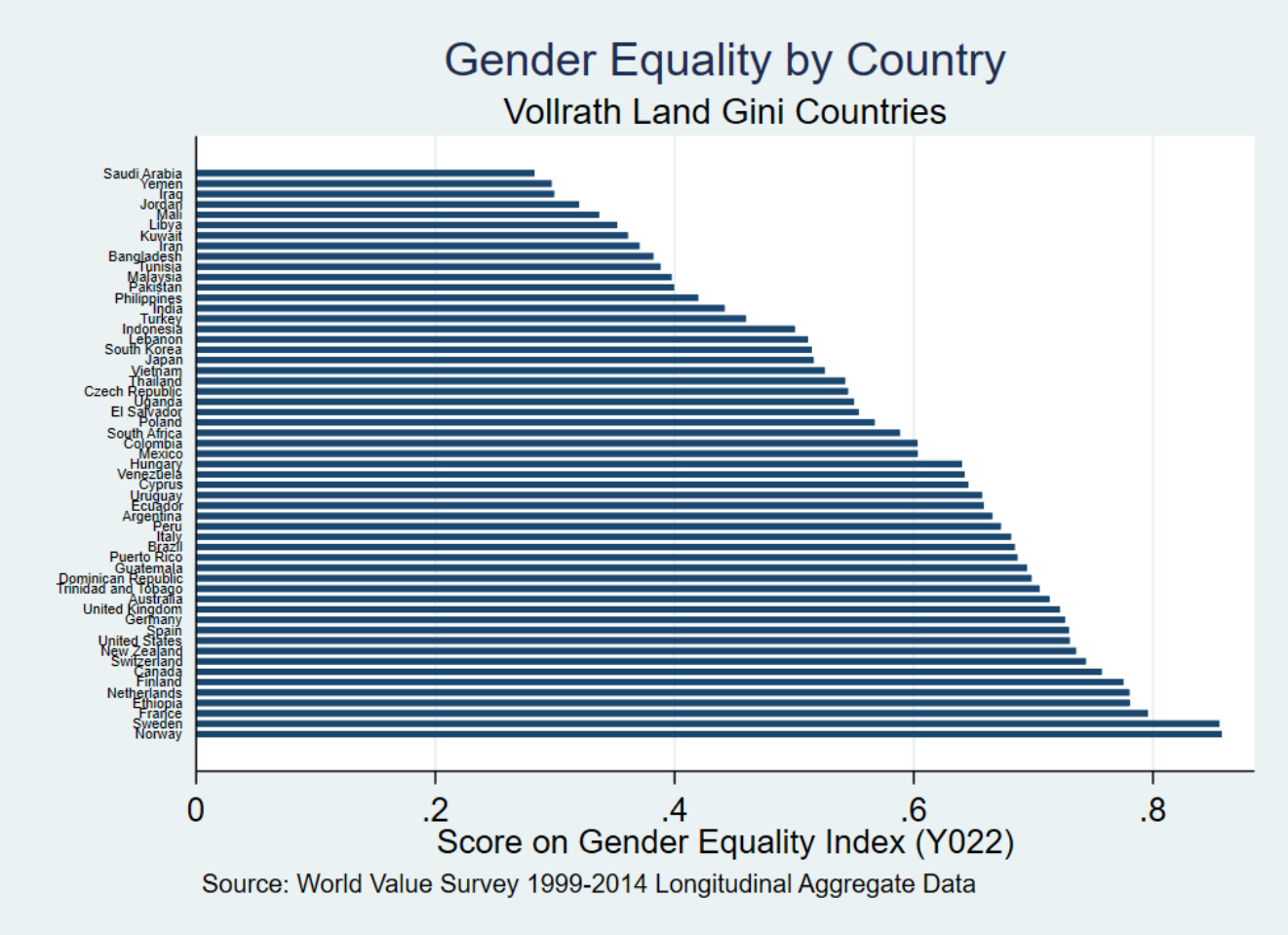
Notes: Data taken from the Longitudinal World Values Survey database (2015).
Deeper shades indicate higher levels of beliefs in favour of gender equality.

Figure 2: *Land Inequality around the World*



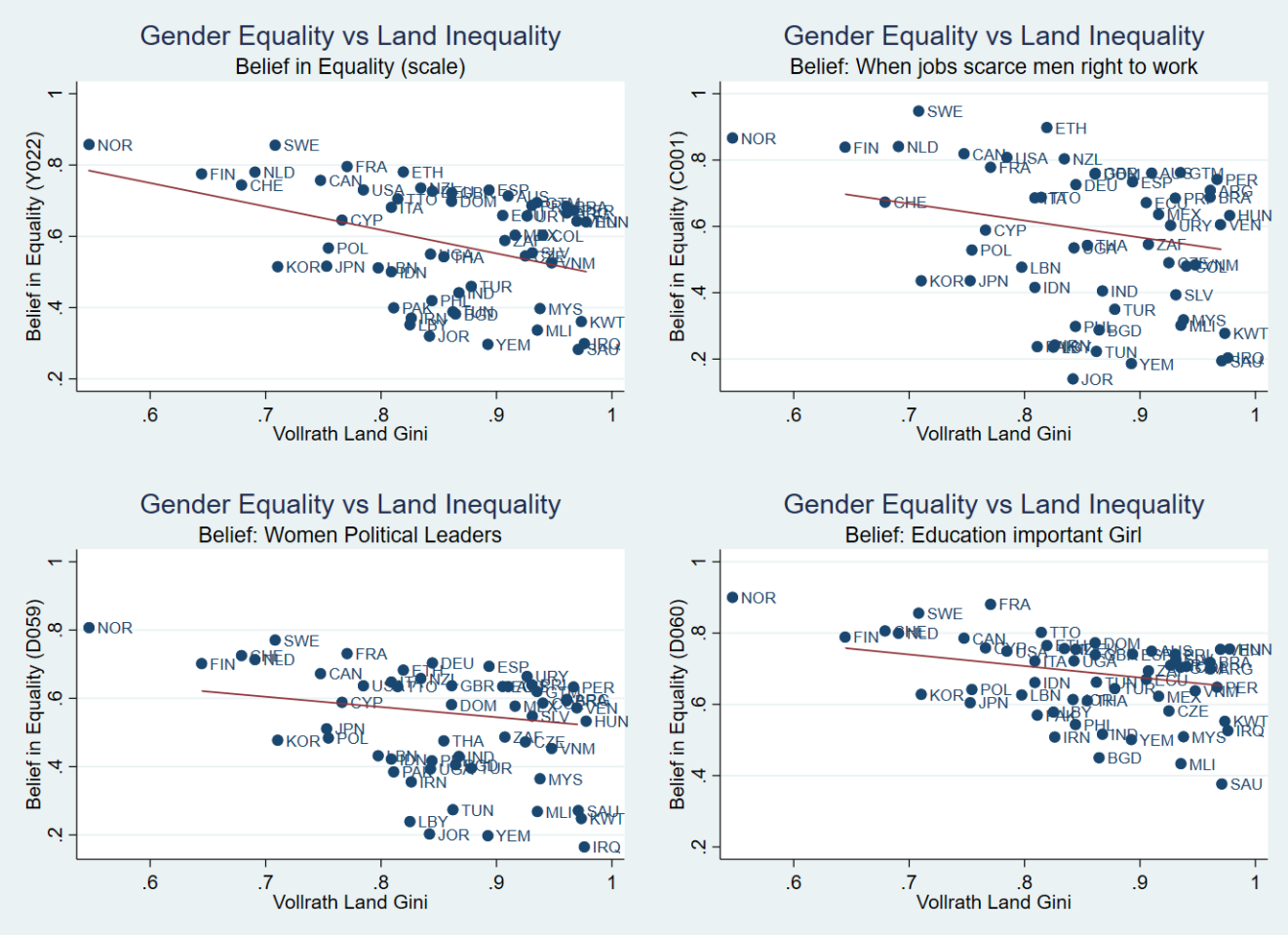
Notes: Data taken from Vollrath 2007, originally from Food and Agricultural Organization (FAO) database. Deeper shades indicate higher levels of land ownership concentration, i.e. land inequality.

Figure 3: *Gender Equality Index by Country*



Notes: Figure shows the Gender Equality Index across countries.

Figure 4: *Correlations between Gender Equality and Land Inequality*



Notes: Figure shows the correlations between Land Gini Measurements and all the variables that form the Gender Equality Index.

Chapter 3

Trade and human capital formation in an agrarian economy

The second empirical chapter is motivated by a historical event transforming the agricultural sector of Greece during the 19th century. Following a series of events in England and France, Greece experienced a significant increased demand for currants, its main exporting good. This unprecedent shock was transmitted through trade in the agricultural population. Using this case study, the chapter investigates how the specialization of the agricultural population in a low-skilled agricultural product affected human capital formation in Greece.

3.1 Introduction

Human capital ranks among the most important determinants of growth and income. Recent studies cite human capital as the prime force of divergence in incomes between rich and poor countries (see e.g. Jones, 2014; Lucas, 2015). In a historical context, investment on human capital is considered the main determinant of the transition from an epoch of economic stagnation to the modern era of sustained economic development (see e.g. Galor and Weil, 1999, 2000; Galor and Moav, 2002).

A parallel body of research investigates why some countries invested earlier in mass

education whereas others were left behind. In particular, this literature explores how specific historical events affected human capital formation, analyzing the role of domestic institutions (see e.g. Lott, 1999; Gallego, 2010; Acemoglu et al., 2014) and socioeconomic structure (see e.g. Baten and Hippe, 2018) on promoting policies and reforms aimed at the general education of the population.[1] Along the same lines, a number of scholars also highlight the importance of the international trade on the demand of human capital across countries and investigate whether international trade affected industrial and nonindustrial nations in a heterogeneous way (see e.g. Wood and Ridao-Cano, 1999; Redding and Schott, 2003; Blanchard and Olney, 2017). Historical studies have likewise explored how the adoption of new maritime technologies affected trade routes and comparative development across countries in the first era of trade globalization (see e.g. Pascali, 2017).

Focusing on the effect of international trade on comparative development during the second phase of industrial revolution, Galor and Mountford (2008) suggest that gains from trade enhanced the specialization of industrial economies in the production of industrial, skill-intensive, goods. The associated rise in the demand for skilled labour increases human capital accumulation and reduces fertility, stimulating technological progress and further enhancing the comparative advantage of these industrial economies. By contrast, in less technologically advanced economies international trade generated an incentive to specialize in the production of unskilled-intensive, nonindustrial goods. This is expected to increase the demand for unskilled labour, reduce human capital accumulation and increase fertility. Consistent with this theory, Bignon and Garcia-Peñalosa (2018) document how agricultural protectionism in an industrialised economy like France in late 19th-century, reversed the

[1] A strand of this literature focuses on the role of specific events, like agricultural shocks, military treats or conflicts on educational attainment (see e.g. Björkman-Nyqvist, 2013; Baker, 2015; Aghion et al., 2019; Baker et al., 2020). Furthermore, a large body of research explores the role of geography and landownership concentration and cite as a prime determinant of mass education reforms, the historical conflict between the entrenched landownership elite and the emerging capitalist elite within each country (see e.g. Galor et al., 2009; Kourtellos et al., 2013; Cinnirella and Hornung, 2016).

long-term improvements in education and the fertility transition that were well under way.

The chapter at hand places the spotlight in a nonindustrial economy, namely Greece, during the second half of the 19th century to explore how a shock that was transmitted through trade in the agricultural population affected education and birth rates. During the period under investigation (i.e. from 1861 to 1879) the Greek economy – a typical agrarian economy with more than 76% of the workforce employed in agriculture – faced an incredible rise in the international demand for currants (i.e. a domestic good that was produced in Southern Greece from the Middle Ages) for two separate and purely exogenous reasons.[2] First, the rising international demand for currants came as a result of the increasing popularity of pudding (i.e. a dessert made by flour and currants) in Britain, where it was consumed by the British aristocracy as well as the ascending British bourgeois, signifying an increasing welfare (see Bakounakis, 1988). Second, in the mid-1870s French vintners decided to substitute currants for grapes in wine and cognac production, since grapes were contaminated by the "phylloxera plague", which destroyed an estimated 2,000,000 acres of vineyards until 1874 (see Pizanias, 1988).[3]

As a result, currants' production in Greece increased by 50% during the 1870's to meet the explosive demand of currant exports, reaching levels around 80% of total exports in the same period [see, Figure 1].[4] The spread of currant viticulture became feasible primarily through in-migration and permanent settlement of peasant families, previously inhabited on the Peloponnesian highlands, to the fertile but marshy coastal plains of the North and West

[2] The first to describe the currant-vine as a distinctive plant, different from the common grape-vive, was the French botanist Bauhin in the 16th century (see Lambrinidis, 1905). He called it Vitis Corinthia sive apyrena and pointed out that its main characteristic was that the berries of currant grapes are seedless and therefore particularly good for consumption in a dried state.

[3] The phylloxera plague has previously been used in notable studies regarding health outcomes (Duflo et al., 2010) and crime rates (Bignon et al., 2017) in 19th century France.

[4] In particular, during the 1860's currants' exports contribute on average 45% of total exports, whereas in 1977 this level increases to 79.5%. Between 1878-1880 data are not available, whereas in 1881 this figure remains high at 69%.

Peloponnese (see e.g. Psichogios, 1986).[5] This phenomenon is often described as internal agricultural colonization (*agrotikos epoikismos*) in the relevant literature (see e.g. Franghiadis, 1990), and is a historical event of major importance as it allowed the commercialization of the agricultural production in Greece, inducing profound structrural changes in the domestic economy.

A set of special historical characteristics make the case of Greece unique both from a theoretical and an empirical point of view. First and foremost, Greece was a purely agricultural economy that engaged in international trade with industrialized nations (i.e. Britain, France) after the second half of the 19th century by being specialized in an unskilled labour-intensive, agricultural good (i.e. currants). This guarantees an ideal setup allowing us to check in a direct way the empirical validity of the theoretical predictions formulated by Galor and Mountford (2008). The second characteristic, further solidifying the case of Greece as a very promising setting for the purposes of our analysis, is the nature of the labour requirements related to currant cultivation per se. Currant cultivation requires a set of delicate tasks, based on the use of hand-held tools (i.e. hoe, digging stick) rather than the usage of plough (see Table 9 from Franghiadis, 1990, for more details on this). Since these operations do not require substantial upper-body strength, grip strength and burst power they can be performed equally well by women or even children.[6] Thus, the incentive of the peasant family to employ their children in the agriculture production rather than sending them to the school is even stronger due to the nature of the labour requirements of this specific cultivation. Third, the fact that currants' production increased for purely exogenous

[5] It is important to note that the increase in currant production did not come as a result of changes in production technology that could increase productivity, but was rather the outcome of the spread of viticulture (see Pizanias, 1988; Franghiadis, 1990).

[6] Starting from Boserup (1970) a number of scholars suggest that that the origin of differences in the role of women in societies lay in the different types of agriculture traditionally practiced across societies and more precisely on the differences between shifting and plough agriculture (see e.g. Alesina et al., 2011, 2013; Giuliano, 2015).

reasons ensures a proper identification for our analysis. The validity of our identification is further reinforced if one takes into account that some regions benefited substantially by this shock (primarilly the coastal areas of North and West Peloponnese) due to their natural endowment to produce currants, whereas other regions remained unaffected.

We develop a unique regional dataset from the mid-19th century Greece, around the period of the increasing pudding consumption on Britain and the outbreak of the phylloxera plague in France. Then, we employ a difference-in-differences (DD) approach to take care of local, time-invariant omitted factors focusing on the change in students' ratio and birth rates between 1870 and 1879. Our empirical specification exploits the uneven spatial variation of land dedicated to currant production prior to the shock (in 1860), as a measure of treatment from the increased demand due to international trade, interacted with the change in the agricultural population during the shock. We use a variable that can be linked to currants' production, since during this period almost all the production of currants was directed to exports, while it also allows us to have variability at the regional level. Furthermore, we use this treatment variable for a period before the shock in an attempt to mitigate endogeneity concerns (see e.g. Cascio and Washington, 2013; Carruthers and Wanamaker, 2015). This variable is interacted with the change in agricultural population, as the shock was materialized at the local level through agricultural colonization in these currant producing areas. Consistent with expectations, our analysis suggests that regions with higher landsize dedicated to currants that experienced a higher increase in agricultural population, experienced a higher reduction in students' ratio between 1870 and 1879.

Our empirical results are in line with the theoretical prediction of Galor and Mountford (2008) as far as it concerns human capital formation. Namely, since Greece was an agricultural economy that engaged in international trade with industrialized nations (i.e. Britain, France), potential gains from trade generated an incentive of specialization in currant cultivation (i.e. an unskilled labour-intensive agricultural good) which was accompanied by a decrease in investment in mass education. However, our analysis fails to provide evidence

of a positive effect on fertility decisions as suggested by Galor and Mountford (2008) in the context of a child quantity-quality trade off. A potential explanation could be that by obliging women to stay away from the field for child bearing activities, the cost of having children increases (see Giuliano, 2015, for more details on this).[7] Moreover, if one takes into account that the time-period of our analysis is overly short, this may debilitate an accurate investigation of potential long-run effects on fertility decisions (see e.g. Becker et al., 2010, for more details on this).

Once we differentiate between gender, our analysis provides empirical evidence that potential gains from trade exerted a negative impact on male student ratio, but had no effect on female student ratio. While it is not possible verify empirically, there are two possible explanations behind this differential effect. First, the number of girls in primary education is substantially lower than boys, hence any effects are significantly smaller to begin with. Second, this may reflect a gender bias in household decision making, where females were allocated primarily towards in-house chores, therefore the potential gains from trade did not affect the choices between schooling or education. The presence of gender bias in agriculture has been noted in older studies (Boserup, 1970) and empiricaly tested in recent ones (Rose, 2000; Alesina et al., 2013; Giuliano, 2015). Similarly, the impact of agricultural shocks tends to affect women disproportionately as well (Mahajan, 2017; Asfaw and Maggio, 2018), related to either lower expenditures (Cameron and Worswick, 2001), or lower probability of investment towards female education (Björkman-Nyqvist, 2013).

To the best of our knowledge this is the first empirical study that explores the effect of a shock transmitted through international trade on human capital formation during the 19th

[7] According to Giuliano (2015) one may expect that societies with historical plough use will have higher levels of fertility. When women are less likely to participate in the field, the cost of having children lowers and consequently fertility increases. On the other hand, with plough agriculture, children, like women, are relatively less useful in agricultural production. The plough requires strength and eliminates the need for weeding, a task particularly suitable for women and children. This in turn generates a preference for fewer children, lowering fertility.

century in a nonindustrial economy. Previous studies either investigate a similar effect using historical data in an industrialized economy (see e.g. Bignon and Garcia-Peñalosa, 2018), or rely on modern data and provide evidence based on large sets of developing and developed countries (see e.g. Galor and Mountford, 2008; Blanchard and Olney, 2017). By employing historical data from the 19th century, our analysis seeks to explore in a direct way the theoretical predictions formulated by Galor and Mountford (2008) that build their analysis upon a phenomenon which took place after the second phase of the Industrial Revolution. Our analysis focuses on the case of a nonindustrial economy and aspires to be complementary to the work of Bignon and Garcia-Peñalosa (2018) that investigate the same phenomenon from the point of view of an industrialized economy.

This chapter shares much with a parallel literature that relates human capital formation and historical events, as well as investigating the effects of agricultural shocks on education. The former strand of literature is centered on the impact that (agricultural or human) diseases such as the boll weevil infestation (Baker, 2015; Baker et al., 2020) or the hookworm disease eradication (Bleakley and Lange, 2009) had on human capital formation, using individual level data. The latter strand of literature either highlights how extreme weather events, such as droughts (Joshi, 2019) and abnormal deviations in rainfall (Jensen, 2000), have an impact on educational outcomes through their effect on household income (Björkman-Nyqvist, 2013), or labour supply (Shah and Steinberg, 2017).

The rest of the chapter is organized along the following lines. Section 3.2 contains an overview of the historical background, along with relevant literature and theoretical arguments. Section 3.3 goes through a description of the data. Section 3.4 presents the empirical model, main results, and a series of robustness checks. Section 3.5 concludes.

3.2 Historical Background

3.2.1 Pudding, plague and the international demand for currants

Britain had already entered the pudding era when Charles Dickens in his famous novel "A Christmas Carol" was praising currants as one of those legendary goods that symbolized abundance and the increasing welfare of the British bourgeois during the Victorian Era. Tea, sugar and pudding consumption grew astonishingly in the 1860s and 1870s. While the average British consumer consumed 14 pounds of sugar per year until then, this increased to 60 pounds in 1876, and similarly the total annual currant consumption increased from 14.000 to 46.000 tons in 1874 (see Bakounakis, 1988). The driving force behind this sharp increase in demand for currants was the increasing popularity of pudding, initially consumed by the British aristocracy and the ascending British bourgeois in the late 1840s. A few decades later pudding gradually became part of the diet of the British working class as well, thus a very popular dessert in Britain. Greek currants quickly displaced other similar goods in the markets of London and Liverpool, and their market share reached a level of approximately 70-75% – as a share of the total consumption of raisins – within Britain during the 1870s (see e.g. Hairetis, 1883).[8]

The international demand for currants was further reinforced in the end of the 1870's, after the decision of French wine makers to substitute grapes with currants in order to produce wine and cognac, due to the "phylloxera plague". Phylloxera, a combination of the Greek words phyllo (leaf) and xera/xeros (dry), is a pest of grapevines originating from North America, that had a devastating impact in late 19th century France (Boubals, 1993).[9] The Great French Wine Blight, as it came to be known, affected the majority of France's vineyards during the 1870s and 1880s, destroying a large proportion (40%) of them until

[8] It should be noted, for the sake of clarification, that currants are essentially one specific type of raisins. In other words, not all raisins are currants, but all currants are raisins i.e. dried grapes.

[9] The probable introduction of the pest can be traced to insect samples received from entomologists in England around 1863, and quickly spreaded to other European countries (Powell et al., 2013).

the late 1880s (Ordish, 1987), leading up to a 70% decrease of wine production (Meloni and Swinnen, 2013) over the period of the infestation.[10] Greek currants became central to the production of "raisin wines" in France from the 1870s onwards (Figure 6).[11] Historical evidence shows that the increase in currant demand from France was even larger during the 1880s (Tsiovaridou, 1980), and only came into an abrupt end after wine growers managed to solve the phylloxera plague in the late 1880s (Gale, 2011). Currants had become an increasingly important component of the agricultural economy of Greece during these years (Figure 7), reaching levels of production similar to dominant crops like wheat and maize by the early 1890s (Figure 2). This overwhelming increase of international demand during the period under investigation, resulted into a specialization in currant production (see e.g. Pizanias, 1988; Franghiadis, 1990).[12]

3.2.2 Agricultural colonization, specialization and currant expansion

The rise in international demand for currants was accompanied by a series of structural changes in the domestic economy. Principal among others, the in-migration and permanent resettlement of peasant families – previously located at the Peloponnesian highlands – to the fertile but marshy coastal plains of the North and West Peloponnese (see e.g. Psichogios, 1986; Franghiadis, 1990). To fully understand how this agricultural colonization actually took place, we have to take into account that prior to the Greek War of Independence (1821-1829) in the peninsula of Peloponnese, one third (33.30%) of the total cultivated lands belonged to the Orthodox Christians that comprised the majority of the local population

[10] A map showing the impact across regions of southern France is provided in the Appendix, Figure 5, originally from (Girard, 1883).

[11] Increased exports of French wines towards England during that time [see for example Figure 9 from Simpson (2004)], may had an additional indirect effect on currant demand.

[12] There are no population censuses available at the same level of aggregation after 1880 and before 1900, thus our analysis only includes the initial period of the shock.

(i.e. 85.50%), whereas the rest two thirds (66.70%) belonged to Muslims (14.50%). The cultivated areas that belonged to Muslims were primarily located on the coastal plains and were definitely more fertile (see e.g. Progoulakis and Bournova., 2001). After the establishment of the Kingdom of Greece (1832) these fertile lands were released and most of them were nationalized from the Greek authorities (the so-called *Public Lands*). Thus, after the 1860s and especially during the 1870s – when the international demand for currants skyrocketed – peasant families from the Peloponnesian highlands migrated, settled and started to cultivate these fertile coastal plains either by paying a specific tax, in essence a form of rent to the Greek State that had the ownership of these lands (the so-called *epikarpia*, see e.g. Franghiadis, 1990, for more details on this) or by deciding to buy a few – relatively small – pieces of cultivated lands or by entering planting agreements for currant cultivation with a landowner to provide labour in exchange for half of the overall crop yield (the so-called *emphyteuseis*, see e.g. Petmezas, 2003, for more details on this).[13]

The provinces of Achaia and Ilia were deserted and lacked any form of agriculture when Leake (1830) visited them in the early 19th century, however they gradually became the broadest area of dense population in the Peloponnese. As stated by the Geographical Handbook of the British Naval Intelligence Division *"[...] the growth of population on these maritime plains has been phenomenal, increasing by over 300% from 1838 to 1938. This has been due almost entirely to the development of the currant trade"*. Between 1870 and 1879 the population of the coastal lowlands of Northern, Western and Southern Peloponnese increased at a rate of 18% against 10% that was the corresponding figure for the rest of the Peloponnese.[14] Between 1870 and 1879, no single province of the Peloponnese increased its

[13] Epikarpia was a specific tax on production (i.e. 15% of the gross production) if the cultivated land was granted by the Greek State and the peasants had been using it with the permission of the authorities. Emphyteuseis were agreements between landowners providing land and capital, and peasant families providing labour-related activities. After five to seven years of labour, mature vineyards were divided, generating property titles for each acquired part. All alternative forms of production, i.e. epikarpia and emphyteuseis, came as a respond to an economic environment characterized by land abundance and scarcity of labour.

[14] As "coastal lowlands of the Peloponnese" we consider the following administrative divisions. From the

population at a rate even equal to that of the provinces involved in currants production. In particular, the latter presented growth rates ranging from 25.1% (for Ilia) and 18.7% (Messini) when the eastern (non currants producing) lowland provinces varied between 16.1% (Limira Epidavros) and 6.4% (Nauplia), and the highlands and insular provinces between 10.4% (Mantineia) and -0.6% (Troizin). It is clear from the above, that currant expansion and agricultural colonization were different aspects of the same historical process. Indeed it was neither possible for the population of the Peloponnesian highlands to colonize the fertile coastal plains of the peninsula without the increased revenues ensured from currants' production, nor could such a labour intensive type of cultivation have ever expanded so quickly without involving an increasing number of people (see e.g. Franghiadis, 1990).

These major structural changes in the domestic economy become feasible due to the shock transmitted through international trade, that allowed the specialization of the Peloponnesian peasantry in currant viticulture. This specialization would not be possible in a context of autarky where the local population would be constrained to cereal cultivation i.e. the basis of the everyday subsistence during that period (see e.g. Psichogios, 1986, 1987). International trade allowed the domestic economy to cover the relative deficit in cereal production – that inevitably came as a result of the specialization in currant production – by increasing imports of wheat from the Black Sea and the Danubian areas. Greece thus ensured sufficient amounts of cereals for the domestic population, achieving an unprecedented escape from subsistence agriculture. Franghiadis (1990) concluded, based on a number of plausible assumptions, that currant viticulture assumed progressively a monocultural character and by the end of 1870s had become the main occupation of the majority of the Peloponnesian peasantry.[15]

province of Corinth the demos Eurostinis, Trikalon, Sikionos, Korinhtion, Parahoras; from the province of Patras the demos Patreon, Dimis, Erineou; the entire province of Aigialeia; the entire province of Messini; the entire province of Kalamata except for the demos Alagonias, the entire province of Pilia; the entire province of Trifilia; the entire province of Olimpia, except for the demos of Adritsaina.

[15]The degree of specialization – that made currant viticulture almost a monoculture in several regions of Peloponesse – can be better understood if one takes into account that during that period centuries-old

3.2.3 International trade and comparative development

To explain the demographic transition and the "Great Divergence" in income per capita across countries in the last two centuries, Galor and Mountford (2008) put the spotlight on international trade. In particular, they argue that the expansion of international trade enhanced specialization of industrial economies in the production of skill-intensive industrial goods, which in turn increased the demand for skilled labour and induced investment in human capital formation. This procedure facilitated the demographic transition, stimulated technological progress and further enhanced the comparative advantage of these countries in the production of skill-intensive goods. On the contrary, in nonindustrial economies international trade generated an incentive to specialize in the production of unskilled labour-intensive agricultural goods and raw materials. The absence of significant demand for human capital failed to produce incentives for investment on education and therefore gains from trade were directed to increases in population size rather than quality of the population. Thus, in nonindustrial economies the demographic transition was significantly delayed, further increasing relative abundance of unskilled labour, delaying the whole process of their economic development.[16]

olive trees were eradicated in order to cede their places to additional vineyards. The British consul of Patras Thomas Wood notes in his annual report that *"[...] the olive oil crop in the Morea is likely to show an annual decrease, as many fine olive groves are been ruthlessly cut down to make way for currant and grape vineyards, which the peasants find more remunerative"* (see Franghiadis, 1990; Dertilis, 2015).

[16] On a paralel context, Findlay and Kierzkowski (1983) provide a sound theoretical basis linking the skill-intensity to a country's exports with investment on human capital formation (see e.g. Grossman and Helpman, 1991; Stokey, 1991; Matsuyama, 1992). Specifically, by following the rationale of the standard Heckscher-Ohlin framework, most of these studies conclude that when a country with a comparative advantage in high-skill intensive goods opens up to trade, the relative price of the skill intensive good will rise and this will drive up demand for high skilled workers and therefore the return to education. Hence, international trade will induce a higher investment in education in countries with comparative advantage in high-skill intensive goods. Obviously, the opposite result will emerge in countries characterized by a comparative advantage in low-skill intensive goods, in which international trade generates incentives to

As we have already noted, the case of Greece ensures an ideal setting that allows us to check the empirical validity of the predictions formulated by Galor and Mountford (2008). Greece was a purely agricultural economy that engaged in international trade with industrialized nations (i.e. Britain, France) after the second half of the 19th century. Given the comparative advantage of the country in an unskilled labour-intensive, agricultural good (i.e. currants), we expect the shock transmitted through trade in the agricultural population to exert a negative impact on investment on education and positive on birth rates. This is because, following the theory, specialization in currants should lessen incentives towards investment in human capital, while on the other hand should increase fertility, since households would benefit from additional labour supply.[17] To better understand these outcomes, it is crucial to elaborate on aspects of this process, such as currant cultivation, the nature of the commercial network and how they affected incentives towards education.

The production of currants was a labour-intensive year-round process, that benefited from extended families (the norm in Greece at the time). Starting around fall various tasks had to take place, such as digging and scrapping of the fields, to prepare the soil for seeding. Afterwards, pruning and similar activities during winter prepared the vineyards, while spring revolved around maintenance chores to ensure the maximization of yields. Finally, early summer was the only period where labour activities were lessened, with harvest taking place around August and September of each year (Kalafatis, 1990).[18] Therefore, due to the nature of this agricultural process (i.e. labour-intensive, long-term cultivation) the

reduce investment on education.

[17]It is important to note that at the national level, it is reasonable to postulate that higher demand regardless of type generates a positive aggregate income effect by increasing GDP (as in Feyrer, 2019). A positive aggregate income effect could in turn induce a higher investment in education that could potentially mitigate (or even offset) the incentive effects driven by the basic Heckscher-Ohlin rationale. To evaluate and control for this possibility, we include in our empirical analysis specifications with and without controls for aggregate income. In the absence of household level data, we cannot control for household income effects.

[18]More details about the currant cultivation process can be found in Table 9 of the Appendix.

increased international demand could be met by cultivators through increased labour supply (Kostelenos et al., 2007). The absence of specific laws against child labour heavily incentivized peasant families to reduce investment in human capital formation of their children, and increase their labour supply instead. That was the main route for families to increase their welfare, as the price of currant remained relative stable during that era (see Figure 8). Section 3.5 in the Appendix elaborates on the nature of the developed commercial network of currants to explain this stability.

3.3 Data Description

The historical data we use had to be digitized from historical archives, such as population and agricultural censuses from late 19th century Greece. We also recreated the geographical boundaries of Greece during that era, by matching information from databases of local administrative units, in order to create spatial maps and geographical variables for the econometric analysis. The final result is a novel dataset with regional data from Greece between 1860 and 1884. Details about the data construction process can be found in Section 47 of the Appendix. Definitions and sources of the variables described below can be found in Table 10.

Our main dependent variables constructed from the censuses of 1870 and 1879 are students, specifically *All Students*, *Female Students* and *Male Students*, as a share of the population (or as we will refer to them, student ratio), as well as births, specifically *Birth Rate*, calculated as the share of births in the total population.[19] Education in Greece between 1850 and 1880 was almost exclusively provided by the state, with private schooling accounting for 5% to 10% of total schooling (Petrogianni, 2005), and more than 80% of students enrolled in primary education (Dimaras, 1975). Schools were distributed evenly across the country (Tsoukalas, 1976), with no notable differences between rural and urban regions at least for

[19] We use this definition due to the fact that we are unable (in the absence of specific age data) to calculate enrollment rates. To keep our analysis consistent, we apply the same definition for births.

the primary level.[20] While the supply of education was relatively homogenous, the quality of primary education largely depended on an ad-hoc basis of each teacher, at least up until 1881 (Lefas, 1942). Both supply of schooling and absolute numbers of male students were substantially higher[21] than female students at the primary level (Tsoukalas, 1977), and such differences were even starker at the secondary level[22], pointing towards an existing gender gap, similar to contemporary agricultural economies (Alderman et al., 1996; WorldBank, 2012).

Our main independent variable is *Currant Landsize* (prior to shock in 1860), defined as the amount of arable land devoted for currant agriculture at the county level, as a share of the total land used for currant production in the country.[23] We prefer this variable since it captures not only the ability of each county to increase agricultural capacity, but it relates this to the availability of such land across the country. Currants were not produced universally across the country due to local natural capacity, with less than half of the counties (20 out of 48) being responsible for all currant production in 1860. Detailed regional data are available for different levels of the currant treatment, proxied by the amount of land used for currant production. A map visualizing the amount of land used for currant production in a county (i.e. *Currant Landsize*) of "old Greece" is shown in Figure 3. Deeper shades of brown indicate higher shares of *Currant Landsize*. Evidently, the production of currants was heavily concentrated on the geographical region of Peloponnesus. This information is not available at the samel level of aggregation for any other year around the period of the

[20] The majority of secondary schools were located in urban areas, due to their low absolute numbers.

[21] In 1865, the number of male-only schools were approximately 7 times that of female-only schools, while male students in primary public education outnumbered female students 4 to 1.

[22] Historical archives estimate that around 4% of secondary education students were female (Chassiotis, 1881).

[23] The data originally comes in the form of *stremmata*, which is the plural of the Greek word *stremma*. One unit of this measurement (stremma) amounts to 1,000 square meters.

shock.[24]

We complement data on crop production at the county level with data from the change in agricultural population between 1870 and 1879 at the municipality level. The logic is that we expect higher agricultural colonization in municipalities that have higher capacity to produce currants as a result of the shock. We provide more details about our empirical strategy in the next section. The variable *Agricultural Population* is the summary of Landowners (Ktimatiai) and Farmers (Agrotai), once again measured as a share of the population.[25] Figure 4 shows the change of *Agricultural Population* in municipalities across "old Greece".[26] Deeper shades of brown indicate higher positive growth rates, while lighter shades indicate negative rates. There seems to be an overlap between currant regions and the change in agricultural population, since many regions with growth rates higher than 15 or 20% belong to regions with high currant production. Intuitively, it seems reasonable that if currants were primarily harvested in specific regions, the shock would increase the number of people associated with the agricultural population in these regions, while decrease it for the rest of the country.

To account for development across different regions, we use the geographical boundaries for the municipalities of 1861 (as described above), to calculate the *Population Density* [see e.g. Acemoglu et al. (2002)]. For the same reason, we create the variable *Industrialists*, defined as the number of industrialists as a share of population. Furthermore, as a proxy for the supply of education at the time, we create the variable *Teachers* as a a share of population, following studies that have used similar measures (see e.g. Cinnirella and Hornung, 2016). Similarly, we create the variable *Buildings*, as a proxy for schools, since we

[24] Data for currant production are available for 1887, but only at the province level, while data with the same level of aggregation only exist for a period after the shock, namely 1907.

[25] A more relaxed defition of the agricultural population that includes the share of Peasants (Poimenes) and Ploughers (Agogiatai) is used for the robustness checks.

[26] Similar maps for the agricultural population as a share of total population in 1870 and 1879 can be found in the Appendix, namely Figure 12 and Figure 13.

expect a high correlation between the number of total buildings and school buildings. In an attempt to control for additional differential effects over time across regions, we calculate the natural logarithm of distance from the capital of its region (*Distance from Capital*), for each municipality. Finally, we create the dummy variable *Islands*, that takes the value 1 if a municipality belongs to an island, and zero otherwise.

Descriptive statistics for the main dataset (censuses of 1870 and 1879) are summarized in Table 12. We can observe in the descriptive statistics that *All Students* represent roughly 5% of the overall population, with *Male Students* outnumbering *Female Students* 4 to 1 (on average), while *Birth Rate* represents roughly 3% of the overall population. These ratios are the same between regions that produced currants and the whole country.

3.4 Empirical Analysis

3.4.1 Empirical Strategy

To capture the shock that was transmitted through trade in the agricultural population, and explore its effect on education and birth rates, we estimate a difference-in-differences model that holds unobserved local characteristics fixed of the following form:

$$\begin{aligned}\Delta ln(Y_{m1879-1870}) = \beta_1 \Delta ln(Agricultural\ Population_{m1879-1870}) + \beta_2 Currant\ Landsize_{c1860} \\ + \beta_3[\Delta ln(Agricultural\ Population_{m1879-1870}) * Currant\ Landsize_{c1860}] \\ + \beta_4 \Delta ln(X_{m1879-1870}) + \beta_5 \Gamma_m + \beta_6 Z_p + \beta_7 \Delta ln(Y_{m1870-1861}) + \Delta ln(\epsilon_{m1879-1870}) \quad (3.1)\end{aligned}$$

where $\Delta \ln(Y_{m1879-1870})$ is municipality m's change of the student ratio (students as a share of population) between the period during (1879) and right before the shock (1870), or alternatively municipality m's change of *Birth Rate* (births as a share of population).[27]

[27] As we noted in Section 4.3, in the absence of data for births for 1879, we use the closest year available in its place, namely 1884.

$Currant\ Landsize_{c1860}$ is county c's landsize used for currant production as a share of the country's total landsize (for currant agriculture) in the year of the nearest agricultural census (1860) and prior to the shock, while the term $\Delta\ln(Agricultural\ Population_{m1879-1870})$ captures municipality m's change of agricultural population between the two periods, and $\Delta ln(\epsilon_{m1879-1870})$ is an i.i.d. error term.

The main variable we use to capture the shock is the interaction between the change in the share of agricultural population, and the $Currant\ Landsize_{c1860}$. We prefer the latter for three different reasons. First and foremost, during this period almost the entire production of currants was directed to exports, whereas this is the only variable from the historical archives that allows us to capture heterogeneity at the regional level. Second, and related to that, data on land suitability for currants are not available (e.g., Global Agro-Ecological Zones (GAEZ) project). Also, the alternative would be to use more general agricultural suitability data (e.g., soil fertility). The main issues with this choice are: (i) we have less precision to capture the potential exposure to the shock; (ii) data are available for a later period (1960-1990) and as a result they can be affected by human intervention (see e.g. Cinnirella and Hornung, 2016). Third, although we are constrained by data availability to use a fixed measure in 1860, we would prefer this even if we had data for later years as it less likely to be endogenous in comparison to a share that changes over time (see e.g. Cascio and Washington, 2013; Carruthers and Wanamaker, 2015). The logic is that counties with a higher share of the country's overall currant landsize prior to the big shock had the natural endowment to respond more intensively in the increased international demand for currants. A clear indication towards this direction is that the correlation of the landsize dedicated to currants production at the province level between 1861 and 1887 is 94 percent.[28]

[28]It should be noted that data from the agricultural census of 1887 are not used in the empirical analysis for three reasons: (i) because as already mentioned we prefer our lagged measure to mitigate endogeneity concerns; (ii) information is available at the province – not the county level as the in the agricultural level of 1860; (iii) information comes much later (1887) in comparison to the last year we have information for the students' ratio (1879).

We combine $Currant\ Landsize_{c1860}$ with the change in the agricultural population in order to capture the phenomenon of agricultural colonization as described in Section 3.2.2. In particular, we expect higher changes in agricultural population in municipalities with natural endowment to produce currants as a result of the shock. In other words, municipalities with better natural endowment would be able to respond to the increased demand faster, through their respective agricultural populations. If the increase in demand for currants incentivized specialization of the agricultural population in this low-skilled agricultural good – thereby prompting households to increase labour supply of their children, rather than investing in their education – we would expect a negative and statistically significant effect of the interaction term. Due to the nature of currant cultivation, this increased demand may have a positive effect on birth rates (incentive to have more children employed in production), while also a negative effect (cost of child bearing activities keeping women away from the field).

As our empirical specification is in changes, we need to worry about the changing rather than fixed characteristics of municipalities. To address these concerns we will use control variables as defined in Section 4.3 (e.g., *Industrialists*), province specific shocks (Z_p) and the previous change of the dependent variable. For our main analysis we focus on municipalities that were part of the currant regions, to capture the effect of the shock on the "treated" municipalities, and expand our sample to include municipalities from the whole country as a robustness check. To address the issue that the amount of landsize dedicated to currants varies at the county level, therefore municipalities within each county are not independent, we cluster the standard errors at the county (eparhia) level, in all specifications. Finally, all regressions are weighted by the population of 1870.

3.4.2 Baseline Results

The results for the effect of currant and agricultural population on the change of total student ratio are reported in Table 1. We adopt an "incremental" strategy and estimate

alternative specifications where we progressively add new controls (regional fixed effects, geographical controls etc). As it can be seen, the interaction term enters the regressions with the expected negative sign and is highly statistically significant throughout, between 5% and 1% level of significance. According to the results, rather than a positive agricultural shock leading to an incentive for further investment in human capital, the overall effect in currant endowed regions with significant agricultural population growth appears to lessen such incentives. For instance, when the agricultural population growth is 30%, a one unit increase in *Currant Landsize* leads to a decrease in the students' ratio by 0.4 percentage points. This finding is in line with the theoretical arguments from Galor and Mountford (2008).

The other side of the argument from Galor and Mountford (2008) stresses that due to the increased specialization towards a low-skilled good, there should be positive effects on fertility rates, due the increased need for labour supply - at least in the long run. To check for this, we repeat our analysis, only now instead of student ratio we use the *Birth Rate* as our dependent variable. The results are reported in Table 2, following the same structure as Table 1. We find no clear evidence of such a positive relationship between the increased demand for currants and birth rates.[29] There are two reasons that may explain this lack of evidence. Firstly, currant cultivation had conflicting effects on fertility decisions, due to the nature of the specific crop. On the one hand, additional children could be used in the field, therefore families had incentives to increase fertility rates. On the other hand, currant cultivation benefited from the participation of women of the household, thus increased child bearing activities may increased the indirect labour cost – i.e. less time spend on the field – therefore lessening incentives towards fertility. Secondly, the relatively short period of our analysis, may not be enough for such changes in fertility to become significant, as in other studies with longer time horizons (e.g. Bignon and Garcia-Peñalosa, 2018).

[29]We only include our baseline analysis for *Birth Rate*, since we find no evidence of such a relationship in the rest of the analysis as well.

Overall, it seems that incentives towards specilization in this low-skilled agricultural good had a more pronounced effect compared to any income effects from the increased international demand for currants. In line with findings from relevant literature (e.g. Kruger, 2007), households may primarily responded to the increased demand by adjusting the time allocated to different activities, and most likely opted to increase labour supply from their children, rather than sending them to school. However, the response of households in the aftermath of agricultural shocks has been shown to differ across gender (Beegle et al., 2008; Maccini and Yang, 2009; Björkman-Nyqvist, 2013). To establish whether this holds true in our case, we proceed by analyzing the effects of the shock on the change in male and female student ratio.

3.4.3 Differential Effect

Breaking down the differential effects of the agricultural population and currant production on female and male students is reported in Table 3. A similiar analysis to Table 1 is provided, following the same structure, only now columns (1) to (6) report the effect on the change in the female student ratio [$\Delta ln(Female\ Students_{m1879-1870})$]. In all specifications, it is clear that there was no effect on female students. It appers that instead of assisting in the production, households may assigned females an increased amount of domestic work which would not interfere with schooling [e.g. similar to arguments from Björkman-Nyqvist (2013)], or just maintained current schooling enrollment.

The rest of Table 3 repeats the analysis in an equivalent fashion, but the dependent variable is replaced with the change in the male student ratio [$\Delta ln(Male\ Students_{m1879-1870})$]. Columns (7) to (12) report the results in the same way as the previous six columns. The interaction between the change of the agricultural population in regions with higher currant production has a negative effect on male students, similar to our baseline results. For males, it seems that being able to contribute more to the household income, as well as making it easier to support a family of their own in the future, was more important. On the other

hand, females were less likely to attend school during this period, which would explain why they were probably not affected, since any effects from changes due to this shock were smaller to begin with.

3.4.4 Robustness checks

Placebo tests

Given that we find no effect on birth rates, in this section we investigate the robustness of the results we obtain for students. Our first robustness check is to perform two placebo tests where we first replace *Currant Landsize* with *Wheat Landsize*, and then *Agricultural Population* with *Shepherd Population*, in our empirical specification. The logic for the first test is that wheat was the main agricultural crop produced at the time (in both total landsize and volume of production), and – perhaps unsurprisingly – was primarily consumed inside the country. An important consideration for our analysis is whether the change in agricultural population may had an effect on the student ratio of municipalities, regardless of the presence of currant production, thereby violating our assumption that the exogenous shock in currant demand had an effect on education through currant agriculture. To test our assumption, we interact the change in agricultural population with the amount of land (as a share % of total country production) that was dedicated to wheat agriculture (*Wheat Landsize*). Along the same lines, in a second specification we interact *Currant Landsize* with a part of the agricultural population that we do not expect to respond to the shock of increased demand for currants, namely *Shepherd Population*.

Results of the two tests are reported in Tables 4 and 5, respectively. Columns (1) and (2) report results without controls, and results with the full set of controls, respectively, for the total student ratio. Columns (3) and (4) repeat the same analysis (baseline and full controls), for the female student ratio, whereas columns (5) and (6) for the male student ratio. We can observe in Table 4 that the interaction between the wheat landsize and the agricultural population is not statistically significant for the total and the male student ratio.

Interestingly, the joint effect of the amount of land used for wheat agriculture and the change in agricultural population on female students, is positive and statistically significant. This effect only applies for this placebo crop, and not for other crops (like maize), and has the opposite sign than our baseline results. Moreover, in Table 5 the interaction term is not statistically significant, in all cases. Overall, these placebo tests support the validity of our assumptions regarding the way the shock was transmitted within the Greek territory, and in particular through the currant agriculture of farmers.

All counties

Our next step is to expand the sample to include all regions of "old Greece". While the baseline comparison was between 1870 and 1879 within regions with higher and lower currant production, now we extend our sample to all regions that we have data availability. This increases our observations from 120 to 270.[30] The reason we did not use these additional observations until now was to avoid having values of zero or very low natural capacity to produce currants, in the majority of observations. Our main variable remains the amount of land used for currant agriculture, as a share (%) of the total country's production, which is available at the county level.

The results from the expansion of our sample are reported in Table 6. The effects for all three categories of students - all students, males and females - are summarized in the same table, following the structure of Table 4 (i.e. two columns for total student ratio, two for females, two for males). Similar with our baseline results, there is no effect on female student ratio, but the effect on male student ratio remains negative, and statistically significant at

[30] We exclude two specific counties from the large sample, due to data concerns. Specifically, we exclude the counties "Gytheiou" and "Oitylou", which formed a well-known sub-region in Greece called "Mani", that famously enjoyed a special tax-free status for a long time (due to historical reasons related to the Ottoman empire). Therefore, there was no documented information available in general for most aspects of the agricultural production at the time. This reduces the total number of municipalities used from 280, down to 270.

the 5% level, driving the results for the ratio of all students.

Pre Trend

Another severe identification concern is that our interaction term could capture pre-existing trends. To alieviate such concerns, we estimate the same difference-in-differences framework, using $\Delta ln(Students_{m1870-1861})$ (the difference between the student ratio of 1861 and 1870) as a placebo test. All other variables remain identical, apart from the lagged dependent variable (no data available prior to 1861). If our assumption is correct, our results should show no significant effect of the differences from 1870 and 1879 to the differences in the number of students in the earlier period (1861 to 1870).

Table 7 reports the results from the change in time period of the dependent variables, with the same structure as Table 4. There is no evidence of a pre-trend for the total and the male student ratios, confirming our assumption, that the main effect of the exogenous shock on education took place after 1870. There is an indication of that in the female student ratio, but once all controls are added, the effect is not statistically significant. Overall, our baseline analysis maintains its importance.

Viticulture and in-migration

As already mentioned, currant viticulture became feasible mostly through in-migration and permanent settlement of peasant families, previously inhabited on the Peloponnesian highlands to the fertile but marshy coastal plains of the North and West Peloponnese (see e.g. Psichogios, 1986). As a result, one threat to our identification strategy is that the observed impact on schooling is due to a selection effect – i.e. migrants coming from the mountains have a lower valuation of education and are less likely to send their children to school. We attempt to provide evidence against this possibility in Table 8.

In particular, using two empirical specifications in levels for the years in 1861 and 1870 (i.e., prior to the shock and the large wave of in-migration), we introduce the natural log-

arithm of elevation (*Elevation*) on its own and interacted with the variable *Agricultural Population*. In that way we can check if in higher altitudes – columns (1) and (3) – or in higher altitudes with higher presence of agricultural population – columns (2) and (4) – the students' ratio is lower. As can be seen, in all cases the coefficients of the variable *Elevation* and its interaction with the variable *Agricultural Population* are not statistically significant. Of course, this evidence is not conclusive against a selection effect, but at least we have a clear indication that pre-migration education of agricultural population is not correlated with the dimension of elevation.

Other robustness checks

We conduct a battery of additional robustness checks. In particular, Table 13 of the Appendix presents our results after interacting our main variable of interest, namely *Currant Landsize*, with all the controls that are differenced. The effects remain similar to our baseline analysis (negative for total number of students and males, no effect for females).

Moreover, in Table 14 the baseline analysis is repeated, only now instead of currant, maize landsize is used, transformed in the same way. Table 15 drops the biggest and smallest two counties that produced currants, and while our results lose some significance, we must note that removing these counties equals to roughly 40% of the total landsize used for currant agriculture. A similar exercise can be found in Table 16 which presents the results when we windsorize outliers, based on a 90% interval.

Regarding alternative measurement of currant production, we use a per capita measurement of *Currant Landsize* in Table 17. Finally, we run the baseline regressions with no population weights in the regressions presented in Table 18. Our main results remain robust to all these different specifications.

3.5 Conclusion

The effect of historical events on determinants of economic significance such as human capital is increasingly being scrutinized. In this chapter, historical events in European countries of 19th-century were utilized, in order to investigate how a shock transmitted through international trade in the agricultural population played a crucial role in the formation of human capital, focusing on Greece. The increasing popularity of pudding in England, combined with the devastating plague of phylloxera in France, significantly increased demand and production of currants.

The magnitude of this exogenous shock was substantial and went on for most the 1870s and 1880s, as documented in historical evindence. We detailed how the transformation of the agricultural Greek economy following the increased demand for currants took place in specific parts of Greece. Following the shock, we argued that the incentive towards specilization in this low-skilled labour-intensive agricultural good, would lead to a decreased focus on the formation of human capital, in line with theoretical models describing the dynamics of trade between agricultural and industrialized economies (Redding and Schott, 2003). In line with findings from existing literature, we expected that this shock may had a differential gender effect as well (Giuliano, 2015; Asfaw and Maggio, 2018). Similarly, a positive effect on birth rates would be expected, since labour-intensive crop cultivations would be able to benefit from increased child labour supply.

Our findings show that this exogenous increase in demand of currants had a negative effect on the student ratio, therefore this agricultural shock had a negative effect on the formation of human capital. This is in line with the theoretical framework of Galor and Mountford (2008), regarding the effects of trade on human capital formation. However, we do not obtain evidence of a positive impact on birth rates, which can probably be attributed to the conflicting effects between currant cultivation and fertility decisions, as well as the short period in consideration. Other studies have pointed out similar effects for contemporary economies (Kruger, 2007), namely that positive shocks in agricultural demand decrease

school enrollment. Differentiating between males and females, we document that the effect was negative on male student ratio, but there was no effect on female ratio. In accordance with literature on the effects of adverse shocks on female education (Beegle et al., 2008; Björkman-Nyqvist, 2013), we document a similar gender bias.

This is the first study providing evidence on the effects of the currant trade on the development of human capital in late 19th-century Greece. Our focus on the historical case of a nonindustrialized economy trading with industrialized economies, seeks to underline the importance of human capital formation in earlier stages of development, and how a transition towards a developed economy may be delayed due to seemingly unrelated historical events. While the historical aspects of this event may be exclusive to Greece, we believe that it can serve as an interesting case study demonstrating the effects that shocks through international trade may have on human capital formation, a fundamental aspect of growth and income.

Chapter Appendices

3.A Chapter 3 Tables

Table 1: *Effect of Currant and Agricultural Pop. on Education - All Students*

	(1) All Students	(2) All Students	(3) All Students	(4) All Students	(5) All Students	(6) All Students
Currant Landsize	-0.064	1.234**	1.268	1.464**	1.494**	1.363**
	(0.510)	(0.541)	(0.776)	(0.674)	(0.645)	(0.623)
Δ(Agricultural Population)	0.873***	0.841***	0.881***	0.832***	0.975***	0.969***
	(0.278)	(0.278)	(0.297)	(0.284)	(0.213)	(0.209)
Agricultural*Currant	-5.503***	-5.021**	-5.238**	-5.169**	-5.321***	-5.187***
	(1.687)	(1.806)	(1.883)	(1.916)	(1.347)	(1.311)
R^2	0.225	0.265	0.288	0.314	0.396	0.421
Regional FE	No	Yes	Yes	Yes	Yes	Yes
Geographical	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes	Yes	Yes
Levels	No	No	No	No	Yes	Yes
LagDependent	No	No	No	No	No	Yes
Observations	120	120	120	120	120	120

Notes: The dependent variable is the (log) change of the student ratio between 1879 and 1870. Currant Landsize at the county (eparhia) level is transformed into the percentage of land used for currant as a share of the total country production. Δ(Agricultural Population) is the (log) change of agricultural population between 1879 and 1870. Column (2) includes fixed effects at the province (nomos) level. Column (3) includes geographical variables (islands, natural logarithm of distance of a municipality from the capital of its region). Column (4) includes the first difference of the controls (population density, buildings, industrialists,teachers). Column (5) includes the level of the controls from column (4). Column (6) includes the lagged depedent variable. Standard errors are clustered at the county (eparhia) level, and presented in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 2: *Effect of Currant and Agricultural Population on Birth Rate*

	(1) Birth Rate	(2) Birth Rate	(3) Birth Rate	(4) Birth Rate	(5) Birth Rate	(6) Birth Rate
Currant Landsize	-0.670	-0.554	-0.131	-0.137	-0.252	-0.607
	(0.568)	(0.614)	(0.770)	(0.696)	(0.643)	(0.456)
Δ(Agricultural Population)	0.102	0.117	0.035	0.004	-0.003	0.146
	(0.133)	(0.108)	(0.143)	(0.125)	(0.163)	(0.152)
Agricultural*Currant	0.588	-0.294	0.096	0.257	0.283	0.071
	(1.910)	(1.737)	(1.734)	(1.743)	(2.150)	(1.658)
R^2	0.021	0.118	0.145	0.169	0.176	0.548
Regional FE	No	Yes	Yes	Yes	Yes	Yes
Geographical	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes	Yes	Yes
Levels	No	No	No	No	Yes	Yes
LagDependent	No	No	No	No	No	Yes
Observations	120	120	120	120	120	120

Notes: The dependent variable is the (log) change of the birth rates between 1879 and 1870. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 1. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 3: *Effect of Currant and Agricultural Population on Education - Female and Male Students*

	(1) Female	(2) Female	(3) Female	(4) Female	(5) Female	(6) Female	(7) Male	(8) Male	(9) Male	(10) Male	(11) Male	(12) Male
Currant Landsize	-0.883	-1.385	-0.732	-0.723	-0.523	-1.006	-0.064	1.320**	1.355	1.544**	1.507**	1.458**
	(0.990)	(1.066)	(1.068)	(1.057)	(1.388)	(1.204)	(0.551)	(0.614)	(0.846)	(0.722)	(0.633)	(0.624)
Δ(Agricultural Population)	0.269	0.252	0.125	0.169	0.256	0.180	0.854**	0.825**	0.869**	0.815**	0.953***	0.948***
	(0.211)	(0.244)	(0.265)	(0.236)	(0.238)	(0.174)	(0.308)	(0.309)	(0.321)	(0.306)	(0.230)	(0.224)
Agricultural*Currant	0.813	-0.455	0.156	-0.072	-1.861	-0.758	-5.592**	-5.038**	-5.276**	-5.175**	-5.116***	-5.046***
	(4.888)	(4.711)	(4.737)	(4.662)	(4.415)	(4.000)	(1.988)	(1.995)	(1.961)	(1.935)	(1.452)	(1.408)
R^2	0.018	0.069	0.085	0.096	0.182	0.281	0.213	0.254	0.281	0.309	0.382	0.414
Regional FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Geographical	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Levels	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
LagDependent	No	No	No	No	No	Yes	No	No	No	No	No	Yes
Observations	120	120	120	120	120	120	120	120	120	120	120	120

Notes: The dependent variable in columns (1) to (6) is the (log) change of the female student ratio, while in columns (7) to (12) is the change of the male student ratio. Columns (1)-(6) and (7)-(12) follow the structure of columns (1)-(6) of Table 1. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 4: *Effect of Currant and Agricultural Population on Education - Placebo (Wheat)*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Wheat Landsize	2.887	6.926	7.092	0.480	2.859	6.994
	(4.826)	(4.978)	(6.241)	(3.782)	(5.084)	(4.867)
Δ(Agricultural Population)	0.805*	1.011***	-0.629	-0.502**	0.812*	1.034***
	(0.390)	(0.291)	(0.364)	(0.235)	(0.431)	(0.300)
Agricultural*Wheat	-8.500	-9.535	43.546***	27.469**	-9.905	-11.013
	(10.821)	(8.466)	(14.293)	(10.456)	(12.163)	(8.642)
R^2	0.182	0.384	0.062	0.297	0.171	0.381
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: The alternative crop used is wheat landsize at the county (eparhia) level, transformed into the percentage of land used for wheat as a share (%) of the total country production. Columns (1), (3) and (5) report specifications for All, Female and Male Students, respectively, without additional covariates as in column (1) of Table 1. Columns (2), (4) and (6) include fixed effects (province level), geographical effects, controls, levels of controls and lagged depedent variable, as in column (6) of Table 1, for the same dependent variables as their previous column. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 5: *Effect of Currant and Agricultural Population on Education - Placebo (Shepherds)*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	0.678	3.060***	-1.003	-0.803	0.706	3.155***
	(0.751)	(0.891)	(1.219)	(1.195)	(0.768)	(0.875)
Δ(Shepherd Population)	-0.040	-0.076	0.126	0.110	-0.054	-0.085
	(0.174)	(0.169)	(0.116)	(0.105)	(0.179)	(0.175)
Shepherd*Currant	0.844	1.084	-1.531	-0.714	1.026	1.203
	(1.379)	(1.569)	(1.359)	(1.145)	(1.426)	(1.648)
R^2	0.009	0.244	0.010	0.283	0.011	0.249
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: Δ(Shepherd Population) is the (log) change of shepherd population between 1879 and 1870. Columns (1), (3) and (5) report specifications for All, Female and Male Students, respectively, without additional covariates as in column (1) of Table 1. Columns (2), (4) and (6) include fixed effects (province level), geographical effects, controls, levels of controls and lagged depedent variable, as in column (6) of Table 1, for the same dependent variables as their previous column. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 6: *Effect of Currant and Agricultural Population on Education - All Counties*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	0.253	1.684**	-0.150	-1.086	0.131	1.762**
	(0.444)	(0.683)	(0.924)	(1.049)	(0.443)	(0.664)
Δ(Agricultural Population)	0.403**	0.447**	-0.110	0.086	0.457***	0.456**
	(0.182)	(0.182)	(0.276)	(0.117)	(0.169)	(0.183)
Agricultural*Currant	-2.363**	-2.072**	3.157	1.579	-2.914***	-2.275**
	(0.986)	(1.017)	(5.063)	(4.478)	(1.014)	(0.879)
R^2	0.078	0.209	0.005	0.281	0.097	0.202
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	270	270	270	270	270	270

Notes: Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 7: *Effect of Currant and Agricultural Population on Education - Pre Trend*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	0.344	-0.867	-1.687**	-1.318	0.886	-0.285
	(0.760)	(1.029)	(0.794)	(1.297)	(1.056)	(1.140)
Δ(Agricultural Population)	-0.181**	-0.039	-0.286	-0.208	-0.117	-0.028
	(0.085)	(0.133)	(0.263)	(0.266)	(0.133)	(0.137)
Agricultural*Currant	1.933	0.889	4.241**	3.011	1.479	0.399
	(1.441)	(1.310)	(2.022)	(2.386)	(1.880)	(1.328)
R^2	0.010	0.147	0.038	0.179	0.014	0.153
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	No	No	No	No	No
Observations	120	120	120	120	120	120

Notes: The dependent variables are defined as the (log) change of the student ratio (All, Female and Male) between 1861 and 1870. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

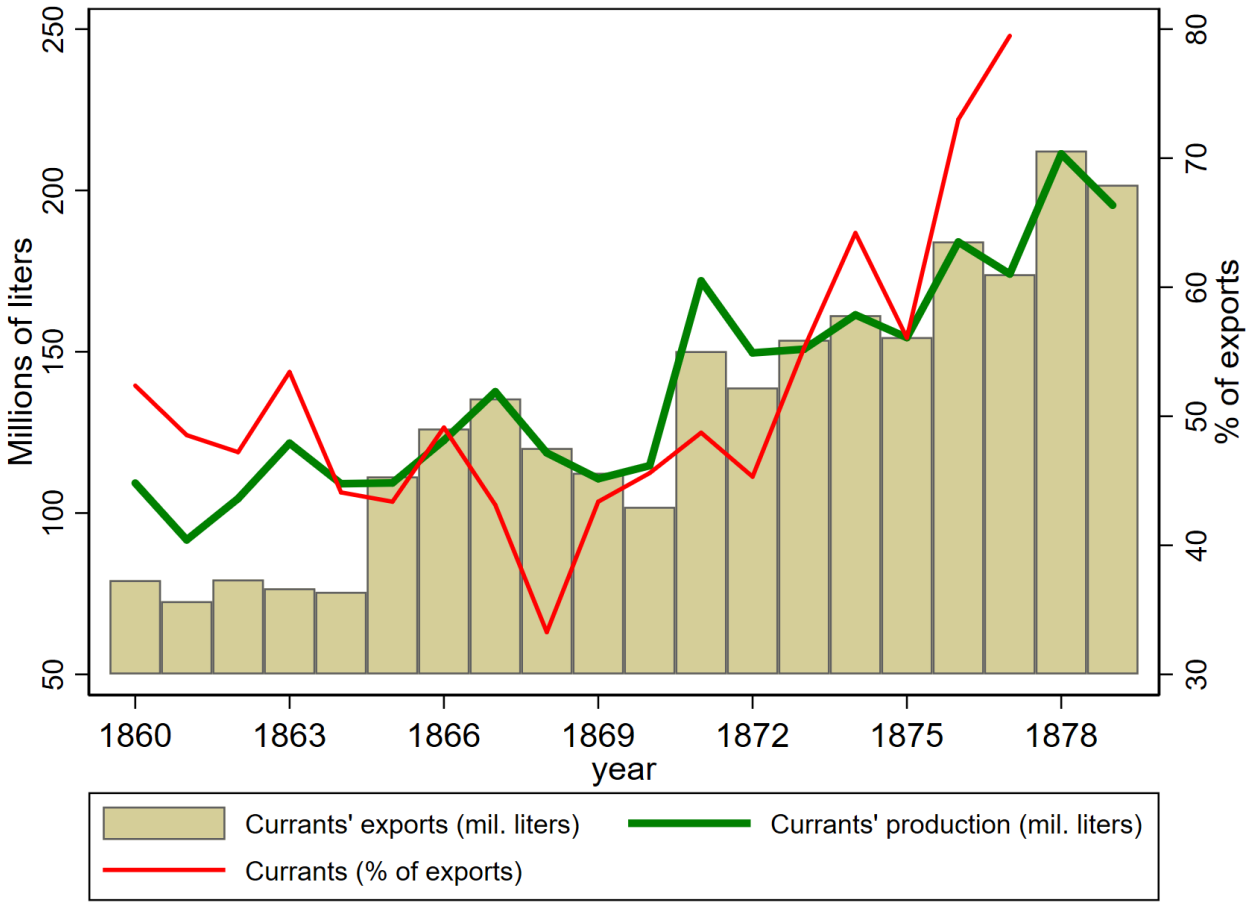
Table 8: *Effect of Currant and Agricultural Population on Education - Elevation*

	(1) Students (1861)	(2) Students (1861)	(3) Students (1870)	(4) Students (1870)
Elevation	0.001	-0.000	-0.003	0.002
	(0.002)	(0.006)	(0.002)	(0.005)
Agricultural Population	-0.050	-0.089	-0.039	0.136
	(0.037)	(0.158)	(0.047)	(0.140)
Agricultural*Elevation		0.007		-0.031
		(0.027)		(0.026)
R^2	0.496	0.496	0.634	0.640
Regional FE	Yes	Yes	Yes	Yes
Geographical	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	120	120	120	120

Notes: Elevation is measured as the natural logarithm of mean altitude in meters, calculated using World Climate data. The dependent variables are defined as the student ratio of 1861 and 1870. Columns (1) and (3) include all controls, while columns (2) and (4) include the interaction between Elevation and Agricultural Population. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1861 census in columns (1) and (2), and from 1870 census in columns (3) and (4). *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

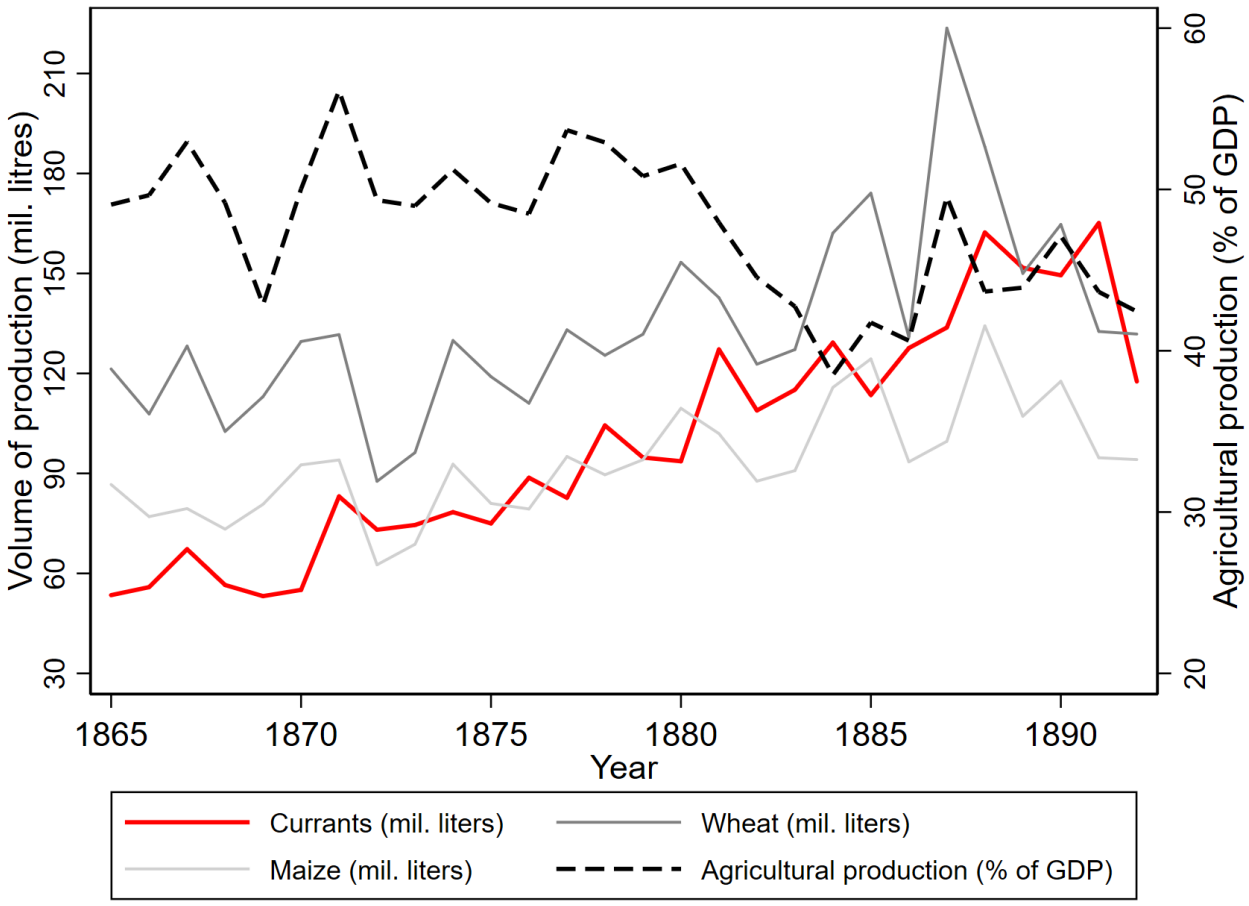
3.B Chapter 3 Figures

Figure 1: *Currant Production and Exports Over Time*



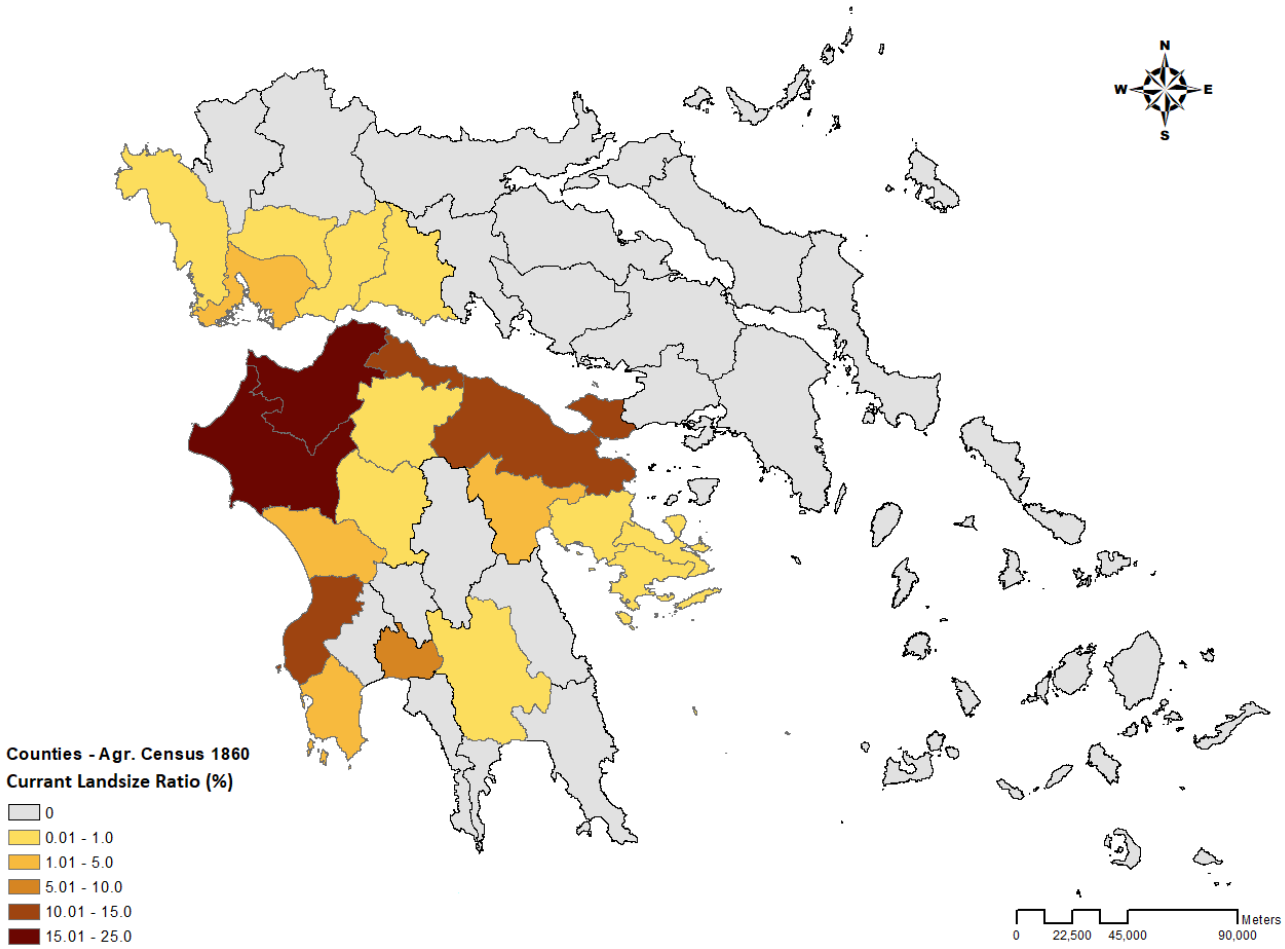
Notes: Graphical representation of the quatity of currant production exports over time, from 1860 until 1878. Data come from the work of Pizanias (1988).

Figure 2: *Agricultural Production Quantity - Over Time*



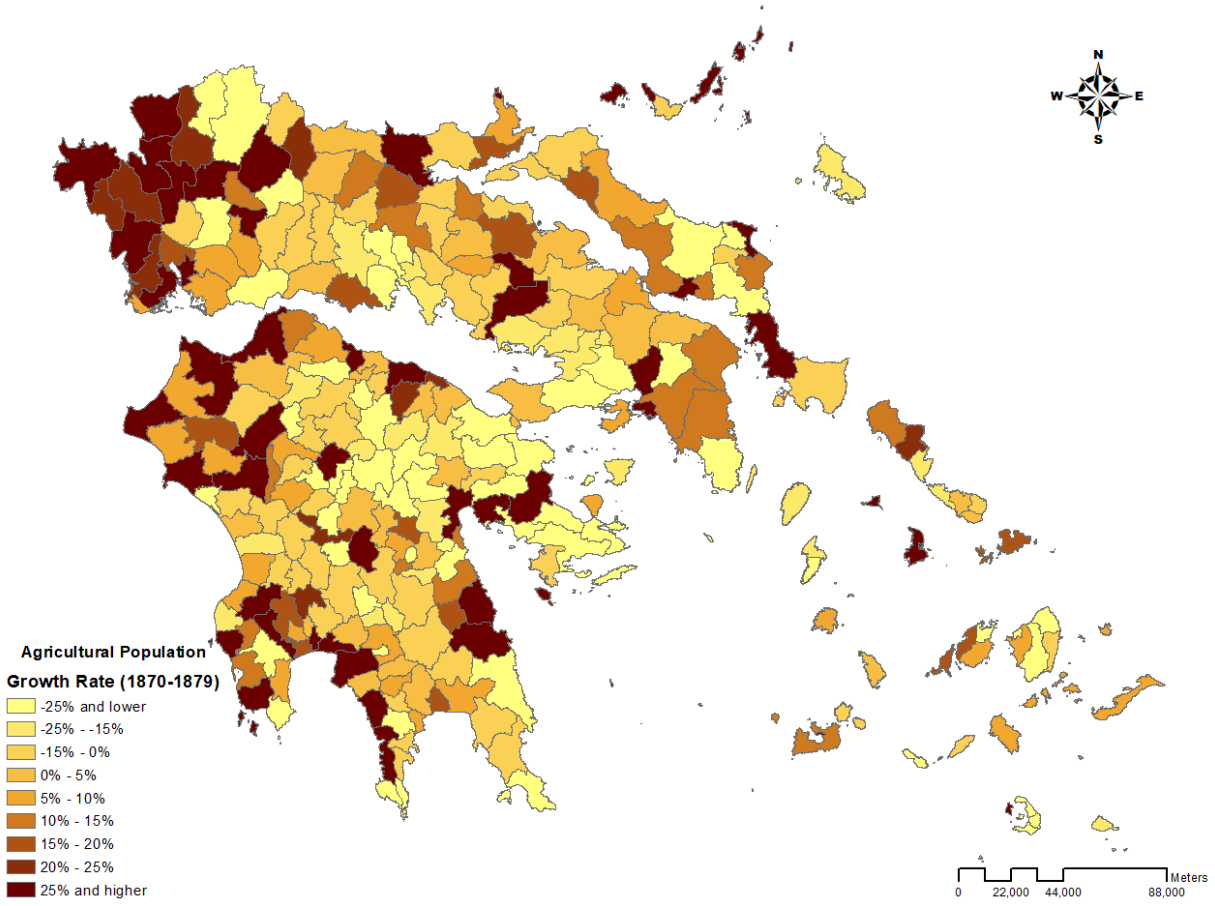
Graphical representation of the production of currants (red line), wheat (grey line), and maize (light grey line) over time, compared to the overall agricultural production in the country as a share of GDP (dashed black line), between 1865 and 1892. Data come from Kostelenos et al. (2007).

Figure 3: *Agricultural Census of 1860 - Currant Landsize*



Notes: Land used for currant agriculture, taken from the Agricultural Census (1860). Transformed as a share (%) of each county's (eparhia) land to the total land used for currant production in the country. Deeper shades of colour indicate higher shares. Original source is Petmezas (2003).

Figure 4: *Population Census of 1870 and 1879 - Agricultural Population*



Notes: Growth rate of the agricultural population between 1870 and 1879. Agricultural population is defined as the summary of landowners and farmers, taken from the population censuses of 1870 and 1879. Transformed as a growth rate (%) for each municipality. Deeper shades of brown indicate higher positive growth rates, while lighter shades indicate negative rates. Original source is ELSTAT (1870, 1879).

3.C Chapter 3 Additional information

Commercial network of currants

The commercial network of currants had specific characteristics, which affected the incentives of agricultural households. While the international demand for currant increased, the international price seemed to remain relatively constant, which may seem puzzling at first, however can be explained by the intricate routes through which the final good was exported to the international ports of London, Manchester and Marseille.

The highest level within the frontiers of Greece was constituted by domestic and foreign exporting houses, with offices in Patras, Aigion and Pirgos. The supply of fruits to the exporting houses was assured by smaller merchants established in the currant-producing villages to whom they provided cheap loans against promise of delivery of determined quantities of currants immediately after the harvest at an "open price" (i.e. at a price that would be determined according to the market forces at the time of the fruit's sale). Village merchants in turn were committing these funds to the direct cultivators (i.e. small peasants) against promise of delivery of determined quantities following a similar "open price" practice. Hence, both the exporting houses and the village merchants were buying in advance predetermined quantities from the domestic cultivators at an "open price" that would be determined later (i.e. September to December of each year) according to the demand and supply in the international market (see e.g. Hairetis, 1883; Franghiadis, 1990).

By applying "open prices", exporters and village merchants were insured against the risks from price fluctuations which fell entirely on the cultivators. More importantly, since the direct cultivators were unable to check the exact date their production was exported – therefore the real price paid by the foreign markets – exporters and village merchants were able to apply specific speculative practices that ensured them the maximum amount of profits.[31] These price manipulation practices – which become obvious if one analyzes

[31] A usual speculative practice was to exploit for themselves the high prices traditionally attributed to the first

the changes of currant prices from September to December in each year (see Hairetis, 1883; Franghiadis, 1990, fore more details on this) – can illuminate the stability of international price of currant during the whole period under investigation. This price stability is further corroborated by the price index provided from Dertilis (1993), where it is evident that currant prices only fluctuated around the mean (Figure 8). Thus, peasant families faced an unprecedented increase in demand and, in the abscence of significant price increase, were heavily incentivized to reduce investment in human capital formation of their children, and increase their labour supply instead. The abscence of specific laws against child labour, combined with the nature of the educational system of Greece at the time, allowed this to take place.

Data construction details

Population censuses from pre-1900 Greece were digitized, namely the censuses of 1861, 1870 and 1879, and can be found in the archives of the Hellenic Statistical Authority (ELSTAT, 1861, 1870, 1879). They contain information regarding various aspects of the Greek population such as professions (e.g. farmers, landowners, industrialists), as well as the number of buildings and teachers.[32] Most importantly, information about the number of male and female students is provided. Moreover, population movement censuses had to be digitized as well, coming from the same archives of ELSTAT (ELSTAT, 1870). They include the number of births for 1870, however instead of 1879, only data from a latter date are available (1884). For both sources, the level of aggregation is the municipality (demos), with many municipalities forming a county (eparhia), and many counties forming a province (nomos).

Two important aspects of these aggregations must be noted. Firstly, during the period

arrivals of fruits abroad (from August to September) and in turn (usually from November to December) to export second quality currants – or produce of previous years that were kept at warehouses – so as to devaluate the international price and therefore to reimburse the domestic growers at the lower prices of the end of the year.

[32] An example of the original data can be found in Figure 10.

of the first census (1861), Greece was notably smaller in size than today. The parts that form "old Greece" were the geographical regions called Peloponnesus and Sterea Ellada (alternatively known as Roúmeli at the time), along with the islands of Evia, Sporades and finally Cyclades. In 1864, the Ionian Islands (alternatively known as Eptanisa i.e. Seven Islands) became a part of "old Greece" as a gesture of support from Britain towards the newly enthroned King George I (Temperley, 1937). Even though they appear in both the 1870 and 1879 censuses, there is no information available regarding currant production, as well as being absent from the 1861 census, therefore the Ionian Islands were excluded from our sample. Secondly, during the years between 1861 and 1879 certain municipalities either changed name or were splitted/unified. In order to make them comparable, all the names were formalized following the census of 1861, and certain municipalities were merged accordingly to reflect the information provided for the municipalities of 1861. Overall, this resulted in a dataset aggregated in 10 provinces, divided in 48 counties, and finally 280 municipalities.

To create the geographical boundaries of these 280 municipalities, geodata files from the website of the Instutute of Informational Systems / Research Center "Athina" were used. Specifically, data on the boundaries of local authorities of the pre-Kapodistrian reform era (i.e. for 1990s Greece).[33] The modern communities and municipalities were individually matched by tracing them back in time using the online database of the Hellenic Society of Local Development and Local Government (EETAA)[34], to create the boundaries of the 280 municipalities, as they existed in 1861. The exact process is outlined in Table 11.

Another historical archive that had to be digitized was the agricultural census of 1860, and can be found from the work of Petmezas (2003). It contains information on agricultural aspects such as value, landsize and volume of production for various crops such as wheat, maize and currants, across "old Greece". Our main interest lies with currant production, and specifically with the amount of land used in currant agriculture prior to the shock (in

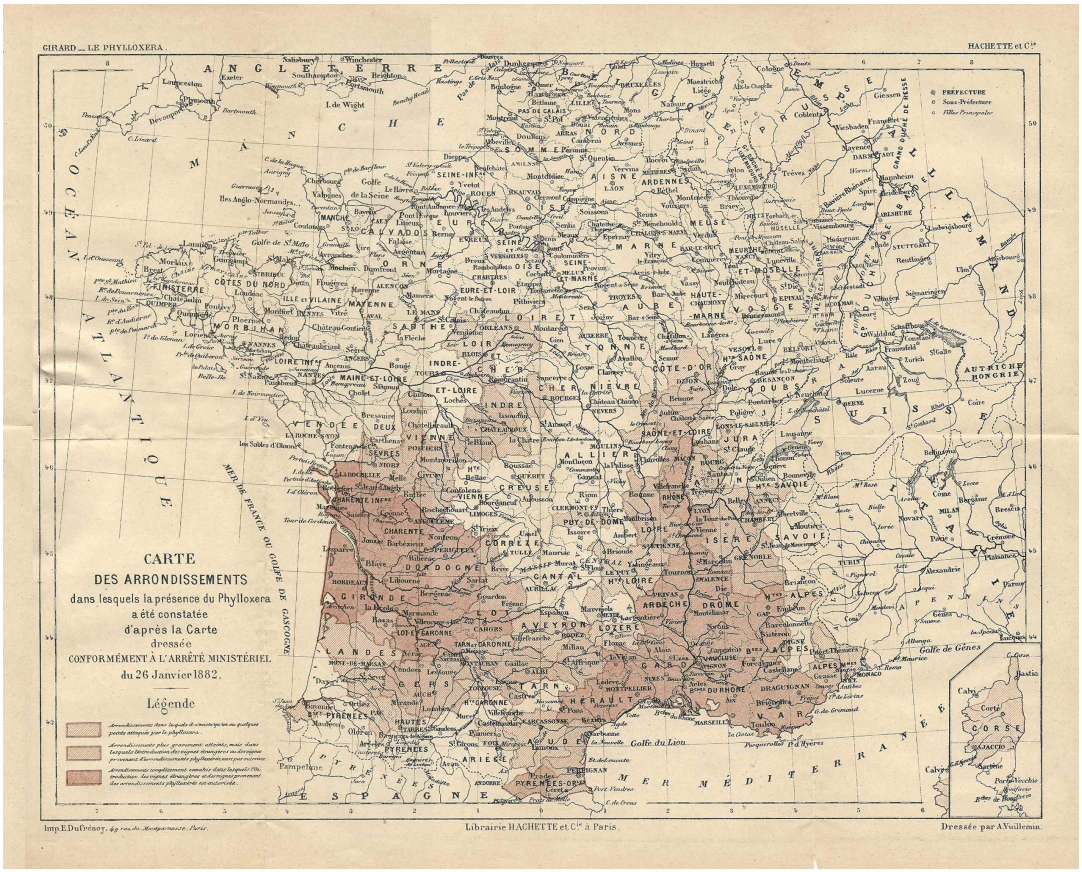
[33]Link for the Geodata.gov.gr data.

[34]An example is provided in Figure 8.

1860) as a proxy for the natural capacity of different areas within the Greek territory to respond to the shock. The data provided in the census has a different level of aggregation to the population censuses. While the latter provide data on the municipality (demos) level, the agricultural census only documents information about currant production in the county (eparhia) level. In order to make further analysis, each municipality was assigned the value of its county.

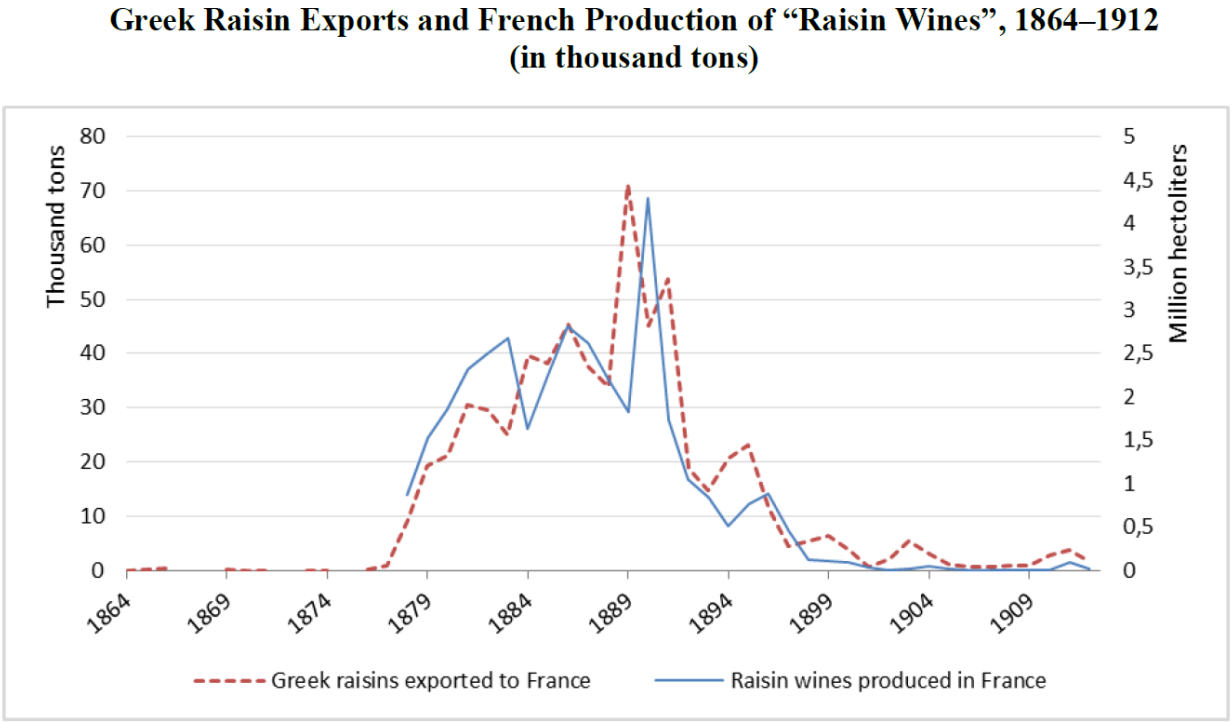
Additional Figures and Tables

Figure 5: *Map of Phylloxera in France - 1882*



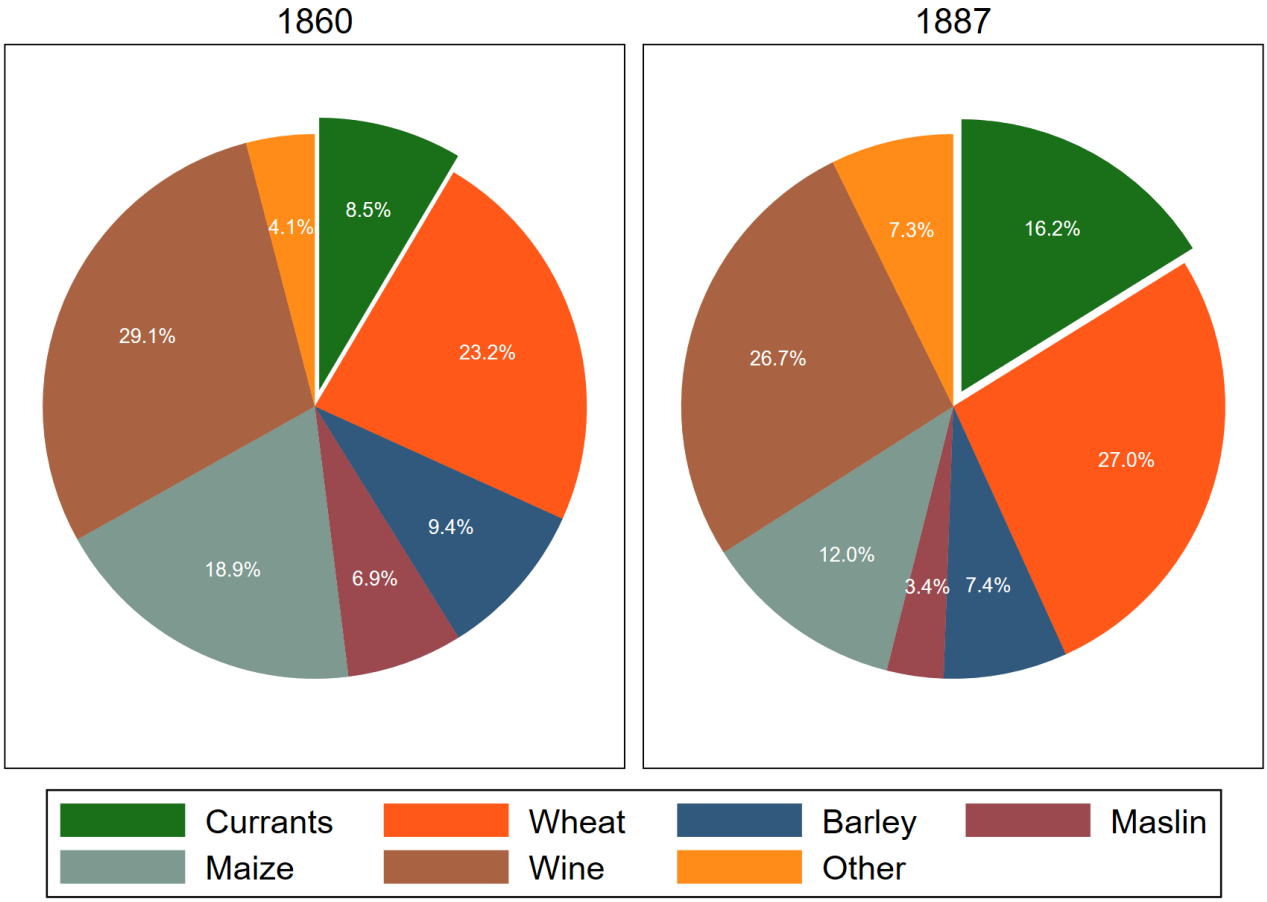
Notes: Map of Phylloxera plague across 1882 France. Carte au 26 Janvier 1882 de l'avancée du Phylloxéra en France. Source: (Girard, 1883)

Figure 6: *Greece and France - Exports and Production*



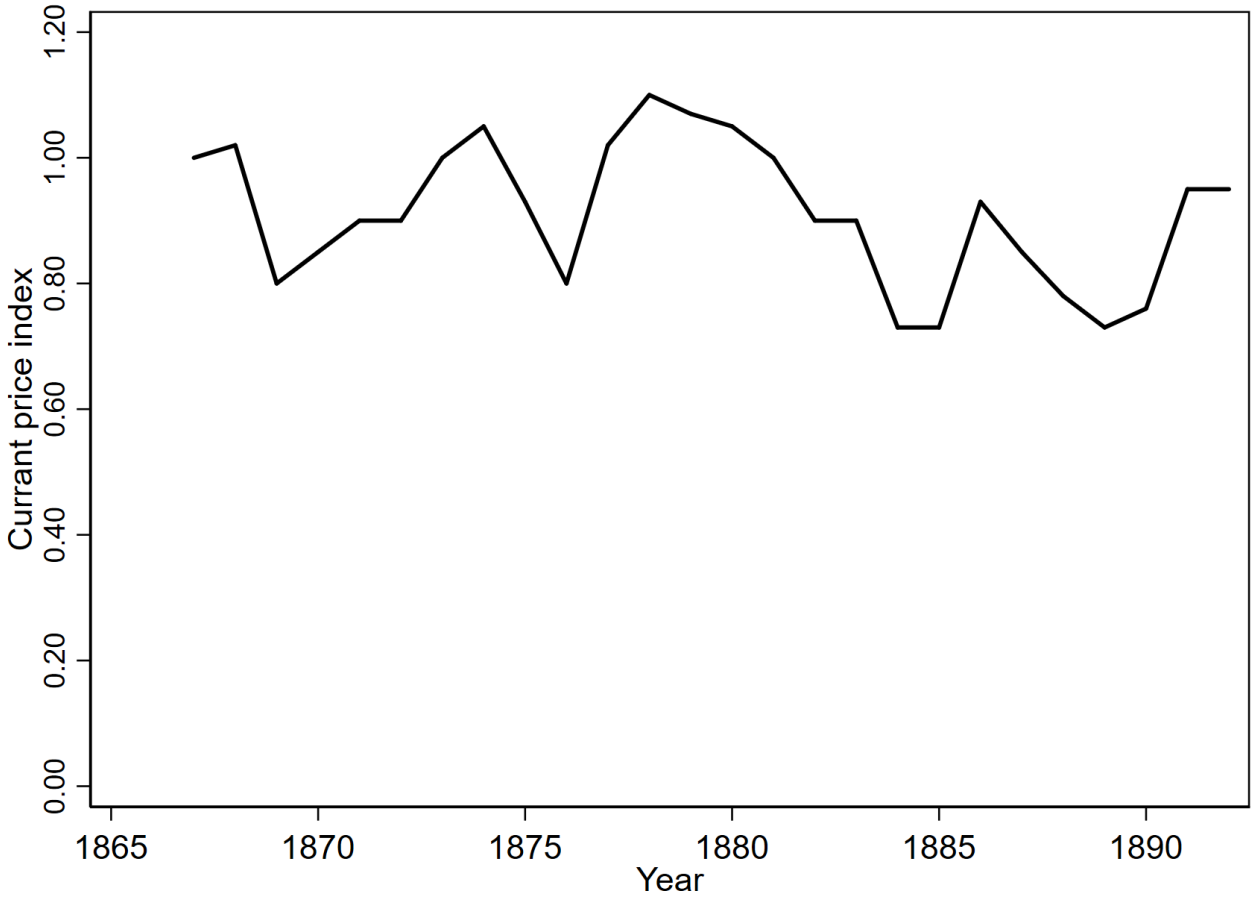
Notes: Graphical representation of Greek raisin exports towards France and French "raisin wines", over time. Source: Figure 11 from Meloni and Swinnen (2016) Original sources (Galet, 1964; Pizanias, 1988).

Figure 7: *Agricultural Production Quantity*



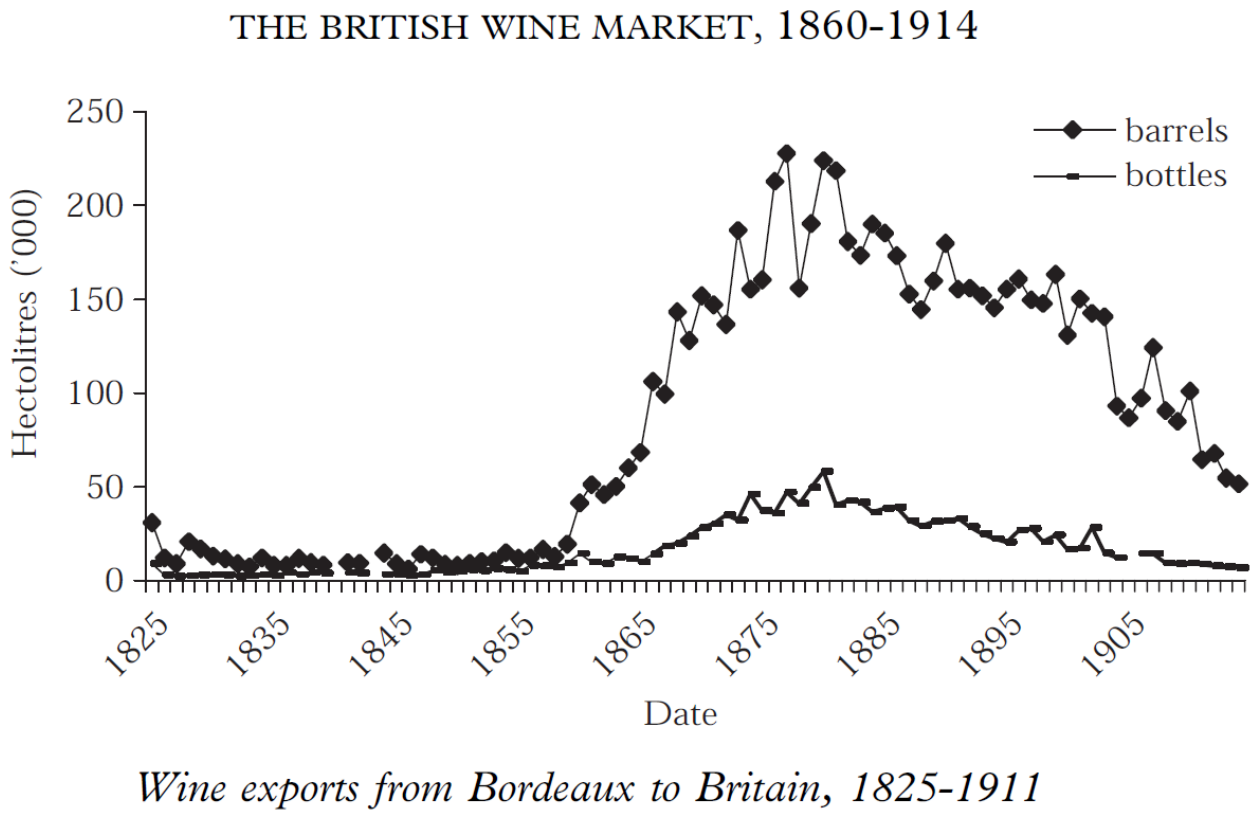
Graphical representation of percentages of agricultural production in 1860 and 1887. Category "Other" includes rye, oats, tobacco, cotton, and edible olives. Data come from Kostelenos et al. (2007).

Figure 8: *Currant Price Index - Over Time*



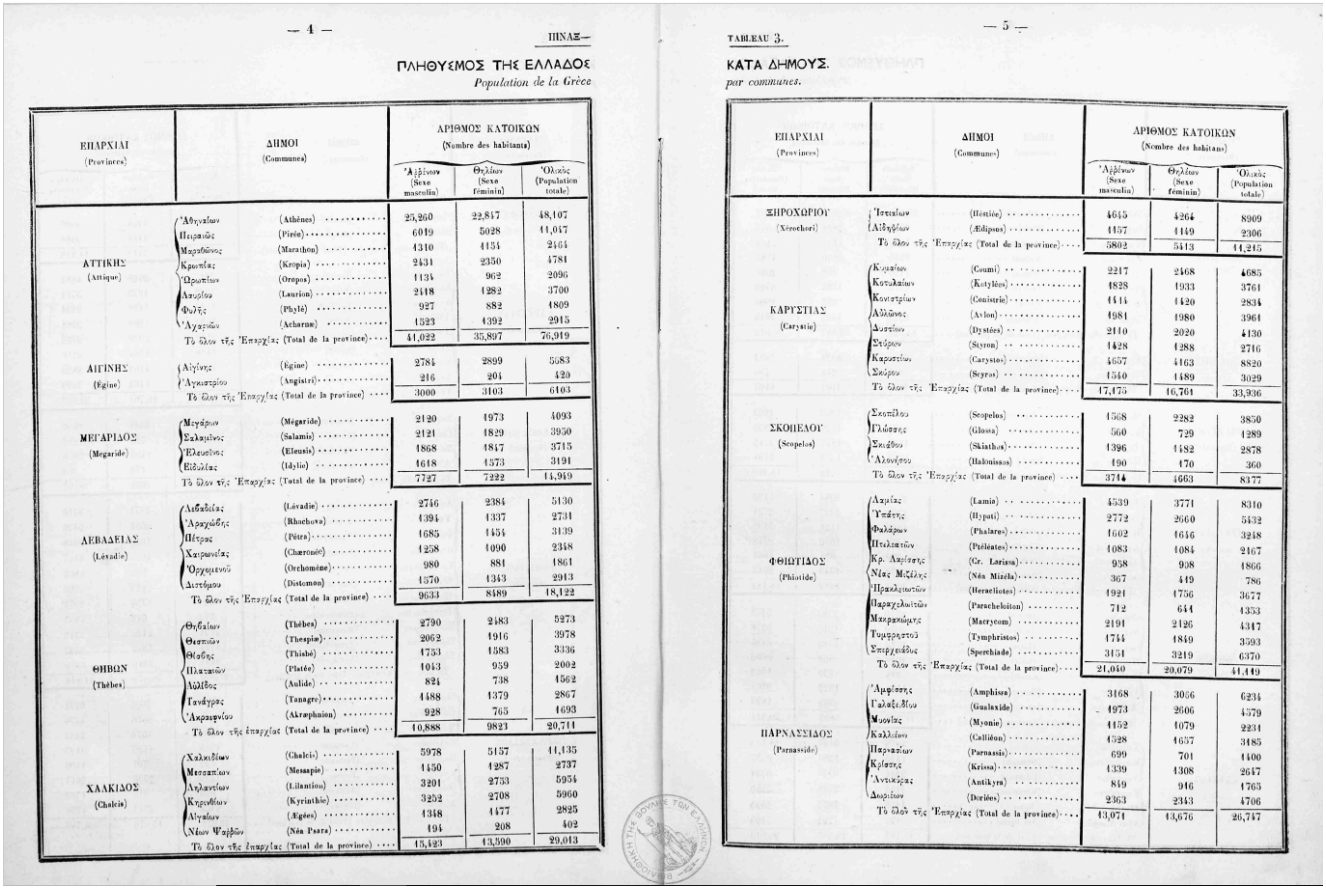
Notes: Graphical representation of the price index of currants over time, between 1867 and 1892. Data come from Dertilis (1993).

Figure 9: *British Imports of French Wine*



Notes: Historical data of wine exports from France to Britain during the 19th century. Source: Figure 3 from (Simpson, 2004).

Figure 10: *Population Census of Greece in 1870 - Example of Population*



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ΠΙΝΑΞ—

ΠΛΗΘΥΣΜΟΣ ΤΗΣ ΕΛΛΑΔΟΣ

Population de la Grèce

ΕΠΑΡΧΙΑΙ (Provinces)	ΔΗΜΟΙ (Communes)		ΑΡΙΘΜΟΣ ΚΑΤΟΙΚΩΝ (Nombre des habitants)		
			Ἀρρένων (Sexe masculin)	Θηλέων (Sexe féminin)	Ὅλων (Population totale)
ΑΤΤΙΚΗΣ (Attique)	Ἀθηναίων	(Athènes)	25,260	22,847	48,107
	Πειραιῶς	(Pirée)	6019	5028	11,047
	Μαραθῶνος	(Marathon)	1310	1154	2464
	Κρωπίας	(Kropia)	2431	2350	4781
	Ὠρωπίων	(Oropos)	1134	962	2096
	Λαυρίου	(Laurion)	2118	1282	3700
	Φυλῆς	(Phylé)	927	882	1809
	Ἀχαρνῶν	(Acharne)	1523	4392	2915
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		41,022	35,897	76,919
ΑΙΓΙΝΗΣ (Égine)	Αἰγίνης	(Égine)	2784	2899	5683
	Ἀγκιστρίου	(Angistri)	216	204	420
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		3000	3103	6103
ΜΕΓΑΡΙΔΟΣ (Mégaride)	Μεγάρων	(Mégaride)	2120	1973	4093
	Σαλαμῖνος	(Salamis)	2121	1829	3950
	Ἐλευσῖνος	(Eleusis)	1868	1847	3715
	Εἰδυλίας	(Idylie)	1618	1573	3191
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		7727	7222	14,949
ΛΕΒΑΔΕΙΑΣ (Lésadie)	Λεβαδείας	(Lévadie)	2746	2384	5130
	Ἀραχωβῆς	(Rhachova)	1394	1337	2731
	Πέτρας	(Pétra)	1685	1454	3139
	Χαιρωνείας	(Charonée)	1258	1090	2348
	Ὀρχομενοῦ	(Orchomène)	980	881	1861
	Διστόμου	(Distomon)	1570	1343	2913
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		9633	8489	18,122
ΘΗΒΩΝ (Thèbes)	Θηβῶν	(Thèbes)	2790	2483	5273
	Θεσπιῶν	(Thespie)	2062	1916	3978
	Θισβῆς	(Thisbé)	1753	1583	3336
	Πλαταιῶν	(Platée)	1043	959	2002
	Αὐλίδος	(Aulide)	824	738	1562
	Τανάγρας	(Tanagre)	1488	1379	2867
	Ἀκραιφνίου	(Akraphnion)	928	765	1693
	Τὸ ὅλον τῆς ἐπαρχίας (Total de la province)		10,888	9823	20,711
ΧΑΛΚΙΔΟΣ (Chalcis)	Χαλκιδέων	(Chalcis)	5978	5157	11,135
	Μεσαπίων	(Mesapie)	1450	1287	2737
	Ληλαντίων	(Lilantion)	3201	2733	5934
	Κυρινθίων	(Kyrinthie)	3252	2708	5960
	Αἰγαίων	(Égées)	1318	1477	2825
	Νέων Ψαρῶν	(Néa Psara)	194	208	402
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		15,423	13,590	29,013

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TABLEAU 3.

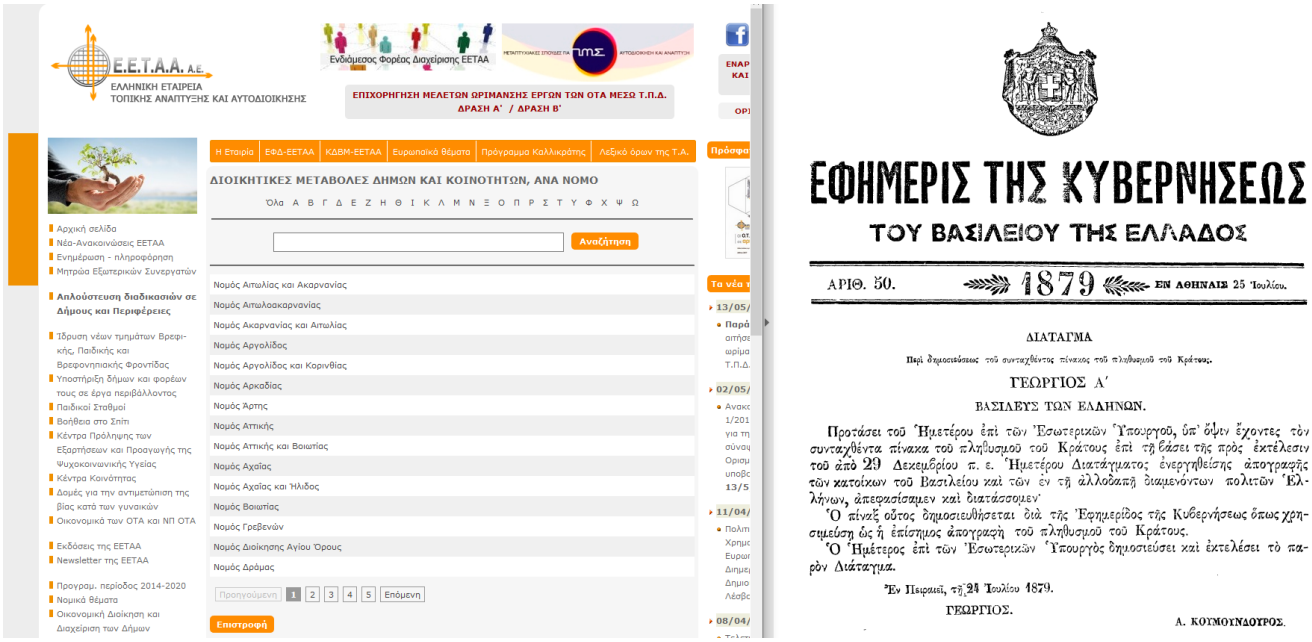
ΚΑΤΑ ΔΗΜΟΥΣ.

par communes.

ΕΠΑΡΧΙΑΙ (Provinces)	ΔΗΜΟΙ (Communes)		ΑΡΙΘΜΟΣ ΚΑΤΟΙΚΩΝ (Nombre des habitans)		
			Ἀρρένων (Sexe masculin)	Θηλέων (Sexe féminin)	Ὅλων (Population totale)
ΞΗΡΟΧΩΡΙΟΥ (Xérochori)	Ἰστιαίων	(Histiée)	4615	4264	8909
	Αἰδηψίων	(Édipsos)	1187	1149	2306
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		5802	5413	11,215
ΚΑΡΥΣΤΙΑΣ (Carystie)	Κουμῶν	(Coumi)	2217	2168	4685
	Κοτυλέων	(Kotylées)	1828	1933	3761
	Κονιστρίων	(Conistrie)	1414	1420	2834
	Ἀυλῶνος	(Avlon)	1981	1980	3961
	Δυστίων	(Dystées)	2110	2020	4130
	Στύρων	(Styron)	1428	1288	2716
	Καρυστίων	(Carystos)	1657	1163	2820
	Σκύρου	(Scyros)	1540	1489	3029
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		17,175	16,761	33,936
ΣΚΟΠΕΛΟΥ (Scopelos)	Σκοπέλου	(Scopelos)	1568	2282	3850
	Γλώσσης	(Glossa)	560	729	1289
	Σκιάθου	(Skiathos)	1396	1482	2878
	Ἀλονήσου	(Halonissos)	190	170	360
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		3714	4663	8377
ΦΘΙΩΤΙΔΟΣ (Phiotide)	Ἀχαΐας	(Lamia)	4539	3771	8310
	Ὑπάτης	(Hypati)	2772	2660	5432
	Φαλάρων	(Phalares)	1602	1646	3248
	Πτελεατῶν	(Ptéléates)	1083	1084	2167
	Κρ. Λαρίσσης	(Cr. Larissa)	958	908	1866
	Νέας Μιζέλης	(Néa Mizéla)	367	419	786
	Ἡρακλειωτῶν	(Heracliotes)	1921	1756	3677
	Παραχελοϊτῶν	(Paracheloïtes)	712	644	1353
	Μακρακώμης	(Matrycom)	2191	2126	4317
	Τυμφρηστοῦ	(Tymphristos)	1744	1849	3593
	Σπερχειάδος	(Sperchiade)	3151	3219	6370
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		21,040	20,079	41,119
ΠΑΡΝΑΣΣΙΔΟΣ (Parnasside)	Ἀμφίσσης	(Amphisa)	3168	3066	6234
	Γαλαξειδίου	(Gualaxide)	1973	2606	4579
	Μυονίας	(Myonie)	1152	1079	2231
	Καλλιέων	(Calliéon)	1528	1657	3185
	Παρνασσίων	(Parnassis)	699	701	1400
	Κρίσσης	(Krissa)	1339	1308	2647
	Ἀντικύρας	(Antikyra)	849	916	1765
	Δωριέων	(Doriées)	2363	2343	4706
	Τὸ ὅλον τῆς Ἐπαρχίας (Total de la province)		13,071	13,676	26,747

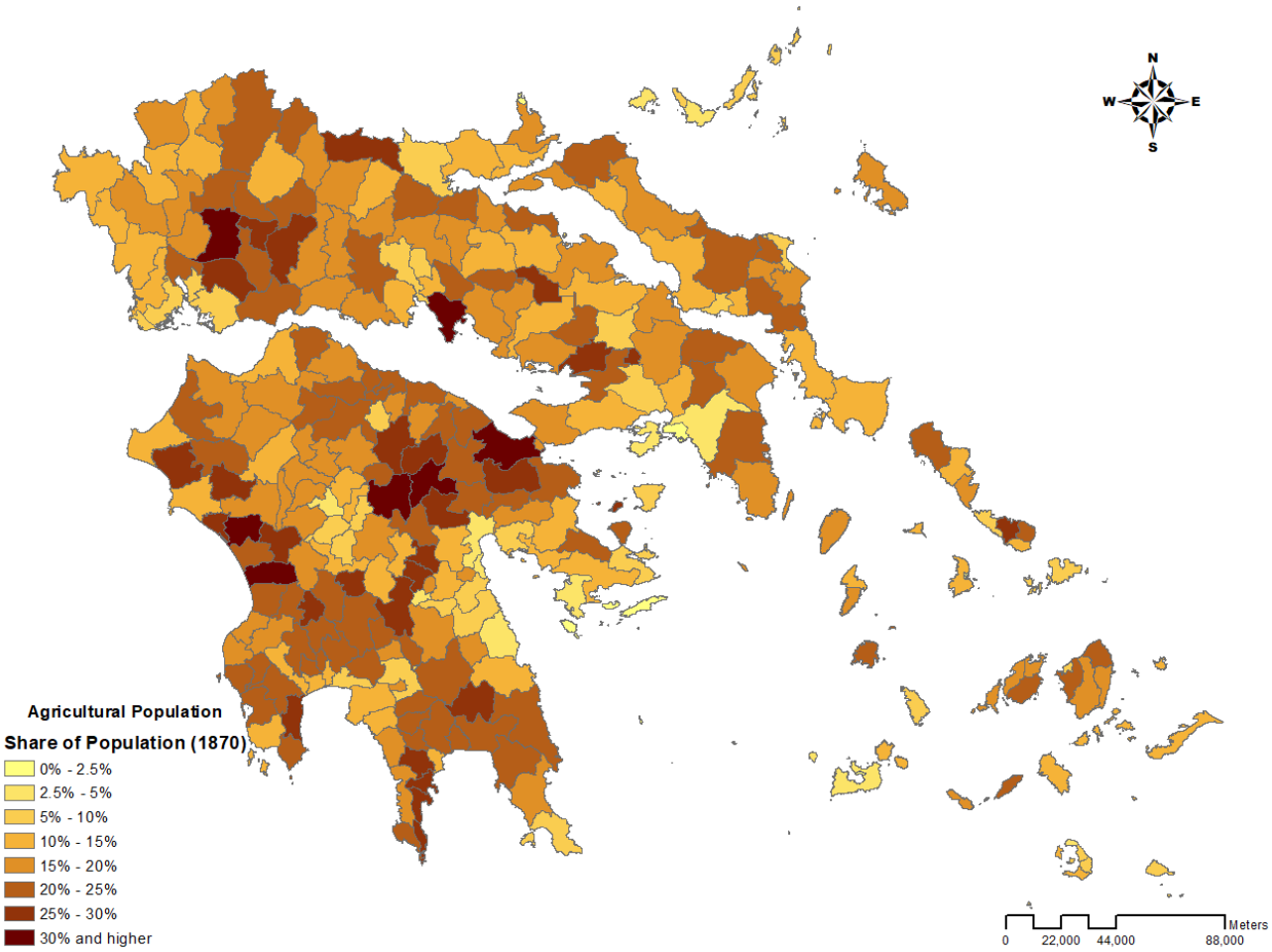
Notes: Example of historical data from the 1870 population census. The level of aggregation is municipality (demos). Source: ELSTAT (1870)

Figure 11: *Matching Municipalities over time*



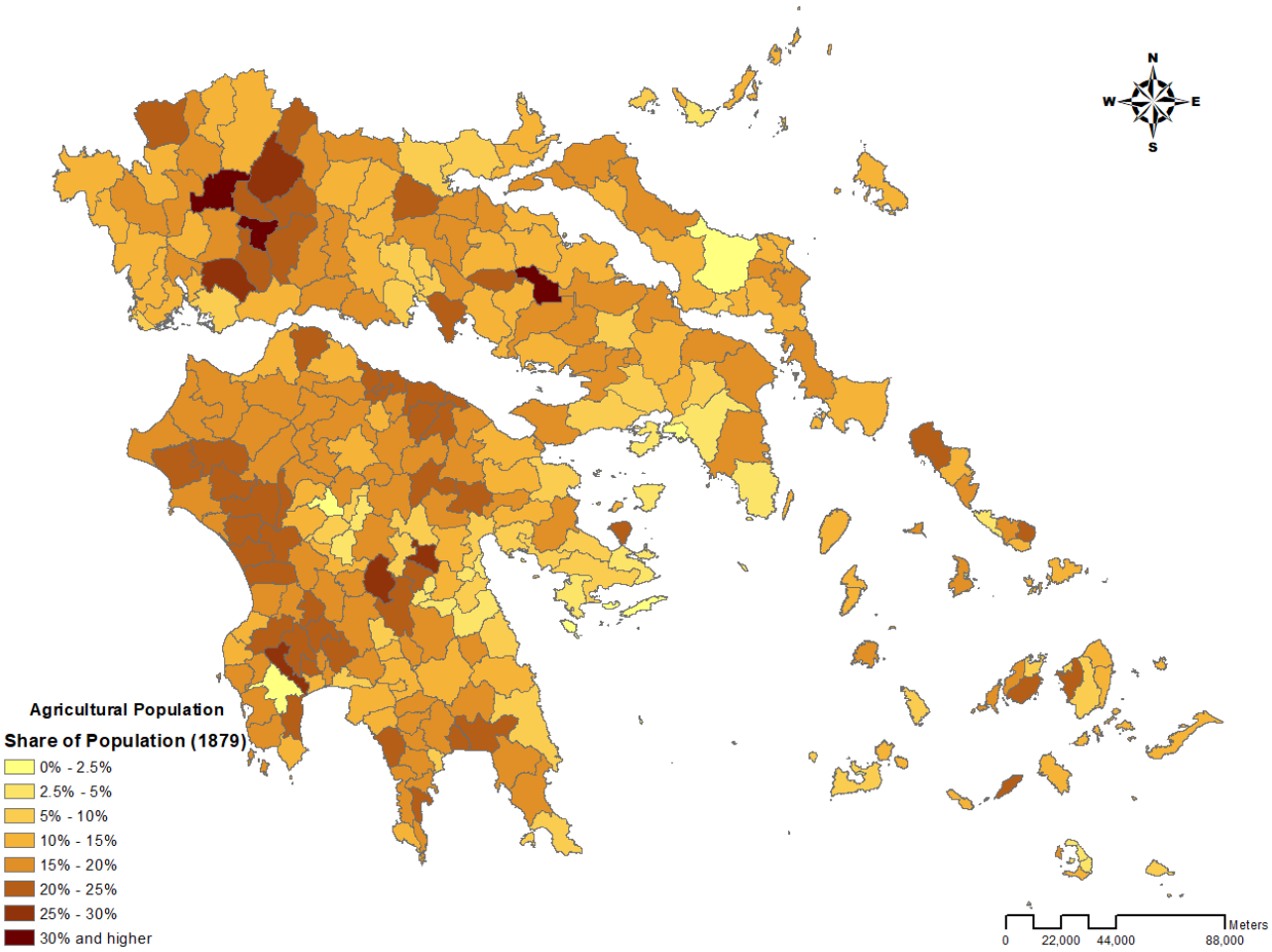
Notes: Tools used to trace and match communities and municipalities back in time to create boundaries for 1861. The website of the online database of the Hellenic Society for Local Development and Local Government (EETAA) is on the left, and an example of a royal decree is shown on the right. Link for website: eetaa.gr.

Figure 12: *Census 1870 - Agricultural Population*



Notes: Summary of Landowners and Farmers, taken from the Population Census of 1870. Transformed as a share (%) of the population. Deeper shades of brown indicate higher shares. Original source is ELSTAT (1870).

Figure 13: *Population Census of 1879 - Agricultural Population*



Notes: Summary of Landowners and Farmers, taken from the Population Census of 1879. Transformed as a share (%) of the population for each municipality. Deeper shades of brown indicate higher shares. Original source is ELSTAT (1879).

Table 9: *Tasks of currant cultivation: Days of labour required per stremma*

	Task	**Period**	**Maximum duration**	**Male Labour**	**Female Labour**	**Total**
1	round-digging (once every 4 years)	October		1-1.5	–	1-1.5
2	manuring (ditto)	October		–	0.5	0.5
3	cleaning and pruning	January	15 days	1.3	–	1.3
4	propping up the stock	February		0.3-0.5	0.5	0.8-1
5	hoeing	March			3.5	3.5
6	harrowing	April			1-1.5	1-1.5
7	sulphuring	May		0.3-1		0.3-1
8	ring-cutting	May	7-12 days	0.77		0.77
9	lopping tops etc	June and July			1.7	1.7
10	harvesting	August	7 days	1.5	2	3.5
11	drying etc.	August	7-10 days	1.5		1.5
12	Total (rounded)			10-12	5	15-17

Notes: One stremma equals to 0.247 acres. Data Source: (Franghiadis, 1990)

Table 10: *Definition and sources of variables*

All / Male / Female Students	Number of total / male / female students as a share of municipal population, for each census year (1861, 1870 and 1879).
Birth Rate	Number of total births as a share of municipal population, for each population movement census year (1870 and 1884).
Agricultural Population	Number of farmers and landowners as a share of municipal population, for each census year (1861, 1870 and 1879). For the alternative measurement in robustness checks, the number of shepherds is used.
Teachers	Number of teachers as a share of municipal population, for each census year (1861, 1870 and 1879).
Industrialists	Number of industrialists as a share of municipal population, for each census year (1861, 1870 and 1879).
Buildings	Number of total buildings in each municipality, as a share of municipal population, for each census year (1861, 1870 and 1879).
Population	Total number of municipal population, for each census year (1861, 1870 and 1879).
Population Density	Number of people per square kilometre in every municipality. Calculated using Geodata files available from Geodata.gov.gr.
Currant Landsize	Amount of arable land used for currant agriculture in each county, as a share of land used for currant agriculture in the country. Originally measured in *stremmata*, with one unit (stremma) equal to 1,000 square meters.
Wheat Landsize	Amount of arable land used for wheat agriculture in each county, as a share of land used for wheat agriculture in the country. Originally measured in *stremmata*, with one unit (stremma) equal to 1,000 square meters.
Maize Landsize	Amount of arable land used for maize agriculture in each county, as a share of land used for maize agriculture in the country. Originally measured in *stremmata*, with one unit (stremma) equal to 1,000 square meters.
Currant Landsize Per Capita	Amount of arable land used in currant agriculture in each county, per capita. Originally measured in *stremmata*, with one unit (stremma) equal to 1,000 square meters.
Distance from Capital	Natural logarithm of distance between a municipality and the capital of its region. Originally measured in meters, calculated using Geodata files available from Geodata.gov.gr.
Elevation	Natural logarithm of mean altitude of each municipality. Originally measured in meters, calculated using data from WorldClim, as provided by (Fick and Hijmans, 2017).

Notes: The source of the 1861, 1870 and 1879 censuses is the digital archive of ELSTAT (1861, 1870, 1879). Source of agricultural census of 1860 is Petmezas (2003).

Table 11: *Creation of Boundaries for Municipalities of 1861*

	The process for creating the boundaries of the municipalities and counties in 1861 can be outlined as follows:
1.	Main shape file used is provided by the Geodata.gov.gr website, and specifically the one with the boundaries of the Local Authorities (LAs) (pre-Kapodistrian) (link: Geodata.gov.gr)
2.	The file contains the administrative boundaries for 1990s Greece, before the so-call Kapodistrian administrative reform of 1997, for local communities and municipalities.
3.	Using ArcGIS, only the relevant communities and municipalities of "Old Greece" were kept (3339 communities and/or municipalities), in order to begin the matching process.
4.	Using the online database of the Hellenic Society of Local Development and Local Government (EETAA, link: eetaa.gr), each of the modern day name of a community and/or municipality was matched with the earliest (chronologically) mention of the municipality of 1861 available.
5.	After a community/municipality was identified as the by-product of the changes (name or administrative unit) that occurred between 1861 and 1997, the value of the municipality (as found in the 1861 census), was assigned to it. Afterwards, the counties and regions that each municipality belonged to, were assigned as well.
6.	The process was repeated for each of the communities/municipalities that belonged to "Old Greece".
7.	After the matching was complete, the boundaries of the communities/municipalities of 1997 were dissolved in the new boundaries of the municipalities of 1861. Similarly, the same process was used to create the boundaries of the counties and regions of 1861.

Table 12: *Descriptive Statistics for Municipalities*

	Currant Regions				All Regions			
	mean	sd	min	max	mean	sd	min	max
All Students	0.05	0.02	0.00	0.12	0.05	0.03	0.00	0.21
Male Students	0.04	0.02	0.00	0.09	0.04	0.02	0.00	0.12
Female Students	0.01	0.01	0.00	0.03	0.01	0.01	0.00	0.09
Currant Landsize	0.07	0.08	0.00	0.21	0.03	0.06	0.00	0.21
Currant Landsize (Per Capita)	1.68	2.34	0.00	13.41	0.76	1.78	0.00	13.41
Wheat Landsize	0.03	0.01	0.01	0.06	0.03	0.02	0.00	0.07
Maize Landsize	0.04	0.02	0.00	0.08	0.03	0.03	0.00	0.08
Agricultural Population	0.16	0.06	0.00	0.31	0.15	0.07	0.00	0.31
Shepherd Population	0.04	0.03	0.00	0.15	0.03	0.03	0.00	0.16
Population Density	45.56	41.67	3.82	293.87	137.51	672.98	2.93	5349.30
Industrialists	0.02	0.02	0.00	0.13	0.03	0.03	0.00	0.13
Buildings	0.21	0.04	0.12	0.56	0.21	0.05	0.06	0.56
Teachers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Islands	0.06	0.24	0.00	1.00	0.14	0.34	0.00	1.00
Distance from Capital	7.29	4.30	0.00	11.12	7.15	4.53	0.00	11.80
Elevation	5.85	0.93	3.15	7.25	5.78	0.88	3.15	7.25
N	120				280			

Notes: The table reports the number of observations, mean, standard deviation, minimum and maximum values of the regression variables. Analytical defitions for all variables are provided in Section 4.3, and Table 10 in the appendix.

Table 13: *Effect of Currant and Agricultural Population on Education - Interactions*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	-0.057	0.861	-3.981*	-1.382	0.295	1.114
	(1.085)	(1.266)	(1.937)	(1.352)	(1.154)	(1.396)
Δ(Agricultural Population)	1.008***	0.958***	0.235	0.191	0.975***	0.934***
	(0.192)	(0.206)	(0.179)	(0.186)	(0.205)	(0.222)
Agricultural*Currant	-4.972***	-4.332***	2.288	0.677	-4.913***	-4.206***
	(1.112)	(1.163)	(5.418)	(4.895)	(1.297)	(1.339)
R^2	0.400	0.447	0.257	0.330	0.386	0.437
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Levels	Yes	Yes	Yes	Yes	Yes	Yes
LagDependent	Yes	Yes	Yes	Yes	Yes	Yes
Observations	120	120	120	120	120	120

Notes: In each specification, the currant landsize variable is interacted with all the controls that are differenced (i.e. population density, buildings, industrialists,teachers). Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 14: *Effect of Currant and Agricultural Population on Education - Placebo (Maize)*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Maize Landsize	0.008	6.532	0.940	-5.099	0.509	6.909
	(3.091)	(5.037)	(4.225)	(3.394)	(3.150)	(4.869)
Δ(Agricultural Population)	0.508	0.790**	0.061	-0.038	0.450	0.749**
	(0.382)	(0.319)	(0.369)	(0.193)	(0.416)	(0.332)
Agricultural*Maize	3.644	0.094	7.106	3.624	4.784	1.049
	(10.431)	(7.985)	(11.503)	(10.037)	(11.150)	(7.869)
R^2	0.168	0.374	0.016	0.283	0.156	0.369
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: The alternative crop used is maize landsize at the county (eparhia) level, transformed into the percentage of land used for maize as a share (%) of the total country production. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 15: *Effect of Currant and Agricultural Population on Education - Dropping Biggest and Smallest Counties*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	0.301	1.189	-1.522	0.073	0.290	0.932
	(1.510)	(1.367)	(1.759)	(1.098)	(1.568)	(1.356)
Δ(Agricultural Population)	0.891***	1.030***	0.058	0.007	0.888**	1.028***
	(0.296)	(0.187)	(0.242)	(0.205)	(0.334)	(0.201)
Agricultural*Currant	-5.767*	-4.417*	10.151*	10.284***	-6.557*	-5.369**
	(3.030)	(2.113)	(5.074)	(2.301)	(3.425)	(2.266)
R^2	0.243	0.457	0.068	0.290	0.235	0.458
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	98	98	98	98	98	98

Notes: The biggest and smallest two currant production counties are excluded (equal to 22 municipalities). Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 16: *Effect of Currant and Agricultural Population on Education - Windsoring Outliers*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	-0.254	1.064*	-0.262	-0.818	-0.261	1.192**
	(0.417)	(0.565)	(0.661)	(1.210)	(0.444)	(0.552)
Δ(Agricultural Population)	0.463***	0.434***	0.323	0.172	0.448**	0.421***
	(0.142)	(0.096)	(0.197)	(0.164)	(0.175)	(0.101)
Agricultural*Currant	-3.015***	-2.259***	-1.820	-0.761	-3.104**	-2.162***
	(0.935)	(0.701)	(3.128)	(3.773)	(1.186)	(0.708)
R^2	0.116	0.366	0.017	0.287	0.107	0.364
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: The Table shows estimates of the dependent variables (All, Female, Male Students) being winsorized at the 90% percentile. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 17: *Effect of Currant and Agricultural Population on Education - Alternative Currant Measure (Per Capita)*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize (Per Capita)	-0.002	0.019	-0.005	-0.006	-0.003	0.019
	(0.025)	(0.028)	(0.026)	(0.022)	(0.026)	(0.028)
Δ(Agricultural Population)	0.864***	0.980***	0.258	0.148	0.851**	0.970***
	(0.276)	(0.219)	(0.199)	(0.154)	(0.304)	(0.229)
Agricultural*Currant	-0.201**	-0.181*	0.017	-0.029	-0.209**	-0.182**
	(0.081)	(0.087)	(0.153)	(0.117)	(0.081)	(0.082)
R^2	0.234	0.423	0.013	0.279	0.224	0.417
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: Currant landsize at the county (eparhia) level is transformed into the per capita currant landsize. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. All regressions are weighted using the population from the 1870 census. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 18: *Effect of Currant and Agricultural Population on Education - No Weights*

	(1) All Students	(2) All Students	(3) Female	(4) Female	(5) Male	(6) Male
Currant Landsize	0.308	1.402*	-0.695	-1.479	0.318	1.491*
	(0.687)	(0.727)	(0.891)	(1.572)	(0.701)	(0.713)
Δ(Agricultural Population)	0.823***	0.900***	0.169	0.149	0.817***	0.888***
	(0.253)	(0.230)	(0.287)	(0.199)	(0.262)	(0.239)
Agricultural*Currant	-6.126***	-5.383***	1.525	0.497	-6.421***	-5.472***
	(1.459)	(1.526)	(5.369)	(4.971)	(1.539)	(1.466)
R^2	0.165	0.334	0.011	0.249	0.163	0.331
Regional FE	No	Yes	No	Yes	No	Yes
Geographical	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes
Levels	No	Yes	No	Yes	No	Yes
LagDependent	No	Yes	No	Yes	No	Yes
Observations	120	120	120	120	120	120

Notes: All regressions are not weighted for population. Columns (1)-(6) follow the structure of columns (1)-(6) of Table 4. Robust standard errors, clustered by county are reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Chapter 4

Land distribution and economic development in a pre-industrial economy

The final empirical chapter is motivated by a historical event of changes in land relations between the late 19th and early 20th century, in a region of the same pre-industrial economy as the previous chapter, namely Greece. After the annexation of the region of Thessaly in Greece, rights of cultivators based on Ottoman customary law were not recognized. The new institutional framework thus had a significant impact on land relations. Using this event, the chapter explores how changes in ownership affected regional development in the period following the annexation.

4.1 Introduction

The relationship between land distribution and economic performance is at the core of a large literature investigating the potential impact of historical inequality on institutions and long run economic development (see e.g., Moore, 1966; Sokoloff and Engerman, 2000). This concentration of land in the hands of a few large landowners may cause underdevelopment

through various channels. For instance, land concentration can block investment in public goods (see e.g., Banerjee and Iyer, 2005), undermine rural labour markets (Rueschemeyer et al., 1992) or – by restricting access to credit for small landowners – lead to underinvestment and consequently lower levels of agricultural productivity (see e.g., Rajan and Ramcharan, 2011).

Inequality in the distribution of land ownership has been similarly highlighted as a serious hurdle for human capital formation. Starting from Galor et al. (2009) there is a growing empirical literature that builds upon historical data and investigates the role of land elites on the expansion of education, shaping the subsequent divergence between agricultural and industrialized economies. Due to the low degree of complementarity between land and human capital, landowners did not expect to benefit from investments in human capital.[1] Empirical studies document this negative relationship between land ownership inequality and school financing in the US during the second half of 19th and the early 20th century (see Galor et al., 2009; Ramcharan, 2010; Go and Lindert, 2010; Vollrath, 2013).[2] Similarly, Cinnirella and Hornung (2016) suggest that large landownership concentration had a detrimental influence on the expansion of mass education in 19th century Prussia, while Goñi (2021) provides robust empirical evidence of this adverse relationship in England during the late 19th century.[3]

[1] The underlying assumption of this analysis is that there is a growing industrial sector in the cities and therefore entrenched landed elites compete with the rising industrialist elite for the labour force (see Galor et al., 2009, for more details on this).

[2] Along the same lines, a number of empirical studies confirm the above-mentioned adverse relationship by employing data from a large set of countries over long time periods (see e.g., Kourtellos et al., 2013; Baten and Juif, 2014; Baten and Hippe, 2018)

[3] It must be noted that the rich dataset of Goñi (2021) allows him to investigate many alternative hypotheses and to disentangle the so-called "supply mechanism" (i.e., the effect of landownership inequality on the provision of mass education) from the so-called "demand mechanism" (i.e., effect of landownership inequality on the demand of the peasants for education). This appears to be a contribution of major importance that was not thoroughly examined by the previous studies.

Hence, the relevant empirical literature appears to be conclusive about the harmful effect of land ownership inequality on human capital formation and economic development for countries that are industrialized – or at the edge of industrialization – during the period under investigation (i.e. England, US, Prussia). Indeed, a growing industrial sector existed in these countries and consequently a rising capitalist elite, so the theoretical argument of Galor et al. (2009) about the competition between landowners and industrialists fully applies.[4]

Nevertheless, empirical research seems to be rather inconclusive in the case of historical pre-industrial countries (see e.g., Beltrán Tapia and Martinez-Galarraga, 2018; Andersson and Berger, 2019). Crucially, in the absence of an emerging industrialist elite, landowners may have entirely different economic incentives and may support different policies, indirectly fostering development. For instance, Andersson and Berger (2019) suggest that landed elites advanced mass education in Sweden during the late 19th century, as part of their historical role as patrons of the local communities and as a response to the increasing proletarianization of the rural population. At the same time, Cinnirella and Hornung (2016) suggest that even in Prussia, where the adverse relationship between landownership concentration and human capital formation is well-established empirically, the enrollement rates increased more intensively in regions characterized initially by stronger concentration of land after the abolition of serfdom.

This empirical finding can been explained by a different theoretical rationale. Once free (i.e., after the abolition of serfdom), peasants that previously worked in large estates increased their demand for education, since investment in human capital improved their outside options as well as their potential migration opportunities. The so-called "emancipation hypothesis" has not received much attention by the relevant literature until recently (see e.g., Ashraf et al., 2020) although it highlights an important finding. It suggests that the

[4] This competition is usually described in the relevant literature as "intra-elite competition" (see e.g. Lizzeri and Persico, 2004; Ansell and Samuels, 2014; Beramendi et al., 2019, for more details on this).

relationship between landownership concentration and human capital is not straightforward but, in contrast, *conditional* on the existence of coercive labour institutions, therefore one should consider the relations of production when investigating the impact of land distribution on education (see e.g., Cinnirella and Hornung, 2016) and regional development. This calls for a deeper investigation of the relationship between land distribution and development in historical pre-industrial economies characterized by a substantially different institutional environment from what Galor et al. (2009) described in their seminal study.

The chapter at hand seeks to explore the relationship between land distribution and economic development by focusing on Greece, an archetypical pre-industrial economy during the late 19th century. Our analysis places the spotlight on Thessaly, a geographical region that became part of the Greek State in 1881 and encountered – for purely exogenous reasons – a striking change in the legal framework that defined the relations of agricultural production until then.

Prior to its annexation by Greece, Thessaly was part of the Ottoman Empire, and relations of agricultural production were determined by Ottoman customary law. In this framework, privately held property rights over the land did not exist. Instead, all lands belonged to the state which assigned a "right of use" to Ottomans who in turn either cultivated these lands on their own (in smaller estates) or assigned the "right of cultivation" to married male workers and their respective families (in larger estates). Crucially, this lifelong "right of cultivation" was inheritable from one generation of peasants to the other, thus peasants were tied to specific land estates on a long run basis (see e.g., Stoianovich, 1953; Karavidas, 1978). After the annexation, Thessaly become part of the Greek State and the customary Ottoman Law ceased to be in effect. Specifically, the Greek authorities recognized the previous "right of use" as a complete (western type) property right over the land and did not recognize the lifelong "right of cultivation" of the peasants that was well-established by the Ottoman customary Law.[5]

[5] In practice, after 1881, the previous "right of use" was recognized as a complete property right over

This significant change on the institutional framework produced distinct categories in the agricultural population: i) those who previously had a "right of use" over land estates and became landowners, ii) those who previously had a lifelong "right of cultivation" and became landless peasants that had to either sign contracts and work as salaried farmers on the respective land estate or explore alternative opportunities. In essence, Thessaly after 1881 can be viewed as a region that experienced an exogenous shock inducing massive labour emancipation. While coercive labour institutions did not exist in Greece or the Balkan region during the time, the abrupt loss of cultivation rights over land forced former cultivators into a new paradigm in which they had to re-establish their livelihoods, i.e. "freeing" them from ties to the land. Thus, this emancipation was not the result of de jure abolishment of coercive labour institutions we observe in countries of Central and Eastern Europe (like e.g., Prussia) during the middle 19th century, but it produced highly comparable economic outcomes to that.

A second interesting attribute of Thessaly is that labour emancipation took place in an economic environment characterized by co-existence of large and small landownership. After its Independence in 1833, and until 1881, Greece was a country of noteworthy equal land distribution and marked absence of a strong landownership elite (see e.g., Petmezas, 2003).[6] In contrast, this new geographical territory was characterized by a completely different ownership status compared to the "Old Greece". Thessalian territories were not part of the country when the Greek State distributed the so-called Public Lands (*Ethnikes Gaies*) to the peasantry, defining clear-cut property rights over land and favoring small ownership. As a result, both large and small landownership existed in Thessaly during this period.

Our interest lies in places where labour emancipation was part of the new ownership reali-

privately held land, i.e. formal, defensible, and alienable.

[6] The main reason for this outcome was the decision of the Greek authorities to nationalize the bulk of land estates that belonged to Ottoman landowners after Independence. These lands were initially rented for cultivation by the State to small peasants and in turn were distributed officially to the peasantry with the Law of Sotiropoulos in 1871 (see e.g., Dertilis, 2015).

ties. To identify the variation in ownership caused by the annexation, we utilize communities where former cultivators and landless peasants became small landowners. In particular, the new categories of ownership were the following: i) communities where formalized "rights of use" allowed the establishment of predominantly large ownership, and ii) communities that transitioned towards various forms of small ownership as a result of either direct purchases, redistributive acts or shared ownership of larger estates. Comparing these areas we can capture how changes in ownership affected development, in the aftermath of the annexation.

To further explore the underlying mechanism and understand how changes in ownership affected the agricultural population, we investigate the role of labour emancipation in this process. Following their emancipation from "rights of cultivation" over land, former cultivators had to decide whether they would continue providing agricultural labour or search for out-farm opportunities. On the one hand, cultivators that chose to increase agricultural effort and productivity, were more likely to settle over a long period in one place. In the medium to long run these decisions should be reflected on marital choices, since extended families could utilize labour supply from all members. Thus, we use the shares of marriages in the agricultural population as a proxy for this increased focus on agricultural labour. On the other hand, according to the "emancipation hypothesis", in order to be able to explore other opportunities, former cultivators would favour an increased focus towards education. Activities favouring the development of human capital, should be reflected on the educational outcomes in these regions, in the medium to long run. To proxy for the increased demand of education, we use the averaage literacy levels of the local population.[7] Overall, changes in ownership that affected this trade-off ultimately shaped regional development.

Using historical data on the community level between 1881 and 1907, our analysis suggests that communities that transitioned towards a small ownership regime experienced significantly higher economic development compared to the other communities, as proxied

[7] In essence, both decisions – i.e. willingness to marry or increase demand for education – were related to the potential mobility of individuals and should reflect medium to long run choices in these regions.

by the change in population density (see Galor, 2011; Ashraf and Galor, 2011, for more details on this).[8] In these communities the former cultivators that became landowners decided to stay for a long period and invest in the agricultural production of their land estates. This decision to stay and invest in agriculture can be understood through the underlying mechanism shaping their choices. In municipalities that experienced this transition towards small ownership, the agricultural population did not invest on human capital formation as much although they decided to get married more frequently.[9] In contrast, in regions characterized by large land concentration we observe an increased demand for education since investment in human capital was expected to improve off-farm income opportunities. At the same time marriage rates were lower, probably because marriage was expected to reduce potential migration opportunities. Overall, this empirical finding is in accordance with the "emancipation hypothesis", albeit from different initial conditions.

Our research contributes to the understanding of land ownership and development in historical pre-industrial economies, highlighting the role of land relations in the agricultural production. At the same time, it is related with a parallel literature on property rights and development (see e.g., Besley and Ghatak, 2010), as well as land reforms (Besley and Burgess, 2000; Banerjee et al., 2002). The conditional relationship between land reforms and development has been documented in recent studies (Faguet et al., 2020; Albertus and Popescu, 2020), mainly through their impact on human capital development (Albertus et al.,

[8] Thessaly during the period under investigation was a pure agricultural economy with Malthusian characteristics. Evidence suggests that during the Malthusian period, resources generated by technological progress and/or land expansion were primarily channeled into increases in the size of population and not to the level of income per capita. Therefore, variations in land productivity were better reflected by differences in population densities rather that on differences in the standards of living (see Galor, 2011).

[9] The effect of landownership inequality on marriages has also been investigated by Cinnirella and Hornung (2017). However, in their analysis marriages are used in order to investigate the possible interference of landed elite with peasants' individual life (i.e., the decision to get married) whereas in our setting marriages are employed as proxy of the individuals' decision to settle for a long time period in a specific geographical territory.

2020). Nonetheless, most of these studies examine relatively recent changes in land relations, while our study is focused on changes related with the institutional framework of a historical pre-industrial economy.

The rest of the chapter is organized in the following way. Section 4.2 presents an overview of the historical background. Section 4.3 describes the data. Section 4.4 presents the empirical methodology, main results and robustness checks. Section 4.5 provides evidence of the mechanism behind the main results. Section 4.6 concludes.

4.2 Historical Background

Greece gained independence from the Ottoman Empire in 1830. Following the Treaty of Berlin in 1878 and subsequent negotiations, the region of Thessaly was finally annexed by Greece after the Convention of Constantinople in 1881, increasing the approximate size of Greece by 26%, and its population by 18% (Patronis, 2015). However, the newly incorporated territories experienced a vastly different ownership regime at the time compared to the old, since the Ottoman empire was a semi-feudal agricultural economy at the time. Historical accounts described this difference in the following way: *"When we move from Peloponnese to Thessaly, we don't just change geographic space, but perhaps historical period: we move from one world to another. [...] Here the problem is the standstill of big land ownership and wheat production, the inertia of semi-feudal relations of production"* (Agriantoni, 1986).

Before 1881, agricultural communities in Thessaly were broadly divided into two main categories, depending on the size of land estates and whether they were located on mountainous or lowland territories. On the one hand, the so-called *Kefalohoria* were villages usually located on mountainous territories, characterized by small estates cultivated by one or two families and followed a communal way of life in social and economic aspects. On the other hand, were the so-called *Cifts*, villages usually located on lowland territories and characterized by large estates. *Cifts* were part of the Ottoman land holding system of çift-hane, a

widely used system in the Ottoman empire at the time. According to this system, all lands belonged to the state, preventing direct commercialization of agriculture (Khoury, 1997). In Cifts, Ottoman beneficiaries that had a "right of use" (the so-called *Tessaruf*) over the land – as given by the state – and assigned the "right of cultivation" to peasant families (the so-called *Kolligoi*) by forming a de facto "ongoing company".[10] Based on customary law, *Kolligoi* had increased rights over the produced outcome (usually a share of two thirds or a half of the agricultural product) but most importantly a lifelong "right of cultivation" of the specific land estate.[11] Scholars have argued that this was effectively a collective insurance policy, where cultivators facing lower yields were able to maintain subsistence until the next period, but additional surpluses would either be taxed or increase the cift-owner's income (Karavidas, 1978). Most villages and rural areas in Thessaly followed the çift-hane system, with the remaining villages being the so-called *Kefalohoria*.[12]

After the annexation of Thessaly to Greece, ownership of cifts was not transferred to the state, but instead all estates were recognized as private estates (Tsopotos, 1912). Consequently, a series of changes related to ownership began across the region. Cultivators demanded ownership of land over estates they were settled over generations, while landless peasants started making claims for lands that belonged to the community. However, the rights of cultivators to the use of land were not recognized (Patronis, 2015), leading to the formation of large private estates. The underlying goal of the Greek state at the time was to create incentives for newly created large private estates to gradually modernize agricultural production and hopefully make the country self-sufficient towards cereal production. Existing titles granting usage of public lands to Ottoman landowners were used as permanent ownership titles, while the rights of *Kolligoi* (based on customary Ottoman law) were

[10] The combination of each family's labour capacity with a pair of yoked oxen had to produce enough surplus to be paid as taxation, feeding the family at the same time.

[11] Cultivators were connected for life with their respective land holdings, and these rights were inherited by their eldest son.

[12] A map of ownership status in Thessaly around 1881 is shown in Figure 7.

not recognized, turning them into renters of the land they resided over generations (Triantafyllidis, 1974). Since *Cifts* amounted to approximately two thirds of total arable land, this caused increasing tensions following the annexation, even leading to armed uprisings in certain villages (Dertilis, 2015). To establish the rights of former cultivators over their land, various legal and political actions took place. The more prominent ones included petitions to the highest courts in the land, as well as legislation passed by successive governments, paving the way for either the purchase or redistribution of cifts to former cultivators and landless peasants. Cultivators and landowners could also form "company cultivations" essentially recognizing responsibilities and benefits of respective parties, a form of shared ownership (Sideris, 1934).

As a result, multiple ownership categories existed in Thessaly after the annexation (Prontzas, 1992).[13] There were large private estates, namely *Cifts* owned by either Christian (C.C.), or Ottoman (C.O.) landowners. Similarly, a number of *Kefalohoria* villages maintained the communal organization of ownership (V.L., from the French word libres i.e. free). However, a number of villages transitioned towards forms of small ownership, as a result of either direct purchases in *Cifts* and *Kefalohoria* from former cultivators (V.R., from the French word rachetés, i.e. redeemed/bought back), redistributive acts from the state (V.P., from the French word répartition, i.e. distribution) or shared ownership of a *Cift* (C.M., for mixed ownership status). In these areas, former cultivators and landless peasants became small landowners either in whole or in part for the first time. This variation signified an upward shift in agency over their livelihoods, since now they were formal (co-)owners of their own cultivated lands. A map of ownership status in Thessaly around 1907 is shown in Figure 1.

[13]For practical reasons, we follow the documentation created by Prontzas (1992).

4.3 Data Description

Data from historical archives containing information about property rights and local populations were digitized, and combined with data from agricultural and population movement censuses from late 19th and early 20th century Greece. Moreover, by matching information from local adminstrative units, we calculated geographical and climatic variables for the econometric analysis.[14] The final result is a novel dataset with regional data in Thessaly at the community and municipality level between 1881 and 1911.

Information related to the status of property rights across Thessaly, as well as the local population during that time, comes from the historical studies of Prontzas (1992). These archives provide information about the type of ownership in Thessaly after the annexation of 1881, and population figures from the period of annexation until 1907, at the community level.[15] Since Thessaly during that period had an agricultural economy with Malthusian characteristics, improvements in agricultural production and land productivity would be translated into increased population density rather than differences in standars of living (see e.g., Galor, 2011, for more details on this). Thus, for our main dependent variable we calculate the population growth or $\Delta POP\%$ between 1881 and 1907.[16] Furthermore, we calculate population growth closer to the annexation of Thessaly in Greece and the change in property rights, namely 1881 and 1889, as well as 1881 and 1896.

For our main treatment variable, we create the indicator $\Delta(\textit{Small Owners})$. This treatment variable captures the impact of the annexation on ownership, focusing on the commu-

[14] Data on the boundaries of local authorities (communities) of the pre-Kapodistrian reform era (i.e. for 1990s Greece), are taken from the Hellenic Statistical Authority (ELSTAT). To recreate the geographical boundaries of Thessaly during that era, modern communities and municipalities are individually matched by tracing them back in time using the online database of the Hellenic Society of Local Development and Local Government (EETAA). An example is provided in the Appendix, at Figure 8.

[15] An example of original ownership data can be found in Figure 9 at the Appendix.

[16] Actually, we take the difference of population density, but because the area is constant between the two periods we end up using population growth.

nities where the emancipated former cultivators and landless became landowners. Hence, it takes the value one for communities characterized as cifts with mixed ownership (C.M.), estates bought by peasants (V.R.) and estates distributed to landless and peasants (V.P.). In contrast, our baseline sample consists of communities where formal "rights of use" were used to create predominantly large ownership estates. In particular, our treatment indicator takes the value zero for communities categorized as cifts owned by Christians (C.C.), or Ottomans (C.O.)], or estates that remained organized in a communal way (V.L.). A map of $\Delta(\textit{Small Owners})$ is shown in Figure 2. Furthermore, to analyze our sample at the municipality level we create an additional treatment variable, measuring the share of *Small Owners* communities within a municipality. This variable is calculated by dividing the amount of treated land with total municipality land, taking higher values in municipalities with a higher share of treated communities. The end result is $\Delta(\textit{Small Owners Share})$ for each municipality, visualized in Figure 3.

We complement data for ownership status and population with proxies for decisions related to agricultural effort and potential chances of migration at the municipality level. In particular, we use *Married* and *Illiterate*, calculated as a share of each municipality's population in 1907. The logic is that if the change in ownership status incentivized local residency but lessened investments towards human capital, such choices would manifest through different marriage and literacy levels. In other words, we indirectly examine decisions related to potential mobility, with marriage capturing low mobility and increased probability to remain in the area, and literacy capturing increased ability to explore out-of-farm opportunities or potentially migrate. Furthermore, to examine the possibility of different trajectories between treated and untreated areas since the annexation, we calculate the share of *Births*, *Deaths*, and *Marriages* out of a municipality's population of 1884, using the population movement census of the same year. Also, we examine if population growth has been affected by movements between different municipalities. To this end we use the number of citizens from different municipalities that are recorded inside a given municipality during the census

(Heterodimotai) and calculate *Outsiders* in the same way (i.e. share of population).

Climatic variations may indirectly affected the trajectory of population growth between communities characterized by different ownership regimes. To account for climatic characterists that affect land ownership, we calculate the natural logarithms of average *Precipitation* and *Temperature* at the community level, using the geographical boundaries of 1907 (as described above), combined with localized geospatial data from the WorldClim organization, as provided by Fick and Hijmans (2017). In the same way, we calculate *Elevation* to check whether communities located in higher average altitudes experienced different population growth rates compared to communities in plain fields. Controlling for these factors serves a dual purpose. First, initial inequality in land ownership could be partially determined by variations in geoclimatic factors, as findings from other historical studies have indicated (see e.g., Baten and Hippe, 2018). Second, they indirectly capture ease of disease spreading – e.g. malaria was one of the leading causes of death in the area at the time – in plain fields closely located to swamps, a common attribute of the region prior to their draining during the following decades. By including time-invariant average measurements of geoclimatic factors, we can account for such comfoundings factors related with hardships affecting survival.

To account for the possibility of convergence between areas with different initial population, we use the initial population of each community at 1881, as well as the total area of each community, which may affected population growth (e.g. limiting of people that could live within a specific area). Controling for such characteristics also captures pre-existing relationships between ownership rights and population (e.g. more densily populated areas in certain types of ownership). To control for differential effects over time across regions, we calculate the natural logarithm of distance for communities and municipalities, from various points of interest such as *Distance from Volos* (the most urbanized municipality of Thessaly), *Distance from coastline* as well as including a dummy variable for being *Part of the capital* of a region (i.e. community that belongs in the same municipality as the capital of the region). Finally, to account for differences in agricultural productivity, we use data from the

agricultural census of 1911, and calculate the per capita values for a variety of agricultural products (wheat, barley, maize, tobacco, olive oil, oils, vine) at the county level. Definitions and sources of the variables can be found in Table 6 of the Appendix, and descriptive statistics are shown in Table 7.

4.4 Empirical Analysis

4.4.1 Methodology

To assess how changes in ownership status affected development across communities of Thessaly, we use a difference-in-differences framework that holds local unobserved characteristics fixed. The fully specified regressions take the following form:

$$\Delta POP\%_{c1907-1881} = \beta_1 \Delta(Small\ Owners)_c + \beta_2 X_{c1881} + \beta_3 \Gamma_c + \beta_4 Z_m + \Delta\epsilon_{c1907-1881} \quad (4.1)$$

where $\Delta POP\%_{c1907-1881}$ is community c's population growth, between the period of the annexation (1881) and the last population census prior the next territorial expansion (1907). Our main variable of interest is $\Delta(Small\ Owners)_{c1907}$, an indicator of "treated" communities c, described in Section 4.3, capturing the impact of ownership change on development as proxied by population growth. This treatment indicator is the best-available proxy describing the change that occured in property rights in these communities, specifically the transition towards forms of small private ownership. We expect that following the annexation, former cultivators in communities with newly acquired private estates were more likely to prioritize longer term agricultural investment rather than exploring off-farm activities. In other words, communities transitioning towards smaller agricultural estates increased their agricultural efforts, hence we expect a positive effect on development – at least in the medium to long run.

To ensure that we capture other factors potentially affecting population growth, we in-

clude a vector of characteristics of each community c in our specification, namely X_{c1881}, while geographical and climatic controls are captured by Γ_c, as described in Section 4.3. Since we compare communities within different municipalities, we employ region specific shocks Z_m at the municipality level (demos). Finally, to address heterogeneity between the number of communities inside each municipality, we cluster standard errors at the municipality level, and $\Delta\epsilon_{c1907-1881}$ is an i.i.d. error term.

4.4.2 Baseline Results

The main results for the effect of ownership change on population growth at the community level between 1881 and 1907 are reported in Table 1. We estimate alternative specifications by progressively adding new controls (regional fixed effects, geographical and climatic controls etc.). As can be seen, the coefficient of our main treatment variable is positive and statistically significant between 1% and 5% levels of significance. While the inclusion of the initial population in the last specification slightly reduces the statistical significance of the coefficient, it doubles the explanatory power compared to the first specification. Following the results, it is apparent that the transition towards small ownership that took place in various communities across Thessaly had a significant impact in the population growth rates between 1881 and 1907. The population in these communities increased at a higher rate compared to communities that experienced forms of large ownership.

Our results can be interpreted along the lines of the "emancipation hypothesis" as described by (see e.g., Ashraf et al., 2020). Since Thessaly experienced a lack of industrial development or increased opportunities in urbanized environments at the time, small owners were more likely to invest in the agricultural production of their estates. In the Malthusian environment of the agricultural economy of Thessaly, emancipated former cultivators or landless peasants that became small landowners in these communities, chose to remain and invest their time and effort in their newly acquired properties. These small owners had lower motivation to get educated in comparison to individuals in large properties, given the

trade-off between prioritizing agricultural effort and searching for off-farm opportunities described earlier. In other words, the emancipated population in these areas was incentivized to increase their agricultural efforts, leading to the increase in agricultural productivity and as a result population density. Furthermore, demand for education was reduced in these areas, following the smaller demand for investment towards human capital.

A number of factors can potentially threaten our results, such as unobserved heterogeneity or selective migration towards communities with small ownership. To mitigate these concerns, we employ a series of robustness checks. We then move on the municipality level, and provide evidence in favour of the trade-off mechanism, by exploring whether these areas were characterized by higher shares of marriages and lower levels of literacy, thus reaffirming our interpretation of emancipated former cultivators choosing to marry more and invest less towards education, in areas where they became landowners.

4.4.3 Robustness checks

Contiguous Border Test

Our first task is to use a subsample of contiguous-community pairs sharing a border, where one community belongs to the treated group (i.e. $\Delta(\textit{Small Owners})$ is equal to one) and the other to the control group (i.e. $\Delta(\textit{Small Owners})$ is equal to zero). The matching criteria between two communities are the following: i) one of the two communities must belong to a treated category (V.R., V.P., C.M.), and the other to a control category (V.L., C.C., C.O.), ii) the treated and control communities must share a border, and iii) the distance between the centroids of treated and control communities is minimized, i.e. in case of multiple matches only the pair with the nearest distance is kept. The intuition behind this methodology is it decreases heterogeneity on observables and at the same time sensitivity to potential bias due to unobserved covariates (see e.g. Dube et al., 2010)

We run a series of regressions between our treatment and control variables, for both the full and the matched sample, and proceed by plotting the coefficients of these regressions,

as illustrated in Figure 4. The coefficients for the full sample indicate significant differences between treated and control communities in various characteristics. Specifically, treated communities were more likely to be smaller, further away from the coastline and in less elevated warmer regions. However, in the case of the contiguous matched border sample, there are no longer statistically significant differences between treated and control communities in their observable characteristics. Nonetheless, there is a statistically significant difference when it comes to the change in population growth between treated and control communities. This reinforces our argument that the onwership changes had an impact on development, even when all other characteristics were similar. In Table 8 we re-run regressions of Table 1, using the contiguous border sample. As can be seen, results remain intact.

Omitted Variables Test

Next, we examine the possibility of omitted variable bias following the approach by Oster (2019), that uses the selection on observables as a guide to assess potential bias from unobservable factors. By running a combination of controlled and uncontrolled regressions, along with a hypothetical upper limit of R-squared values, this test creates a measure (delta) indicating how large the selection on unobservables needs to be, relative to selection on observables, to fully explain away the estimated effects. Results are reported in Table 9. As a cut-off for robustness to omitted variable bias, the omitted variables test takes the value of one; indicating that selection on unobservables is equally important as selection on observables. In our case, for a community experiencing a change towards small ownership, selection on observables would have to be two to three times larger than selection on our control variables to explain away the estimated effects. This provides confidence that our estimated effect is unlikely to be driven by omitted variable bias.

Previous Years

Our third check is to use the population growth between 1881 and two time periods prior to 1907, specifically 1889 and 1896, to examine whether there was a positive effect during the earlier phase of the reform. If transition to small ownership indeed affected long-term decisions and our results are not contaminated by other shocks (e.g., migration), the effect in the earlier period (between 1881 and 1889) should be absent or relatively weak, while becoming stronger in the latter (between 1881 and 1896).

Results are reported in Table 2. Columns (1) to (3) show the effect of ownership change on population growth between 1881 and 1889, while columns (4) to (6) show the same effect between 1881 and 1896, gradually adding controls in the same way as Table 1. The treatment variable for ownership change does not have a statistically significant effect on population growth between 1881 and 1889, however the size of the coefficients doubles for the period between 1881 and 1896, becoming statistically significant at the 10% level in one specification.[17] This provides evidence in favour of our hypothesis that population growth rates increased gradually in the treated communities, culminating in a significant difference when compared to the overall period between 1881 and 1907.

Other robustness

We conduct two additional robustness checks at the community level. Table 10 drops one region of the sample at the time. The effects remain qualitatively and quantitatively similar, at the 5% significance level. Second, Table 11 gradually drops large, small and both large and small communities from the sample. The overall effect of ownership change remains positive and statistically significant between 1% and 5% levels of significance.

[17]It should be noted that we also perform a test on whether the coefficients between the two sub-periods are equal [e.g., columns (3) and (6)]. This test indicates that the estimated coefficients are statistically different between the sub-periods.

4.4.4 Municipality Level Treatment

We expect that changes in ownership development through the underlying trade-offs faced by former cultivators regarding agricultural investment or demand for education. Given that our proxies for this trade-off are available at the municipality level, we first have to establish the effect on population growth at this level of aggregation. As a result, we estimate a modified version of equation (1):

$$\Delta POP\%_{m1907-1881} = +\beta_1 \Delta(Small\ Owners\ Share)_m + \beta_2 X_{m1881} + \beta_3 \Gamma_m + \beta_4 Z_r + \Delta\epsilon_{m1907-1881} \tag{4.2}$$

where now $\Delta POP\%_{m1907-1881}$ captures the difference in population growth for municipality m, while $\Delta(Small\ Owners\ Share)_m$ is the share of land allocated to treated communities within that municipality m, as described in Section 4.3. The rest of the variables are the same as in Section 4.4, now aggregated at the municipality level. Given the decreased number of observations compared to the community level, we include province specific shocks at the regional (county) level and use robust standard errors across all specifications.

Results for the municipality level regressions are reported in Table 3. We gradually add the same controls as in our baseline specification, for the first three columns. We further expand our analysis by controlling for agricultural production value per capita of dominant crops produced in the region (wheat, barley, maize, tobacco, olive oil, oils and vine), in the fourth column. For all these specifications, our treatment variable enters the regression with a positive sign and remains statistically significant between the 1% and 5% level.

4.5 Mechanism

4.5.1 Effect on marriage and literacy

Pre-industrial societies have been shaped by the inverse relationship between fertility and education (Galor, 2012). In an environment characherized by low agricultural productivity and limited industrialized development, the acquisition of private ownership was bound to have an impact on households' decisions across Thessaly. To investigate how higher shares of small ownership affected the underlying mechanism of emancipated former cultivators in areas where they became small landowners, we turn on data for *Married* and *Illiterate*, as defined in Section 4.3. While these variables do not capture directly agricultural investment or education attendance, it seems like a reasonable assumption that higher shares of *Married* households reflect choices related with long term settlement and increased effort in their land estates. Likewise, higher shares of *Illiterate* households should indicate lower educational attendance rates – i.e. lower demand for investment in human capital – since the distinction between literate and illiterate in the census depends on ability to write, an outcome heavily dependent on schooling attendance.

Our new dependent variables are only available for the latter year of the analysis (i.e. 1907). This does not allow us to control for fixed local characteristics as in our estimates so far, making the use of an instrumental variable approach even more essential. Furthermore, omitted variables correlated with the type of landownership and the effort or education decision might bias our results. We have to also consider the possibility of reverse causality. For instance, increased need to support extended families – the norm of most marriages in Greece at the time – may contributed in claims for ownership as well. Although our estimates in the previous section implicitly control for fixed effects and we have also performed the omitted variable and contiguous border tests, we complement these estimates with our instrumental variable approach to further address concerns of endogeneity.

We focus on factors related to the ease of cultivation for prospective owners, affecting

the likelihood of changes in ownership. At the time, agriculture was highly dependent on geological constraints, such as the quality of the soil. A number of studies have used contemporary (Libecap et al., 2011; Baten and Juif, 2014; Dimico et al., 2017) or historical (Cinnirella and Hornung, 2016) data on soil quality, in an effort to identify exogenous variation that generated heterogenous demand for land. In the abscence of localized historical soil information, we use data from the FAO-GAEZ (Food and Agriculture Organization – Global Agro-Ecological Zones). We utilize local boundaries for municipalities of Thessaly and create the variable *Soil Fertility*, based on a seven-point score measuring constraints on soil fertility.[18] This variable takes higher values when more labour-intensive tasks are required prior to making the soil ready for cultivation (i.e. more constraints exist).[19]

Using the GAEZ data comes with certain advantages and drawbacks. On the one hand, constraints to enter agricultural production are an important factor for prospective cultivators, regardless of technological process. Additionally, compared to other suitability measurements, constraints on *Soil Fertility* provide a more nuanced picture capturing a variety of possible challenges faced by prospective cultivators. On the other hand, due to our focus on a small region compared to the global scale, the 5-arc-minute resolution of the original GAEZ data leads to small decline in the number of observations we are able to construct. Nonetheless, since detailed historical measurements of soil quality for Thessaly during the early 20th century are unlikely to exist at all – let alone at a similar level of aggregation – we argue that the benefits far outweigh the downsides.

To examine how agricultural constraints affected regional development and household choices, through their impact on changes in ownership, we estimate the following two-stage regression:

[18] Original data come from the International Institute for Applied Systems Analysis, at 5-arc-minute resolution.

[19] An illustration of *Soil Fertility* constraints is provided in Figure 10.

First stage:

$$\Delta(Small\ Owners\ Share)_m = \beta_1 Soil\ Fertility_m + \beta_2 X_{m1881} + \beta_3 \Gamma_m + \beta_4 Z_r + \epsilon_{m1907} \quad (4.3)$$

Second stage:

$$Y_m = \alpha_1 \Delta(Small\ Owners\ Share)_m + \beta_2 X_{m1881} + \beta_3 \Gamma_m + \beta_4 Z_r + \epsilon_{m1907} \quad (4.4)$$

where Y_m is municipality m's population growth between 1881 and 1907, as well as shares of *Married* or *Illiterate* at 1907, while $Soil\ Fertility_m$ are the constraints of the soil for agricultural usage in each municipality m. The logic is that in the abscence of centralized reform, places with higher constraints for cultivation were more likely to experience a change in ownership status, since they would either have lower value or considered less desirable for large scale cultivation (Headey et al., 2014). The rest of the variables are the same as in Section 4.4.4, and robust standard errors are used in all specifications.

Our main identification assumption is that constraints in *Soil Fertility* affected household choices towards stable residency, and in turn population growth, only through their effect on changes in land ownership. Although it is difficult to test the exclusion restriction, one can imagine a situation in which it may not be accurate. For instance, it would be violated if variations in *Soil Fertility* directly affected the productivity of crops that have higher levels of child labour employment, thus keeping them out of school (see e.g., Cinnirella and Hornung, 2016). Conversely, wealth effects generated from variations in *Soil Fertility* may in turn increased demand for education from households. To mitigate these concerns, as already mentioned, our estimates control for the per capita value of agricultural production of dominant crops. Another potential threat would be if variations in *Soil Fertility* had an impact on the balance between males and females in certain areas, since the marriage market is partially shaped by sex ratios in the adult population (Angrist, 2002; Abramitzky et al., 2011). We find no evidence of such a relationship, however we can only account for

the sex ratio in 1907 rather than the initial period.[20] Given these possibile violations to the exclusion restriction, interpretation of our instrumetal variable estimates must be cautious.

Results for the mechanism are reported in Table 4. The first three columns show the effect of Δ(*Small Owners Share*) on $\Delta POP\%_{m1907-1881}$, shares of *Married*, and shares of *Illiterate* respectively, using the OLS model with all relevant controls at the municipality level.[21] The treatment variable has a positive and statistically significant effect between the 1% and 5% level for all specifications. In other words, municipalities that transitioned towards small ownership following the annexation, also ended up with a higher share of married and illiterate households. This provides evidence that the increase in population growth came as a result of choices prioritizing long term stability and agricultural effort in the newly acquired properties, as indirectly captured by the higher shares of married households. At the same time it coincides with lower preferences towards educational attendance in these regions, as proxied by higher shares of illiterate. These results are in line with empirical findings that highlight how changes in ownership affected household decisions (Becker et al., 2010), and provide support to the "emancipation hypothesis" (Ashraf et al., 2020).

Results from the two-stage-least-squares regressions are reported in columns (4) to (6) of Table 4, in the same format as the previous columns. *Soil Fertility* is positively correlated with changes towards small ownership, as can be seen in the lower part of the table. The F-test values are slightly lower than 10, however still over the range of 5, therefore our instrument still has some strength (see e.g., Stock and Yogo, 2005). Similar to our OLS regressions, changes in ownership had a positive and statistically significant effect on shares of *Married* and *Illiterate*, albeit with a lower level of statistical significance between 5 and 10%. Overall, results from both OLS and IV regressions provide evidence of the underlying mechanism shaping actions of individuals in the aftermath of the annexation.

[20] The correlation between *Soil Fertility* and the ratio of females to males is 0.05.

[21] Results for the full sample are reported at Table 12 of the Appendix.

4.5.2 Excluding Alternatives

There is a possibility that different trajectories following the annexation, led to different population growth rates. To examine whether this was the case, we relate the change in property rights with the flow of *Births*, *Deaths*, and *Marriages* in 1884, as described in Section 4.3. Similarly, there is a chance that internal migration between municipalities may affect our results. To account for that possibility, we included municipality effects in our empirical specification at the community level to control for migratory shocks after the annexation. We have also shown in Table 2 that there was no change in population between 1881 and 1889. As an additional check, we use the share of *Outsiders* in 1907, described as well in Section 4.3, to examine whether changes in property rights are related with different shares of internal migration, as captured by the share of population not permanently established in a municipality.

Table 5 reports the regression results exploring these possibilities.[22] We follow a similar structure to Table 4, only now we use *Births*, *Deaths*, *Marriages* and *Outsiders* as our dependent variables for the first four respective columns, using an OLS model with the same controls. There is no statistically significant relationship between changes towards small ownership and either one of these variables. Similarly, we repeat our instrumental variable analysis using constraints on *Soil Fertility*, in the next four columns. Once again, there seems to be no statistically significant relationship between our treatment variable and any dependent variable. We take this lack of results as further evidence that initial differences in any of these factors related with fertility choices or internal migration did not had a significant impact on population growth.

[22]Results for the full sample are reported at Table 13 of the Appendix.

4.6 Conclusion

Land relations play a significant role in the development of agricultural economies. However, disentangling between changes in property rights and land redistribution can be difficult. In this chapter, a historical event of annexation was utilized to explore the impact from changes in land relations in the abscence of formal land redistribution. We used historical data on early 20th century Greece, and investigated how the transition from a semi-feudal towards a market economy affected regional development in Thessaly.

The annexation of Thessaly in Greece in the late 19th century had a profound effect on land relations in the region, as documented in historical evidence. While initially characterized by cooperative forms of ownership and bound to customary law, private ownership and national law became the new norm after the annexation. These changes in ownership followed an exogenous event (i.e. the annexation), and did not change the average property sizes. Nonetheless, this legal change was not accompanied by any region-wide redistributive policies, which only took place significantly later. We argued that these changes in land relations led to significant changes over relations of production in the agricultural production, since the cultivation rights of segments of the agricultural population were not recognized after the annexation.

Our findings show that communities transitioning towards small ownership, experienced a positive effect on population growth. These positive effects came from a process similar to labour emancipation, where former cultivators and landless peasants that became small landowners increased their investment towards their agricultural estates. To further establish the mechanism behind the results, we employed data for marriages and literacy, as proxies for choices related with potential mobility of individuals. Municipalities with higher shares of small ownership have significantly higher shares of married and illiterate households. We interpret this effect as evidence that emancipated former cultivators that became small landowners chose to settle in their newly acquired estates and increase their agricultural effort, leading to positive effects for development.

This study contributes to the comparative development literature, in the context of historical economics. While it focuses on a historical case study, we believe that it provides useful insights for the relationship between property rights and development. Overall, relations of production and property rights can be crucial in agricultural economies, and their impact on development should always be taken into consideration.

Chapter Appendices

4.A Chapter 4 Tables

Table 1: *Effect of Ownership change on Population Growth*

	(1) ΔPOP%	(2) ΔPOP%	(3) ΔPOP%
Δ(Small Owners)	0.405***	0.407***	0.344**
	(0.143)	(0.150)	(0.133)
R^2	0.210	0.272	0.432
Regional FE	Yes	Yes	Yes
Geographical	No	Yes	Yes
Initial Pop.	No	No	Yes
Observations	467	467	467

Notes: The dependent variable is the population growth between 1907 and 1881, for communities of Thessaly. Δ(*Small Owners*) is an indicator variable at the community level, taking value 1 in communities that transitioned towards forms of small ownership. Column (1) includes fixed effects at the municipality (demos) level. Column (2) includes geographical and climatic variables (area, precipitation, temperature, elevation, distance from coastline, distance from Volos, part of capital). Column (3) includes the initial population of 1881. Standard errors are clustered at the municipality (demos) level, reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 2: *Effect of Ownership change on Population Growth - Previous Years*

	(1) (89-81)	(2) (89-81)	(3) (89-81)	(4) (96-81)	(5) (96-81)	(6) (96-81)
Δ(Small Owners)	0.096	0.086	0.024	0.223	0.232*	0.183
	(0.180)	(0.179)	(0.166)	(0.139)	(0.139)	(0.120)
R^2	0.147	0.163	0.339	0.139	0.175	0.350
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	No	Yes	Yes
Initial Pop.	No	No	Yes	No	No	Yes
Observations	467	467	467	467	467	467

Notes: The dependent variables are population growth between 1881 and 1889 (columns 1-3), and between 1881 and 1896 (columns 4-6). Columns (1)-(3) and (4)-(6) follow the same structure as columns (1)-(3) of Table 1. Standard errors are clustered at the municipality (demos) level, reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 3: *Effect of Ownership change on Population Growth - Municipality Level*

	(1) ΔPOP%	(2) ΔPOP%	(3) ΔPOP%	(4) ΔPOP%
Δ(Small Owners Share)	0.545***	0.652***	0.522***	0.506**
	(0.156)	(0.178)	(0.188)	(0.229)
R2	0.241	0.455	0.555	0.627
Regional FE	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes
Initial Pop.	No	No	Yes	Yes
Agricultural Prod.	No	No	No	Yes
Observations	64	64	64	64

Notes: The dependent variable is population growth between 1881 and 1907, for municipalities in Thessaly. Δ(Small Owners Share) measures the share of land belonging to treated communities, within a municipality. Columns (1)-(3) and follow the same structure as columns (1)-(3) of Table 1. Column (4) includes agricultural value per capita for the prominent crops produced in Thessaly at the time (wheat, barley, maize, tobacco, olive oil, oils and vine). Robust standard errors are reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 4: *Effect of Ownership change on Marriage and Literacy*

	(1) ΔPOP%	(2) Married	(3) Illiterate	(4) ΔPOP%	(5) Married	(6) Illiterate
Δ(Small Owners Share)	0.502**	0.049***	0.113**	1.333*	0.068*	0.209**
	(0.236)	(0.013)	(0.046)	(0.704)	(0.039)	(0.094)
R2	0.614	0.530	0.735	0.488	0.493	0.446
Model	OLS	OLS	OLS	IV	IV	IV
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	Yes	Yes	Yes	Yes	Yes	Yes
Initial Pop.	Yes	Yes	Yes	Yes	Yes	Yes
Agricultural Prod.	Yes	Yes	Yes	Yes	Yes	Yes
First stage estimates			Treat Share			
Soil Fertility (constraints)				0.010**	0.010**	0.010**
				(0.004)	(0.004)	(0.004)
First stage F-stat				7.240	7.240	7.240
Underidentification test:				0.004	0.004	0.004
Observations	59	59	59	59	59	59

Notes: The dependent variables are population growth between 1881 and 1907 (columns 1 and 4), *Married* (columns 2 and 5), and *Illiterate* (columns 3 and 6), the latter two calculated as a share of population of a municipality at 1907. Columns (1) to (3) report results from the OLS model, following the same specification as column (4) of Table 3, restricting the sample to observations available from the instrumental variable model. The upper part of columns (4) to (6) report results from the second stage of the instrumental variable model. The lower part of the table reports the first stage results of the IV model, using *Soil Fertility* constraints as described in Section 4.5, at columns (4) to (6). Robust standard errors are reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

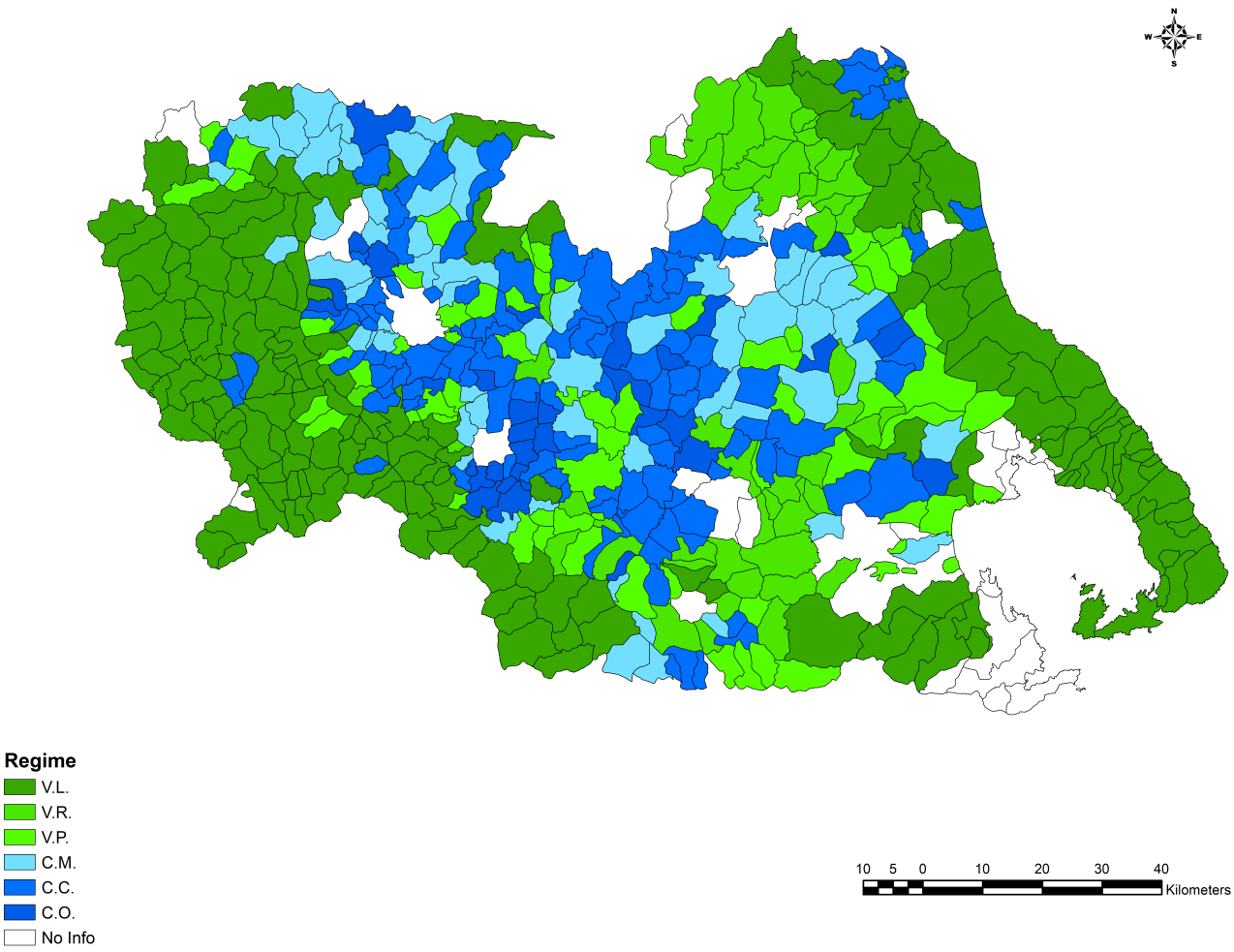
Table 5: *Effect of Ownership change on births, marriages, deaths (1884), and outsiders (1907)*

	(1) Births	(2) Marriages	(3) Deaths	(4) Outsiders	(5) Births	(6) Marriages	(7) Deaths	(8) Outsiders
Δ(Small Owners Share)	-0.047	-0.009	-0.049	-0.013	-0.028	-0.007	-0.052	0.022
	(0.036)	(0.008)	(0.041)	(0.024)	(0.042)	(0.009)	(0.044)	(0.077)
R2	0.423	0.387	0.407	0.387	0.405	0.373	0.385	0.348
Model	OLS	OLS	OLS	OLS	IV	IV	IV	IV
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Pop.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agricultural Prod.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage estimates							Treat Share	
Soil Fertility (constraints)					0.010**	0.010**	0.010**	0.010**
					(0.004)	(0.004)	(0.004)	(0.004)
First stage F-stat					7.240	7.240	7.240	7.240
Underidentification test:					0.004	0.004	0.004	0.004
Observations	59	59	59	59	59	59	59	59

Notes: The dependent variables are *Births* (columns 1 and 5), *Marriages* (columns 2 and 6) and *Deaths* (columns 3 and 7) as a share of population calculated at the municipality (demos) level, using the 1884 population movement census. The dependent variable for columns (4) and (8) is *Outsiders*, calculated the same way, using the 1907 population census. Columns (1)-(4) report results from the OLS model, following the specification of column (5) of Table 3. Columns (5)-(8) repot results from the IV model, following the structure of column (6) of Table 3. Robust standard errors are reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

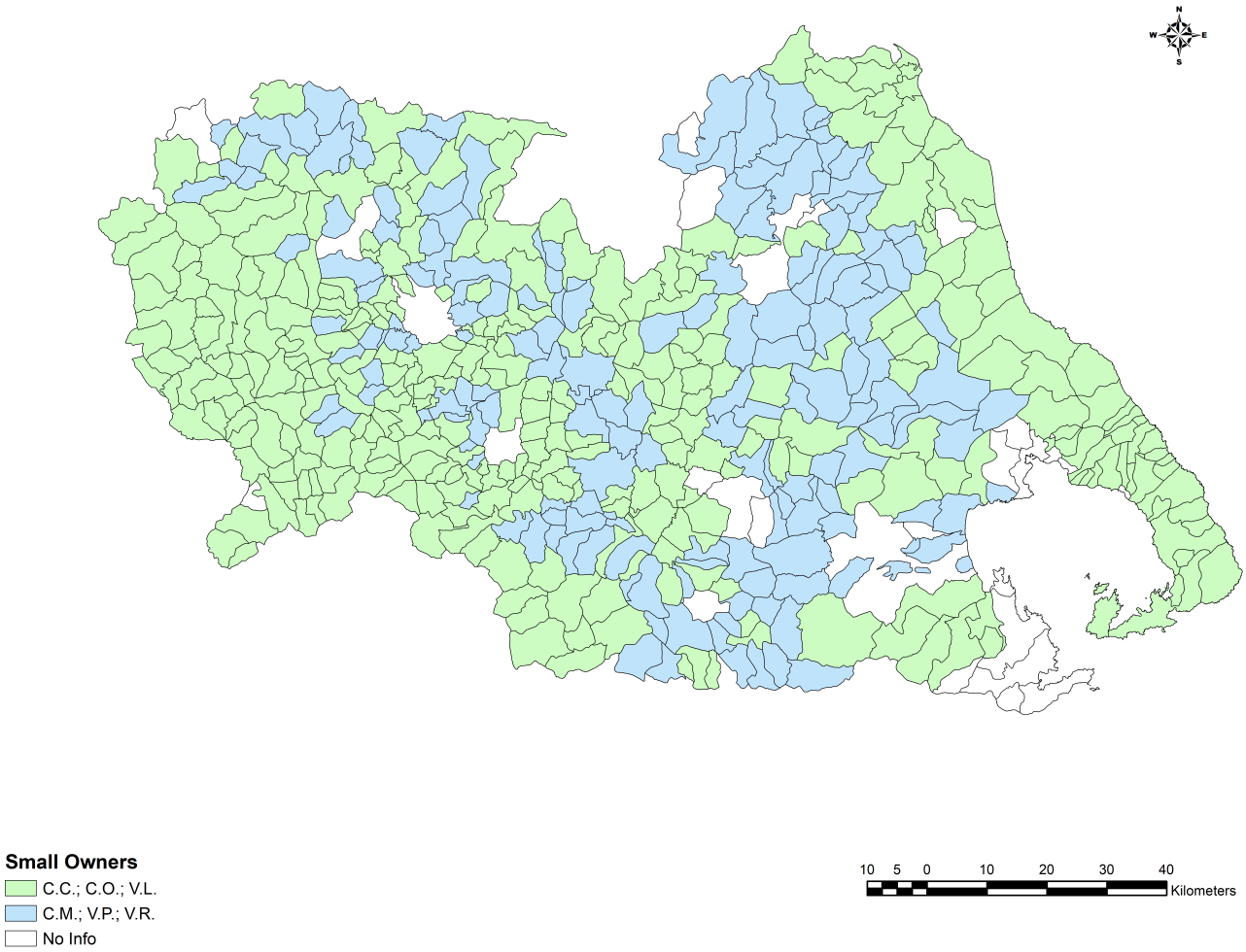
4.B Chapter 4 Figures

Figure 1: *Ownership Status in Early 20th Century Thessaly*



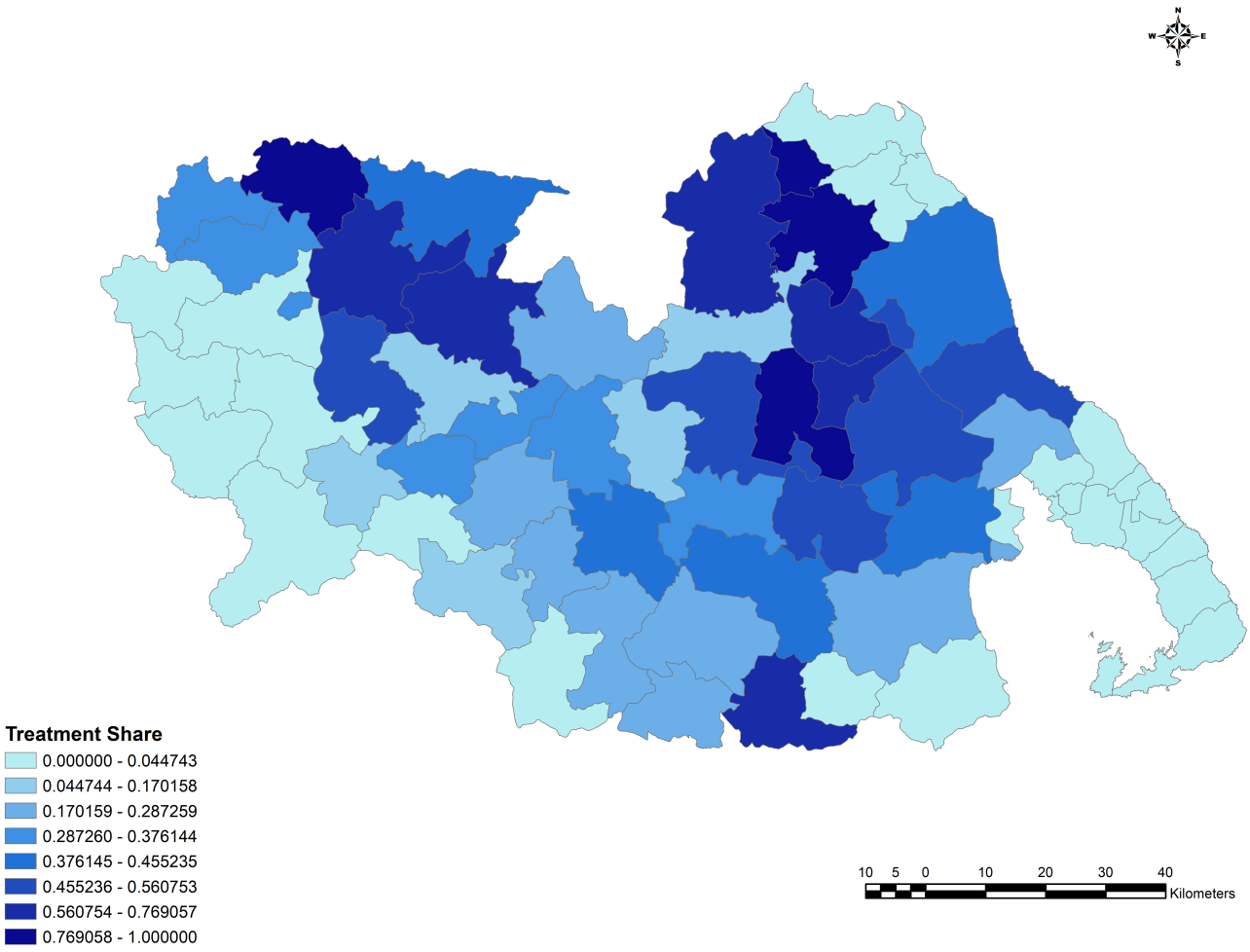
Notes: Ownership categories in Thessaly around 1907, taken from historical archives of (Prontzas, 1992). Shades of green indicate different categories of Kefalohoria, while shades of blue indicate different categories of Tsiflikia, as described in Section 4.3. White indicates lack of information from the archives.

Figure 2: *Map of Treatment - Community*



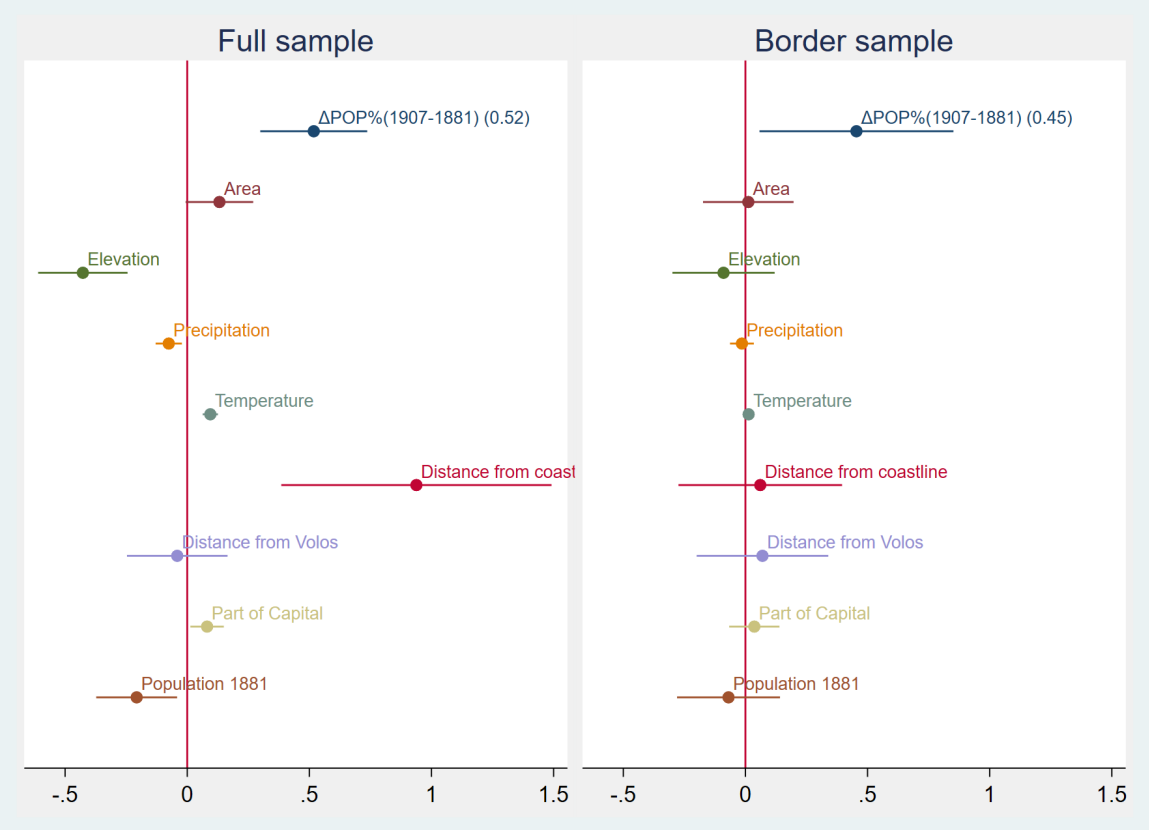
Notes: Illustration of the treatment variable $\Delta(\textit{Small Owners})$, as described in Section 4.3. Green indicates control communities C.C., C.O., and V.L., blue indicates treated communities C.M., V.P., V.R., and communities with no information are shown in white.

Figure 3: *Map of Treatment - Municipality*



Notes: Illustration of the treatment variable $\Delta(\textit{Small Owners Share})$, as described in Section 4.3. Constructed by using variable $\Delta(\textit{Small Owners})$ and information from the agricultural census of 1911 on land sizes of each community. Deeper shades of blue indicate higher shares of land belonging to treated communities inside a municipality.

Figure 4: *Contiguous Border Test*



Notes: Comparison between the full and border samples, as described in Section 4.4.3. Coefficients of regressions between the treatment variable *Small Owners* and the other variables are plotted for the full (on the left) and contiguous matched border sample (on the right). Straight lines represent a 95% confidence interval for each outcome.

4.C Chapter 4 Additional information

Additional Tables

Table 6: *Definition and sources of variables*

POP%	Population growth rate, calculated at the community (village) level. Original data come from (Prontzas, 1992).
Small Owners	Indicator taking value one if a community belongs to either (C.M.) (V.R.) or (V.P.) categories, zero otherwise. Original data come from (Prontzas, 1992)
Small Owners Share	Share of treated community land inside a municipality. Calculated by dividing the amount of land of treated communities, with total land area of the municipality.
Married	Share of people that were married inside a municipality, at 1907. Calculated by dividing the number of unmarried people to the total population.
Illiterate	Share of people that were not literate inside a municipality, at 1907. Calculated by dividing the number of illiterate people to the total population.
Outsiders	Share of people that were not registered as citizens from the same municipality (heterodimotai), at 1907. Calculated by dividing the number of heterodimotai to the total population.
Births	Share of births inside a municipality, at 1884. Calculated by dividing the number of births to the total population.
Deaths	Share of deaths inside a municipality, at 1884. Calculated by dividing the number of deaths to the total population.
Marriages	Share of marriages inside a municipality, at 1884. Calculated by dividing the number of marriages to the total population.
Elevation	Natural logarithm of mean altitude of each community. Originally measured in meters, calculated as the average elevation within the community borders.
Precipitation	Natural logarithm of mean rainfall of each community. Originally measured in mm, calculated as the average summer rainfall between 1970 and 2000, within the community borders.
Temperature	Natural logarithm of mean temperature of each community. Originally measured in celcius degrees, calculated as the average summer temperature between 1970 and 2000, within the community borders.
Distance from Volos	Natural logarithm of distance between a municipality and Volos. Originally measured in meters, calculated using Geodata files available from Geodata.gov.gr.
Distance from coastline	Natural logarithm of distance between a municipality and the coastline. Originally measured in meters, calculated using Geodata files available from Geodata.gov.gr.
Part of the capital	Dummy variable, takes value one if a community is in the same municipality as the capital of the respective county.
Wheat (value per capita)	Value of total wheat production in a county at 1911, per capita.
Barley (value per capita)	Value of total barley production in a county at 1911, per capita.
Maize (value per capita)	Value of total maize production in a county at 1911, per capita.
Tobacco (value per capita)	Value of total tobacco production in a county at 1911, per capita.
Olive oil (value per capita)	Value of total olive oil production in a county at 1911, per capita.
Oils (value per capita)	Value of total production of oils in a county at 1911, per capita.
Vine (value per capita)	Value of total vine production in a county at 1911, per capita.

Notes: Population data come from the population movement census of 1884, and the population census of 1907, both from ELSTAT. Climatic data at 30-arc-second resolution come from WorldClim, as provided by (Fick and Hijmans, 2017). Agricultural and total land data come from the agricultural census of 1911.

Table 7: *Descriptive Statistics for Municipalities and Communities*

	(1) Municipalities				(2) Communities			
	mean	sd	min	max	mean	sd	min	max
ΔPOP% (1907-1881)	0.36	0.45	-0.80	1.98	0.63	1.16	-0.93	14.53
ΔPOP% (1896-1881)	0.27	0.32	-0.39	1.45	0.46	0.86	-0.96	13.12
ΔPOP% (1889-1881)	0.13	0.31	-0.85	1.04	0.34	1.08	-1.00	19.84
Δ(Small Owners Share)	0.27	0.29	0.00	1.00				
Δ(Small Owners)					0.34	0.47	0.00	1.00
Area	18.87	0.79	15.86	19.91	16.76	0.72	14.33	18.62
Elevation (Ln.)	5.76	0.87	3.26	7.31	5.64	0.97	0.43	7.36
Precipitation (Ln.)	3.07	0.34	1.40	3.71	3.12	0.28	1.40	3.74
Temperature (Ln.)	3.09	0.20	1.96	3.23	3.12	0.17	1.54	3.24
Distance from Coastline (Ln.)	7.52	4.64	0.00	11.17	9.76	2.91	0.00	11.34
Distance from Volos (Ln.)	10.05	2.49	0.00	11.83	10.94	1.07	0.00	11.91
Part of Capital	0.15	0.27	0.00	1.00	0.15	0.36	0.00	1.00
Population 1881 (Ln.)	8.04	0.47	6.40	8.98	5.73	0.86	3.22	8.37
Married	0.37	0.02	0.30	0.45				
Illiterate	0.73	0.09	0.51	0.89				
Births	0.04	0.03	0.01	0.22				
Marriages	0.01	0.01	0.00	0.04				
Deaths	0.02	0.03	0.00	0.23				
Outsiders	0.08	0.05	0.00	0.27				
Wheat	66.74	56.66	8.73	228.92				
Maize	17.39	12.75	0.32	34.79				
Tobacco	16.07	24.82	0.44	99.58				
Olive Oil	15.90	29.54	0.00	71.27				
Oils	15.41	26.07	0.00	62.87				
Vine	11.82	9.72	2.15	44.24				
N	64				467			

Notes: The table reports the number of observations, mean, standard deviation, minimum and maximum values of the regression variables. Analytical defitions for all variables are provided in Section 4.3, and Table 6.

Table 8: *Effect of Ownership change on Population Growth - CBT sample*

	(1) ΔPOP%	(2) ΔPOP%	(3) ΔPOP%
Δ(Small Owners)	0.412**	0.430**	0.362**
	(0.187)	(0.211)	(0.166)
R^2	0.186	0.306	0.505
Regional FE	Yes	Yes	Yes
Geographical	No	Yes	Yes
Initial Pop.	No	No	Yes
Observations	220	220	220

Notes: The sample consists of matched communities, sharing a border, as described in Section 4.4.3. Columns (1)-(3) follow the same structure as columns (1)-(3) of Table 1. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 9: *Omitted variables test*

	delta	R max
ΔPOP% (baseline)	2.62249	0.273
ΔPOP% (geographical)	2.87119	0.350
ΔPOP% (all controls)	2.28567	0.562

Notes: Following Oster (2019), delta is a measure indicating how large selection on unobservables needs to be, relative to selection on observables, to fully explain away the estimated effects for population growth, in our baseline results. We set R-+,- = 1.3 R.

Table 10: *Effect of Ownership change on Population Growth - Dropping Regions*

	(1) ΔPOP%	(2) ΔPOP%	(3) ΔPOP%
Δ(Small Owners)	0.321*	0.429**	0.321**
	(0.178)	(0.170)	(0.138)
R^2	0.441	0.483	0.431
Regional_FE	Yes	Yes	Yes
Geographical	Yes	Yes	Yes
Initial Pop.	Yes	Yes	Yes
Observations	302	191	441

Notes: Column (1) drops the region of Larissa from the sample, column (2) drops the region of Trikala, while column (3) drops the region of Fthiotida. All columns follow the same structure as column (3) of Table 1. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 11: *Effect of Ownership change on Population Growth - Dropping Large & Small*

	(1) ΔPOP%	(2) ΔPOP%	(3) ΔPOP%
Δ(Small Owners)	0.466***	0.341**	0.484***
	(0.074)	(0.141)	(0.074)
R^2	0.484	0.440	0.464
Regional_FE	Yes	Yes	Yes
Geographical	Yes	Yes	Yes
Initial Pop.	Yes	Yes	Yes
Observations	419	420	372

Notes: Column (1) drops communities with the lowest population from the sample, column (2) drops communities with the highest population, while column (3) drops both categories. All columns follow the same structure as column (3) of Table 1. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

Table 12: *Effect of Ownership change on Marriage and Literacy - OLS sample*

	(1) Married	(2) Illiterate
Δ(Small Owners Share)	0.048***	0.120**
	(0.015)	(0.046)
R2	0.513	0.752
Model	OLS	OLS
Regional FE	Yes	Yes
Geographical	Yes	Yes
Initial Pop.	Yes	Yes
Agricultural Prod.	Yes	Yes
Observations	64	64

Notes: Columns (1) and (2) follow the structure of columns (2) and (3) of Table 4, for the sample of column (4) of Table 3. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

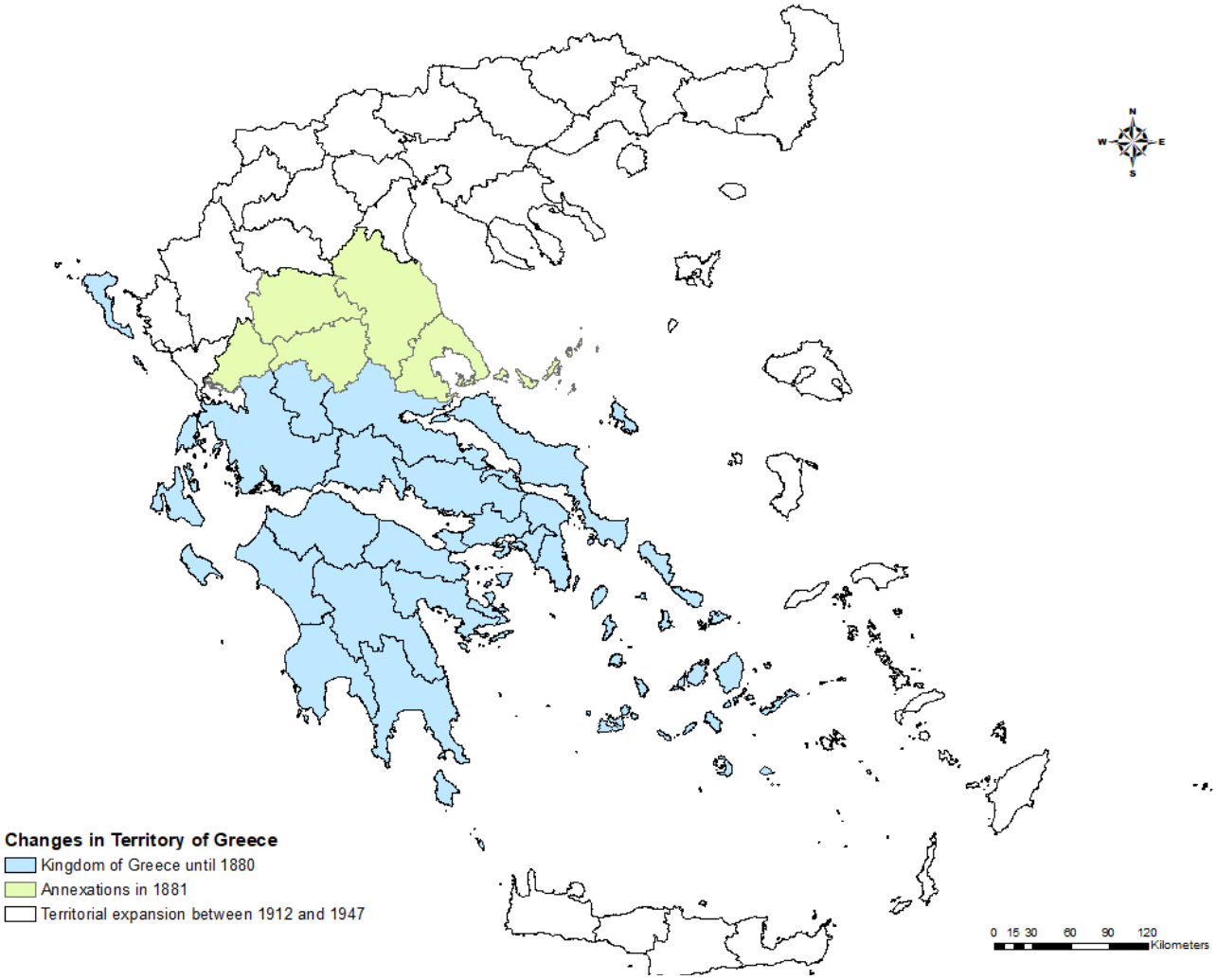
Table 13: *Effect of Ownership change on births, marriages, deaths (1884), and outsiders (1907) - OLS sample*

	(1) Births	(2) Marriages	(3) Deaths	(4) Outsiders
Δ(Small Owners Share)	-0.047	-0.009	-0.049	-0.003
	(0.036)	(0.008)	(0.041)	(0.027)
R2	0.417	0.374	0.402	0.277
Model	OLS	OLS	OLS	OLS
Regional FE	Yes	Yes	Yes	Yes
Geographical	Yes	Yes	Yes	Yes
Initial Pop.	Yes	Yes	Yes	Yes
Agricultural Prod.	Yes	Yes	Yes	Yes
Observations	64	64	64	64

Notes: Columns (1) - (4) follow the structure of columns (1) - (4) of Table 5, for the sample of column (4) of Table 3. Robust standard errors are reported in parentheses. *** denotes significance at 1% level, ** denotes significance at 5% level and * denotes significance at 10% level.

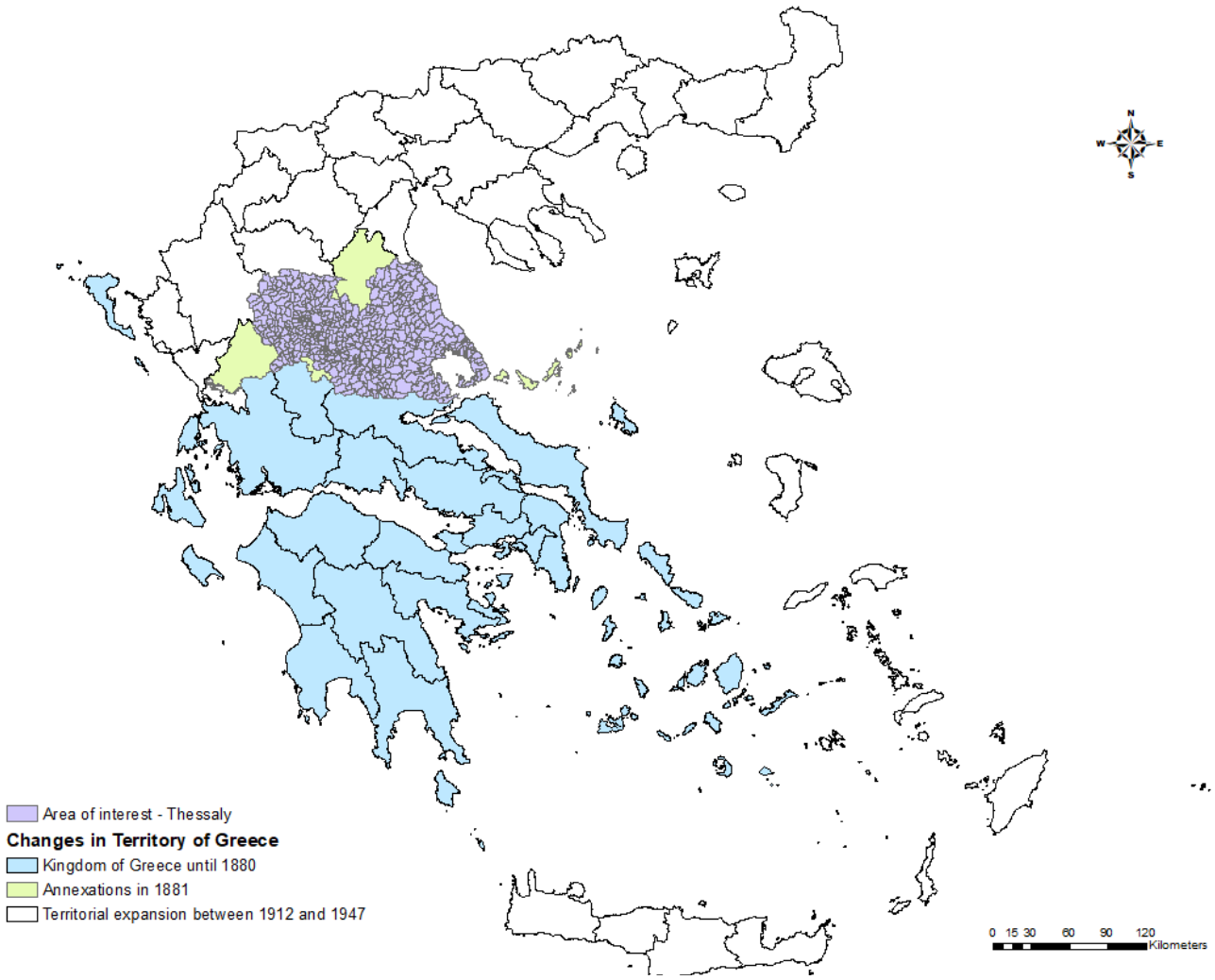
Additional Figures

Figure 5: *Greece over Time*



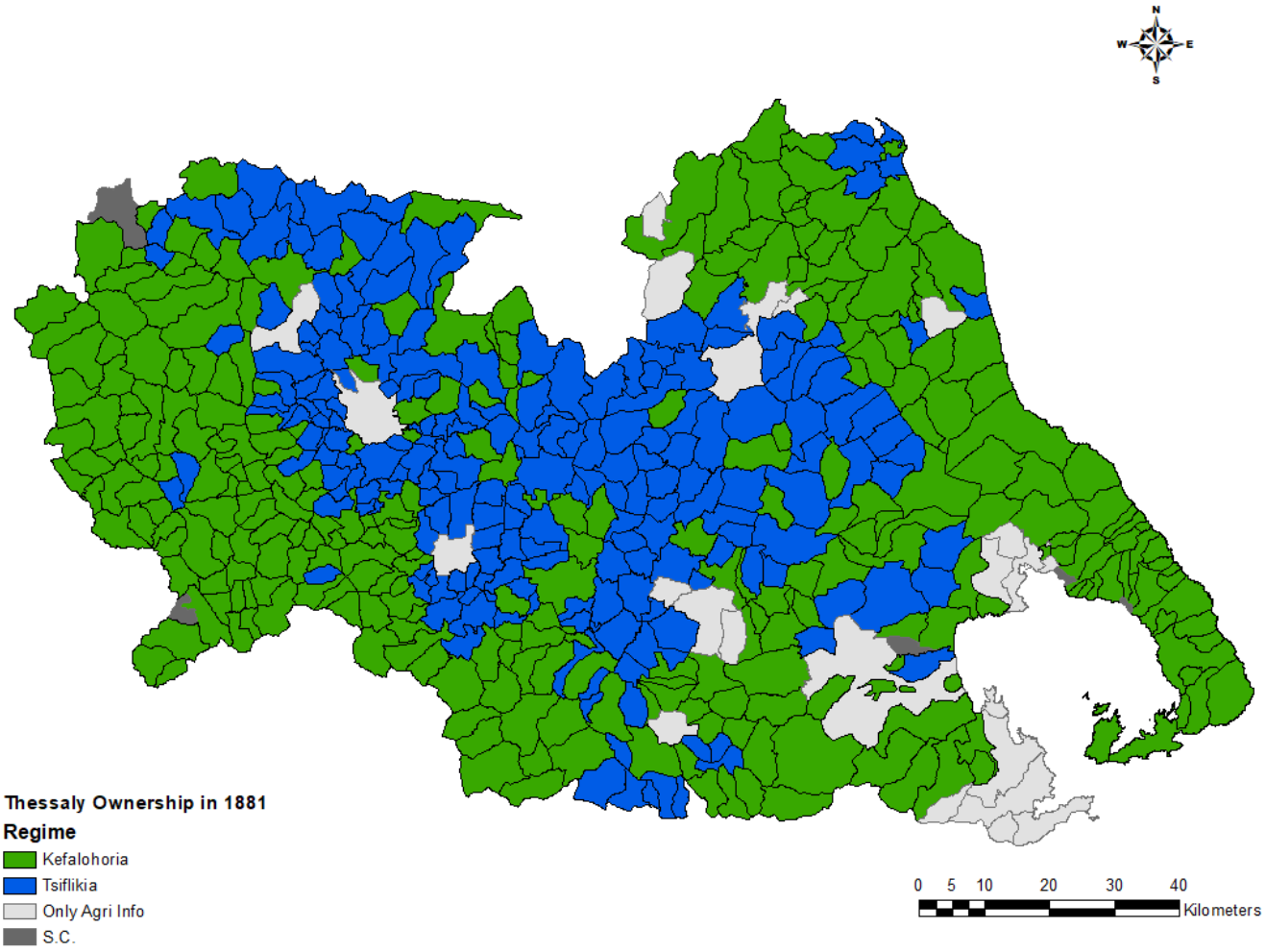
Notes: The map illustrates the changes occuring to the territory of Greece over time, in late 19th and early 20th century. All territories in blue belonged to Greece prior to the annexation of modern-day Thessaly and Arta in 1881, shown in green. The outcome of territorial expansions after 1912 until 1947 can be seen in white.

Figure 6: *Greece over Time - Thessaly*



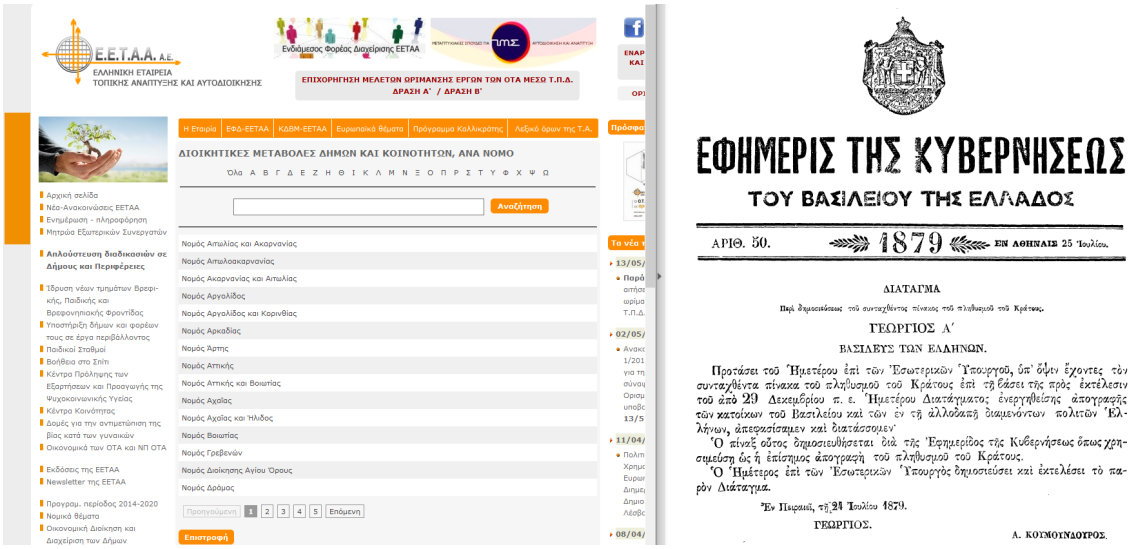
Notes: The area of interest, Thessaly excluding Elassona and Arta, is shown in purple. The rest of the territories are described in Figure 5.

Figure 7: *Ownership Status Before Annexation*



Notes: Approximation of ownership status in Thessaly around 1881, using data from (Prontzas, 1992). Kefalohoria can be seen in green, while Tsiflikia in blue as described in Section 4.3. Communities with lack of ownership information are illustrated in light gray, while communities with unclear ownership information status are illustrated in dark gray.

Figure 8: *Matching Municipalities over time*



Notes: Tools used to trace and match communities and municipalities back in time to create boundaries for 1912. The website of the online database of the Hellenic Society for Local Development and Local Government (EETAA) is on the left, and an example of a royal decree is shown on the right. Link for website: eetaa.gr.

Figure 9: *Ownership Data Example*

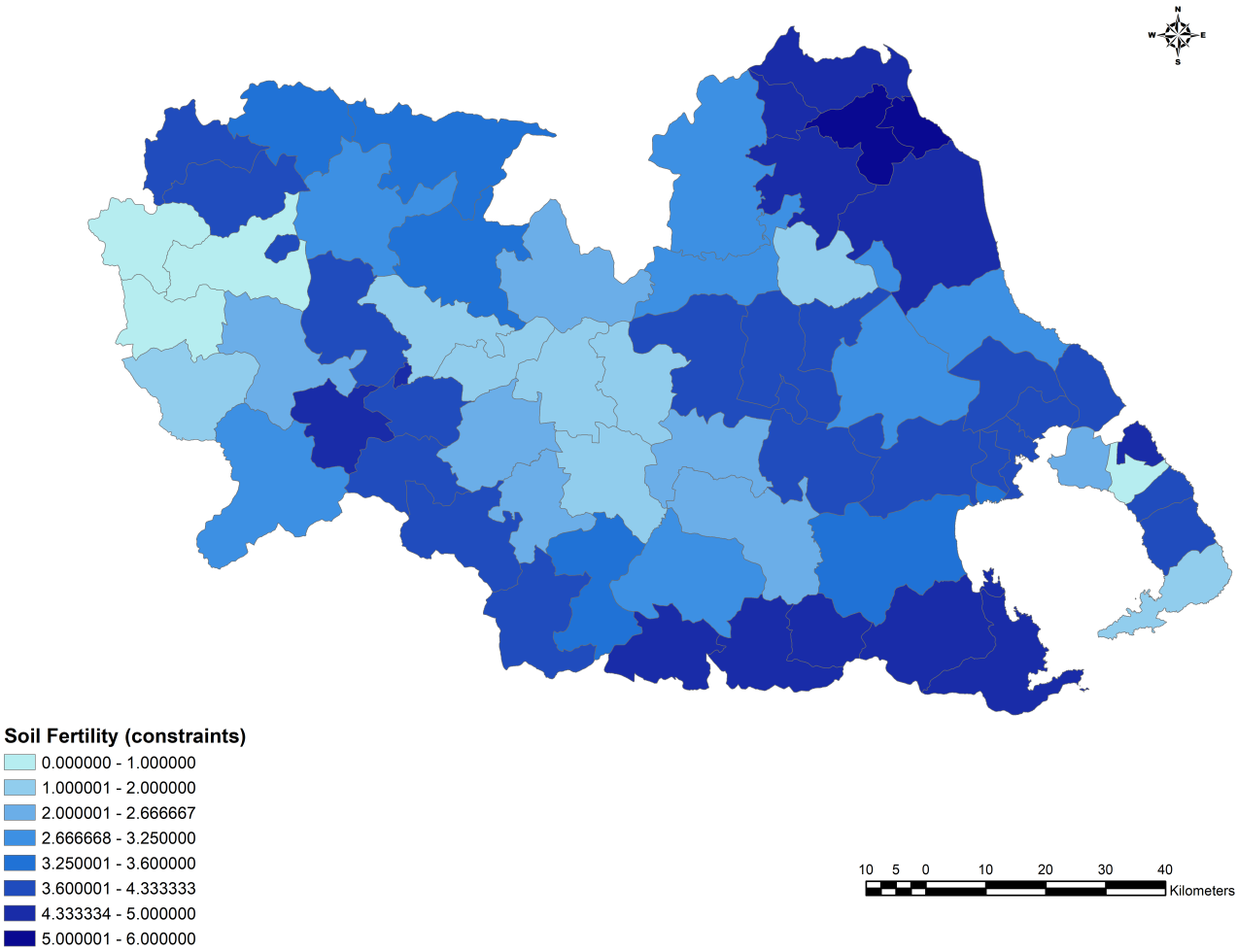
ΠΙΝΑΚΑΣ/TABLEAU A-1

(Συνέχεια/Suite)

Κωδικός Code	Οἰκισμός Village	Δῆμος Dème	Καθεστὼς ἰδιοκτησίας Régime foncier	Ἔτος ἀπογραφῆς Année du recensement			
				1881	*1889*	*1896*	*1907*
1.038	Tachtalesman	Phérée	V.R.	118	305	151	293
	Σύνολο/Total		V.R.	(118)	(305)	(151)	(293)
1.039	Capourna	Vive	V.P.	443	436	483	543
	Σύνολο/Total		V.P.	(443)	(436)	(483)	(543)
1.040	Persophli	Phérée	Ç.O.	40	91	59	78
	Σύνολο/Total		Ç.O.	(40)	(91)	(59)	(78)
1.041	Palea Mintzéla	Zagora	Ç.C.	—	—	49	14
1.042	Ouzlar	Phérée	Ç.C.	85	200	98	87
1.043	Moussaphacli	»	Ç.C.	50	154	136	119
1.044	Serantzi	»	Ç.C.	163	212	152	233
1.045	Germi	»	Ç.C.	27	40	11	31
	Σύνολο/Total		Ç.C.	(325)	(606)	(446)	(484)
1.046	Dampegli	Phérée	Ç.M.	190	110	124	138
1.047	Aj. Georgios	»	Ç.M.	311	445	332	318
	Σύνολο/Total		Ç.M.	(501)	(555)	(456)	(456)
1.048	Malaki	Nilée	S.C.	—	—	—	46
1.049	Paieocastron	»	S.C.	—	—	107	129
1.050	Platanidi	»	S.C.	—	—	—	74

Notes: Example of historical archives of (Prontzas, 1992).

Figure 10: *Map of Treatment - Municipality*



Notes: Illustration of the instrumental variable $\Delta(\textit{Soil Fertility})$, as described in Section 4.5. Constructed by using data from FAO-GAEZ global measuments. Deeper shades of blue indicate higher shares of constraints in soil fertility for each municipality.

Chapter 5

Conclusion

This thesis analyses the impact of agriculture on development, investigating how developmental attributes such as beliefs, human capital formation and land relations, were shaped by history. Starting from a general perspective and then focusing on historical case studies, it contributes to the expanding literature of historical economics. The first empirical chapter examines the role of land ownership inequality on beliefs towards gender equality, documenting evidence in favour of cultural transmission as well. The following empirical chapter explores the impact of historical events on human capital formation in an agrarian economy, namely Greece. By examining a shock in international demand of the main export agricultural good, the evidence shows that the increasing specialization of the economy in a low-skilled agricultural good, lowered human capital accumulation, in line with expectations. The following chapter, chapter 4, examines a historical event related with land distribution and regional development in the same economy at the early 20th century. Focusing on the recently annexed region of Thessaly, and changes in land relations, it provides insight on the mechanisms behind the regional development of pre-industrial economies, and how historical framework plays a significant part in this process.

5.1 Summary of findings

Chapter 2 analyzes how historical land ownership inequality affected the formation of beliefs towards gender equality. Combining land inequality measurements and cross-country surveys, I show that higher inequality in land ownership had a negative effect on beliefs such as the participation of women in politics, higher education, and the labour market. To overcome reverse causality concerns and the possibility of omitted variables, I employed an instrumental variable methodology, using the average slope of the terrain as an instrument for land inequality. Furthermore, I provide evidence on the cultural transmission mechanism, by analyzing survey data on second generation immigrants. I find that individuals from countries with higher shares of historical land inequality are less likely to be in favor of gender equality, as measured by their support towards female labour market participation. When differentiating between the parents' country of origin, it appears that the mother's side is driving the effect, in line with expectations from cultural transmission literature.

Chapter 3 explores the impact of historical events on the formation of human capital in an agrarian economy, namely 19th century Greece. After a series of historical events related with international trade, Greece experienced a significant increase in demand for its main exporting good at the time, currants. Using digitized data from national archives, I show that this exogenous shock had a negative effect on investments towards human capital. Specifically, I employ a difference-in-differences methodology to identify the causal impact of this shock, by comparing regions with different levels of capacity to respond to the increased demand through their agricultural populations. The evidence shows that regions with higher shares dedicated to currant production, and increased agricultural population before and after the shock, experienced a decrease in their respective student ratios. When I differentiate between males and females, it appears that male student ratios are driving the effect. Additionally, this chapter provides placebo tests as evidence that this negative effect on human capital formation is robust, while also documents that it is not driven by other factors such as parallel trends or selective migration.

The final chapter, chapter 4, investigates the impact of changes in land relations on development, focusing on a region in the same agrarian economy, i.e., Greece, during the early 20th century. After the annexation of Thessaly from the Ottoman empire, all properties had to transition out of feudal land relations towards private ownership. Using digitized data from historical studies, I show that communities transitioning towards small private ownership experienced a higher increase in their population growth rates, compared to other communities. To ensure that this result is not driven by other factors, I conduct several tests, such as a contiguous border matching and an omitted variables test, as well as testing the parallel trends assumption. Moreover, to shed light behind the mechanism of this finding, I examine the effect of changes in property rights on proxies related with potential mobility of emancipated former cultivators. I show that municipalities with higher shares of communities transitioning towards small ownership were more likely to be characterized by higher shares of married and illiterate households. These results provide support to the argument that new small landowners chose to invest time and effort in their newly acquired estates, leading to improvements in agricultural productivity, while decreasing their demand towards human capital, since there was a reduced need to search for out-of-farm opportunities.

5.2 Implications, limitations, and future research

The results of chapter 2 indicate that inequality in land ownership has contributed to differences in beliefs regarding gender equality. The findings are not only of interest for economists working in development or other social scientists interested in formation and transmission of beliefs, but to the general population as well. While inequality in land ownership is not as dominant of a factor in industrial and post-industrial societies anymore, it remains important for developing economies characterized by agriculture. As gender equality becomes an increasingly salient issue across the world, it is crucial to keep in mind that various beliefs have been influenced by past economic realities and understand contemporary

beliefs towards gender through a historical perspective (Giuliano, 2017). Acknowledging that this form of inequality has an impact on such beliefs, may help policy makers understand the importance of economic factors related with the economic independence of women, in their efforts to design a more equal society. Nonetheless, the role of identity, especially in the sub-national ethnic group level remains highly influential (Akerlof and Kranton, 2000), and in that sense this work is limited by comparing beliefs across countries. The reason for that comes from the lack of comparable measures of land inequality, disaggregated in sub-country regions. Recent efforts to measure land inequality more accurately (Bauluz et al., 2020), still primarily focus on creating consistent measures of comparison between countries. More work can be done so comparable measures of land ownership can become available in lower levels of aggregation, making national and regional policy easier.

The following chapter finds that shocks related with the international demand of agricultural products have a negative effect on the formation of human capital in agrarian economies. Even though it is focused on the historical case of Greece during the 19th century, the results can be of interest to any economist working on human capital in developing countries. Shocks in demand may increase income, however if there is an increased specialization towards such low-skill agricultural products, in the medium to long term this lessens incentives towards human capital. This historical case study demonstrates that such trade-offs existed even during the early stages of development, for now-developed countries. Being one of the first studies focusing on this trade-off from the historical perspective of an agrarian economy, it offers important evidence for researchers and policy makers alike, highlighting how events related with international trade can affect agrarian economies. The drawback of this research is that while the historical context provides a unique opportunity to empirically assess theoretical models from the relevant literature, data availability for 19th century Greece is limited compared to contemporary cases. Future research of historical archives will undoubtedly benefit from advances in deep learning algorithms used for layout detection and character recognition of document images (Shen et al., 2021). Successful usage of this toolkit can

drastically increase the number of archives that can be processed, allowing increased focus for primary research of historical documents from various sources that may be underutilized.

The third empirical chapter documents that changes towards small ownership increased the population growth of rural communities at higher rates compared to other types of ownership. The historical context of this study may differ from other countries; however, the findings underline the importance of understanding the historical framework in which land relations affect regional development of agricultural economies. The highly focused sub-regional analysis is certainly a limitation of this study – in terms of generalized validity – even though it is generally accepted that case studies have unique historical backgrounds. Nevertheless, it contributes to an emerging literature focusing on the conditional nature on the effects of land concentration on aspects of development in historical pre-industrial societies (Andersson and Berger, 2019). Relations of production, such as the presence of coercive labour institutions, are receiving attention in recent studies (Ashraf et al., 2020), highlighting the importance of examining the historical context in which changes occur. Overall, future research can benefit from closer examination of the institutional framework in which the transition out of agricultural economies takes place, since policy decisions that fail to recognize such historical realities may not succeed in their respective targets.

In summary, each chapter of this thesis contributes to various strands of literature related with cultural beliefs, human capital, and regional development. This thesis builds upon literature from these fields and aims to further develop the growing historical economics literature, along with the comparative development literature. While certain limitations were presented in this thesis, future extensions were discussed with the hope to develop better original research. The implications of this research are important for economists, social scientists, and policy makers alike, as motivated throughout different chapters.

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