

Agricultural Practices, Organised Workers and Female Empowerment: Evidence from Italian *Mondine*^{*}

Luca Bagnato¹, Yu Pan², and Miriam Venturini³

¹University of Bologna

²University of Zurich

³University of California Riverside

[Preliminary draft]

Abstract: We study whether work practices adopted in recent history in agriculture influence the empowerment of women. Focusing on Italy, we study the case of female rice weeders (*Mondine*) and their successful history of unionisation and mobilisation for better working conditions at the turn of the XX century. Relying on an instrumental variable strategy to predict quasi-exogenous variation in rice production, we test whether the historical presence of female rice weeders predicts differences in measures of women's economic and political empowerment during the second half of the XX century. We find that towns where rice production was historically relevant have higher women labour force participation, stronger support for divorce in the 1974 referendum, more women in politics, and are more likely to have a nursery school. Moreover, these towns were more likely to experience an agricultural strike between 1883 and 1905. Our results suggest the importance of collective action of working women to achieve persistent women's empowerment.

*We thank Bruno Caprettini, David Yanagizawa-Drott, Pietro Biroli, Joachim Voth, Lorenzo Casaburi, Jane Humphries, Pablo Martinelli Lasheras and Paola Giuliano for useful comments. We also thank Michela Giorcelli and Tancredi Buscemi for kindly sharing nursery schools and strike data with us.

1 Introduction

Despite the radical changes that affected the role of women in society during the XX century (Fernández, 2007), in many countries (even OECD countries), we still observe gender gaps in participation in the labour force, earnings, and representation in leadership positions (Fortin, 2005; Gagliarducci and Paserman, 2012; Baltrunaite et al., 2019). There also exist substantial differences across societies in the tasks that men and women usually perform, the participation of women in politics, and the beliefs about the appropriate role of women in society (Alesina et al., 2013). In Italy, recent evidence shows that almost a third of the respondents in a representative survey believe men are responsible for providing for the needs of the household, while women are more suitable for housework; with substantial variation across regions (ISTAT, 2018).

Many studies investigated the determinants of these differences in gender norms across societies (see, e.g., Iversen and Rosenbluth, 2010; Doepke et al., 2012) and, in particular, a strand of literature focused on the cultural determinants of this variation (Fortin, 2005; Fernández, 2007). In line with research emphasising the long-term persistence of cultural traits in societies (Guiso et al., 2016), many scholars analysed how traditional (and often disappeared) work practices (together with historical economics shocks) influenced gender roles and gender norms (Qian, 2008; Alesina et al., 2013; Carranza, 2014; Federico and Martinelli, 2015; Xue, 2024).

In this paper, we study how Italy's traditional agricultural practices in the early XX century affected historical and contemporary female empowerment. In particular, we examine whether female political and labour force participation and female-friendly policies are affected by the (past) presence of women working, mobilising for their rights, and organising in unions.

We focus on the case of the Italian *Mondine*, women who worked as seasonal rice weeders from the late XIX century to the 1960s in Italy's rice belt, located in the heart of Northwestern Italy¹. During the XIX century, weeding in the rice fields soon became an activity almost exclusively carried out by teams of women, who performed this arduous task for long working shifts and in bad health conditions. The collaborative nature of their work, its essential role in ensuring a successful harvest, and the unsatisfactory working arrangements led to the high unionisation of female rice weeders in Italy and to their strong capacity to mobilise and protest to obtain better working conditions. Such mobilisation was eventually successful, achieving the eight-hour working day in 1906, with weeders' salaries surpassing those of men working in the rice fields. We argue that the empowerment of female rice weeders by means of protests for workers' rights (and their success in obtaining them) had consequences also outside the working field, affecting the economic and political empowerment of women who participated in or were exposed to the agricultural practice of rice weeding.

We test for the effects of female rice weeders in a town on different measures of women's economic and political empowerment, in terms of labour force participation, voting behaviour for

¹Rice production in Italy is and was historically concentrated in the current provinces of Vercelli, Novara, Pavia, and Milan.

divorce laws, the share of women running and being elected as politicians, and the provision of nursery schools, a public good especially relevant for women. We proxy for the past presence of rice weeders using data on the production of rice in a town in the 1923-1929 period. We validate this proxy using data on actual *Mondine*'s presence in 1954 for a subset of towns, showing that it strongly correlates with rice production. We complement such a dataset with information on women's labour force participation, the share of votes in a town in support of divorce, women candidates and elected politicians in city councils, and the presence of nursery schools. Importantly, we look at the effects of the (past) presence of *Mondine* on women's empowerment not only when the rice weeders were still active in the rice fields but also in later decades and today.

Rice cultivation in a town could be correlated with other factors able, in turn, to predict differences in the political empowerment of women. For example, if areas where gender norms were ex ante more equitable decided to invest more (or less) in the production of rice, we would estimate a positive (negative) correlation between rice and female empowerment, even if rice cultivation (and hence the presence of rice weeders) did not have a causal effect on the outcomes under analysis. To isolate the causal effect of historical rice production and the presence of female weeders on our outcomes of interest, we instrument rice cultivation in a town with the agro-climatically attainable yield for rainfed rice ([FAO, 2015](#)), for which we observe large variation across the Italian territory. In this way, we isolate the effects of rice production that are solely due to quasi-exogenous differences in the climatic and soil conditions of a town, which are unlikely to affect female empowerment through channels other than actual rice cultivation.

Results show that towns where rice production was larger in 1923-1929 have not only significantly higher women labour force participation (from the 1950s until today) but also stronger women's empowerment in the political arena. In these towns, we observe more votes in favour of divorce in the 1974 referendum, a result suggesting more equitable gender norms and a more favourable attitude towards female enfranchisement. Moreover, towns where rice production was more relevant had more women running as candidates and being elected as local politicians in 1956, when *Mondine* were still working in the rice fields, and had larger shares of women elected in city councils also in the thirty-five years between 1986 and 2021 (that is, more than two decades after rice weeders exited the labour market in the rice belt). Finally, in census years between 1991 and 2011, such towns were more likely to host a nursery school. Consistent with the role of *Mondine*'s mobilisation for women's empowerment, we also find that towns with higher rice production were more likely to have an agricultural strike between 1883 and 1905, crucial years for *Mondine*'s successful protests to obtain better working conditions. We show that our results remain positive after controlling for geographical characteristics of towns that may influence our outcomes of female empowerment, and we discuss why the effects we estimate can reasonably be attributed to the historical presence of female rice weeders. In particular, left-leaning politics does not fully explain the results on the stronger prevalence of women politicians, since these results are present also when focusing on elected women aligned with the Christian-Democratic party. Since

weeding also attracted substantial temporary migration of young women to rice-producing towns during the weeding period, we expand our analysis to towns with historical temporary emigration of *Mondine*. We find that a stronger prevalence of *Mondine* among (female) temporary emigrants in 1904 is positively associated with most of our measures of female empowerment. This suggests that temporary migrant workers in the rice fields also developed and brought back to their home-towns attitudes that translated into more gender equality in the labour market and in the political arena.

The salient presence of empowered women in the recent history of a town can thus predict long-lasting differences in the gender norms of its population, even after such women lost their bargaining power as workers and, arguably, when they start to disappear from the voters' pool. The evidence we provide studying Italian female rice weeders underscores the importance of the ability to mobilise for the political empowerment of women in settings where, ex ante, agricultural practices and historical shocks would not necessarily lead to relatively higher female income.

The rest of this paper is organised as follows: section 2 discusses the contribution to the existing literature; section 3 discusses the history and characteristics of Italian female rice weeders; section 4 describes the data used in this paper; section 5 describes the identification strategy; section 6 presents our main results; section 7 discusses the motives behind the unionisation of weeders and alternative explanations, and section 8 concludes.

2 Related literature

This paper relates to several strands of literature. First, it contributes to a strand of literature that has studied the impact of agricultural practices on cultural norms and, more specifically, on gender norms. Previous studies provided evidence that gender roles (and arguably also female empowerment) between societies can be traced back to traditional agricultural practices (Hansen et al., 2015), like the use of the plough (Alesina et al., 2013; Carranza, 2014), or by the presence of crops whose production entails gender-specific comparative advantages (Qian, 2008; Federico and Martinelli, 2015); other studies provided evidence that other traditional activities for which gender advantages exist (like cattle-raising or cotton-weaving) are predictive of long-run differences in gender norms (Voigtländer and Voth, 2013), also in terms of beliefs about women and presence of women in powerful positions (Xue, 2024). This paper's contribution to this strand of literature is to look at a setting where unionisation and mobilisation of women played a central role and to study the effects of agricultural arrangements on political outcomes, not only in terms of elected politicians but also of female-friendly policies and voting behaviour with respect to topics particularly relevant for women's lives. More broadly, this paper contributes to the large and growing literature on the determinants and effects of gender norms (see e.g. Fernández et al., 2004; Chong and Ferrara, 2009; Fernández and Fogli, 2009; Jensen and Oster, 2009; La Ferrara et al., 2012; Fernández, 2013; Alesina et al., 2016; Field et al., 2016; Bernhardt et al., 2018; McKelway, 2019;

Bursztyn et al., 2020) by studying the effects of (relatively recent) agricultural practices on female empowerment in a European context.

Second, this paper relates to the literature on the persistent effects of past institutions (both formal and informal) on citizens' attitudes in the Italian setting (Guiso et al., 2016; Buonanno et al., 2019; Bagnato, 2021) by looking at the effect of work arrangements on female empowerment.

Finally, this paper contributes to the research investigating rice production and its effects. A large body of historical and sociological research studied rice production in Italy and the case of *Mondine*, focusing on the history of their unionisation process, the assessment of their achievements, their relevance in the Italian popular culture, and the links between their case, the socialist movement and the fight against malaria (Zappi Gentili, 1991; Snowden, 2003; Imbergamo, 2014; Faccini, 1976; Preti, 1955; Soave, 1979; Lorenzoni, 1904; Golgi, 1907; Castelli et al., 2005; Luraghi, 1974). This paper adds to this literature by providing quantitative evidence on the long-lasting effects of the presence of rice weeders on female empowerment out of the work setting, even decades after their disappearance from the Italian fields. We also contribute to a new strand of empirical literature studying the psychological and social effects of rice production (Talhelm et al., 2014) by focusing on the effects it had on gender norms and women empowerment.

3 Historical background

The cultivation of rice in Italy traces back at least to the XV century when there is evidence of rice production in the Duchy of Milan (Gavinelli, 2018); the history of its introduction is uncertain, as it can be traced back to the Arabian domination in Southern Italy, to the Aragonese one, or to the commercial activities of Venetian merchants (Cai et al., 2013). The production of rice grew with time and characterized several areas of Northern Italy, but it did not involve the presence of workers specifically devoted to weeding until the XVIII century, when the price of rice grew to the point of making it a profitable crop and hence encouraged an increase in productivity (Imbergamo, 2014). Starting in the XIX century, thanks to substantial investment in irrigation infrastructure,² the Italian production of rice greatly increased (Ferrero and Vidotto, 2010), making Italy by far the major producer of rice in Europe (Snowden, 2003). Before World War I, rice was Italy's most profitable farming activity and the most capital-intensive one (Camp, 1992).

The organisation of work that started to be common in the Italian rice fields in the XIX century envisaged the division of labour in several phases, each one allocated to different types of (and differently skilled) workers. While seeding and flooding of the fields were performed by high-skilled men, weeding soon became an activity overwhelmingly performed by women.³ In terms

²The effort to improve the production of rice in Northwestern Italy was led by Cavour, the last prime minister of the Sardinia Kingdom around the XIX century, that also supported the construction of the Cavour Canal, which greatly enhanced the production potential of rice fields in the areas of Vercelli, Novara, and Lomellina.

³The share of women in rice weeding in Italy was 73% in 1904 and kept increasing during the XX century (Imbergamo, 2014).

of the number of workers involved in it, weeding was the most relevant part of the rice production process: at the beginning of the XX century, around 130,000 weeders worked in the Italian rice fields (Imbergamo, 2014). This division of tasks between genders was motivated by several reasons. First, weeding does not require particular muscular strength, while body flexibility and short stature are advantageous for the job (Snowden, 2003). Second, most of the male labour force was involved in harvesting wheat, which occurred simultaneously with weeding. Third, in the first years after the introduction of the role of specialized weeder, owners and contractors aimed to reduce costs by hiring workers with lower wages (i.e., women and migrants), especially considering the labour-intensive nature of the weeding task (Imbergamo, 2014).⁴

Despite not requiring muscular strength, weeding was a meticulous and strenuous activity involving repeated bending, working in stagnant water, and a high degree of attention to distinguish weeds from rice plants. At the beginning of the XX century, women often worked for ten or more hours for around forty-fifty days per year, between May and July. Working in stagnant water exposed weeders to a high risk of malaria. While contractors preferred migrant weeders (as they ignored the rules and conditions of the local labour market, relied on contractors for meals and accommodation, and therefore were less likely to protest against the hard working conditions), two-thirds of total weeders were natives. Native workers kept living in their houses, while migrants lived together in farmsteads provided by contractors in poor sanitation conditions and often worked more hours than native weeders. Weeders worked in teams, usually divided between natives and migrants.

The wearing and unhealthy nature of weeding and the exploitative nature of the work arrangements favored the mobilisation of weeders for better working conditions between the end of the XIX century and the beginning of the XX century. Several factors favored the particularly high degree of unionisation of weeders. First, teamwork favored the emergence of horizontal bonds between workers. Second, the out-migration of Italian citizens to American countries heavily impacted the Italian labour market, making women more difficult to replace and increasing their bargaining power. Third, the large number of weeders among agricultural workers made them extremely relevant for the rising agricultural (mostly socialist) union movement, whose activities would have been hindered if such a large group of workers had not supported its activities (Imbergamo, 2014). Finally, and crucially (as explained in detail in section 7), the Italian anti-malaria campaign implemented around 1900 served as a catalyst for the unionisation of rice weeders (Snowden, 2003).

The mobilisation for better working conditions, which in early forms started in the 1890s without the organisation from unions, became a widespread and effective phenomenon starting in 1901

The prevalence of women (and children) in weeding was not a peculiarity of Italian rice fields but has also been observed in the Philippines, India, and Pakistan (Foster and Rosenzweig, 1996).

⁴As a result of the mobilisation of rice weeders, by the beginning of the XX century, the salaries of male and female workers in the rice fields were almost equal (Faccini, 1976), and female rice weeders eventually ended up earning more than men (performing other tasks).

when two *Camere del Lavoro* (centralized labour unions) were founded in Vercelli and Mortara, two of the most prominent centers in the rice district ([Zappi Gentili, 1991](#)). During the first years of mobilisation, weeders' requested higher salaries and their homogenisation across towns of the rice district; starting in 1903, however, requests included also workers' protection (e.g., against replacement with migrant weeders following a protest), improvements to working conditions and abidance to the existing regulations on work in the rice fields, which were mostly not enforced while still being mild ([Imbergamo, 2014](#)). From 1904, mobilisations' main objective became the cap to eight working hours per day. Following a wave of strikes and protests, in 1906, weeders finally obtained the reduction of working time to eight hours per day without salary reductions, eleven years before it was recognized to steelworkers, another heavily unionized (but male-dominated) group of workers ([Bertrand, 1982](#)).⁵ Across the years, weeders obtained several improvements to their working and living conditions, which nonetheless remained particularly hard: a ban on night working shifts; two hours break; protection for pregnant women; sanitation of and anti-mosquitoes measures in the farmsteads where weeders lived, the right to participate in mediation committees for working disputes, and salary raises ([Imbergamo, 2014](#); [Snowden, 2003](#)).

While improvements to working conditions continued after the Fascism regime and World War II, starting at the end of the 1950s, the burgeoning processes of industrialisation and urbanisation that took place in Italy (including, and even more so, in the areas where rice weeders typically originated from) greatly reduced the influx of weeders (who could easily find better working arrangements in manufacturing), despite the influx of new workers from Southern Italy. Such labour shortages coupled with (and, arguably, also encouraged) the modernisation and mechanisation of agricultural tasks, including the use of herbicides: the use of such substances became widespread from 1963, and, by the end of the 1960s, they made the work of weeders obsolete ([Imbergamo, 2014](#)).

4 Data

4.1 Data sources

The data described below is matched to the 1991 list of Italian municipalities, the first year for which the Italian Statistical Institute (ISTAT) provides a municipality-level shapefile.⁶

Rice production. We obtain data on rice production in Italy in the 1923-1929 period from the Italian Agrarian Cadastre ([ISTAT, 1936](#)). While in these years the production of rice had reduced compared to the beginning of the century, the Cadastre is the most accurate source providing data

⁵While the agreement on the eight-hours day in 1906 was short-lasting (being raised to nine hours in 1907), the cap to eight hours became permanent in 1910 ([Imbergamo, 2014](#)).

⁶The shapefile (GIS file format, storing the geometry and attributes of geographic features) is available at the following link: [Confini delle unità amministrative a fini statistici](#).

on rice production at the town level, while earlier data are considered less reliable by scholars ([Zappi Gentili, 1991](#)). Specifically, for each town, we obtain information on the total production of rice in hundreds of tonnes and the total number of hectares devoted to rice production. We use the total production of rice and the share of a town's area devoted to rice as our measures of rice production. For robustness, we also use the average production of rice per hectare and an indicator of the presence of rice fields in the town.

Land suitability. To measure the land suitability of Italian towns for rice, we obtain data on agro-climatically attainable yield for rainfed rice with medium-level of inputs from FAO-GAEZ ([FAO, 2015](#)); we also use information for attainable yields with medium-level of inputs for other common crops in Italy: wheat, tomato, olive, potato, maize, oat, rye, and barley.⁷

Presence of rice weeders (*Mondine*). Comprehensive data on the presence of *Mondine* covering all Italian towns does not exist to the best of our knowledge. However, we collected data on the exact number of rice weeders working in 1954 in each of the 43 rice-producing towns of the province of Vercelli from the *Camera del Lavoro* historical archive in Vercelli ([Camera del Lavoro di Vercelli, Archivio storico Federbraccianti](#)).

Women labour force participation (1951-2011). We measure women's participation in the labour force as the share of women in a town who are active on the labour market, either employed or unemployed, in each census year between 1951 and 2011. Data are from the Italian Population Census.⁸

Votes in referenda. We obtain town-level data on the 1974 referendum to repeal the Divorce Law (Law n.898/1970) from the Italian Ministry of Interior.⁹ As outcome of interest, we use the share of "No" votes against the repeal of the law out of the total votes expressed in a town. Additionally, we collect town-level data on the 1981 referenda on abortion and use the share of "No" against the repeal of the abortion law (L.194/1978) as outcome of interest.

Female political candidates for local councils (1956). To measure women's empowerment in the political arena and their active political participation, we measure the share of women among candidates running in municipal elections for local city councils. We digitize new data from the Ministry of Interior ([ISTAT – Ministero dell'Interno, 1959](#)) regarding elected and non-elected candidates in the 1956 local elections, when *Mondine* were still active in the rice fields.

Female politicians in local councils. As an additional measure of female empowerment in politics across time and nowadays, we use data on the share of women elected in local city councils. We digitise new data on elected and non-elected candidates in the 1956 local elections ([ISTAT](#)

⁷We focus on attainable yields for rainfed rice to identify the areas where rice production was historically common in Italy before it became a capital-intensive crop during the XIX century. Attainable yields for irrigated rice with medium-level inputs are high for basically every flat area in Italy.

⁸Data for 1951 and 1961 are relative to the resident population above 9 years old, and data for subsequent years are relative to the resident population above 14 years old. Digitised data available at: <https://ottomilacensus.istat.it/>.

⁹Available online at <https://elezioni.interno.gov.it/>.

– Ministero dell’Interno, 1959) and we use data from the Ministry of Interior¹⁰ on the universe of Italian elected politicians in city councils in the 1986-2021 period. For each election cycle, we compute the share of female councillors out of the total number of councillors. For the years between 1986 and 2021, we also build an indicator variable for the presence of a female mayor in the town. Such data allows us to measure the women’s representation in local councils both when *Mondine* were still actively working in the rice fields and in later years when this job had completely disappeared. From the election data for 1986-2021, we also encode the political party of each elected city councillor.

Nursery schools and other town-level variables. We use information from ISTAT on the presence of children enrolled in nursery schools by town in 1991, 2001, and 2011, originally used in Bianchi et al. (2023).¹¹ We build an indicator variable for the presence of a nursery school in a town if at least one child from that town is counted as enrolled in a nursery school.¹²

Share of votes for the left in national elections. We use data on national election results from the Italian Ministry of Interior.¹³ to measure the political leaning of towns by computing the share of votes supporting left-wing parties, by summing the votes in favour of the communist and socialist parties.

Agricultural strikes (1883-1905). To measure agricultural strikes in Italian municipalities, we use data extracted from the strike statistics published yearly during this period (Ufficio del Lavoro, 1904).¹⁴ We construct an indicator variable equal to one for the municipalities where there was at least one agricultural strike in the 1883-1905 period.

Rice weeders’ internal migration (1904). To measure the internal temporary migration of rice weeders, we use data extracted from the 1904 bulletin of the work office of the Ministry of Agriculture, Industry and Commerce (Ministero di Agricoltura, Industria e Commercio, 1904). We compute the share of rice weeders among temporary emigrants and the share of rice weeders among female temporary emigrants moving from each municipality. The first measure, using the total number of emigrants as the denominator, controls for the propensity to migrate from the municipality; the second measure, using female emigrants as the denominator, controls for the propensity of women to migrate from the municipality.

Irrigation potential. We follow Buggle (2020) to construct a measure of irrigation potential using data provided by FAO-GAEZ (also previously used by Sinding Bentzen et al., 2017) and consider a raster cell suitable for irrigation if irrigation increases agricultural output by 50% or more. We

¹⁰ Available online at <https://dait.interno.gov.it/elezioni/anagrafe-amministratori>.

¹¹ In the analyses split by single years, we focus on information for 1991 and 2011, as data on nursery schools in 2001 is missing for more than 38% of the sample.

¹² In the main analysis we focus on the presence of a nursery school (instead of the number of enrolled children) to abstract from a measure that may be influenced by differences in population, age structure, and fertility rates. In the appendix, we also provide evidence of the effects by looking at the number of enrolled children.

¹³ Available online at <https://elezioni.interno.gov.it/>

¹⁴ We thank Tancredi Buscemi for sharing the digitised data with us.

then aggregate the measure at the municipal level by computing the share of the municipality's area suitable for irrigation.

Other control variables. Finally, we use data from [USGS \(2005\)](#) to compute a town's average elevation and slope; we further compute the distance of towns from Rome and from the coast. We also add an indicator for whether they were the province capital in 1991.¹⁵ We digitise information regarding malaria prevalence in Italian municipalities from the health investigation ran by the government in the 1880s ([Direzione Generale della Statistica, 1886](#)).

4.2 Summary statistics

In Table 1 we present summary statistics for the variables we use in the empirical strategy. Cultivation of rice, on average, occupied a small fraction of towns' area in 1923-1929. However, there exists meaningful variation in such a measure (as well as in total production of rice), with towns in the Italian rice belt having the vast majority of their area allocated to rice fields. This pattern is also clear when looking at Figures 1, 2 and 3, which show how rice production, the share of land devoted to rice, and attainable yield for rice are extremely high for towns in the centre of Northwestern Italy.

The share of women active in the labour force between 1951 and 2011 is lower than 32%, a very low average share that did not increase until the 2000s (36% in 2001, 40% in 2011).¹⁶ Still today, Italy has the lowest women labour force participation in the European Union (51.7% at the end of 2022).¹⁷

The share of "No" votes against the repeal of the Divorce Law in the 1974 referendum is around 49% for the mean town of our sample¹⁸; as Figure 4 shows, the share of "No" votes was substantially higher in the Centre and Northwestern Italy (the areas that include most rice-producing towns).

The share of female councillors in Italian city councils is, on average, quite low in the 1986-2021 period (20%); additionally, in no town or year we observe the share of women reaches 50%; Figure 5 shows that high shares of female councillors can be observed in every region, while being more common in Centre Italy, similarly to other indicators of female empowerment.

Most Italian towns hosted a nursery school both in 1991 and 2011. Nonetheless, variation in the presence of nursery schools in Northwestern Italy is substantial, as can be noticed in Figure 6.

¹⁵We also use data from ISTAT to obtain information on towns' area and population in 1951. 1951 is the first census year for which ISTAT provides full digitised data on towns' population. Data from ISTAT available at: <https://ottomilacensus.istat.it/>

¹⁶Note that these statistics are averages across towns: the labour force participation of big cities has the same weight as the one of small towns that are also more frequent among Italian municipalities.

¹⁷[Link to Bloomberg \(2023\)](#).

¹⁸While the referendum was eventually not approved (and the law not repealed), the result was significantly driven by voters in large Italian cities, while small towns (the majority in the sample) were more likely to vote to repeal the Divorce Law.

5 Identification strategy

In this section, we elaborate on the identification strategy that allows us to evaluate the consequences of the historical presence of rice weeders in Italy on several indicators of female empowerment. Unfortunately, no geographically disaggregated data on the presence of rice weeders are available. For this reason, we will use different measures of rice production to proxy for the presence of weeders. However, rice production in a town is probably determined by cultural and institutional factors that may directly impact women's empowerment, political participation, and policy making. As a consequence, OLS analyses on the effects of rice production on female empowerment would deliver a biased estimation of the effect of rice production on these outcomes. For this reason, our identification strategy relies on an instrumental variable estimation. We use the agro-climatically attainable yield for rice in a town as an instrumental variable to predict rice production. Attainable yield is an index computed by FAO-GAEZ ([FAO, 2015](#)) using time-invariant geographical and soil characteristics to measure whether and how much agricultural land in a particular territory is suitable for a specific crop. This measure is frequently used in the literature as an exogenous determinant of the cultivation of a specific crop in an area (e.g., [Alesina et al., 2013](#)). Hence, we use the attainable yield for rice in town i ($Rice Attainable Yield_i$) to predict rice production in the following first stage regression:

$$Rice_i = \pi + \theta Rice Attainable Yield_i + \sum_{c \in C} \mu_c Attainable Yield_{ic} + (\boldsymbol{\Gamma}_i \sigma) + \xi_i \quad (5.1)$$

where $Rice_i$ is either the total annual production of rice in town i or the share of town's i area cultivated with rice. To take into account the fact that a town with high attainable yield for rice may also have high (or even higher) attainable yield for other crops ($c \in C$), in our main specification, we control for the attainable yield of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. The intuition behind this strategy is that rice cultivation in a town is likely to be determined by the comparative advantage of rice with respect to other crops. In some specifications, we additionally control for a vector of geographical (or town-level) controls ($\boldsymbol{\Gamma}_i$): the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. The predicted rice production and the same set of control variables are then used as independent variables in the second stage regression:

$$Y_i = \alpha + \beta \widehat{Rice}_i + \sum_{c \in C} \gamma_c Attainable Yield_{ic} + (\boldsymbol{\Gamma}_i \delta) + \varepsilon_i \quad (5.2)$$

where Y_i is either women's labour force participation, the share of votes against the repeal of divorce law in the 1974 referendum, the share of women elected in a town's council (elections between 1986 and 2021), or whether town i has a nursery school (in 1991 and 2011). When

considering outcomes that we can observe in multiple years (women labour force participation, the share of female council members and the nursery schools' data) we pool together data for different years and add electoral cycle or year fixed effects. In addition, as a robustness check we add region fixed effects.¹⁹

Two sets of concerns may arise regarding our strategy to measure the impact of women rice weeders on women's political participation and policy outcomes. First, two main identification assumptions are needed for our instrument to be valid: relevance and exclusion restriction. We show that our instrument is relevant in section 5.1 when discussing the results from the first stage regression in equation 5.1. Regarding the exclusion restriction, it is reasonable to assume that attainable yield for rice (a geographical index summarizing how much an area is suitable for rice cultivation) does impact our outcomes of interest only through actual rice cultivation and production.

Second, we use rice cultivation as a proxy for women weeders' presence. In fact, rice cultivation, even if as good as random, may have an effect on our outcomes of interest independently of the presence of female rice weeders through two main channels: income and socialist presence. We discuss the relevance of these potential threats in section 7.

5.1 First stage: Rice attainable yield and rice production

In Table 2 we test for the relevance condition for the validity of our instrument by regressing our two indicators for rice production on our measure of attainable yield for rice. The results show that a higher attainable yield for rainfed rice in a town significantly predicts both larger production of rice and a larger share of the town's area devoted to rice cultivation in 1923-1929. Such evidence confirms the spatial patterns observed in Figures 3 and 2, where it is evident that rice production in Italy is concentrated only in the areas where the attainable yield for rice is higher.

As already discussed, the attainable yield for rice could predict larger production of rice simply because they capture generalized suitability for agriculture²⁰; however, we find that our instrument is significant both in bivariate regressions and controlling for the attainable yield of other crops, therefore attenuating this concern.

In all results tables in section 6, we report F -statistics on excluded instrument for every regression of our main results; in the vast majority of cases, the first stage F -statistics suggest we do not face a weak instrument problem.

¹⁹We also run reduced form regressions of the form: $Y_i = \alpha + \beta \text{Rice Attainable Yield}_i + \sum_{c \in C} \gamma_c \text{Attainable Yield}_{ic} + (\Gamma_i \delta) + \varepsilon_i$

²⁰A similar case has been faced by [Lowes and Montero \(2021\)](#); when studying attainable yields for cassava in Cameroon and former French Equatorial Africa.

6 Results

In this section, we show evidence of the strong connection between rice production and the presence of *Mondine* and we present the results of our instrumental variable analysis, where we test the effects of the historical presence of rice weeders in Italy (as proxied by the production of rice) on several indicators of female empowerment.

An underlying, historically very plausible, assumption in our analysis is that rice production is a good proxy for the presence of rice weeders. Unfortunately, to the best of our knowledge, there is no comprehensive municipal-level data on the presence of *Mondine*. However, we were able to collect data reporting the number of *Mondine* for each town in the province of Vercelli in 1954 from the historical archive of the *Camera del Lavoro* ([Camera del Lavoro di Vercelli, Archivio storico Federbraccianti](#)). Figure 7 shows the strong positive correlation between their presence and rice production. The correlation is strong (0.77 and 0.75) and significant: towns with more rice weeders in 1954 used a higher share of their land to produce rice (Subfigure 7(a)) and produced more rice between 1923 and 1929 (Subfigure ffig:scatter2). Importantly, in Subfigure 7(a), many observations align almost perfectly with a 45-degree line where the number of rice weeders is equal to the share of land devoted to rice production. This confirms historical records reporting that usually, to complete weeding in time, landowners and managers had to and used to hire around 1 rice weeder per hectare. The scatter plot closely aligns with this statistic even if the dependent and independent variables are observed twenty-five years apart. This result reassures us and supports our empirical strategy using the share of land cultivated with rice and total rice production as a proxy for the historical presence of rice weeders (*Mondine*) in Italian towns.

Reassured by this evidence, we can apply our empirical strategy to study the effects of the historical presence of rice weeders. We summarise our main results in Table 3. We present instrumental variable regressions of our five main outcomes of interest (women labour force participation, the share of votes in favour of divorce in the 1974 referendum, the share of female candidates in city councils in 1956, the share of female politicians in city councils (1986-1921), and the presence of nursery schools in a town) on our two proxies of the presence of rice weeders in a town, i.e., the share of a town's area devoted to rice cultivation and the annual production of rice in the 1923-1929 period (measured in 100 tonnes); each column is based on our preferred specification, which includes controls for attainable yields of relevant crops other than rice.

For every combination of outcome of interest and proxy for the presence of rice weeders, the results show that the production of rice in a town has a significant effect on female empowerment: towns where rice production was larger had higher women labour force participation, higher shares of votes in favour of divorce in 1974, more female political candidates and elected politicians in their city councils in the 1986-2021 period, and were more likely to host a nursery school between 1991 and 2011.

In the following sections, we discuss our results in greater detail, separately for each outcome

of interest.

6.1 Cultivation of rice and female labour force participation

As shown by [Alesina et al. \(2013\)](#) the participation of women in the labour force (WLFP) has been used as an indicator of gender norms, or the beliefs held by individuals about gender roles. In particular, the labour force participation rate of women in a society is likely to be correlated to the gender norms of such society when it reflects the participation of women in activities outside of the home. Following previous research, we investigate the effect of a town's exposure to female rice weeders on its WLFP for all Census years from 1951 until 2011.

In Table 4 we show our results, reporting (in columns 2 and 6) both estimates already presented in columns 1 and 2 of Table 3, and estimates from alternative specifications with no controls or different sets of controls. As the regression sample pools together all Census years between 1951 and 2011, we include year fixed effects in the regressions and use clustered standard errors at the town level. Results show that, overall, since 1951 the participation of women in the labour force has been significantly higher in towns with larger shares of land dedicated to rice cropping and that produced more rice. The coefficients report the effect of unitary increases in our two independent variables; that is, a shift from null to total coverage of rice of a town's area and a 100 tonnes increase in rice production for our second regressor. To understand the magnitude of our effects, it is helpful to interpret them in terms of standard deviation changes of the regressors (0.06 for the ratio of land cultivating rice and 6.37 for total rice production). Focusing on our preferred specification, a 1 SD increase in the share of land cultivating rice (as predicted by differences in attainable yield for rice) is associated with a 18.9 p.p. higher share of women in the labour force, a 59% increase compared to the dependent variable's mean; conversely, a 1SD increase in rice produced in a town in 1923-1929 is associated with a 15 p.p. higher share of women in the labour force, a 47% increase compared to the mean. After testing for the average effect across the years, in Figures 8 and 9 we plot the effect for each Census year separately. Two interesting facts emerge: first, the effect of *Mondine* on WLFP is notably high in 1951, a year in which rice weeding was still done by hand, so rice weeders were still at work; second, while from 1961 effects are at most half the size of the one estimated in 1951, exposure to *Mondine* persists in being associated with significantly higher WLFP until 2011. Importantly, the Census data we use for 1951 and 1961 count women as part of the labour force only if they are both involved in (gainful) activities outside the home and there are *predominantly* employed in activities outside the home rather than in activities within the home. This may inflate the difference in the first two years, since women working in family-based agriculture (rather than rice production) may have been less likely to be registered as employed.

The results for 1951 and 1961, in line with previous literature, are consistent with rice weeders increasing the share of women working outside of the home, as the demand for weeders opened

new work opportunities for women living in rice-producing towns compared to towns where rice production was absent. However, the persistent effect of exposure to *Mondine* on WLFP is consistent with two more interpretations: first, rice weeders may have been more likely to remain in the labour force even when hand-weeding stopped, arguably because of a sticky change in gender norms; second, exposure to rice weeders may have affected gender norms even of women not working in the rice fields and of young women joining the workforce, arguably through a role model effect.

6.2 Cultivation of rice and votes against the repeal of the Divorce Law

The introduction of divorce in Italy in 1970 and the 1974 referendum to repeal it was accompanied by fierce political fights, with Catholic groups (and politicians) intensely campaigning to repeal the law and feminist groups supporting its retention (Petricola, 2006). The introduction of divorce arguably improved the possibility of emancipation of women in Italy. Indeed, in other contexts, the introduction of divorce (especially the unilateral one) improves the situation of women by decreasing domestic violence, women's suicides, and the likelihood that one spouse received financial support from the other (Stevenson and Wolfers, 2006; Stevenson, 2007). In light of this evidence, we look at support for divorce in a town (or, better, opposition to the repeal of the Divorce Law) as a measure of gender attitudes and, in particular, as a measure of support for women's emancipation.

In Table 5 we reproduce (in columns (2) and (6)) the results on votes for Divorce Law already presented in Table 3 and test for their robustness to the inclusion of several sets of controls. The results show that, both in the bivariate case and including town-level controls, towns with larger production of rice had significantly higher shares of votes against repealing the Divorce Law, i.e., in favour of divorce. Estimated results are quantitatively meaningful: in our preferred specification, a 1 SD increase in the share of land devoted to rice (as predicted by differences in attainable yield for rice) is associated with a 12.8 p.p. higher share of votes in favour of divorce in a town, while a 1 SD increase in the amount of rice produced in a town in the 1923-1929 period (again, as predicted by differences in attainable yield for rice) is associated with a 10.1 p.p. increase in the share of votes for divorce.

It is important to notice that the share of votes in favour of divorce, while being an arguably valid proxy for the gender attitudes of citizens in a town, is an outcome that pertains to both male and female voters' behaviour. Under the assumption that rice production affects votes for divorce through the historical presence of (unionized) rice weeders, this result is consistent with two (not mutually exclusive) interpretations: women in the rice belt were more conscious of their condition, felt more entitled to civil rights (after having obtained important rights as workers), and voted to obtain them; men in the rice belt, on the other side, may have learned to recognize legitimacy to women's requests, and were more prone to accept new rights that would have arguably benefited women more.

6.3 Cultivation of rice and female politicians

The presence of women in powerful positions, such as in politics (Alesina et al., 2013) and in managerial positions (Xue, 2024), has been commonly used as a measure of female empowerment, signalling the participation of women in activities performed outside the house, where they are still underrepresented. Following this line of research, we test for the effect of the presence of rice weeders (proxied by rice production) on the participation of women in local politics, as measured by the share of female candidates and politicians in city councils. We are interested in studying whether the presence of rice weeders increased the share of women among candidates and elected politicians when *Mondine* were still active in the rice fields and whether these effects persist until today even decades after this profession disappeared²¹.

Regarding women's active political participation in 1956, Table 6 shows the effect of the presence of rice weeders on the share of women among candidates running for a seat in the city council. The table replicates results from Table 3 in columns (2) and (6) and adds specifications with different sets of controls. Results show that towns with higher rice production have significantly more female candidates running in the 1956 local elections. Consequently, Table 7 shows that women were also more likely to be elected city councillors in towns with higher rice production, in the same local election. A 1 SD increase in the share of land cultivating rice (as predicted by differences in attainable yield for rice) is associated with a 5.0 p.p. larger share of women running and a 5.5 p.p. share of women elected in city councils, a large increase compared to a mean of just 1%. Conversely, a 1 SD increase in rice produced in a town in the 1923-1929 period is instead associated with a 3.8 p.p. increase in the share of female candidates and a 4.4 p.p. increase in the share of female councillors. Appendix Table A.1 re-estimates the regressions in Table 7 controlling for the share of female candidates and provides suggestive evidence that the increase in women elected city councillors is completely driven by the increased number of candidates: women are more likely to be elected because they are more likely to run. Overall, these results suggest that when rice weeders were still active in the Italian rice fields towns with more extensive or higher rice production had a higher share of female politicians in local town councils.

Considering more recent local elections, Table 8 looks at the gender composition of city councils between 1986 and 2021, replicating results from Table 3 in columns (2) and (6) and adding specifications with different sets of controls. As we observe several electoral cycles for each town (and, consequently, several elected city councils for each town), each regression includes electoral cycle fixed effects.²² Results show that towns with larger production of rice have significantly more women in politics between 1986 and 2021; a 1 SD increase in the share of land cultivating rice (as

²¹Note that in Italy women gained the right to vote in administrative elections only in 1946. The 1956 administrative elections are the first for which we found data on the number of candidates by gender and are also convenient for our empirical analysis because they involved a large number of Italian towns.

²²Local elections in Italy take place in different years for different towns; while we consider the inclusion of fixed effects for electoral cycles as the most appropriate choice to account for multiple observations per town, our results are robust to using election year fixed effects instead of electoral cycle ones.

predicted by differences in attainable yield for rice) is associated with an 9.3 p.p. larger share of women in city councils, a 46.5% increase compared to the mean; a 1 SD increase in rice produced in a town in the 1923-1929 period is instead associated with a 7.2 p.p. increase in the share of female councillors. Additionally, Figures 10 and 11 show that the effects are positive and quite stable for each electoral cycle that took place in Italian towns between 1986 and 2021, suggesting strong persistence of the effect of the presence of rice weeders on female political representation. In towns with higher rice production, women were and are more likely to become politicians, not only when rice weeders were still active in the rice fields but also decades after their profession disappeared.

These results suggest that women living in the rice belt were (and are) more empowered, compared to women in other Italian towns, and therefore more likely to participate in politics. The observed patterns may arise if women living in the rice fields were more interested in participating in politics because of looser time constraints associated with their home duties, arguably because of higher bargaining power in the household (see, e.g., Schlozman et al., 1994), or being more self-confident (Fox and Lawless, 2004), or translating their organized-labour activism in the political arena. Additionally, the results regarding the 1956 elections seem to suggest that while women were more likely to run in rice-producing towns (and this translated to more women being elected), women were not more likely to win conditional on running²³. These results are consistent with rice weeders both being more prone to political participation and leaving a vivid memory of their mobilisation on the following generation of women and changing gender norms in towns where they used to work.

6.4 Cultivation of rice and nursery schools

In order to test for the policy consequences of the past presence of rice weeders (and their history of empowerment), we explore whether governments of towns with a historical tradition of rice production provided public goods that were particularly relevant for women. When analysing public goods provided by town governments in the Italian setting, the presence of nursery schools is a natural candidate to study for investment in female-relevant public goods (Bianchi et al., 2021). Nursery school provision is a service particularly relevant for women, as it may be essential to allow them to work; additionally, town governments are responsible to create (and fund) nursery schools, so that differences in constituencies between towns can lead to differences in the provision of such a service; finally, also because of the cost of private nursery schools, demand for public nursery schools is vastly higher than supply, making their funding a salient spending area.

In Table 9 we test for the effect of rice production in the 1923-1929 period on the presence of nursery schools between 1991 and 2011. Columns (2) and (6) replicate results from Table 3,

²³The smaller and mostly not significant results on the likelihood to have a female mayor also support this interpretation.

while other columns report results from different specifications.²⁴ Regardless of the specification, results show that towns where rice was more relevant are significantly more likely to provide nursery school services. A 1 SD increase in the share of land devoted to rice (as predicted by our instrument) is associated with a 66.5 p.p. increase in the likelihood to host a nursery school, while a 1 SD increase in rice produced in a town is associated with a 48.2 p.p. increase in such likelihood.

Both female voters (Funk and Gathmann, 2015) and politicians (Chattopadhyay and Duflo, 2004) have been shown to have different preferences over public spending; when given the chance, women decide to preferably allocate public funds to programs more aligned with their preferences. Therefore, also in light of previous results on the share of elected politicians, evidence from this section can be consistent with both politicians providing public services targeted towards a prominent group of voters (i.e., relatively more empowered women), and with female politicians elected in larger numbers who succeed to push the government to invest more in spending categories that appeal the group they belong to.

6.5 Migrant weeders and the effects in the towns of origin

In our context, weeding, a very labour-intensive task, also attracted substantial temporary migration of young women to rice-producing towns during the weeding period (May until June, around 40 days). Migrant women, while less involved in collective action, were exposed to local *Mondine* and their labour activism and had the opportunity to work in an environment that fostered women's mobilisation and promoted their (partial) economic independence. For this reason, we expect migrant *Mondine* to bring some of these cultural norms back to their hometowns. In Table A.14 we investigate this hypothesis using data on internal seasonal migrants in Italy during 1904. Specifically, we look at the correlation between the share of *Mondine* among emigrants (Columns 1, 3, 5, 7, 9) and the share of *Mondine* among female emigrants (Columns 2, 4, 6, 8) from a particular town. We find that a higher share of *Mondine* among internal emigrants is associated with greater female empowerment across most of our main outcomes. While this is just a correlation, using the number of *Mondine* among emigrants controls for differential total migration propensity and differential women's migration propensity at the municipality level, which may be influenced by different gender norms across municipalities. Towns that had a higher share of *Mondine* among (female) emigrants experienced more support for divorce, more women in local politics, and higher women's labour force participation, while they do not differ from other Italian towns for the presence of nursery schools.

²⁴We use data from three Censuses, ending up with three observations per town (except for missing values in 2001); each specification includes census year fixed effects.

6.6 Additional analyses and robustness

In Table A.2 we find evidence fully consistent with our main results when looking at reduced form estimates of the effect of land for rice on our measures of female empowerment.

We also obtain consistent results when using alternative measures of rice production, i.e., average production per hectare and an indicator variable for the presence of rice fields in a town, as shown in Table A.3; such evidence corroborates our main results, despite the risk of capturing effects of differences in productivity of farmers from different towns (in the case of average production), or of losing important sources of variation (in the case of the indicator variable), which are the reasons leading us to choose the two measures used in the main analysis.

In Table A.4 we show that our results are robust (and are, in fact, larger in magnitude) to restricting the analysis to towns in Northern Italy. In Tables A.5 and A.6 we show that the effect of rice production (and of the former presence of rice weeders) on the provision of nursery school services is statistically significant (although less robust) also when observing towns separately in 1991 and 2011. In table A.7 we also provide results that rice production in 1923-1929 is associated with another measure of nursery school provision, i.e., the share of children enrolled in nursery schools.²⁵

Evidence from Table A.8 suggests the past presence of rice weeders could be (positively) associated with the likelihood of electing a female mayor; however, results are imprecisely estimated and not robust to the inclusion of controls.

Finally, in Table A.9 we detect no clear pattern in the relationship between rice production and votes supporting the legalisation of abortion (from the 1981 referendum).²⁶

7 Discussion

7.1 Cultivation of rice and unionisation of rice weeders

As we discussed in the background section, *Mondine* quickly became very well-known for their activism for better working conditions, which then translated into formal unionisation. Strikes were among the most effective tools these workers had to improve their working conditions, and indeed, a strike led to a reduction in their workday to 8 hours, without salary reductions in 1906. For

²⁵Such a measure is built as the share of children enrolled in nursery schools over a town's population; in the absence of information for each town on the number of children eligible to be enrolled, we focus on the indicator variable for the presence of nursery school services.

²⁶This result seems at odds with previous results on votes in favor of civil rights and evidence regarding female empowerment. While suggestive, a potential explanation may come from anecdotal evidence claiming women in the rice belt were particularly successful in birth-control practices, at least since the beginning of the XIX century (Zappi Gentili, 1991). An interpretation consistent with results on abortion, therefore, could be that legal abortion was not an issue particularly prominent for rice weeders, or at least not comparatively more prominent for them than for women from other Italian towns.

this reason, we use agricultural strike data between 1883 and 1905²⁷ as a measure of agricultural workers' mobilisation for better working conditions, to study whether agricultural workers (*Mondine*) were indeed especially active in rice-producing towns. Indeed, Table A.12 shows that towns with higher rice production were more likely to experience an agricultural strike between 1883 and 1905, crucial early years for *Mondine*'s activism demanding better working conditions. Overall, this result, combined with historical accounts, suggests that unionisation and mobilisation for better working conditions were important factors in explaining *Mondine*'s significant and long-lasting impact on women's empowerment.

But why did rice weeders, among other categories of women facing arduous working conditions, have such a high level of unionisation, and why did this affect their political empowerment? As mentioned in section 3, among other factors that made rice weeders workers with high bargaining power (including, crucially, working in teams), the Italian anti-malaria campaign and the means of its implementation played an important role in raising weeders consciousness about their condition as workers and women.

Starting in the 1890s, the Italian central government, in cooperation with local authorities, launched several initiatives to eradicate malaria, which was endemic and affected a third of the Italian territory (Majori, 2010); such initiatives mostly affected three pilot zones, which included the rice district in Northern Italy. The measures involved a massive provision of quinine at a subsidized price, an increase in the number of facilities distributing quinine, hospitals treating malaria patients, and information campaigns on self-protection and the use of quinine. Funding for these measures came from a quinine tax levied on landlords of towns of malarial zones. In such a way, the state's effort to eradicate malaria affected the perception of workers and changed their relationship with employers, signaling that workers were entitled to healthy and fair working conditions, that malaria was the result of negligence, and that landlords had to be kept accountable of such negligence (Snowden, 2003).

As gaining citizens' trust proved difficult, physicians (as well as teachers of peasant schools) coupled the government's effort with intense volunteering activity aimed at educating agricultural workers, later organizing in two associations operating to eradicate malaria.²⁸ Most volunteers of the anti-malaria campaign were close to the socialist movement (Snowden, 2003), and their teaching often included not only instructions on malaria prophylaxis but also lessons on workers' rights, women's rights, and feminism. The several components of the malaria eradication campaign paved the way to the unionisation of rice weeders, by increasing consciousness about their rights; such a situation (coupled with the rising interest of unions) made rice weeders a strongly organized group able to protest effectively against their employers and arguably made them more willing to mobilize for women's rights also in the political arena. While most of the malarial zones were exposed to the campaign and to the radical teachings by volunteers, the anti-malaria effort likely

²⁷We thank Tancredi Buscemi for sharing the data with us.

²⁸*Society for the Study of Malaria* and *National League against Malaria*.

spurred the mobilisation and unionisation of women especially in the rice district, as in this area malaria was a disease predominantly affecting women (who mainly worked in flooded fields) while in other malarial zones in Southern Italy men were overwhelmingly more targeted by the disease.²⁹ To assess the role of malaria empirically, we replicate our results in Table A.13, including a dummy measuring malaria presence in the 1880s ([Direzione Generale della Statistica, 1886](#)). The effect of rice production and the presence of *Mondine* on women's empowerment measures is overall robust to the inclusion of the control (i.e. comparing towns only within their malaria-presence status), only the results on the support for the divorce law become non-significant at conventional levels (p-values are 0.140 in Column 3 and 0.130 in Column 4, but coefficients remain positive).

7.2 Attributing the effects of rice production to the presence of female weeders

Throughout our empirical analysis, we used rice production as a proxy for rice weeders mainly due to the lack of fine-grained and comprehensive data on the presence (and the number) of rice weeders in Italian towns³⁰. Can the effects we estimate be attributed instead to other socio-economic characteristics of towns commonly associated with rice production, like differences in collectivist norms or income?

Collectivism and the rice theory of culture. Recent papers by Talhelm and coauthors ([Talhelm et al., 2014](#); [Talhelm, 2022](#); [Talhelm and Dong, 2024](#)) show that rice production induced more collectivist norms in societies where it was present. They hypothesise that rice production leads to collectivism because it requires farmers to cooperate to build irrigation infrastructure and to perform time-sensitive tasks such as weeding, transplanting, and harvesting within a short period of time. Even if there is no conclusive empirical evidence showing it, collectivism might also be positively correlated with gender equality. If this were true, our results may arise from rice-producing towns being more collectivist.

First, to investigate the role of irrigation for collectivism, we follow [Buggle \(2020\)](#) who finds that irrigation potential causally predicts collectivist norms. We use his measure of irrigation potential (constructed by FAO-GAEZ and also previously used by [Sinding Bentzen et al., 2017](#)) as an additional control to test whether our results can be completely explained by rice-induced collectivist norms (potentially correlated with gender-equality). Figures A1 and A1 show that our results are robust to the inclusion of an exogenous proxy of collectivism (irrigation potential) as a control. This suggests that higher women's empowerment in rice-producing towns cannot be fully

²⁹Wheat production in Southern Italy had been, until the end of the XIX century, almost exclusively a prerogative of male workers. While the mass out-migration and World War I balanced the gender composition of the agricultural workforce also in Southern Italy, in these areas malaria still affected both genders, so that the association between the movement against malaria and the movement for women's rights was less marked.

³⁰In Figure 7 we show that rice production is strongly correlated with the number of rice weeders in a small sample of Italian towns (province of Vercelli) for which we found disaggregated data.

explained by collectivism. These results are reasonable in our context, where the rice theory of culture may not fully apply. Rice production in Italy and the irrigation infrastructure connected to it were mostly developed in the second half of the XIX Century, thanks to substantial investments by large landowners. Therefore, they did not emerge from ancestral practices or from the cooperation among small farmers, which could have more easily led to the emergence of collectivist norms.

Second, collectivist norms can be correlated with left-wing economic and political preferences, resulting in higher vote shares for left-wing parties that foster gender equality. We address these concerns empirically. Indeed, Appendix Table A.10 shows that towns with higher rice production also had higher vote shares for left-wing parties (socialists, PSI, and communists, PCI) in the 1953 national elections. Note that we cannot exclude that the left-leaning preferences in rice-producing towns (after WWII) may be a consequence of *Mondine*'s political activism. Nevertheless, the effect of *Mondine*'s presence on female empowerment goes beyond party lines: going back to local elections and the gender of elected politicians, we find that in towns producing more rice, more women are elected city councillors even among candidates of the Christian Democratic Party (DC), representing the Center-Right (Appendix Table A.11). In towns with higher rice production, more women become city councillors independently of their party and even within non-leftist parties.

Income and wealth. In Italy, rice was a very valuable crop compared to, e.g., wheat or maize (Camp, 1992) and this may have caused rice-producing towns to be wealthier than others. If income were correlated with our outcomes of interest, we would be capturing a causal effect of rice production that does not transmit through the presence of weeders. Yet, this is not obvious. In fact, the comparison group for towns producing rice includes towns where manufacturing is predominant and the average income is probably higher.³¹

8 Conclusion

In this paper, we study the effects of past work practices in agriculture on female empowerment, focusing on the case of Italian female rice weeders between the second half of the XIX century and the first half of the XX century. Analyzing differences in the presence of rice cultivation across Italian towns, we find that in towns where rice production is more common (and where, therefore, female rice weeders worked until the end of the 1960s), more women participated in the labour force after WWII, more voters supported divorce in 1974, more women are part of the labour force and get elected in city councils in the 1986-2021 elections, and local governments are more likely to provide nursery school services since 1991.

Our results are in line with previous studies on the long-run effects of traditional work practices on women's labour force participation, their bargaining power within the household, and beliefs

³¹This is not a concern for our identification strategy because we predict rice cultivation presence using geographically determined (exogenous) attainable yield.

about women (Qian, 2008; Alesina et al., 2013; Xue, 2024). While previous research studied settings in which female empowerment arises from a tradition of high relevance of women for the household's income, through the case of Italian rice weeders we point out another important factor determining empowerment, complementary to income: the ability of women to mobilize and engage in collective action. Such effects could potentially extend out of agriculture and be found in other work settings in which women work in teams and have the power to improve their conditions through group bargaining.

The detectable effects of the presence of female rice weeders on female empowerment even decades after the disappearance of weeding as an occupation suggest the memory of unionised working women can affect the female empowerment of generations subsequent to the ones directly exposed to weeding. It is still an open question whether the obsolescence of weeders at the beginning of the 1970s decreased (or, in any case, changed) their political power by arguably reducing their bargaining power as workers.

Finally, another question to be addressed in future research work is whether the effects we find will fade away or persist even when towns' voters will be only composed of citizens who could never choose to work as weeders and whether persistence could work through cultural (e.g., within-family intergenerational transmission of values) or institutional channels.

References

- Alesina, A., B. Brioschi, and E. La Ferrara (2016). Violence against women: A cross-cultural analysis for africa. Technical report, National Bureau of Economic Research. 4
- Alesina, A., P. Giuliano, and N. Nunn (2013). On the Origins of Gender Roles: Women and the Plough. *The Quarterly Journal of Economics* 128(2), 469–530. 2, 4, 11, 14, 16, 23
- Bagnato, L. (2021). From taxation to fighting for the nation: Historical fiscal capacity and military draft evasion during wwi. 5
- Baltrunaite, A., A. Casarico, P. Profeta, and G. Savio (2019). Let the voters choose women. *Journal of Public Economics* 180, 104085. 2
- Bernhardt, A., E. Field, R. Pande, N. Rigol, S. Schaner, and C. Troyer-Moore (2018, May). Male social status and women's work. *AEA Papers and Proceedings* 108, 363–67. 4
- Bertrand, C. L. (1982). The biennio rosso: Anarchists and revolutionary syndicalists in italy, 1919-1920. *Historical Reflections/Réflexions Historiques*, 383–402. 7
- Bianchi, N., M. Giorcelli, and E. M. Martino (2021). The Effects of Fiscal Decentralization on Publicly Provided Services and Labor Markets. *NBER Working Paper* 29538. 17
- Bianchi, N., M. Giorcelli, and E. M. Martino (2023). The effects of fiscal decentralisation on publicly provided services and labour markets. *The Economic Journal* 133(653), 1738–1772. 9
- Bugge, J. C. (2020). Growing collectivism: Irrigation, group conformity and technological divergence. *Journal of Economic Growth* 25(2), 147–193. 9, 21, 49
- Buonanno, P., M. Cervellati, S. Lazzaroni, and G. Prarolo (2019). Political history, fiscal compliance and cooperation: Medieval social contracts and their legacy. *Fiscal Compliance and Cooperation: Medieval Social Contracts and Their Legacy* (December 2019). 5
- Bursztyn, L., A. L. González, and D. Yanagizawa-Drott (2020). Misperceived social norms: Women working outside the home in saudi arabia. *American economic review* 110(10), 2997–3029. 5
- Cai, X., J. Fan, Z. Jiang, B. Basso, F. Sala, A. Spada, F. Grassi, and B.-R. Lu (2013). The puzzle of italian rice origin and evolution: determining genetic divergence and affinity of rice germplasm from italy and asia. *PLoS One* 8(11). 5
- Camera del Lavoro di Vercelli, Archivio storico Federbraccianti (1954). Campagne monda e tagliariso. 8, 13

- Camp, R. (1992). Elda Gentili Zappi. If Eight Hours Seem Too Few: Mobilization of Women Workers in the Italian Rice Fields.(SUNY Series on Women and Work.) Albany: State University of New York Press. 1991. Pp. XIV, 396 . [5](#), [22](#)
- Carranza, E. (2014). Soil endowments, female labor force participation, and the demographic deficit of women in india. *American Economic Journal: Applied Economics* 6(4), 197–225. [2](#), [4](#)
- Castelli, F., E. Jona, and A. Lovatto (2005). *Senti le rane che cantano: canzoni e vissuti popolari della risaia*. Donzelli Editore. [5](#)
- Chattopadhyay, R. and E. Duflo (2004). Women as policy makers: Evidence from a randomized policy experiment in india. *Econometrica* 72(5), 1409–1443. [18](#)
- Chong, A. and E. L. Ferrara (2009). Television and divorce: Evidence from brazilian novelas. *Journal of the European Economic Association* 7(2-3), 458–468. [4](#)
- Direzione Generale della Statistica (1886). *Risultati dell'Inchiesta sulle Condizioni Igieniche e Sanitarie nei Comuni del Regno - Parte II*. Roma, Tipografia in San Michele di Reggiani e Soci. [10](#), [21](#)
- Doepke, M., M. Tertilt, and A. Voena (2012). The economics and politics of women's rights. *Annu. Rev. Econ.* 4(1), 339–372. [2](#)
- Faccini, L. (1976). *Uomini e lavoro in risaia: il dibattito sulla risicoltura nel'700 e nell'800*. Franco Angeli editore. [5](#), [6](#)
- FAO (2015). Global Agro-Ecological Zones. [3](#), [8](#), [11](#), [30](#)
- Federico, G. and P. Martinelli (2015). The role of women in traditional agriculture: Evidence from italy. [2](#), [4](#)
- Fernández, R. and A. Fogli (2009). Culture: An empirical investigation of beliefs, work, and fertility. *American economic journal: Macroeconomics* 1(1), 146–77. [4](#)
- Fernández, R. (2007, 05). Women, Work, and Culture. *Journal of the European Economic Association* 5(2-3), 305–332. [2](#)
- Fernández, R. (2013, February). Cultural change as learning: The evolution of female labor force participation over a century. *American Economic Review* 103(1), 472–500. [4](#)
- Fernández, R., A. Fogli, and C. Olivetti (2004, 11). Mothers and Sons: Preference Formation and Female Labor Force Dynamics*. *The Quarterly Journal of Economics* 119(4), 1249–1299. [4](#)

- Ferrero, A. and F. Vidotto (2010). 11 history of rice in europe. *Rice: origin, antiquity and history*, 341. [5](#)
- Field, E., R. Pande, N. Rigol, S. Schaner, and C. T. Moore (2016). On her account: Can strengthening women's financial control boost female labor supply? [4](#)
- Fortin, N. M. (2005). Gender role attitudes and the labour-market outcomes of women across oecd countries. *oxford review of Economic Policy* 21(3), 416–438. [2](#)
- Foster, A. D. and M. R. Rosenzweig (1996). Comparative advantage, information and the allocation of workers to tasks: Evidence from an agricultural labour market. *The Review of Economic Studies* 63(3), 347–374. [6](#)
- Fox, R. L. and J. L. Lawless (2004). Entering the arena? gender and the decision to run for office. *American Journal of Political Science* 48(2), 264–280. [17](#)
- Funk, P. and C. Gathmann (2015). Gender gaps in policy making: Evidence from direct democracy in switzerland. *Economic Policy* 30(81), 141–181. [18](#)
- Gagliarducci, S. and M. D. Paserman (2012). Gender interactions within hierarchies: evidence from the political arena. *The Review of Economic Studies* 79(3), 1021–1052. [2](#)
- Gavinelli, D. (2018). Donne, agricoltura e paesaggio: una geografia storico-culturale delle pianure risicole del nord-ovest italiano. [5](#)
- Golgi, C. (1907). Le condizioni fisiche dei contadini nelle zone risicole : relazione dell'on. senatore prof. camillo golgi. [5](#)
- Guiso, L., P. Sapienza, and L. Zingales (2016). Long-term persistence. *Journal of the European Economic Association* 14(6), 1401–1436. [2](#), [5](#)
- Hansen, C. W., P. S. Jensen, and C. V. Skovsgaard (2015). Modern gender roles and agricultural history: the neolithic inheritance. *Journal of Economic Growth* 20(4), 365–404. [4](#)
- Imbergamo, B. (2014). Mondine in campo: dinamiche e retoriche di un lavoro del novecento. *Mondine in campo*, 1–293. [5](#), [6](#), [7](#)
- ISTAT (1936). Catasto Agrario. Roma: Istituto Poligrafico dello Stato. [7](#), [32](#)
- ISTAT (2018). Gli stereotipi sui ruoli di genere e l'immagine sociale della violenza sessuale. Technical report. [2](#)
- ISTAT – Ministero dell'Interno (1959). Elezioni Amministrative del 1956. Roma: Istituto Poligrafico dello Stato. [8](#)

- Iversen, T. and F. Rosenbluth (2010). Women, work, and politics: The political economy of gender inequality. [2](#)
- Jensen, R. and E. Oster (2009). The power of tv: Cable television and women's status in india. *The Quarterly Journal of Economics* 124(3), 1057–1094. [4](#)
- La Ferrara, E., A. Chong, and S. Duryea (2012). Soap operas and fertility: Evidence from brazil. *American Economic Journal: Applied Economics* 4(4), 1–31. [4](#)
- Lorenzoni, G. (1904). *I lavoratori delle risaie: inchiesta sulle condizioni del lavoro nelle risaie della Lomellina, del Vercellese e del Novarese compiuta dall'ufficio nell'estate del 1903*, Volume 5. Editore l'Ufficio del lavoro. [5](#)
- Lowes, S. and E. Montero (2021). The legacy of colonial medicine in central africa. *American Economic Review* 111(4), 1284–1314. [12](#)
- Luraghi, R. (1974). *Wage Labor in the "rice Belt" of Northern Italy and Slave Labor in the American South: A First Approach*. [5](#)
- Majori, G. (2010). Il laboratorio di malariologia e l'eradicazione della malaria in italia. *Il Laboratorio di Malariologia. A cura di Giancarlo Majori e Federica Napolitani*. Roma: Istituto Superiore di Sanità. [20](#)
- McKelway, M. (2019). Vicious and virtuous cycles: self-efficacy and employment of women in india. *Unpublished manuscript*. [4](#)
- Ministero di Agricoltura, Industria e Commercio (1904). *Bollettino dell'Ufficio del lavoro*. Roma: Tipografia Nazionale di Giovanni Bertero & C. [9](#)
- Petricola, E. (2006). Un passo versol'"esterno". culture politiche, femminismo e referendum sul divorzio. *Quaderni di Storia Contemporanea* (40), 28–43. [15](#)
- Preti, L. (1955). Le lotte agrarie nella valle padana. *Il socialismo nella storia d'Italia. Storia documentaria dal Risorgimento alla Repubblica*, a cura di G. Manacorda, Bari, 229. [5](#)
- Qian, N. (2008). Missing women and the price of tea in china: The effect of sex-specific earnings on sex imbalance. *The Quarterly Journal of Economics* 123(3), 1251–1285. [2](#), [4](#), [23](#)
- Schlozman, K. L., N. Burns, and S. Verba (1994). Gender and the pathways to participation: The role of resources. *The Journal of Politics* 56(4), 963–990. [17](#)
- Sinding Bentzen, J., N. Kaarsen, and A. Moll Wingender (2017). Irrigation and autocracy. *Journal of the European Economic Association* 15(1). [9](#), [21](#), [49](#)

- Snowden, F. M. (2003). Mosquitoes, quinine and the socialism of italian women 1900-1914. *Past & present* (178), 176–209. [5](#), [6](#), [7](#), [20](#)
- Soave, S. (1979). Socialismo e socialisti nelle campagne dal 1890 alla grande guerra. [5](#)
- Stevenson, B. (2007). The impact of divorce laws on marriage-specific capital. *Journal of Labor Economics* 25(1), 75–94. [15](#)
- Stevenson, B. and J. Wolfers (2006). Bargaining in the shadow of the law: Divorce laws and family distress. *The Quarterly Journal of Economics* 121(1), 267–288. [15](#)
- Talhelm, T. (2022). The rice theory of culture. *Online Readings in Psychology and Culture* 4(1), 7. [21](#)
- Talhelm, T. and X. Dong (2024). People quasi-randomly assigned to farm rice are more collectivistic than people assigned to farm wheat. *Nature Communications* 15(1), 1782. [21](#)
- Talhelm, T., X. Zhang, S. Oishi, C. Shimin, D. Duan, X. Lan, and S. Kitayama (2014). Large-scale psychological differences within china explained by rice versus wheat agriculture. *Science* 344(6184), 603–608. [5](#), [21](#)
- Ufficio del Lavoro (1886–1904). *Statistica degli Scioperi Avvenuti in Italia*. [9](#)
- USGS (2005). Shuttle Radar Topography Mission (SRTM). [10](#)
- Voigtländer, N. and H.-J. Voth (2013). How the west "invented" fertility restriction. *American Economic Review* 103(6), 2227–64. [4](#)
- Xue, M. M. (2024). High-Value Work and the Rise of Women: The Cotton Revolution and Gender Equality in China. *Working Paper*. [2](#), [4](#), [16](#), [23](#)
- Zappi Gentili, E. (1991). *If Eight Hours Seem Too Few: Mobilization of Women Workers in the Italian Rice Fields*. SUNY Press. [5](#), [7](#), [8](#), [19](#)

Tables and Figures

Table 1: Summary statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
Rice Agro-climatically Attainable Yield (Mid-Input, Rainfed)	8,100	0.53	1.40	-0.00	5.67
Share of Land Cultivating Rice (1929)	8,100	0.01	0.06	0.00	0.85
Total Average Production of Rice (1923-1929, 100t)	8,100	0.87	6.37	0.00	188.49
Average Women's Labour Force Participation (1951-2011)	8,100	31.88	7.37	9.31	56.29
Share of "No" to repeal Divorce Law	8,100	0.49	0.15	0.07	0.94
Share of Female Candidates (1956)	7,476	0.01	0.02	0.00	0.38
Share of Female Elected Councilors (1956)	7,472	0.01	0.03	0.00	0.27
Average Share of Female Councilors (1986-2021)	8,100	0.20	0.07	0.01	0.49
Nursery School in 1991	8,100	0.60	0.49	0.00	1.00
Nursery School in 2011	8,100	0.58	0.49	0.00	1.00
Area (ha)	8,100	37.29	50.81	0.12	1,499.51
Distance from Coast (km)	8,100	69.97	55.72	0.02	229.29
Distance from Province Capital (km)	8,100	29.22	17.36	0.00	209.77
Distance from Rome (km)	8,100	384.57	142.93	0.00	699.61
Slope (degrees)	8,100	4.23	4.08	0.01	22.83
Log Elevation (m)	8,041	5.56	1.34	-3.43	7.93
Population in 1951	8,100	5,866.12	31,138.49	65.82	1651754

Notes: The table reports summary statistics for the main regression variables of interest: attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details), the share of a town's area cultivated with rice, total production of rice in the town in hundreds of tonnes, the share of a towns' women in working age participating in the labour force, the share of votes in a town against the repeal of divorce in the 1974 referendum, the share of women running for city councils (1956 elections), the share of women elected in the town's city council (1956 elections), the share of women elected in the town's city council (elections between 1986 and 2021), whether the town had a nursery school in 1991 and 2011, area of the town in hectares, distance from the coast, distance from province capital in kilometres, slope in degrees, log elevation in meters, town's population in 1951.

Figure 1: Rice attainable yield

[0.043805, 5.6745] [0.413078, 0.048403] [0.392302, 0.043079] [0.151628, 3.762594] [2.023232, 0.041489] [1.889176, 2.252092] [1.288176, 1.889176] [0.687584, 0.042021] [-0.002, 0.628724]



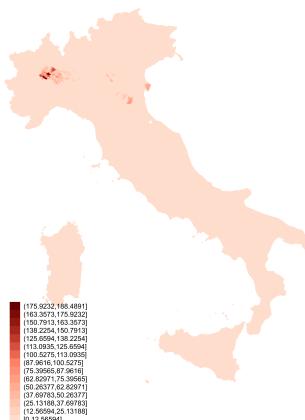
Figure 2: Share of land cultivated with rice

[0.795187, 0.852056] [0.795187, 0.852056] [0.682446, 0.739167] [0.682446, 0.739167] [0.568706, 0.625755] [0.511034, 0.561834] [0.466361, 0.461834] [0.398031, 0.454963] [0.341701, 0.341701] [0.294519, 0.341225] [0.227381, 0.227381] [0.170910, 0.227481] [0.113742, 0.170910] [0.069686, 0.069686] [0.056869, 0.056869]



Figure 3: Total rice production (100t)

[175.9232, 186.4891] [163.3573, 175.9232] [163.3573, 175.9232] [163.3573, 175.9232] [138.2254, 150.7913] [138.2254, 150.7913] [138.2254, 150.7913] [113.0935, 125.6594] [113.0935, 125.6594] [113.0935, 125.6594] [87.9616, 100.5275] [75.8956, 87.5416] [75.8956, 87.5416] [50.2637, 62.5291] [50.2637, 62.5291] [25.1318, 37.6978] [25.1318, 37.6978] [12.5659, 25.1318] [12.5659, 25.1318]



Notes: Figure 1 maps rice attainable yields in Italian towns from FAO (2015). Figure 2 maps the share of a town's area cultivated with rice. Darker colors are associated with larger values. Figure 3 maps the annual total rice production in Italian towns between 1923 and 1929.

Figure 4: Share against repeal of divorce

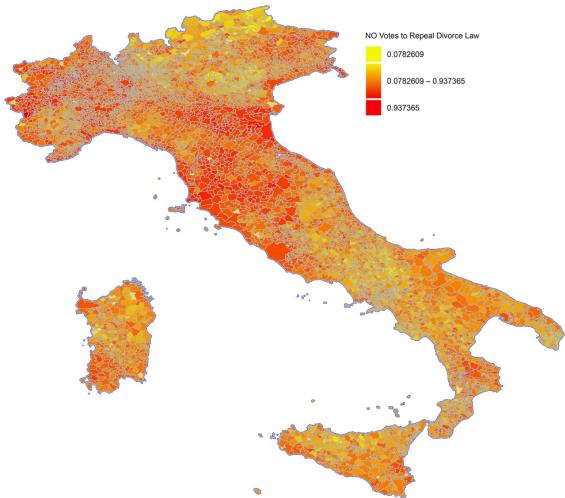


Figure 5: Share of women in city councils

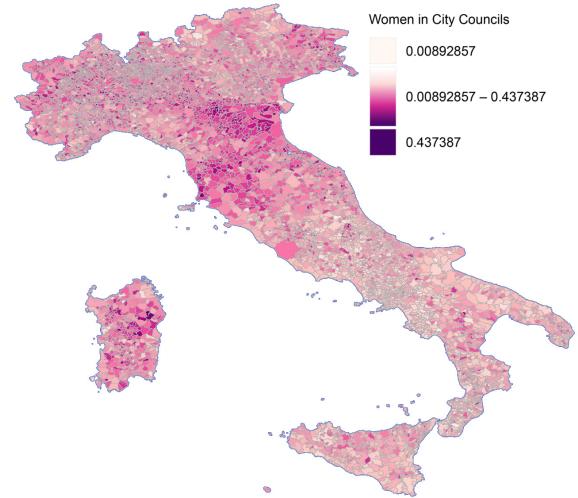
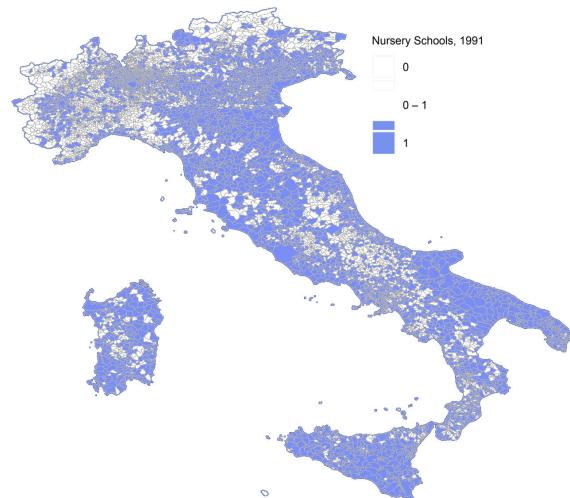
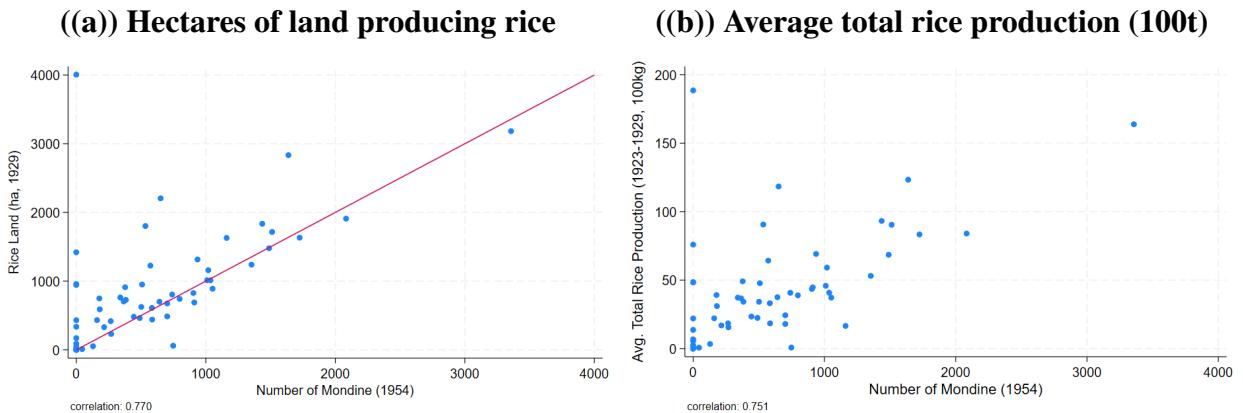


Figure 6: Presence of nursery schools



Notes: Figure 4 maps the share of "No" votes, against the repeal of divorce in 1974 referendum (red = higher share). Figure 5 maps the share of women in city council for Italian towns in election years between 1986 and 2021 (purple = larger share). Figure 6 maps whether a town has a nursery school (purple) or not (white).

Figure 7: Rice production and *Mondine*'s presence



Notes: The figure shows the correlation between two measures of rice production and the number of rice weeder (*Mondine*) for towns in the province of Vercelli. The two measures of rice production are Hectares of land producing rice in 1929 and the average total rice production in a year (between 1923 and 1929) from the *Catasto Agrario* (ISTAT, 1936, see Section 4 for additional details) the number of rice weeder is recorded in 1954 (data is from the historical archive of the *Camera del Lavoro* of Vercelli, see Section 4 for additional details).

Table 2: First stage: Attainable yield for rice and rice production

	Ratio of land cultivating rice (1923-1929)		Total Production of Rice (1923-1929, 100t)	
	(1)	(2)	(3)	(4)
Land Suitability for Rice (Mid-Input, Rainfed)	0.00500*** (0.000619)	0.00219*** (0.000697)	0.467*** (0.0691)	0.293*** (0.0736)
DV Mean	0.00970	0.00970	0.868	0.868
Crop controls	no	yes	no	yes
Observations	8100	8100	8100	8100
R-squared	0.0149	0.0582	0.0105	0.0385
F-Statistic	65.28	25.29	45.59	17.85

Notes: The table reports θ coefficients from first stage equation 5.1. Units of observation are towns. In columns 1 and 2, the dependent variable is the share of the town's area cultivated with rice. In columns 3 and 4, the dependent variable is the average total production of rice in the town between 1923 and 1929. The explanatory variable is the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 2 and 4 control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Cultivation of rice and female empowerment

	Women's LFP		NO to Repeal Divorce Law '74		Women candidates '56		Women in City Council '86-'21		Presence of Nursery Schools '91-'11	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ratio of land cultivating rice, 1923-1929	3.1496*** (1.0176)		2.1341** (0.9296)		0.7840** (0.3044)		1.5529*** (0.5724)		11.0849** (4.4057)	
Rice production (100t, avg. 1923-1929)	0.0235*** (0.0061)		0.0159** (0.0063)		0.0059*** (0.0019)		0.0113*** (0.0036)		0.0756*** (0.0239)	
DV Mean	0.32	0.32	0.49	0.49	0.01	0.01	0.20	0.20	0.61	0.61
F-Statistics of excluded instrument	89.79	129.22	12.81	18.44	10.68	16.01	92.01	133.63	29.85	47.62
Crop Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year/Election FE	yes	yes					yes	yes	yes	yes
Observations	56287	56287	8041	8041	7419	7419	58649	58649	20967	20967

Notes: The table reports β coefficients from the IV regression from Equation 5.2. Units of observation are town×year in columns 1 and 2, town in columns 3, 4, 5 and 6, town×election in columns 7 and 8, and town×year in columns 9 and 10. In columns 1 and 2 the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In columns 3 and 4 the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In columns 5 and 6, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In columns 7 and 8, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In columns 9 and 10, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991 and 2011). The explanatory variables are the share of the town's area cultivated with rice (columns 1, 3, 5, 7 and 9) and the average total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 2, 4, 6, 8 and 10). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 7 and 8 control for election FE and columns 1, 2, 9 and 10 control for year FE. All columns control for the attainable yield with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. DV Mean is the dependent variable mean. In parentheses: robust standard errors (columns 3, 4, 5 and 6) and clustered standard errors at the town level (remaining columns). *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Cultivation of rice and women labour force participation

	Women Labor Force Participation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	2.9200*** (0.3583)	3.1496*** (1.0176)	2.6647** (1.1805)	2.5813*** (0.8784)				
Rice production (1923-1929, 100t)					0.0311*** (0.0046)	0.0235*** (0.0061)	0.0165*** (0.0049)	0.0170*** (0.0043)
DV Mean	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
F-Statistics of excluded instrument	852.62	89.79	47.26	140.81	611.23	129.22	98.13	253.98
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	56287	56287	56287	56287	56287	56287	56287	56287

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Since units of observation are town×year, year fixed effects are added. The dependent variable is the share of women who are active in the labour market in a town in the census years between 1951 and 2011. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include controls, columns 2 and 6 control for the attainable yield with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. All regressions include year fixed effects. DV Mean is the dependent variable mean. Clustered standard errors in parentheses (town level). *** p<0.01, ** p<0.05, * p<0.1.

Figure 8: Rice land ratio and women labour force participation: effects by year

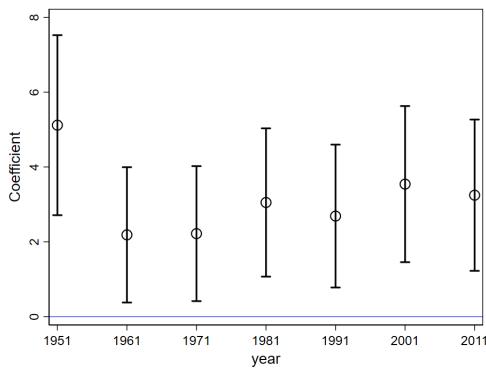
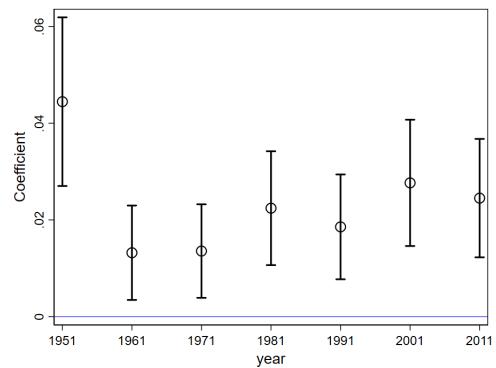


Figure 9: Rice production and women labour force participation: effects by year



Notes: Figure 8 plots estimated coefficients from a single regression of the effects of the share of a town's land cultivating rice on the share of women who are active in the labour market in a town, separately for each census year in the 1951-2011 period. Figure 9 show coefficients from a similar regression using total production of rice (in 100 tonnes) as proxy for rice cultivation. Both regressions include attainable yields for tomato, olive, potato, wheat, maize, oat, rye and barley as controls and year fixed effects.

Table 5: Cultivation of rice and votes for divorce

	NO to Repeal of Divorce Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	1.7469*** (0.2789)	2.1341** (0.9296)	4.0115** (1.9039)	1.2383* (0.6394)				
Total Production (1923-1929, 100t)					0.0186*** (0.0033)	0.0159** (0.0063)	0.0248*** (0.0087)	0.0081** (0.0038)
DV Mean	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
F-Statistics of excluded instrument	121.80	12.81	6.74	20.03	87.31	18.44	13.99	36.13
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	8,041	8,041	8,041	8,041	8,041	8,041	8,041	8,041

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include controls, columns 2 and 6 control for the attainable yield with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Cultivation of rice and female political candidates (1956)

	Share of female candidates, municipal councils (1956)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	0.1523*** (0.0442)	0.7840** (0.3044)	1.0140** (0.5144)	0.3563** (0.1659)				
Total Production(1923-1929, 100t)					0.0017*** (0.0005)	0.0059*** (0.0019)	0.0063*** (0.0021)	0.0024*** (0.0009)
DV Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
F-Statistics of excluded instrument	110.17	10.68	5.48	16.68	81.53	16.01	12.23	31.39
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	7,419	7,419	7,419	7,419	7,419	7,419	7,419	7,419

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the share of women among candidates running for the town's city council in the 1956 municipal elections. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total rice production in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yield with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. *DV Mean* is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Cultivation of rice and female politicians (1956)

	Share of female elected municipal councilors (1956)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	0.1831*** (0.0563)	0.9091** (0.3608)	1.1888* (0.6102)	0.4221** (0.2021)				
Total Production(1923-1929, 100t)					0.0020*** (0.0006)	0.0069*** (0.0022)	0.0073*** (0.0026)	0.0028** (0.0011)
DV Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
F-Statistics of excluded instrument	110.06	10.62	5.46	16.75	81.45	15.95	12.20	31.48
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	7,415	7,415	7,415	7,415	7,415	7,415	7,415	7,415

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the share of women elected in the 1956 municipal elections in the town's city council. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total rice production in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Cultivation of rice and female politicians (1986-2021)

	Women in City Councils							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	1.5637*** (0.2148)	1.5529*** (0.5724)	1.5200** (0.7697)	0.6050** (0.2996)				
Total Production (1923-1929, 100t)					0.0184*** (0.0029)	0.0113*** (0.0036)	0.0092*** (0.0036)	0.0039** (0.0017)
DV Mean	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
F-Statistics of excluded instrument	822.75	92.01	48.82	148.01	649.81	133.63	101.67	268.86
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Election-cycle FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	58649	58649	58649	58649	58649	58649	58649	58649

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are town \times election. The dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total rice production in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All regressions include electoral cycle fixed effects. Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Figure 10: Rice land ratio and female politicians: effects by election cycle

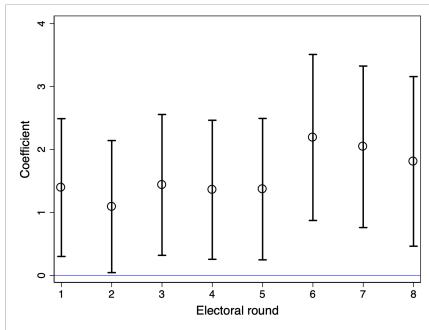
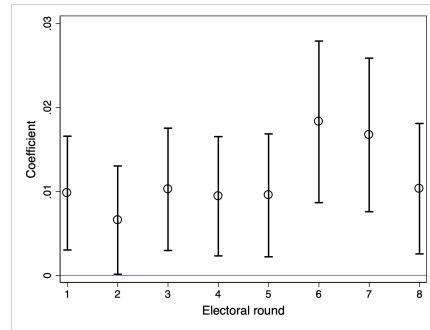


Figure 11: Rice production and female politicians: effects by election cycle



Notes: Figures 10 plots estimated coefficients from a single regression of the effects of the share of a town's land cultivating rice on the share of women in city councils, separately for each election cycle of the town in the 1986-2021 period. Figure 11 show coefficients from a similar regression using total production of rice (in 100 tonnes) as proxy for rice cultivation. Both regressions include attainable yields for tomato, olive, potato, wheat, maize, oat, rye and barley as controls and election cycle fixed effects.

Table 9: Cultivation of rice and nursery schools

	Presence of Nursery Schools							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	6.2775*** (1.0624)	11.0849** (4.4057)	16.9674* (8.7450)	8.6023** (3.7380)				
Total Production (1923-1929, 100t)					0.0649*** (0.0122)	0.0756*** (0.0239)	0.0919*** (0.0306)	0.0500*** (0.0160)
DV Mean	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
F-Statistics of excluded instrument	291.32	29.85	14.35	45.20	205.85	47.62	35.99	96.44
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are town*year. The dependent variable is a dummy equal to 1 if the town has a nursery school, and 0 otherwise (years 1991 and 2011). The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All regressions include census year fixed effects. Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Additional tables

Table A.1: Cultivation of rice and female politicians (1956) - control for share of female candidates

	Share of female elected municipal councilors (1956)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	0.0215 (0.0291)	0.0736 (0.0887)	0.1086 (0.1253)	0.0530 (0.0748)				
Total Production(1923-1929, 100t)					0.0002 (0.0003)	0.0006 (0.0007)	0.0007 (0.0008)	0.0004 (0.0005)
Share female candidates	1.0630*** (0.0416)	1.0640*** (0.0412)	1.0655*** (0.0436)	1.0442*** (0.0460)	1.0610*** (0.0423)	1.0565*** (0.0425)	1.0551*** (0.0441)	1.0405*** (0.0468)
DV Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
F-Statistics of excluded instrument	111.49	12.94	7.09	17.67	80.23	16.61	13.12	31.61
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	7,190	7,190	7,190	7,190	7,190	7,190	7,190	7,190

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the share of women elected in the 1956 municipal elections in the town's city council. All regression control for the share of female candidates running in each town in the 1956 municipal election. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total rice production in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.2: Cultivation of rice and female empowerment - Reduced form estimates

	Women's LFP (1)	NO to Repeal Divorce Law '74 (2)	Women candidates '56 (3)	Women in City Council '86-'21 (4)	Presence of Nursery Schools '91-'11 (5)
Rice Potential Yield (Intermediate input, rainfed)	0.0068*** (0.0006)	0.0046*** (0.0015)	0.0017*** (0.0003)	0.0034*** (0.0006)	0.0220*** (0.0037)
DV Mean	0.32	0.49	0.01	0.20	0.61
Crop Controls	yes	yes	yes	yes	yes
Year/Election FE	yes		yes	yes	yes
Observations	56287	8041	7419	58649	20967

Notes: The table reports β coefficients from the reduced form Equation 19. Units of observation are town×year in column 1, towns in columns 2 and 3, town×election in column 4, and town×year in column 5. In column 1, the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In column 2, the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In column 3, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In column 4, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In column 5, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991, 2001 and 2011). The explanatory variable is the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 control for year FE, and column 4 controls for election FE. All columns control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. *DV Mean* is the dependent variable mean. In parentheses: robust standard errors (columns 2 and 3) and clustered standard errors at the town-level (columns 1, 4 and 5). *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Cultivation of rice and female empowerment - Other measures of rice production

	Women's LFP (1)	NO to Repeal Divorce Law '74 (2)	Women candidates '56 (3)	Women in City Council '86-'21 (4)	Presence of Nursery Schools '91-'11 (5)	Women's LFP (6)	NO to Repeal Divorce Law '74 (7)	Women candidates '56 (8)	Women in City Council '86-'21 (9)	Presence of Nursery Schools '91-'11 (10)
Avg. Production per hectare (1923-1929, 100t/ha)	0.1830*** (0.0665)	0.1240** (0.0571)	0.0423** (0.0171)	0.0901** (0.0365)	0.6221** (0.2798)					
Actual Rice Produced (Dummy, 1923-1929)		0.7037*** (0.2134)	0.4768** (0.2008)	0.1624*** (0.0568)	0.3457*** (0.1211)					2.3451*** (0.8987)
DV Mean	0.32	0.32	0.49	0.49	0.01	0.01	0.20	0.20	0.61	0.61
F-Statistics of excluded instrument	74.57	111.98	10.64	15.98	10.38	15.66	76.68	115.43	24.57	38.28
Crop Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year/Election FE	yes		yes	yes	yes	yes	yes	yes	yes	yes
Observations	56287	56287	8041	8041	7419	7419	58649	58649	20967	20967

Notes: The table reports β coefficients from the IV regression from Equation 5.2. Units of observation are town×year in columns 1 and 2, town in columns 3, 4, 5 and 6, town×election in columns 7 and 8, and town×year in columns 9 and 10. In columns 1 and 2 the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In columns 3 and 4 the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In columns 5 and 6, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In columns 7 and 8, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In columns 9 and 10, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991-2011). The explanatory variables are average rice production per hectare in 100 tonnes (columns 1, 3, 5, 7 and 9) and a dummy equal to 1 if rice was cultivated in a town between 1923 and 1929 and 0 otherwise (columns 2, 4, 6, 8 and 10). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1, 2, 9 and 10 control for year FE and columns 7 and 8 control for election FE. All columns control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. *DV Mean* is the dependent variable mean. In parentheses: robust standard errors (column 3, 4, 5 and 6) and clustered standard errors at the town level (column 1, 2, 7, 8, 9 and 10). *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Cultivation of rice and female empowerment - Towns in Northern Italy

	Women's LFP		NO to Repeal Divorce Law '74		Women candidates '56		Women in City Council '86-'21		Presence of Nursery Schools '91-'11	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ratio of land cultivating rice, 1923-1929	1.4903*** (0.5255)		4.8274*** (1.5965)		0.9589*** (0.3484)		2.3061*** (0.7773)		14.1228*** (5.1503)	
Rice production 100t, avg. 1923-1929 (Cat.1929)		0.0099*** (0.0028)		0.0349*** (0.0093)		0.0071*** (0.0020)		0.0163*** (0.0045)		0.0943*** (0.0266)
DV Mean	0.40	0.40	0.51	0.51	0.01	0.01	0.22	0.22	0.58	0.58
F-Statistics of excluded instrument	17.61	29.17	7.42	11.30	6.45	10.09	52.13	80.01	17.61	29.17
Crop Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year/Election FE	yes	yes					yes	yes	yes	yes
Observations	11809	11809	4486	4486	4212	4212	32310	32310	11809	11809

Notes: The table reports β coefficients from the IV regression from Equation 5.2, including in the sample only towns in the North of Italy. Units of observation are town×year in columns 1 and 2, town in columns 3, 4, 5 and 6, town×election in columns 7 and 8, and town×year in columns 9 and 10. In columns 1 and 2 the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In columns 3 and 4 the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In columns 5 and 6, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In columns 7 and 8, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In columns 9 and 10, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991, 2001 and 2011). The explanatory variables are the share of the town's area cultivated with rice (columns 1, 3, 5, 7 and 9) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 2, 4, 6, 8 and 10). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1, 2, 9 and 10 control for year FE and columns 7 and 8 control for election FE. All columns control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. DV Mean is the dependent variable mean. In parentheses: robust standard errors (column 3, 4, 5 and 6) and clustered standard errors at the town level (column 1, 2, 7, 8, 9 and 10). *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Cultivation of rice and nursery schools in 1991

	Presence of Nursery Schools in 1991							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	6.7424*** (1.1901)	13.9884*** (5.3555)	21.3578** (10.1929)	9.8505** (4.0951)				
Total Production (1923-1929, 100t)					0.0718*** (0.0137)	0.1043*** (0.0327)	0.1320*** (0.0433)	0.0648*** (0.0210)
DV Mean	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
F-Statistics of excluded instrument	121.80	12.81	6.74	20.03	87.31	18.44	13.99	36.13
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	8,041	8,041	8,041	8,041	8,041	8,041	8,041	8,041

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is a dummy equal to 1 if the town has a nursery school in 1991, 0 otherwise. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.6: Cultivation of rice and nursery schools in 2011

	Presence of Nursery Schools in 2011							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	7.4740*** (1.1974)	9.5128** (3.9372)	12.6278* (6.4613)	7.3496** (3.1773)				
Total Production (1923-1929, 100t)					0.0796*** (0.0141)	0.0709*** (0.0250)	0.0781*** (0.0295)	0.0484*** (0.0171)
DV Mean	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
F-Statistics of excluded instrument	121.80	12.81	6.74	20.03	87.31	18.44	13.99	36.13
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	8,041	8,041	8,041	8,041	8,041	8,041	8,041	8,041

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is a dummy equal to 1 if the town has a nursery school in 2011, 0 otherwise. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Cultivation of rice and children enrolled in nursery schools

	Number of children enrolled in nursery schools (per capita)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	0.0205*** (0.0040)	0.0439** (0.0179)	0.0488* (0.0271)	0.0310** (0.0143)				
Total Production (1923-1929, 100t)					0.0002*** (0.0000)	0.0003*** (0.0001)	0.0003** (0.0001)	0.0002*** (0.0001)
DV Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F-Statistics of excluded instrument	291.32	29.85	14.35	45.20	205.85	47.62	35.99	96.44
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are town*year. The dependent variable is the number of children enrolled in nursery schools per capita (years 1991, 2001, and 2011). The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All regressions include year fixed effects. Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.8: Cultivation of rice and female mayors

	Female Mayor							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	1.8277*** (0.3290)	1.2950 (0.8725)	1.2691 (1.1914)	1.2407* (0.7515)				
Rice production 100t, avg. 1923-1929 (Cat.1929)					0.0191*** (0.0038)	0.0095 (0.0061)	0.0077 (0.0068)	0.0080* (0.0045)
DV Mean	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
F-Statistics of excluded instrument	903.98	92.05	48.87	148.07	649.94	133.67	101.78	268.92
Crop Controls		yes	yes	yes		yes	yes	yes
Geographical Controls			yes	yes		yes	yes	yes
Region FE				yes				yes
Election round FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	58663	58663	58663	58663	58663	58663	58663	58663

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are town \times election. The dependent variable is a dummy equal to 1 if a woman mayor is elected (elections between 1986 and 2021). The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All regressions include election fixed effects. Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.9: Cultivation of rice and votes for abortion

	NO to Repeal of Abortion Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	-0.4942*** (0.1889)	0.3213 (0.4316)	1.9474* (0.9977)	0.3342 (0.4010)				
Total Production (1923-1929, 100t)					-0.0052** (0.0021)	0.0026 (0.0035)	0.0127** (0.0055)	0.0022 (0.0026)
DV Mean	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
F-Statistics of excluded instrument	116.80	21.64	7.98	19.94	86.93	26.71	15.24	36.86
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	7,721	7,721	7,721	7,721	7,721	7,721	7,721	7,721

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the share of votes in a town against the repeal of abortion in the 1981 referendum. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include controls, columns 2 and 6 control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.10: Rice production and left-wing voting (1953)

	Votes for Communist + Socialist Parties (1953)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	1.7267*** (0.2516)	5.7019*** (1.8279)	7.0709** (3.0374)	2.5927*** (0.9059)				
Total Production (1923-1929, 100t)					0.0184*** (0.0031)	0.0423*** (0.0110)	0.0432*** (0.0125)	0.0169*** (0.0048)
DV Mean	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
F-Statistics of excluded instrument	121.17	12.40	6.48	19.20	86.87	18.04	13.79	35.17
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Observations	7,961	7,961	7,961	7,961	7,961	7,961	7,961	7,961

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is the sum of the shares of votes obtained by the Communist and the Socialist parties in a town in the 1953 national elections. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include controls, columns 2 and 6 control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.11: Cultivation of rice and women politicians among Christian Democrats (DC)

	Share of female city councilors (among Christian Democrats)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of land cultivating rice (1923-1929)	2.2368*** (0.3645)	4.5052* (2.7022)	5.7856 (5.6888)	2.0778* (1.1654)				
Total Production (1923-1929, 100t)					0.0216*** (0.0044)	0.0244** (0.0108)	0.0220* (0.0117)	0.0109** (0.0051)
DV Mean	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
F-Statistics of excluded instrument	127.94	5.94	2.05	14.64	96.64	14.00	9.83	36.24
Crop Controls	no	yes	yes	yes	no	yes	yes	yes
Geographical Controls	no	no	yes	yes	no	no	yes	yes
Region FE	no	no	no	yes	no	no	no	yes
Election cycle FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	9,250	9,250	9,250	9,250	9,250	9,250	9,250	9,250

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are town×election. The dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021) among Christian Democrats councillors only. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the average total rice production in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All regressions include election cycle fixed effects. Columns 1 and 5 do not include additional controls, columns 2 and 6 additionally control for the attainable yield with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed-effects. DV Mean is the dependent variable mean. In parentheses: standard errors clustered at the town level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.12: Rice production and agricultural strikes (1883-1905)

	Any agricultural strike in the town, 1883-1905							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ratio of Land Cultivating Rice, 1879-83	4.4222*** (0.8398)	7.6570*** (2.2819)	7.8813** (3.3392)	4.1823*** (1.4126)				
Total Production(1879-83, 100hl)					0.0059*** (0.0013)	0.0082*** (0.0021)	0.0074*** (0.0022)	0.0042*** (0.0012)
DV Mean	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
F-Statistics of excluded instrument	81.10	18.33	8.80	25.49	70.13	24.82	16.18	41.27
Crop Controls	yes	yes	yes	yes	yes	yes	yes	yes
Geographical Controls			yes	yes			yes	yes
Region FE				yes				yes
Observations	7,721	7,721	7,721	7,721	7,721	7,721	7,721	7,721

Notes: The table reports β coefficients from the IV regression from Equation 5.2, verifying robustness to different specifications. Units of observation are towns. The dependent variable is an indicator variable equal to 1 if at least one strike was reported in the town between 1883 and 1905, and equal to 0 otherwise. The explanatory variables are the share of the town's area cultivated with rice (columns 1 to 4) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 5 to 8). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). Columns 1 and 5 do not include controls, columns 2 and 6 control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. Columns 3 and 7 add geographical controls: the area of the town (only when the explanatory variable is total production), whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951. Columns 4 and 8 add region fixed effects. DV Mean is the dependent variable mean. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.13: Cultivation of rice and female empowerment – control for malaria presence

	Women's LFP		NO to Repeal Divorce Law '74		Women candidates '56		Women in City Council '86-'21		Presence of Nursery Schools '91-'11	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ratio of land cultivating rice (1923-1929)	2.9356*** (0.8851)		0.9555 (0.6468)		0.6029*** (0.2243)		1.1345*** (0.4206)		9.7809*** (3.6625)	
Rice production (100t, avg. 1923-1929)		0.0224*** (0.0056)		0.0073 (0.0048)		0.0047*** (0.0015)		0.0085*** (0.0028)		0.0689*** (0.0212)
DV Mean	0.32	0.32	0.49	0.49	0.01	0.01	0.20	0.20	0.62	0.62
F-Statistics of excluded instrument	106.56	146.33	15.20	20.87	12.99	18.42	108.35	150.41	36.74	54.79
Crop Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Malaria control	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year/Election FE	yes	yes					yes	yes	yes	yes
Observations	52983	52983	7569	7569	7054	7054	55238	55238	19837	19837

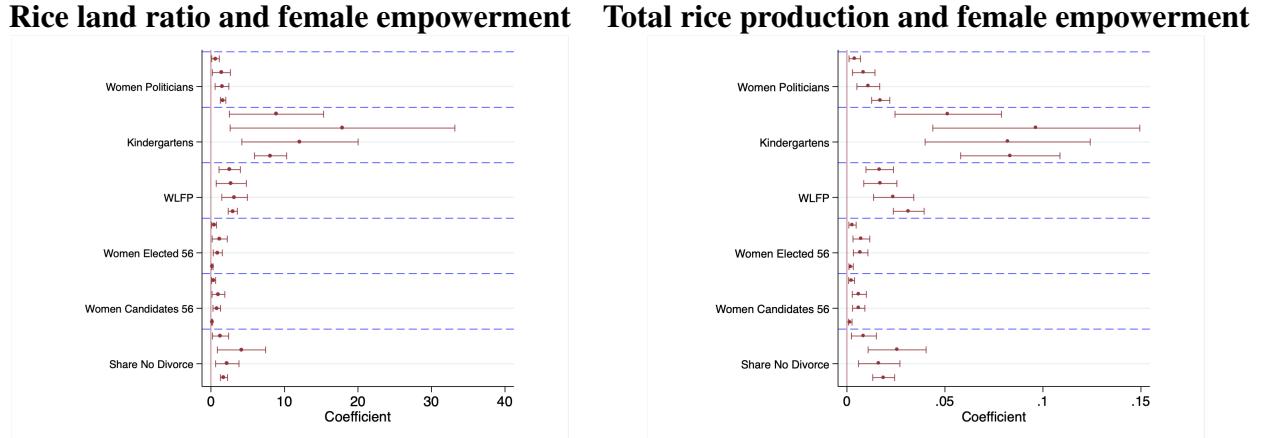
Notes: The table reports β coefficients from the IV regression from Equation 5.2, accounting also for the effect of malaria. Units of observation are town×year in columns 1 and 2, town in columns 3, 4, 5 and 6, town×election in columns 7 and 8, and town×year in columns 9 and 10. In columns 1 and 2 the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In columns 3 and 4 the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In columns 5 and 6, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In columns 7 and 8, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In columns 9 and 10, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991, 2001, and 2011). The explanatory variables are the share of the town's area cultivated with rice (columns 1, 3, 5, 7 and 9) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (columns 2, 4, 6, 8 and 10). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details). All columns control for an indicator variable equal to 1 if malaria cases were reported in a town in 1880-1885, and equal to 0 otherwise. Columns 1, 2, 9 and 10 control for year FE and columns 7 and 8 control for election FE. All columns control for the attainable yields with medium input levels of a number of other crops: tomato, olive, potato, wheat, maize, oat, rye, and barley. DV Mean is the dependent variable mean. In parentheses: robust standard errors (column 3, 4, 5 and 6) and clustered standard errors at the town level (column 1, 2, 7, 8, 9 and 10). *** p<0.01, ** p<0.05, * p<0.1.

Table A.14: Share of *Mondine* among emigrants and female empowerment

	WLFP (1951-2011)		NO to Repeal Divorce Law (1974)		Women candidates (1956)		Women in City Council (1986-2021)		Nursery Schools (1991-2011)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mondine/emigrants	0.0340*** (0.0079)		0.1703*** (0.0128)		0.0187*** (0.0036)		0.0908*** (0.0080)		-0.0142 (0.0455)	
Mondine/female emigrants		0.0124** (0.0058)		0.0973*** (0.0091)		0.0098*** (0.0022)		0.0573*** (0.0053)		-0.0088 (0.0319)
DV Mean	0.31	0.31	0.49	0.50	0.01	0.01	0.19	0.20	0.64	0.62
Year/Election FE	yes	yes					yes	yes	yes	yes
Observations	15631	7987	2233	1141	2037	1056	16349	8352	5841	2982

Notes: The table reports β coefficients from OLS bivariate regressions relating several indicators of female empowerment to rice weavers. The sample includes all Italian towns that reported temporary worker migration in 1904. Units of observation are town×year in columns 1 and 2, town in columns 3, 4, 5 and 6, town×election in columns 7 and 8, and town×year in columns 9 and 10. In columns 1 and 2, the dependent variable is the share of women participating in the labour force (in Census years between 1951 and 2011). In columns 3 and ,4 the dependent variable is the share of votes in a town against the repeal of divorce in the 1974 referendum. In columns 5 and 6, the dependent variable is the share of women running as candidates for the town's city council in the 1956 local elections. In columns 7 and 8, the dependent variable is the share of women elected in the town's city council (elections between 1986 and 2021). In columns 9 and 10, the dependent variable is a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991, 2001 and 2011). The explanatory variables are the share of female migrant rice weavers from a town out of all workers temporarily emigrating from the town in 1904 (columns 1, 3, 5, 7 and 9) and the share of female migrant rice weavers from a town out of all female workers temporarily emigrating from the town in 1904 (columns 2, 4, 6, 8 and 10). DV Mean is the dependent variable mean. In parentheses: robust standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1: Rice production and female empowerment – control for irrigation potential



Notes: Figures A1 and A1 plot β coefficients and 95% confidence intervals of separate IV regressions from the IV regression based on Equation 5.2, accounting also for the effect of a town's irrigation potential. Dependent variables are: the share of votes in a town against the repeal of divorce in the 1974 referendum; the share of women running as candidates for the town's city council in the 1956 local elections; the share of female councillors in the town's city council in 1956; the share of women participating in the labour force (in Census years between 1951 and 2011); a dummy equal to 1 if the town has a nursery school and 0 otherwise (years 1991, 2001 and 2011); the share of women elected in the town's city council (elections between 1986 and 2021). For each dependent variable, each figure plots the coefficients from four specifications: in the first (the bottom one) only includes as a control the average irrigation potential of a town, computed using data from Sinding Bentzen et al. (2017) and Buggle (2020); the second (from the bottom) includes controls for the attainable yield with medium input level of several other crops (tomato, olive, potato, wheat, maize, oat, rye, and barley); the third also includes geographical controls (the area of the town, whether the town is a province capital, distance from the coast, distance from Rome, slope, log elevation, population in 1951); the fourth also includes region fixed effects. The explanatory variables are the share of the town's area cultivated with rice (in Figure A1) and the annual total production of rice in hundreds of tonnes in the town between 1923 and 1929 (in Figure A1). They are instrumented by the attainable yield for rainfed rice with medium input levels from FAO-GAEZ (see Section 4 for additional details).