Australian National University

Crawford School of Public Policy

CAMA

Centre for Applied Macroeconomic Analysis

Revisiting the ancient origins of gender inequality

CAMA Working Paper 11/2025
February 2025

Trung V. Vu
Loughborough Business School, Loughborough University, UK
Centre for Applied Macroeconomic Analysis, Australian National University, Australia

Abstract
This paper probes the robustness and plausibility of the long-term impact of traditional plough use on contemporary gender roles established by Alesina, Giuliano and Nunn [*Quarterly Journal of Economics* (2013) Vol. 128, pp. 469 – 530]. It finds that the reduced-form women-plough relationship is robust to testing a falsification hypothesis, using alternative proxies for gender inequality, and accounting for selection bias from unobservables and spatial dependence. Further evidence suggests that ancestral plough adoption affects today's gender inequality through shaping historically persistent gender-biased norms reflected in oral traditions. Additionally, the culturally embodied, intergenerationally transmitted impact of traditional plough use on gender inequality is significantly lower among societies whose ancestors were exposed to unstable climatic environments during the period 500 – 1900 CE.

Keywords

Plough, Gender inequality, Female empowerment, Replication

JEL Classification

N10, O10, Q15, Z13

Address for correspondence:

(E) cama.admin@anu.edu.au

ISSN 2206-0332

The Centre for Applied Macroeconomic Analysis in the Crawford School of Public Policy has been established to build strong links between professional macroeconomists. It provides a forum for quality macroeconomic research and discussion of policy issues between academia, government and the private sector.

The Crawford School of Public Policy is the Australian National University's public policy school, serving and influencing Australia, Asia and the Pacific through advanced policy research, graduate and executive education, and policy impact.

February 2025

Revisiting the ancient origins of gender inequality

Trung V. Vu*
Loughborough Business School, Loughborough University, UK
Centre for Applied Macroeconomic Analysis, Australian National University, Australia

Abstract
This paper probes the robustness and plausibility of the long-term impact of traditional plough use on contemporary gender roles established by Alesina, Giuliano and Nunn [*Quarterly Journal of Economics* (2013) Vol. 128, pp. 469 – 530]. It finds that the reduced-form women-plough relationship is robust to testing a falsification hypothesis, using alternative proxies for gender inequality, and accounting for selection bias from unobservables and spatial dependence. Further evidence suggests that ancestral plough adoption affects today's gender inequality through shaping historically persistent gender-biased norms reflected in oral traditions. Additionally, the culturally embodied, intergenerationally transmitted impact of traditional plough use on gender inequality is significantly lower among societies whose ancestors were exposed to unstable climatic environments during the period 500 – 1900 CE.

JEL Classification: N10, O10, Q15, Z13

Keywords:
Plough
Gender inequality
Female empowerment
Replication

Declarations of interest: None

* Correspondence: Loughborough Business School, Loughborough University, Leicestershire LE11 3TU, UK
Email: Trung.Vu@lboro.ac.uk

1. Introduction

A sizeable body of research focuses on identifying the deep historical roots of wide and persistent disparities in gender roles across countries and regions. A high-profile contribution to this strand of literature is the study by Alesina et al. (2013) establishing an economically and statistically significant, negative association between traditional plough use and female empowerment. In countries whose ancestors traditionally practised plough agriculture, women are less likely to participate in the labour force, represent in politics, or own firms. By contrast, descendants of shifting agricultural societies tend to experience egalitarian gender roles.

The underlying idea builds upon the seminar work of Boserup (1970) emphasizing the importance of different types of agriculture for shaping the gendered division of labour. Accordingly, in plough-based farming societies, women tend to specialize in household tasks. This is because the plough requires considerable upper body strength to pull the plough or control the animal that pulls it, putting a premium on male dominance in plough agriculture. However, shifting agriculture adopting hand-held tools (e.g., the hoe or the digging stick) is relatively more labour-intensive and thereby involves greater female participation in farm work. Furthermore, plough-based agriculture is less compatible with childcare – a task typically performed by females. Therefore, traditional plough use was conducive to early task segregation by gender during the pre-industrial era, which would gradually increase cultural beliefs about the appropriate role of women in society. To the extent that gender-biased norms might have been transmitted across generations, gender inequality tends to prevail and persist in countries descending from plough-based agricultural societies even if the economy moves out of agriculture (Alesina et al., 2013).

A novel aspect of Alesina et al. (2013) is to step back from the analysis of the 'proximate' causes of gender inequality and shed light on the ancient origins of worldwide differences in contemporary

equality in gender roles.[1] Nonetheless, there are growing concerns over the inability to replicate scientific results (Brodeur et al., 2016; Owen, 2018; Brodeur et al., 2023). Because a comprehensive analysis of the women-plough relationship is important for understanding whether and through which mechanisms ancestral characteristics affect gender roles in the first place, it is important to probe the robustness and plausibility of Alesina et al.'s (2013) findings. Assessment of the reliability of their results is central to designing effective evidence-based approaches to mitigating the persistence of deep-rooted gender inequality worldwide. Against this background, a key objective of the current paper is to replicate Alesina et al. (2013) to check for the robustness of the cross-country women-plough relationship. I also re-examine key predictions of Alesina et al.'s (2013) conceptual framework and extend their migrant analysis. As articulated below, my empirical exercises are consistent with the replication framework proposed by Hamermesh (2007).[2]

First, to implement a pure replication, I re-estimate Alesina et al.'s (2013) cross-country regressions but use the rate of male labour force participation as an alternative dependent variable. This enables me to test a falsification hypothesis that traditional plough use affects structural changes in the labour market and may not influence gender inequality. Furthermore, I check for the robustness of Alesina et al.'s (2013) results to using alternative proxies for gender inequality in labour force participation, employment rates, and political empowerment measured for various years. I also mitigate concerns about selection bias from unobservables and spatial dependence in cultures, institutions, and economic development across country observations.

[1] Conventional explanations of variations in gender roles across countries and regions rest upon the role of economic development, women's education and family choices in affecting female labour force participation (Goldin, 1992). It is noteworthy that these proximate determinants of gender inequality are interrelated with and jointly determined by female empowerment. Thus, several studies attempt to identify the long-term legacy of ancestral characteristics for modern gender roles to provide a deeper, more fundamental understanding of factors determining gender inequality in the first place (see Giuliano, 2018; 2020 for reviews of related studies).

[2] According to Hamermesh (2007), pure replications involve re-estimating the same model using the same dataset and estimation approaches, whereas statistical replications are defined as adopting alternative estimation methods, comparable data, statistical software, or variable constructions. Moreover, scientific replications are referred to using different theoretical or conceptual frameworks. See also Pesaran (2003) and Duvendack et al. (2017).

Second, I conduct a statistical replication to re-examine the hypothesis that ancestral plough adoption affects today's gender inequality via shaping the early formation and persistence of gender-biased norms, based on Michalopoulos and Xue (2021). To understand the reduced-form women-plough nexus across contemporary countries, Alesina et al. (2013) exploit data available in the Ethnographic Atlas (EA) and document that plough-based agricultural societies tended to experience the under-representation of women in agriculture in pre-industrial times. While the EA dataset contains valuable information on early development, it does not capture the prevalence of deep-rooted gender norms and how they persist until today. In this regard, Michalopoulos and Xue (2021) provide a globally comprehensive dataset of gender norms transmitted across generations by word of mouth.[3] This provides an intuitive approach to measuring historically persistent cultural beliefs about gender inequality across world societies and thereby allows me to examine a key mechanism underlying the cross-country women-plough nexus.[4]

Finally, building upon Giuliano and Nunn (2021), I perform a scientific replication of Alesina et al.'s (2013) migrant analysis to examine whether the intergenerational transmission of cultural beliefs about inequality differs across countries. Alesina et al.'s (2013) central hypothesis is premised on the intergenerational persistence of gender norms. Nevertheless, there is ample evidence suggesting rapid and dramatic cultural changes even within one generation.[5] This implies that the degree of time persistence in cultural beliefs is far from homogeneous across countries. For example, Giuliano and

[3] On the empirical side, Michalopoulos and Xue (2021) show that societies with a greater prevalence of gender-biased norms reflected in oral traditions tend to have lower rates of female labour force participation in 2019 (Table VII, panel A). Leveraging data across pre-industrial societies, they regress the folklore-base indicator of male dominance bias on the extent of men's involvement in agriculture or traditional plough use, and find a positive association between gender-biased norms and the under-representation of women in farm work or the traditional use of the plough (Table VII, panel C). This demonstrates the highly predictive power of gender norms reflected in oral traditions for disparities in gender roles across contemporary countries and pre-industrial societies.

[4] The extent of male dominance bias depicted in a country's oral traditions permits capturing how attitudes towards gender inequality persist or change across generations. This approach rhymes well with Brown (1989) emphasizing the importance of folkloristic assumptions and procedures for the collection and analysis of expressive cultures.

[5] For example, anecdotal evidence indicates that norms and traditions could be quickly abandoned within one generation following the European contact, including the examples of the village of Peri on the Island of Manus or the Polynesian community of Tikopia, among other cases (Giuliano and Nunn, 2021).

Nunn (2021) establish that individuals whose ancestors were exposed to stable climatic environments tend to maintain existing norms and traditions.[6] Thus, I propose and establish empirically the hypothesis that the culturally embodied, intergenerationally transmitted impact of traditional plough use on gender inequality is negatively associated with climatic variability across generations, following Giuliano and Nunn (2021).

My results indicate that the women-plough nexus is robust to testing a falsification hypothesis, using alternative proxies for gender inequality, and accounting for unobservables and spatial dependence. I also find large reductions in the magnitude and statistical precision of the estimated plough coefficients after holding gender-biased norms fixed at a particular level, suggesting that traditional plough use hampers present-day female empowerment through inducing the early formation and persistence of cultural beliefs about gender inequality. Using data from the Integrated Values Survey, I find evidence suggesting that ancestral climatic variability reduces the intergenerationally transmitted impact of ancestral plough adoption on gender inequality.

2. Empirical results

Appendix S1 contains a description of Alesina et al.'s (2013) main economic models and variables. Below, I re-estimate their cross-sectional models using data across countries, pre-industrial societies, and second-generation migrants and discuss the results.

2.1. Robustness of the women-plough relationship

The empirical analysis begins with testing a placebo hypothesis that traditional plough use affects structural changes in the labour market. Thus, ancestral plough use may influence male empowerment, making it difficult to assess the long-term impact of the plough on gender inequality. Although ancestral plough adoption is highly predictive of cross-country differences in female

[6] Giuliano and Nunn (2021) establish empirically that climate variability across 20-year generations from 500 CE to 1900 CE is negatively associated with cultural persistence across countries and individuals residing in the same country but descending from various ethnic groups.

empowerment, it has no statistically significant effect on men's representation in marketplace activities (Table A1). This lends support to the women-plough relationship. Furthermore, Alesina et al.'s (2013) results are robust to using alternative proxies for gender equality, including female labour force participation rate and the female-to-male ratio of labour force participation measured for each year from 1991 to 2022, the ratio of women's to men's 2010 employment rates, and the female political empowerment index measured for each year from 1900 to 2022 (Figures A1 – A4 and Table A2). Following Oster (2019), I estimate the scale of selection bias from unobservables and show that Alesina et al.'s (2013) results are unlikely to be confounded by omitted variable bias (Table A3). I also estimate spatial-autoregressive models with spatial-autoregressive disturbances, and find that the women-plough nexus withstands accounting for spatial dependence in cultures institutions, and economic development across country observations (Table A4). In the interest of brevity, I provide detailed interpretations of the results in Appendix S2.[7]

2.2. Understanding the persistent influence of traditional plough use on gender roles

Following Michalopoulos and Xue (2021), I employ the index of male dominance bias reflected in oral traditions to capture variations in gender-biased norms across pre-industrial societies and contemporary countries.[8] In Table 1, I document a positive association between traditional plough use and gender-biased norms across countries, as depicted in Figure A5.[9] This finding is robust to

[7] As shown in Alesina et al.'s (2013) Tables III and IV, heteroscedasticity-robust standard errors are used to examine the cross-country women-plough association. I follow this approach to replicate the cross-country regressions.

[8] Employing data from Berezkin (2015), Michalopoulos and Xue (2021) develop a digitalized collection of folklore, comprising thousands of motifs that correspond to a social group's customs, beliefs, traditions and narratives transmitted across generations by word of mouth. Then, they construct a folklore-based measure of gender norms by identifying motifs related to gender roles, yielding gender stereotypes in the oral tradition. The degree of male dominance bias is captured by the difference between male and female motifs for each gender stereotype, normalized by the total number of motifs in a country's oral tradition. The male dominance bias index reflects the extent to which males are portrayed as more violent, less dependent, less engaged in domestic affairs, and more physically active than females (Michalopoulos and Xue, 2021). Higher values correspond to a greater prevalence of gender-biased norms.

[9] An extra standard deviation of the cross-country variation in ancestral plough adoption predicts a 0.314-standard-deviation increase in the folklore-based measure of gender-biased norms (Table 1, column 2). For example, the Philippines has a historical plough use score of 0.337, whereas Vietnam has a higher score of 0.872. If the Philippines were to experience the traditional use of the plough of Vietnam (equivalent to an increase in the plough score of 0.535),

accounting for historical characteristics, continent dummies, and contemporary controls.[10] Given that the plough is highly predictive of cross-country differences in the prevalence of gender-biased norms, I exploit traditional plough use as an instrumental variable (IV) for male dominance bias in oral traditions, and estimate 2SLS regressions of the effect of gender-biased norms on female labour force participation. The IV estimates indicate that the exogenous component of gender-biased norms isolated by ancestral plough adoption is negatively associated with female empowerment (Table 2). Leveraging variations across pre-industrial societies, I also find that traditional plough use is positively associated with gender norms favouring male dominance, which in turn correlates with women's under-representation in agriculture (Table A9). My findings suggest that traditional plough use transmits to today's gender inequality via shaping historically persistent gender-biased norms.

Following Acharya et al.'s (2016) adoption of sequential *g*-estimation, I also implement a simple two-stage regression procedure to estimate the average controlled direct effect (ACDE) of traditional plough use on female labour force participation. Details are provided in Appendix S3; here, I briefly summarize the key findings. The ACDE estimates suggest large reductions in the size and statistical significance of the estimated women-plough relationship across countries after holding the prevalence of gender-biased norms fixed at a particular level (Table A10). In line with the 2SLS estimates, the ACDE results indicate that the pervasiveness of slowly evolving cultural norms favouring male dominance is a key mechanism underlying Alesina et al.'s (2013) core results.

2.3. Intergenerational persistence in deep-rooted cultural beliefs about gender inequality

Table 1, column (2) results imply an increase in Philippines's male dominance bias score from 0.064 to 0.083. This predicted change is equivalent to 35% of a standard deviation of gender-biased norms depicted in oral traditions.

[10] Additionally, I find that the cross-country association between the plough and gender-biased norms is robust to excluding historical controls that can be endogenous in regression models explaining the worldwide variation in gender inequality (Table A5), considering ancestral plough adoption before European contact (Table A6), removing countries with a significant proportion of missing language data used to construct the traditional plough use index (Table A7), and sample truncation (Table A8).

Alesina et al. (2013) indicate that traditional plough use at the country-of-origin level is highly predictive of variations in female labour force participation and attitudes towards gender inequality among second-generation migrants in the European Social Survey and the Current Population Survey. This reflects the culturally embodied, intergenerationally transmitted impact of ancestral plough adoption on contemporary gender inequality. While the intergenerational transmission of gender norms is established among children of immigrants in the United States and Europe, less is known about the sensitivity of this finding to using an alternative comparable dataset of migrants with wider country coverage.[11]

Alesina et al.'s (2013) migrant analysis carries an implicit assumption that cultural persistence is uniform across countries. However, countries differ widely from one another in many factors shaping cultural evolution, leading to worldwide heterogeneity in cultural persistence or change. This argument is consistent with Giuliano and Nunn's (2021) theoretical model postulating that it is relatively more beneficial for individuals whose ancestors were living in stable environments to adopt existing cultural values because norms that have evolved up to the previous generation tend to be relevant for the current generation. Thus, cultural persistence is greater among societies with more similar environments across generations. In their model, individuals facing uncertainty about making optimal decisions tend to rely on existing traditions as decision-making heuristics, instead of choosing their actions through costly information acquisition, if the ancestral environment is stable. This proposition builds upon conventional models explaining the formation and evolution of cultures (Boyd and Richerson, 1985; Rogers, 1988), highlighting that cultural values evolve optimally depending on their compatibility with the existing environment.

[11] This aligns with the definition and classification of replication exercises put forward by Hamermesh (2007) and Duvendack et al. (2017). Furthermore, testing the sensitivity of Alesina et al.'s (2013) findings to using an alternative dataset fits into the discussions of Eronen and Bringmann (2021) highlighting the role of obtaining robust and constant empirical results underlying relevant theories.

I use Giuliano and Nunn's (2021) measure of climatic variability across 20-year generations between 500 CE and 1900 CE to capture ancestral instability. I first reproduce Alesina et al.'s (2013) Tables IX and X but augment the regression analysis with ancestral instability and its interaction term with traditional plough use. As shown in Tables A11 and A12, there are large reductions in the statistical precision of the estimated coefficient on traditional plough use. The interaction variable enters all the regressions with expected signs, implying that ancestral instability reduces the intergenerationally transmitted impact of traditional plough use on gender inequality. However, this impact is imprecisely estimated at conventional levels of statistical significance. These results indicate that Alesina et al.'s (2013) estimates are sensitive to allowing for worldwide heterogeneity in cultural persistence.

I now replicate their migrant analysis in a wider sense by using newly constructed samples of second-generation migrants with broader country coverage to obtain a more comprehensive understanding of the intergenerational transmission of gender norms worldwide. For this purpose, I use data from the Integrated Values Survey (IVS) and restrict the analysis to second-generation migrants currently residing in 75 countries with at least one parent born in a foreign country.[12] These individuals are exposed to common economic and institutional settings but differ widely from one another in terms of parental cultural backgrounds; they descended from 127 countries.[13] I follow Alesina et al. (2013) to identify an individual's ancestry based on self-reported father's country of birth, mother's country of birth, or both parents' same country of birth, yielding three alternative samples of 5846, 5531 and 2885 surveyed respondents, respectively.[14] Then, I relate traditional

[12] The IVS is a joint dataset of the World Values Survey (WVS) and the European Values Survey (EVS) conducted between 2017 and 2022 in 90 countries.

[13] The country-of-origin-level index of traditional plough use has a mean score of 0.869 and a standard deviation of 0.279. The mean and standard deviation values of ancestral climatic instability at the country-of-origin level are 0.269 and 0.125, respectively.

[14] Using father's country of birth to identify migrants' cultural backgrounds, I obtain information on 5,846 individuals living in 75 countries. In this sample, 65 and 17 out of 75 countries of residence have more than 10 and 100 migrants,

plough use at the country-of-origin level to individuals' self-reported attitudes towards gender inequality. By augmenting all the regressions with country-of-residence fixed effects, I only compare individuals residing in the same country, thereby accounting for a wide range of institutional or economic correlates of cultural beliefs. This allows me to re-examine the hypothesis that ancestral plough adoption affects today's female empowerment via shaping intergenerationally transmitted cultural beliefs about the appropriate role of women in society.

I rely on survey participants' attitudes towards the statement that "When jobs are scarce, men should have more right to a job than women" to capture individual attitudes towards gender roles. Responses recorded on a categorical scale are multiplied by minus one so that higher values reflect greater support for unequal gender roles.[15] Therefore, I rely on an ordered probit model to re-estimate the above proposition.[16] As shown in Table 3, panel A, traditional plough use has no statistically significant effect on attitudes towards gender inequality among second-generation migrants in the IVS in all cases. This result reflects sensitivity to using alternative samples of migrants with wider country coverage and allowing for worldwide heterogeneity in cultural persistence. In Table 3, panel B, I include ancestral climatic instability and its interaction term with traditional plough use in the regression. Accordingly, I find that the estimated plough coefficient is positive and statistically significant in most cases. The estimated coefficient on the interaction variable is negative and statistically significant in all cases.[17] The results indicate that the culturally embodied,

respectively. Singapore, Australia, and Canada are the most diverse countries of residence, with 400, 416, and 542 migrants, respectively. Specifically, I have information on 75 countries of origin of 542 migrants residing in Canada. It is worth noting that many of the most diverse countries in this sample are not included in Alesina et al.'s (2013) migrant analysis. This justifies the importance of checking for the robustness of their findings to varying sample composition based on data available in the IVS. However, it is important to note that the total number of migrants in the IVS is relatively smaller than that included in Alesina et al.'s (2013) migrant analysis.

[15] Responses include (1) strongly agree, (2) agree, (3) neither agree nor disagree, (4) disagree and (5) strongly disagree.

[16] Consistent with Alesina et al. (2013), I calculate standard errors clustered at the country-of-origin level to reduce concerns about arbitrary correlations of the error terms across individuals descending from a given country of origin.

[17] I also re-estimate the specifications from Table 3 but use an OLS estimator, following the approach adopted in Alesina et al. (2013). As reported in Table A13, the results are quantitatively similar.

intergenerationally transmitted impact of traditional plough use on today's gender inequality is lower among individuals whose ancestors were exposed to unstable climatic environments during the period 500 – 1900 CE.[18] This reveals that descendants of societies with greater climatic variability are less likely to maintain gender-biased norms determined by the traditional use of the plough during the pre-industrial era, consistent with the theories of cultural formation and development (Boyd and Richerson, 1985; Rogers, 1988; Giuliano and Nunn, 2021). My findings provide empirical support for conventional models of cultural evolution, indicating that similarities between environments across generations play a key role in shaping how deep-rooted cultural values persist over time.

3. Concluding remarks

I replicate the findings of Alesina et al. (2013) and establish the robustness and plausibility of the cross-country relationship between ancestral plough adoption and present-day gender inequality. I further show that traditional plough use hampers female empowerment mainly through shaping historically persistent gender-biased norms reflected in oral traditions. My findings also indicate that the culturally embodied, intergenerationally transmitted impact of traditional plough use on gender inequality is lower among societies with larger climatic variability across generations. The results imply that fostering egalitarian roles requires mitigating the persistent nature of deep-rooted gender-biased norms especially in societies descending from plough-based farming societies and whose ancestors were exposed to stable environments between 500 CE and 1900 CE.

[18] Using cross-country data, I regress female labour force participation rate measured for each year between 1991 and 2022 on traditional plough use, ancestral climatic instability, and the plough-instability interaction term; results are available on request. Accordingly, traditional plough use and its interaction variable with climatic instability enters the regressions with expected signs and statistically significant coefficients, suggesting that ancestral instability mitigates the negative women-plough association. However, the results turn out to be statistically insignificant when historical characteristics, continent dummies and contemporary controls are included in the regressions. It is worth noting that the cross-country estimates can be confounded by contemporary or historically persistent socio-economic and political factors. This is in contrast to the migrant analysis exploiting variations in diverse cultural backgrounds across individuals with exposure to common institutional or economic environments to isolate cultural transmission. This helps explain why cross-country evidence of worldwide heterogeneity in the persistent influence of traditional plough use on gender roles is weaker than that obtained from the second-generation migrant analysis.

Table 1

Traditional plough use and gender-biased norms across countries

	(1)	(2)	(3)	(4)
OLS estimates. Dependent variable: Male dominance bias in oral traditions				
Ancestral plough adoption	0.038***	0.035***	0.029***	0.029**
	(0.010)	(0.011)	(0.011)	(0.013)
Standardized beta coefficient	0.340	0.314	0.259	0.260
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
Observations (# of countries)	181	181	164	164
R-squared	0.316	0.351	0.345	0.360

Notes: This table reports OLS estimates of the reduced-form cross-country relationship between traditional plough use and gender-biased norms reflected in oral traditions. I use Michalopoulos and Xue's (2021) folklore-based index of male dominance bias to capture the worldwide prevalence of historically persistent cultural norms favouring gender inequality. It reflects the degree to which a country's oral traditions describe males as more violent, less dependent, less engaged in domestic affairs, and more physically active than their female counterparts. Historical controls are average land suitability for agriculture, the presence of a tropical climate, the presence of large domesticated animals, jurisdictional hierarchies, and settlement density, measured for the ancestors of a country's populations. Continent dummies are binary indicators for Asia, Europe, North America, Oceania, and South America. Contemporary controls are the linear and quadratic terms of log of GDP per capita. Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2

Traditional plough use, gender-biased norms and female labour force participation across countries

	(1)	(2)	(3)	(4)
Second-stage estimates. Dependent variable: Female labour force participation in 2000				
Male dominance bias in oral traditions	-420.433***	-487.578***	-433.555***	-467.805**
	(124.149)	(156.630)	(166.536)	(186.371)
Standardized beta coefficient	-1.451	-1.683	-1.489	-1.606
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
First-stage *F*-statistic	13.67	8.01	5.83	4.50
AR confidence interval	[-850.559,	[-1247.3,	[-1735.87,	[N/A,
	-236.094]	-286.019]	-252.22]	-264.872]
Observations	168	168	159	159

Notes: This table reports 2SLS estimates of the effect of the exogenous component of gender-biased norms reflected in the oral tradition, isolated by the traditional use of the plough, on women's participation in the labour market in 2000 across countries. The first-stage estimates are presented in Table 1. First-stage *F*-statistic shows Olea and Pflueger's (2013) robust-weak-instrument *F*-statistics. AR confidence interval shows the 95% confidence intervals that are robust to weak identification and efficient in the just-identified case (Andrews et al., 2019). Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. See also the notes to Table 1.

Table 3

Traditional plough use, ancestral climatic instability, and attitudes towards gender roles among second-generation migrants

Dependent variable:	Agree with the statement: "When jobs are scarce, men should have more right to a job than women"								
Country of origin:	Father's country of birth			Mother's country of birth			Parents' same country of birth		
Sample: IVS respondents	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Specifications without ancestral instability (500 – 1900 CE)									
Ancestral plough adoption	0.018	0.185	-0.034	0.074	0.036	-0.088	0.201	0.051	-0.126
	(0.091)	(0.202)	(0.215)	(0.094)	(0.218)	(0.218)	(0.125)	(0.261)	(0.274)
Country-of-origin controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Individual-level controls	No	No	Yes	No	No	Yes	No	No	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of clusters (countries of origin)	125	116	112	127	116	115	102	98	97
Observations (# of individuals)	5,846	5,816	5,482	5,531	5,502	5,181	2,885	2,877	2,720
Pseudo *R*-squared	0.123	0.123	0.150	0.125	0.124	0.152	0.146	0.145	0.171
Panel B. Specifications with ancestral instability (500 – 1900 CE)									
Ancestral plough adoption	0.569**	0.804**	0.669**	0.744***	0.693**	0.483	1.268***	1.159***	1.241***
	(0.241)	(0.315)	(0.277)	(0.230)	(0.321)	(0.296)	(0.327)	(0.431)	(0.419)
Ancestral instability	2.464***	2.875***	3.474***	2.038**	2.256**	2.395***	4.425***	4.785***	6.164***
	(0.869)	(0.979)	(0.801)	(0.865)	(1.078)	(0.917)	(1.480)	(1.668)	(1.517)
Plough × Ancestral instability	-2.588***	-3.143***	-3.461***	-2.764***	-3.096***	-2.712***	-5.054***	-5.242***	-6.274***
	(0.942)	(1.111)	(0.865)	(0.907)	(1.141)	(0.972)	(1.533)	(1.781)	(1.614)
Country-of-origin controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Individual-level controls	No	No	Yes	No	No	Yes	No	No	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of clusters (countries of origin)	124	116	112	126	116	115	102	98	97
Observations (# of individuals)	5,845	5,816	5,482	5,529	5,502	5,181	2,885	2,877	2,720
Pseudo *R*-squared	0.123	0.123	0.150	0.126	0.125	0.152	0.147	0.146	0.172

Notes: This table shows ordered probit estimates of the relationship between traditional plough use at the country-of-origin level and self-reported attitudes towards gender inequality among second-generation migrants residing in the same country but whose at least one parent was born in a foreign country, as reported in the IVS. In columns (1) to (6), ancestry is identified by father's or mother's country of origin. The specifications from columns (7) to (9) are restricted to individuals whose both parents were born in the same foreign country. Attitudes towards gender inequality are recorded on a categorical scale, with higher values corresponding to greater support for unequal gender roles. Ancestral instability is measured by climatic variability across generations during the period 500 – 1900 CE constructed by Giuliano and Nunn (2021). Country-of-origin controls are the presence of large domesticated animals, the density of settlement, the degree of political authority, average land suitability for agriculture and the presence of a tropical climate, and the linear and quadratic terms of log of real GDP per capita in 2010. Individual controls are age, age squared, a binary indicator of being female, and dummy variables for marital status, educational attainment, and size of the town. All the regressions are augmented with dummies for countries of residence and time factors (WVS versus EVS survey wave). Heteroscedasticity-robust standard errors in parentheses are clustered at the country-of-origin level. *** p<0.01, ** p<0.05, * p<0.1.

References

Acharya, A., Blackwell, M., and Sen, M. (2016). Explaining Causal Findings without Bias: Detecting and Assessing Direct Effects. *American Political Science Review, 110,* 512-529.

Alesina, A., Giuliano, P., and Nunn, N. (2013). On the Origins of Gender Roles: Women and the Plough. *Quarterly Journal of Economics, 128,* 469-530.

Andrews, I., Stock, J. H., and Sun, L. (2019). Weak Instruments in Instrumental Variables Regression: Theory and Practice. *Annual Review of Economics, 11,* 727-753.

Berezkin, Y. (2015). Folklore and Mythology Catalogue: Its Lay-out and Potential for Research. *Retrospective Methods Network Newsletter, 10,* 58-70.

Boserup, E. (1970). *Woman's Role in Economic Development*. London, UK: George Allen & Unwin.

Boyd, R., and Richerson, P. J. (1985). *Culture and the Evolutionary Process*. Chicago: University of Chicago Press.

Brodeur, A., Carrell, S., Figlio, D., and Lusher, L. (2023). Unpacking P-Hacking and Publication Bias. *American Economic Review, 113,* 2974-3002.

Brodeur, A., Lé, M., Sangnier, M., and Zylberberg, Y. (2016). Star Wars: The Empirics Strike Back. *American Economic Journal: Applied Economics, 8,* 1-32.

Brown, M. E. (1989). Women, Folklore and Feminism. *Journal of Folklore Research, 26,* 259-264.

Duvendack, M., Palmer-Jones, R., and Reed, W. R. (2017). What Is Meant by "Replication" and Why Does It Encounter Resistance in Economics? *American Economic Review, 107,* 46–51.

Eronen, M. I., and Bringmann, L. F. (2021). The Theory Crisis in Psychology: How to Move Forward. *Perspectives on Psychological Science, 16,* 779-788.

Giuliano, P. (2018). Gender: A Historical Perspective. In S. L. Averett, L. M. Argys, & S. D. Hoffman (Eds.), *The Oxford Handbook of Women and the Economy* (pp. 645–672). New York: Oxford University Press.

Giuliano, P. (2020). Gender and Culture. *Oxford Review of Economic Policy, 36,* 944-961.

Giuliano, P., and Nunn, N. (2021). Understanding Cultural Persistence and Change. *Review of Economic Studies, 88,* 1541–1581.

Goldin, C. (1992). *Understanding the Gender Gap: An Economic History of American Women*. New York: Oxford University Press.

Hamermesh, D. S. (2007). Replication in Economics. *Canadian Journal of Economics, 40,* 715-733.

Michalopoulos, S., and Xue, M. (2021). Folklore. *Quarterly Journal of Economics, 136,* 1993-2046.

Olea, J. L. M., and Pflueger, C. (2013). A Robust Test for Weak Instruments. *Journal of Business & Economic Statistics, 31,* 358-369.

Oster, E. (2019). Unobservable Selection and Coefficient Stability: Theory and Evidence. *Journal of Business & Economic Statistics, 37,* 187-204.

Owen, P. D. (2018). Replication to Assess Statistical Adequacy. *Economics: The Open-Access, Open-Assessment E-Journal, 12,* 1-16.

Pesaran, H. (2003). Introducing a Replication Section. *Journal of Applied Econometrics, 18,* 111-111.

Rogers, A. R. (1988). Does Biology Constrain Culture? *American Anthropologist, 90,* 819-831.

ONLINE APPENDIX FOR

"Revisiting the ancient origins of gender inequality"

S1. Alesina et al.'s (2013) data and key methods

Alesina et al. (2013) regress the rate of female labour force participation in 2000 on ancestral plough adoption using data for 177 countries to establish that countries with the traditional use of the plough tend to experience the under-representation of women in the labour force, as shown in the following model:

$$Y_i = \alpha + \beta Plough_i + \gamma X_i^H + \varphi X_i^C + \mu_i + \varepsilon_i, \quad [1]$$

where Y_i is gender inequality for country i captured by the rate of female labour force participation in 2010; $Plough_i$ is the proportion of a country's population with ancestors adopting plough-based agricultural technology; β is found to be negative; X_i^H is a vector of observed historical controls; X_i^C is a set of contemporary controls; μ_i is a set of continent dummies; and ε_i is an unobserved error term.

Alesina et al. (2013) also use data for 660 pre-industrial societies available in the Ethnographic Atlas of Murdock (1967) and estimate the following cross-sectional model to document that plough-based agricultural societies tended to experience the under-representation of women in activities outside the household during the pre-industrial era:

$$Y_e = \alpha + \beta Plough_e + \gamma X_e + \varepsilon_e, \quad [2]$$

where Y_e is the participation of women in agriculture for ethnic group e; $Plough_e$ is the historical plough use index at the ethnicity level; β is found to be negative; X_e is a vector of ethnicity-level controls; and ε_e is an unobserved disturbance term.

Using individual-level data from the European Social Survey (ESS) and the Current Population Survey (CPS), Alesina et al. (2013) estimate the following cross-sectional model to

provide evidence that individuals descending from countries of origin with traditional plough use are more likely to exhibit cultural norms favouring male dominance:

$$Y_{i,s,c,p} = \alpha + \beta Plough_p + \gamma X_p^H + \varphi X_p^C + \varphi X_i + \varepsilon_{i,s,c,p}, \quad [3]$$

where $Y_{i,s,c,p}$ is an outcome of interest for individual i residing in state s as reported in the CPS *or* country c as reported in the ESS and having at least one parent born in country p; X_p^H and X_p^C are vectors of historical and contemporary controls for country of origin p; X_i is a set of individual controls; and $\varepsilon_{i,s,c,p}$ is an unobserved disturbance term.

S2. Robustness of the women-plough relationship

1. Using male labour force participation as the dependent variable

Existing studies on the causes and consequences of gender inequality have widely exploited the rate of women's participation in the labour force as a proxy for gender inequality. For example, consistent with Alesina et al. (2013), Hansen et al. (2015) use the female labour force participation rate in 2000 to measure cross-country differences in contemporary equality in gender roles, and establish empirically that the duration of agricultural history is a deep determinant of modern gender inequality across the globe. It has been documented that agricultural technologies and history fundamentally drive worldwide differences in cultures, institutions, and economic performance (Spolaore and Wacziarg, 2013). Thus, traditional plough use plausibly affects structural changes in the labour market and thereby helps shape male empowerment worldwide. If this is true, ancestral plough adoption may not have an impact on gender inequality. Against this backdrop, following Fredriksson and Gupta (2023) and Vu (2024), I implement a placebo exercise to check whether traditional plough use is associated with male empowerment across countries. In particular, as reported in Table A1, I replicate Alesina, Giuliano, and Nunn's (2013) Tables III and IV but use the rate of male labour force participation in 2010 as the dependent variable. Accordingly, the plough enters all the regressions with a negative but statistically insignificant coefficient. It is evident that traditional plough use has no impact on men's representation in the labour force. This lends credence to the hypothesis proposed by Alesina et al. (2013) that the traditional use of the plough fundamentally drives cross-country differences in contemporary equality in gender roles.

2. Using alternative measures of gender inequality

To further check whether Alesina, Giuliano, and Nunn's (2013) core findings are insensitive to varying the year chosen to measure the cross-country variation in gender inequality, I replicate their Tables III and IV but use the rate of female labour force participation for each

year between 1991 and 2022 as alternative dependent variables. This is mainly dictated by data availability in the World Bank's Development Indicators and by the purpose of estimating various repeated cross-sectional regressions using a comparable sample of countries. Figure A1, panel A depicts the point estimates and 95% confidence intervals of the plough coefficient. It suggests a negative association between ancestral plough adoption and contemporary equality in gender roles across countries consistently observed during the period 1991 – 2022. The results remain robust to incorporating contemporary controls in the regression, as illustrated in Figure A2, panel A. As discussed above, a potential concern is that ancestral plough adoption may affect both men's and women's labour force participation by shaping structuring changes in the labour market worldwide. Therefore, I also use the female-to-male ratio of labour force participation for each year between 1991 and 2022 as an alternative proxy for gender equality. The results depicted in panel B of Figures A1 and A2 are suggestive of the robustness of Alesina, Giuliano, and Nunn's (2013) main results to performing this check.

It is worth noting that gender disparities in labour force participation rates may not be a good proxy for contemporary equality in gender roles if women are unemployed or engage in unpaid work (Vu, 2024). For this reason, I follow Vu (2024) to use the female-to-male ratio of employment rates to capture cross-country differences in equality in gender roles. The ratio of women's to men's 2010 employment rates is based on the proportion of males and females of working age in the population who engage in work to produce goods and services for pay or profit, respectively. In Table A2, I reproduce Alesina, Giuliano, and Nunn's (2013) Tables III and IV but use the female-to-male ratio of employment rates as an alternative dependent variable. Accordingly, the estimated coefficient on ancestral plough adoption remains negative and statistically significant at the 1% level in all cases. This indicates that the traditional use of the plough is negatively associated with female economic empowerment worldwide.

Alesina et al. (2013) establish that ancestral plough adoption negatively correlates with female political representation in 2010 proxied by the proportion of seats held by women in national parliaments. This association is statistically insignificant, conditional on historical controls and continent dummies. However, after the linear and quadratic terms of log of GDP per capita are included in the regressions, the coefficient on traditional plough use turns out to be statistically significant at the 1% or 5% levels. I now check for the robustness of their findings to using an alternative proxy for female political empowerment. To perform this robustness test, I re-estimate the specifications from Alesina, Giuliano, and Nunn's (2013) Tables III and IV but use a comprehensive measure of women's political empowerment available in the Varieties of Democracy (V-Dem) dataset (https://v-dem.net/) as the dependent variable. This is a summary measure of female political empowerment, reflected in women's representation in decision-making bodies of a government, women's open discussion of political issues in civil society organizations, and female fundamental civil liberties (Coppedge et al., 2023). An advantage of using the V-Dem-based indicator of female political empowerment lies in its wide coverage of countries and years. Hence, I estimate various repeated cross-sectional regressions using data on female political empowerment for each year between 1900 and 2022.

Figure A3 depicts the relationship between traditional plough use and female political empowerment for each year during the period 1900 – 2022. I find that the estimated plough coefficient is negative and statistically significant at the 5% level in most cases when the dependent variable is measured between 1990 and 2022. However, the results are statistically insignificant before the 1990s. After controlling for log of income per head and its squared term, the coefficient on the plough turns out to be statistically significant at the 1% or 5% levels in most cases when using data for the outcome variable measured during the period 1975 – 2008, as illustrated in Figure A4. This is consistent with Alesina, Giuliano, and Nunn's (2013)

proposition that traditional plough use is positively correlated with GDP per person and that countries with higher levels of economic development tend to have greater female political representation. For this reason, controlling for the degree of economic development increases the statistical precision of the negative coefficient on ancestral plough adoption. Overall, using a comprehensive measure of female political empowerment available in the V-Dem dataset, I find additional support for a negative association between traditional plough use and contemporary equality in gender roles across countries in most repeated regressions where the dependent variable is measured for each year between 1975 and 2008. However, the results are statistically insignificant when female political empowerment is measured for each year before the 1970s or after 2008.

3. Estimating the scale selection bias from unobserved confounding factors

A key challenge with establishing the persistent influence of ancestral plough adoption on modern gender roles across countries relates to potential selection bias from unobservables. In particular, there are large variations between countries in terms of contemporary and historically persistent characteristics that may fully account for the women-plough relationship. In this regard, Alesina et al. (2013) establish the robustness of their findings to controlling for several characteristics of the ancestors of a country's populations and unobserved time-invariant heterogeneity across world regions. However, Oster (2019) suggests that including observed confounders in the regressions may provide an invalid basis for statistical inference on selection bias from unobservables if observed controls are imperfect proxies for the true omitted variable or variables. Therefore, I rely on coefficient stability test developed by Oster (2019) to check whether Alesina et al.'s (2013) results are attributed to unobservables.

The coefficient stability approach relies on the idea that the scale of selection bias from unobservables can be assessed by observing the reduction in selection bias when the regression analysis is augmented with observed controls (Altonji et al., 2005). In addition to observing

the stability of the estimated coefficients, this exercise exploits the empirical relevance of observables to estimate selection bias from unobserved confounding factors (Oster, 2019). The underlying idea is that small changes in *R*-squared values when observed controls are incorporated in the regressions are associated with a higher probability that unobserved confounders can fully account for the results (Oster, 2019). As reported in Table A3, I replicate Alesina, Giuliano, and Nunn's (2013) Tables III and IV and then calculate Oster's (2019) coefficient stability test results. The δ test statistic captures how strong the correlation between unobservables and traditional plough use, relative to the association between traditional plough use and observed controls, needs to be to attenuate the coefficient on the plough towards zero. Accordingly, the δ values are higher than the threshold of 1 proposed by Oster (2019) in all cases. This indicates that selection bias from unobservables needs to implausibly larger than selection on observables to explain away Alesina, Giuliano, and Nunn's (2013) core findings. Assuming that $\delta = 1$ and the *R*-squared of a hypothetical regression of modern gender roles on ancestral plough adoption with full observed and unobserved confounders is 30% higher than the *R*-squared of a model with full observed controls, I calculate the bias-adjusted plough coefficient (β^*), following Oster (2019). It would reflect the women-plough relationship across countries if one were to fully account for all unobservables in the regressions. All the intervals bounded by β^* and the baseline plough coefficient exclude zero. These results suggest that the established relationship between traditional plough use and modern gender roles across countries is unlikely to be confounded by unobservables.

4. Accounting for spatial dependence across country observations

An additional concern is that the established relationship between traditional plough use and gender inequality across countries can be confounded by spatial dependence across country observations. This stems from the possibility that cultures, technologies, attitudes, knowledge, institutions, and economic development could have been diffused across contemporary

countries and pre-industrial societies, thus violating the basic assumption of independence between observations in standard OLS regressions. To mitigate this concern, I re-implement the main analysis of Alesina et al. (2013) but adopt a generalized spatial two-stage least-squares estimator to estimate spatial-autoregressive models with spatial-autoregressive disturbances (SARAR (1,1)), following Drukker et al. (2013). This approach has been used in several studies identifying the deep roots of worldwide comparative development (see, for example, Arbatlı et al., 2020; Vu, 2024). The estimation procedure exploits an inverse-distance spatial weighting matrix, using the great-circle distances between the geodesic centroids of country pairs. As shown in Table A4, Alesina, Giuliano, and Nunn's (2013) core findings remain intact after I account for spatial dependence.

S3. Understanding the persistent influence of traditional plough use on gender roles

1. The ACDE of traditional plough use on female labour force participation

As discussed in the main text, the main hypothesis proposed by Alesina et al. (2013) rests upon the premise that ancestral plough adoption was conducive to the early emergence and persistence of cultural beliefs about the appropriate role of women in society. This ultimately helps shape variations in contemporary equality in gender roles observed across the world. To provide further support for this proposition, I examine whether traditional plough use transmits to present-day gender roles exclusively through shaping historically persistent gender-biased norms. Hence, I also use Michalopoulos and Xue's (2021) index of male dominance bias reflected in oral traditions to capture the worldwide variation in cultural norms favouring male dominance. This indicator is based on the degree to which a country's oral traditions portray men as more violent, less dependent, less engaged in domestic affairs, and more physically active (Michalopoulos and Xue, 2021).

A conventional approach is to regress female labour force participation on traditional plough use and the male dominance bias index. If the above prediction is true, the statistical significance of the coefficient on the plough will reduce substantially after controlling for the prevalence of gender-biased norms.[1] This exercise, however, may yield biased and inconsistent estimates mainly due to concerns about intermediate variable bias, as suggested by Acharya et al. (2016). Therefore, I follow Acharya et al. (2016) to conduct a simple two-stage regression procedure using sequential *g*-estimation, yielding estimates of the average controlled direct effect (ACDE) of traditional plough use on contemporary gender roles. To perform this

[1] When I regress the rate of female labour force participation on traditional plough use and the male dominance bias index, the estimated coefficient on the plough is negative but statistically insignificant. By contrast, the male dominance bias index of Michalopoulos and Xue (2021) enters the regression with a negative and statistically significant coefficient, suggesting that countries with a greater prevalence of cultural norms favouring male dominance tend to be characterized by the under-representation of women in the labour force. These results, omitted for brevity, are available upon request.

empirical exercise, I identify intermediate confounding factors and pretreatment covariates. Specifically, I consider fundamental geographical attributes – including absolute latitude, distance to the nearest waterway, terrain ruggedness, average land suitability for agriculture, mean elevation, and island nation dummy – as pretreatment controls because geography may affect ancestral plough adoption, contemporary gender roles, and historically persistent gender-biased norms.[2] Furthermore, pretreatment covariates include continent dummies that capture unobserved region-specific factors, including histories, cultures and geography. Intermediate confounding factors are variables affected by traditional plough use that may also influence women's representation in the labour market and the prevalence of gender-biased norms. Hence, I treat contemporary economic and institutional development as intermediate confounders, including the linear and quadratic terms of log of GDP per capita, institutional quality, the share of oil rents in total GDP, the contributions of three main sectors to total GDP, and the emergence and prevalence of civil conflicts.[3]

To implement the ACDE analysis, I first regress the rate of female labour force participation in 2000 on traditional plough use and the mediator (gender-biased norms) controlling for pretreatment covariates and intermediate confounders. Then, I remove the estimated effect of the mediator from the outcome variable. The transformed dependent variable is regressed on traditional plough use and pretreatment controls, removing all

[2] It is widely recognized in the long-run development literature that geographical characteristics fundamentally drive variations in social, economic and political development across pre-industrial societies and contemporary countries (Spolaore and Wacziarg, 2013). See, for example, Arbatlı et al. (2020) and Vu (2024) for discussions on how these geographical attributes provide alternative explanations for the deep roots of gender roles worldwide.

[3] I use the data on log of 2000 GDP per capita and its squared term adopted by Alesina et al. (2013). The quality of institutions is measured by a simple average of six Worldwide Governance Indicators in 2000 (Kaufmann et al., 2010). Oil rents are the difference between the value of crude oil production at world prices and total costs of production. Sectoral shares are the value added of major economic sectors (including manufacturing, services, and agriculture, forestry and fishing) as a percentage of total GDP. Data on oil rents and sectoral shares were obtained from the World Bank's Development Indicators (https://wdi.worldbank.org). Civil conflicts are measured by the average number of new civil conflicts per annum during the period 1960 – 2017, compiled by Arbatlı et al. (2020) from various sources.

intermediate confounders from the regression. This corresponds to the ACDE estimates of the cross-country women-plough relationship after controlling for the mediating role of gender-biased norms. I also compare the ACDE results with the total effect (without accounting for the mediator). As shown in Table A10, after holding the mediator fixed at a particular level, I find large reductions in the size and statistical precision of the estimated coefficient on traditional plough use. This provides empirical support for Alesina, Giuliano, and Nunn's (2013) proposition that the prevalence of historically persistent gender-biased norms is a key mechanism underlying the persistent influence of traditional plough use on contemporary equality in gender roles across countries. The ACDE results remain quantitatively similar in regressions with and without accounting for intermediate confounders.

Table A1

Traditional plough use and male labour force participation across countries

	(1)	(2)	(3)	(4)
OLS estimates. Dependent variable: Male labour force participation in 2010				
Ancestral plough adoption	-0.025	-0.033	-0.029	-0.031
	(0.020)	(0.025)	(0.022)	(0.028)
Standardized beta coefficient	-0.149	-0.194	-0.177	-0.184
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
Observations	153	153	146	146
R-squared	0.054	0.134	0.126	0.244

Notes: This table shows estimates of the cross-country relationship between traditional plough use and male labour force participation in 2010. Specifically, I replicate the specifications from columns (1) and (3) of Alesina, Giuliano, and Nunn's (2013) Tables III and IV but use the proportion of men aged 15 – 64 that supply labour for the production of goods and services in 2010 as the outcome variable; data are obtained from the World Bank's Development Indicators (https://wdi.worldbank.org). Historical controls are average land suitability for agriculture, the presence of a tropical climate, the presence of large domesticated animals, jurisdictional hierarchies, and settlement density, measured for the ancestors of a country's populations. Continent dummies are binary indicators for Asia, Europe, North America, Oceania, and South America. Contemporary controls are the linear and quadratic terms of log of GDP per capita. See also Alesina et al. (2013) for variables' description. Heteroscedasticity-robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A2

Traditional plough use and gender roles in employment across countries

	(1)	(2)	(3)	(4)
Dependent variable: Female-to-male ratio of employment rates in 2010				
Ancestral plough adoption	-0.215***	-0.212***	-0.170***	-0.168***
	(0.052)	(0.058)	(0.050)	(0.055)
Standardized beta coefficient	-0.469	-0.462	-0.387	-0.382
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
Observations	153	153	146	146
R-squared	0.311	0.373	0.398	0.449

Notes: This table reports estimates of the cross-country relationship between traditional plough use and the female-to-male ratio of employment rates in 2010. The rate of male or female employment is the proportion of males or females of working age in the population who engage in work to produce goods and services for pay or profit, respectively. Historical controls are average land suitability for agriculture, the presence of a tropical climate, the presence of large domesticated animals, jurisdictional hierarchies, and settlement density, measured for the ancestors of a country's populations. Continent dummies are binary indicators for Asia, Europe, North America, Oceania, and South America. Contemporary controls are the linear and quadratic terms of log of GDP per capita. See also Alesina et al. (2013) for variables' description. Heteroscedasticity-robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3

Traditional plough use and female labour force participation across countries, accounting for selection on unobservables

	(1)	(2)	(3)	(4)
OLS estimates. Dependent variable: Female labour force participation in 2000				
Ancestral plough adoption	-14.895***	-15.962***	-12.401***	-12.930***
	(3.318)	(3.881)	(2.964)	(3.537)
Standardized beta coefficient	-0.452	-0.485	-0.375	-0.391
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
Observations	177	177	165	165
R-squared	0.222	0.284	0.399	0.409
Oster's (2019) δ statistic	1.46507	1.29660	1.98619	1.35091
Oster's (2019) bound	[-22.356,	[-29.315,	[-16.753,	[-27.772,
	-14.895]	-15.962]	-12.401]	-12.930]

Notes: This table shows estimates of the cross-country relationship between traditional plough use and female labour force participation in 2000 and their robustness to accounting for selection bias from unobservables. Specifically, I implement the coefficient stability test of Oster (2019), based on the specifications from columns (1) and (2) of Alesina, Giuliano, and Nunn's (2013) Tables III and IV. Historical controls are average land suitability for agriculture, the presence of a tropical climate, the presence of large domesticated animals, jurisdictional hierarchies, and settlement density, measured for the ancestors of a country's populations. Continent dummies are binary indicators for Asia, Europe, North America, Oceania, and South America. Contemporary controls are the linear and quadratic terms of log of GDP per capita. See also Alesina et al. (2013) for variables' description. Oster's (2019) δ statistic is the coefficient of proportionality reflecting how strong the correlation between unobservables and traditional plough use, relative to the correlation between observables and traditional plough use, needs to be to drive down the baseline coefficient on plough towards zero. Oster's (2019) bound is the interval bounded by the bias-adjusted coefficient (β^*) and the baseline coefficient on plough. β^* would reflect the cross-country relationship between traditional plough use and modern gender roles if one were to account for all unobserved confounders in the regression. Heteroscedasticity-robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4

Traditional plough use and female labour force participation across countries, accounting for spatial dependence

	(1)	(2)	(3)	(4)
SARAR OLS estimates. Dependent variable: Female labour force participation in 2000				
Ancestral plough adoption	-17.697***	-18.487***	-11.014***	-12.002***
	(4.297)	(4.621)	(3.668)	(3.876)
Standardized beta coefficient	-0.530	-0.553	-0.330	-0.359
Spatial lag AR(1) of gender roles (λ)	-0.300	-0.400**	-0.337**	-0.383**
	(0.209)	(0.173)	(0.158)	(0.164)
Spatial lag AR(1) of error (ρ)	1.377*	1.114	1.008	0.989
	(0.737)	(0.733)	(0.627)	(0.638)
Extra covariates				
Historical controls	Yes	Yes	Yes	Yes
Continent dummies	No	Yes	No	Yes
Contemporary controls	No	No	Yes	Yes
Observations	141	141	141	141

Notes: This table shows estimates of the cross-country relationship between traditional plough use and female labour force participation in 2010 accounting for spatial dependence across country observations. Specifically, I replicate the specifications from columns (1) and (2) of Alesina, Giuliano, and Nunn's (2013) Tables III and IV but use a generalized spatial two-stage least-squares estimator to estimate spatial-autoregressive models with spatial-autoregressive disturbances (SARAR (1,1)), following Drukker et al. (2013). Historical controls are average land suitability for agriculture, the presence of a tropical climate, the presence of large domesticated animals, jurisdictional hierarchies, and settlement density, measured for the ancestors of a country's populations. Continent dummies are binary indicators for Asia, Europe, North America, Oceania, and South America. Contemporary controls are the linear and quadratic terms of log of GDP per capita. See also Alesina et al. (2013) for variables' description. Heteroscedasticity-robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5

Traditional plough use and gender-biased norms across countries, excluding endogenous controls

	(1)	(2)
Dependent variable: Male dominance bias in the oral tradition		
Ancestral plough adoption	0.054***	0.045***
	(0.009)	(0.012)
Land suitability for agriculture	-0.030**	-0.023
	(0.013)	(0.014)
Tropical climate	0.012	0.021*
	(0.010)	(0.012)
Continent dummies	No	Yes
Observations	181	181
R-squared	0.226	0.269

Notes: This table reports OLS estimates of the cross-country relationship between traditional plough use and gender-biased norms reflected in oral traditions controlling for average land suitability for agriculture, a dummy variable for tropical climate and unobserved time-invariant heterogeneity across world regions. Following Alesina et al. (2013), I re-estimate the specifications from Table 1 but exclude several ancestral characteristics that can be endogenous in regression models explaining the cross-country variation in gender noms. Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A6

Traditional plough use before European contact and gender-biased norms across countries

	(1)	(2)
Dependent variable: Male dominance bias in oral traditions		
Traditional plough adoption	0.034***	0.036***
	(0.010)	(0.011)
Historical controls	Yes	Yes
Contemporary controls	Yes	Yes
Continent dummies	No	Yes
Observations	164	164
R-squared	0.357	0.371

Notes: This table reports OLS estimates of the cross-country relationship between traditional plough use before European contact and gender-biased norms reflected in oral traditions. Specifically, following Alesina et al. (2013), I reproduce Table 1 but restrict the analysis to the traditional use of the plough before European contact. Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A7

Traditional plough use and gender-biased norms across countries, excluding countries with significant missing language data

	(1)	(2)
Dependent variable: Male dominance bias in oral traditions		
Ancestral plough adoption	0.028**	0.024*
	(0.012)	(0.013)
Historical controls	Yes	Yes
Contemporary controls	Yes	Yes
Continent dummies	No	Yes
Observations	147	147
R-squared	0.395	0.398

Notes: This table reports OLS estimates of the cross-country relationship between traditional plough use and gender-biased norms reflected in oral traditions. I follow Alesina et al. (2013) to exclude countries with a significant proportion of missing language data used in the construction of the traditional plough use index. Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A8

Traditional plough use and gender-biased norms across countries, sample truncation

	(1)	(2)
Dependent variable: Male dominance bias in oral traditions		
Ancestral plough adoption	0.025**	0.036***
	(0.012)	(0.010)
Historical controls	Yes	Yes
Contemporary controls	Yes	Yes
Observations	124	120
R-squared	0.363	0.190

Notes: This table reports OLS estimates of the cross-country relationship between traditional plough use and gender-biased norms reflected in oral traditions. In column (1), I follow Alesina et al. (2013) to exclude Europe and countries belonging to the New World (including the United States, Canada, Australia and New Zealand) from the regression. I also exclude countries in Sub-Saharan Africa in Column (2). Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A9

Traditional plough use, gender-biased norms, and female participation in agriculture across pre-industrial societies

	(1)	(2)
Panel A. Second-stage estimates. Dependent variable: Traditional participation of females relative to males in agriculture		
Male dominance bias in oral traditions	-16.076***	-22.088***
	(2.961)	(6.957)
Standardized beta coefficient		
Panel B. First-stage estimates. Dependent variable: Male dominance bias in oral traditions		
Ancestral plough adoption	0.052***	0.039***
	(0.009)	(0.012)
Extra covariates		
Ethnographic controls	No	Yes
First-stage *F*-statistic	33.32	10.52
Anderson-Rubin confidence interval	[-23.989, -11.679]	[-54.455, -13.136]
Observations	654	654

Notes: This table reports 2SLS estimates of the effect of the exogeneous component of gender-biased norms reflected in oral traditions, isolated by the traditional use of the plough, on female representation in agriculture across ethnic groups available in the Ethnographica Atlas (Murdock, 1967). Ethnographic controls are the presence of large domesticated animals, jurisdictional hierarchies, settlement density, the presence of a tropical climate, and average land suitability for agriculture. First-stage *F*-statistic shows Olea and Pflueger's (2013) robust-weak-instrument *F*-statistics. AR confidence interval shows the 95% confidence intervals that are robust to weak identification and efficient in the just-identified case (Andrews et al., 2019). Heteroscedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A10

Traditional plough use, gender-biased norms and female labour force participation across countries, OLS and ACDE estimates

		Mediator: Male dominance bias in oral traditions	
	(1)	(2)	(3)
	Total effect	ACDE (Ignoring intermediate confounders)	ACDE (sequential *g*-estimation)
Dependent variable: Female labour force participation in 2000			
Ancestral plough adoption	-11.561**	-7.466*	-2.361
95% bootstrapped CI	[-20.899, -2.224]	[-16.070, 1.138]	[-16.793, 3.433]
Pretreatment controls	Yes	Yes	Yes
Intermediate confounders		No	Yes
Observations	153	153	129
Number of replications	955	944	864

Notes: This table reports estimates of the cross-country relationship between traditional plough use and female labour force participation in 2000. In column (1), I report the OLS estimates without controlling for gender-biased norms reflected in oral traditions. In columns (2) and (3), I report the average controlled direct effect (ACDE) of traditional plough use on female labour force participation in 2000 holding the mediator fixed at a particular level, with and without accounting for intermediate confounding factors. Pretreatment controls are absolute latitude, distance to the nearest waterway, terrain ruggedness, average land suitability for agriculture, mean elevation, island nation dummy, and continent dummies. Intermediate confounders are the linear and quadratic terms of log of GDP per capita, institutional quality, the share of oil rents in total GDP, the contributions of three main sectors to total GDP, and civil conflicts. 95% bootstrapped confidence interval (CI) based on 1,000 resamples are reported in squared brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A11

Traditional plough use, ancestral instability, and female labour force participation among second-generation migrants in the United States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All women			Married women					
	Woman's ancestry			Woman's ancestry			Husband's ancestry		
	Father's country	Mother's country	Parents same country	Father's country	Mother's country	Parents same country	Father's country	Mother's country	Parents same country
Panel A. Alesina et al.'s (2013) original estimates									
Traditional plough use	-0.044***	-0.043**	-0.062***	-0.094**	-0.118***	-0.136**	-0.065***	-0.045**	-0.058**
	(0.015)	(0.018)	(0.020)	(0.046)	(0.043)	(0.054)	(0.024)	(0.022)	(0.024)
Country-of-origin controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	57,138	55,341	32,776	10,206	9,508	6,835	35,393	35,158	23,124
R-squared	0.227	0.230	0.256	0.111	0.107	0.122	0.086	0.080	0.087
Panel B. Specifications with ancestral instability (500 – 1900 CE)									
Traditional plough use	-0.053	-0.065	-0.117*	-0.030	-0.255**	-0.217	-0.159**	-0.085	-0.148**
	(0.054)	(0.053)	(0.067)	(0.151)	(0.103)	(0.154)	(0.063)	(0.063)	(0.068)
Climatic instability	0.005	-0.042	-0.192	0.304	-0.510	-0.285	-0.383	-0.156	-0.373
	(0.208)	(0.202)	(0.287)	(0.652)	(0.452)	(0.717)	(0.272)	(0.253)	(0.297)
Plough × Climatic instability	0.053	0.113	0.272	-0.279	0.666	0.394	0.451	0.194	0.437
	(0.244)	(0.237)	(0.318)	(0.681)	(0.496)	(0.756)	(0.306)	(0.306)	(0.331)
Country-of-origin controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	57,043	55,310	32,772	10,187	9,502	6,833	35,333	35,111	23,101
R-squared	0.227	0.230	0.256	0.111	0.108	0.123	0.086	0.080	0.087

Notes: This table reports OLS estimates of the effect of ancestral plough adoption at the country-of-origin level on female labour force participation among second-generation migrants in the United States. In panel A, I reproduce the results reported in Alesina et al.'s (2013) Table IX for ease of comparison. In panel B, I replicate the specifications in Alesina et al.'s (2013) Table IX but include ancestral climatic instability and its interaction term with traditional plough use in the regression. Heteroscedasticity-robust standard errors in parentheses are clustered at the country-of-origin level. *** p<0.01, ** p<0.05, * p<0.1.

Table A12

Traditional plough use, ancestral instability and attitudes towards gender roles among second-generation European migrants

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variables: "When jobs are scarce …" survey response, 2004 – 2011					
	Father's country		Mother's country		Same country	
	1 – 5 scale	Indicator	1 – 5 scale	Indicator	1 – 5 scale	Indicator
Panel A. Alesina et al.'s (2013) original estimates						
Ancestral plough adoption	0.219**	0.073**	0.214**	0.070**	0.298***	0.094**
	(0.091)	(0.034)	(0.086)	(0.033)	(0.096)	(0.038)
Country-of-origin controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,545	13,024	15,260	12,788	10,535	8,780
R-squared	0.177	0.165	0.175	0.164	0.174	0.167
Panel B. Specifications with ancestral instability (500 – 1900 CE)						
Ancestral plough adoption	0.310*	0.126*	0.301*	0.143**	0.346*	0.158**
	(0.168)	(0.066)	(0.171)	(0.068)	(0.192)	(0.075)
Climatic instability	0.567	0.287	0.338	0.320	0.231	0.295
	(0.569)	(0.221)	(0.662)	(0.262)	(0.690)	(0.275)
Plow × Climatic instability	-0.329	-0.207	-0.348	-0.292	-0.184	-0.267
	(0.631)	(0.241)	(0.701)	(0.274)	(0.752)	(0.302)
Country-of-origin controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,536	13,015	15,251	12,779	10,528	8,773
R-squared	0.177	0.165	0.175	0.164	0.174	0.167

Notes: This table reports OLS estimates of the effect of ancestral plough adoption at the country-of-origin level on gender attitudes among second-generation migrants in Europe. In panel A, I reproduce the results reported in Alesina et al.'s (2013) Table X for ease of comparison. In panel B, I replicate the specifications in Alesina et al.'s (2013) Table X but include ancestral climatic instability and its interaction term with traditional plough use in the regression. Heteroscedasticity-robust standard errors in parentheses are clustered at the country-of-origin level. *** p<0.01, ** p<0.05, * p<0.1.

Table A13

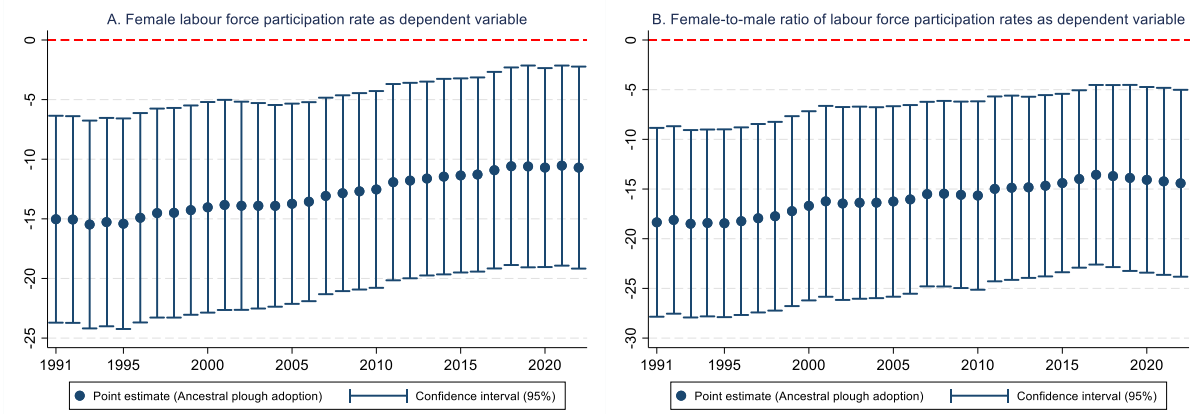
Traditional plough use, ancestral instability and attitudes towards gender roles

Dependent variable:	Agree with the statement: "When jobs are scarce, men should have more right to a job than women"								
Ancestry:	Father's country of birth			Mother's country of birth			Parents' same country of birth		
Sample: IVS respondents	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Specifications without ancestral instability (500 – 1900 CE)									
Ancestral plough adoption	-0.003	0.163	-0.025	0.062	0.078	-0.044	0.158	0.070	-0.089
	(0.084)	(0.177)	(0.178)	(0.080)	(0.178)	(0.170)	(0.103)	(0.201)	(0.201)
Country-of-origin controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Individual-level controls	No	No	Yes	No	No	Yes	No	No	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of clusters (countries of origin)	125	116	112	127	116	115	102	98	97
Observations (# of individuals)	5,846	5,816	5,482	5,531	5,502	5,181	2,885	2,877	2,720
R-squared	0.314	0.313	0.364	0.317	0.317	0.367	0.359	0.359	0.405
Panel B. Specifications with ancestral instability (500 – 1900 CE)									
Ancestral plough adoption	0.524**	0.680**	0.509**	0.632***	0.618**	0.385	1.134***	0.975***	0.916***
	(0.225)	(0.269)	(0.223)	(0.204)	(0.275)	(0.237)	(0.235)	(0.277)	(0.243)
Climatic instability	2.295***	2.495***	2.803***	1.626**	1.832*	1.845**	4.056***	4.095***	4.849***
	(0.836)	(0.856)	(0.667)	(0.782)	(0.958)	(0.792)	(1.155)	(1.186)	(0.980)
Plough × Climatic instability	-2.456***	-2.670***	-2.685***	-2.315***	-2.569**	-2.067**	-4.629***	-4.361***	-4.735***
	(0.892)	(0.965)	(0.733)	(0.809)	(1.005)	(0.849)	(1.170)	(1.263)	(1.080)
Country-of-origin controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Individual-level controls	No	No	Yes	No	No	Yes	No	No	Yes
Survey-wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-of-residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of clusters (countries of origin)	124	116	112	126	116	115	102	98	97
Observations (# of individuals)	5,845	5,816	5,482	5,529	5,502	5,181	2,885	2,877	2,720
Pseudo *R*-squared	0.123	0.123	0.150	0.126	0.125	0.152	0.147	0.146	0.172

Notes: This table reports OLS estimates of the effect of ancestral plough use on attitudes towards patriarchal values among second-generation migrants as reported in the Integrated Values Survey (IVS). Country-of-origin controls are the presence of large domesticated animals, the density of settlement, the degree of political authority, average land suitability for agriculture and the presence of a tropical climate, and the linear and quadratic terms of log of real GDP per capita in 2010. Individual controls are age, age squared, a binary indicator of being female, and dummy variables for marital status, educational attainment and size of the town. Additionally, all the regressions are augmented with dummies for countries of residence and time factors (WVS versus EVS survey wave). Heteroscedasticity-robust standard errors in parentheses are clustered at the country-of-origin level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1

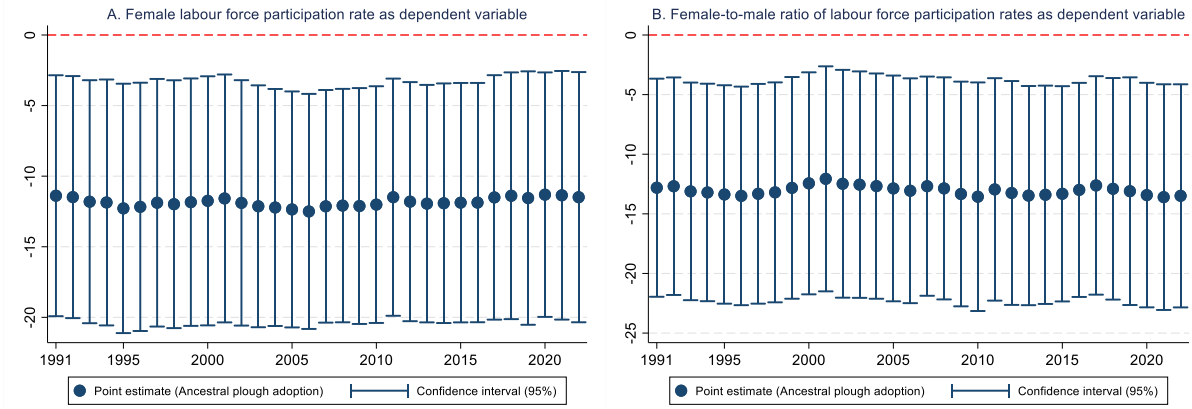
The effect of traditional plough use on gender inequality across countries, 1991 – 2022



Notes: This figure depicts point estimates and 95% confidence intervals of the relationship between traditional plough use and contemporary equality in gender roles across countries for each year between 1991 and 2022. Specifically, I replicate the specification from column (2) of Alesina et al.'s (2013) Table III but use the rate of female labour force participation or the female-to-male ratio of labour force participation for each year between 1991 and 2022 as alternative dependent variables. Data were obtained the World Bank's Development Indicators (https://wdi.worldbank.org). All the regressions are augmented with historical controls and continent dummies.

Figure A2

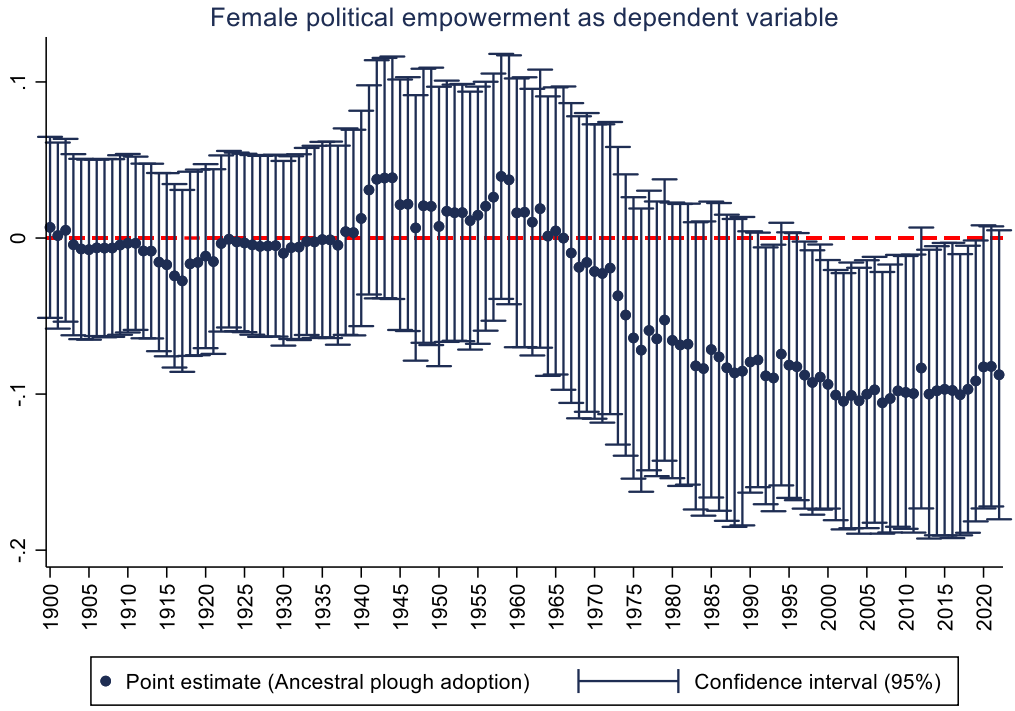
The effect of ancestral plough adoption on gender inequality across countries, 1991 – 2022



Notes: This figure depicts point estimates and 95% confidence intervals of the relationship between traditional plough use and contemporary equality in gender roles across countries for each year between 1991 and 2022. Specifically, I replicate the specification from column (2) of Alesina et al.'s (2013) Table IV but use the rate of female labour force participation or the female-to-male ratio of labour force participation for each year between 1991 and 2022 as alternative dependent variables. Data were obtained the World Bank's Development Indicators (https://wdi.worldbank.org). All the regressions are augmented with historical controls, continent dummies, and the linear and quadratic terms of log of GDP per capita.

Figure A3

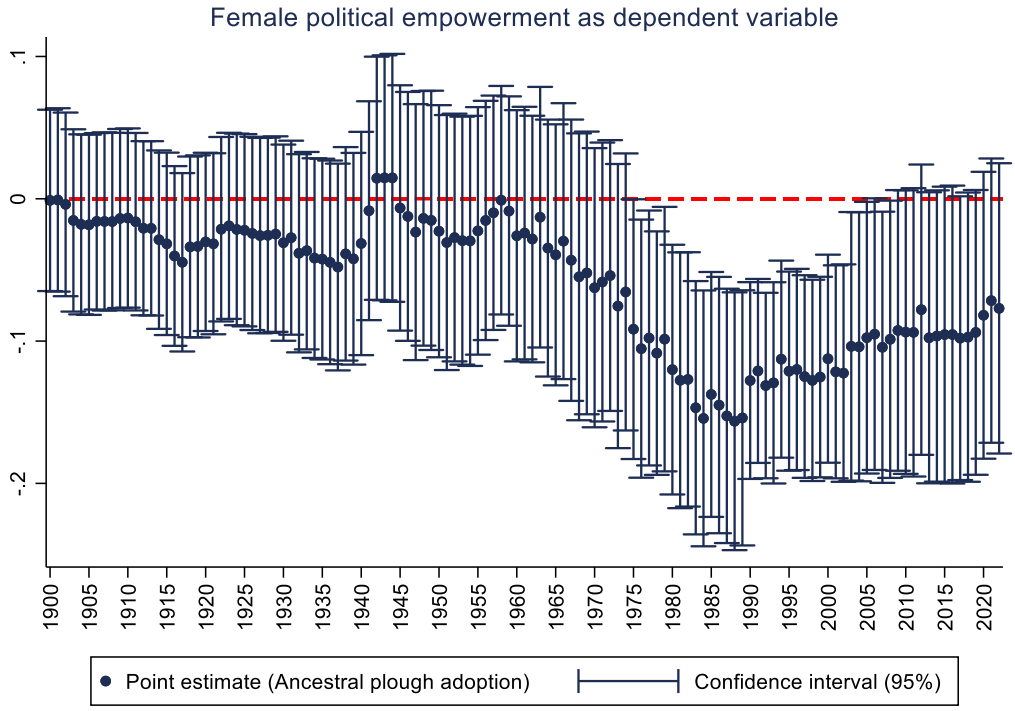
Traditional plough use and female political empowerment without contemporary controls, 1900 – 2022



Notes: This figure depicts point estimates and 95% confidence intervals of the relationship between traditional plough use and female political empowerment across countries for each year between 1900 and 2022. Specifically, I replicate the specification from column (2) of Alesina, Giuliano, and Nunn's (2013) Table III but use the V-Dem-based indicator of female political empowerment the dependent variable. Data were obtained from the Varieties of Democracy dataset (https://www.v-dem.net/). All the regressions are augmented with historical controls and continent dummies.

Figure A4

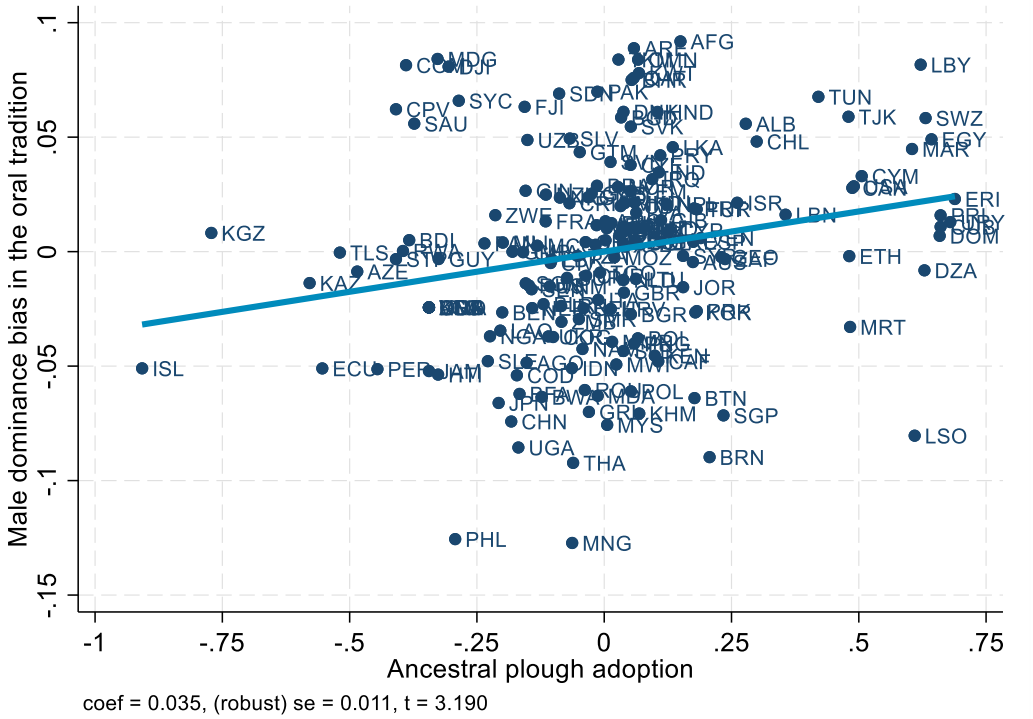
Traditional plough use and female political empowerment with contemporary controls, 1900 – 2022



Notes: This figure depicts point estimates and 95% confidence intervals of the relationship between traditional plough use and female political empowerment across countries for each year between 1900 and 2022. Specifically, I replicate the specification from column (2) of Alesina, Giuliano, and Nunn's (2013) Table IV but use the V-Dem-based indicator of female political empowerment the dependent variable. Data were obtained from the Varieties of Democracy dataset (https://www.v-dem.net/). All the regressions are augmented with historical controls, continent dummies, and the linear and quadratic terms of log of GDP per capita.

Figure A5

Traditional plough use and gender-biased norms across countries



Notes: This figure depicts the cross-country relationship between traditional plough use and gender-biased norms reflected in oral traditions, conditional on historical characteristics and continent dummies. The full estimates are shown in Table 1, column (2).

Appendix References

Acharya, A., Blackwell, M., and Sen, M. (2016). Explaining Causal Findings without Bias: Detecting and Assessing Direct Effects. *American Political Science Review, 110*, 512-529.

Alesina, A., Giuliano, P., and Nunn, N. (2013). On the Origins of Gender Roles: Women and the Plough. *Quarterly Journal of Economics, 128*, 469-530.

Altonji, J. G., Elder, T. E., and Taber, C. R. (2005). An Evaluation of Instrumental Variable Strategies for Estimating the Effects of Catholic Schooling. *Journal of Human Resources, 40*, 791-821.

Andrews, I., Stock, J. H., and Sun, L. (2019). Weak Instruments in Instrumental Variables Regression: Theory and Practice. *Annual Review of Economics, 11*, 727-753.

Arbatlı, C. E., Ashraf, Q. H., Galor, O., and Klemp, M. (2020). Diversity and Conflict. *Econometrica, 88*, 727-797.

Coppedge, M., Gerring, J., Knutsen, C. H., Lindberg, S. I., Teorell, J., Altman, D., . . . Ziblatt, D. (2023). V-Dem Methodology V13. Varieties of Democracy (V-Dem) Project.

Drukker, D. M., Prucha, I. R., and Raciborski, R. (2013). Maximum Likelihood and Generalized Spatial Two-Stage Least-Squares Estimators for a Spatial-Autoregressive Model with Spatial-Autoregressive Disturbances. *Stata Journal, 13*, 221-241.

Fredriksson, P. G., and Gupta, S. K. (2023). Irrigation and Gender Roles. *Journal of Development Economics, 163*, 103076.

Hansen, C. W., Jensen, P. S., and Skovsgaard, C. V. (2015). Modern Gender Roles and Agricultural History: The Neolithic Inheritance. *Journal of Economic Growth, 20*, 365-404.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2010). The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues. World Bank Policy Research Working Paper.

Michalopoulos, S., and Xue, M. (2021). Folklore. *Quarterly Journal of Economics, 136*, 1993-2046.

Murdock, G. P. (1967). Ethnographic Atlas: A Summary. *Ethnology, 6*, 109-236.

Olea, J. L. M., and Pflueger, C. (2013). A Robust Test for Weak Instruments. *Journal of Business & Economic Statistics, 31*, 358-369.

Oster, E. (2019). Unobservable Selection and Coefficient Stability: Theory and Evidence. *Journal of Business & Economic Statistics, 37*, 187-204.

Spolaore, E., and Wacziarg, R. (2013). How Deep Are the Roots of Economic Development? *Journal of Economic Literature, 51*, 325-369.

Vu, T. V. (2024). How Deep Are the Roots of Female Empowerment? Population Diversity and Gender Inequality. *Oxford Bulletin of Economics and Statistics*, https://doi.org/10.1111/obes.12651.