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THE ROLE OF WOMEN IN TRADITIONAL AGRICULTURE: EVIDENCE FROM ITALY[†]

Abstract

Gender roles in the past may affect current perceptions of the 'rightful' place of women in the society, with potential major consequences on economic development. This paper explores the historical roots of gender roles by focusing on female work in agriculture, which accounted for most employment in traditional societies. We rely on a newly compiled data-set of female occupation and crop mix for Italy in the 1930s. We show that crop mix did determine the level of female gainful employment in a complex way. Some products could be classified either 'male-intensive' (like wheat and cow milk) or 'female-intensive' (like corn and beef), but quite a few were largely 'gender-neutral' (like wine and oil).

JEL Classification: J16, N30, N50, O13 and Q12
Keywords: agriculture, gender roles and Italy

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1) Introduction

Cultural beliefs have always been deemed to be long-lasting features, but only recently economists have tried to trace them back to specific events in the past. For instance, Guiso et al. (2013) explain different levels of social capital in contemporary Italy with the city freedom in 12th century while Nunn and Wantchekon (2011) and Deconinck and Verpoorten (2013) relate the differences in the amount of trust between African regions nowadays to the number of exported slaves. Some papers go even farther back in time, and explain current cultural values as the legacy of our distant agricultural past. For example, Galor and Özak (2015) claim that high agricultural productivity, as measured by yields, fostered a helpful time preference for long-run investments. Collectivistic norms are associated with early transitions to agriculture by Olsson and Paik (2015). Similarly, a growing body of literature focuses on the agricultural origins of gender roles. In an influential paper, Alesina et al. (2013) argue that the ancestral choice of food-crops that needed the use of the plough limited the employment of females in agriculture and thus fostered the prejudices against gainful employment of women and other related cultural traits. Hansen et al. (2015) claim that this effect is stronger the earlier a society adopted agriculture. Carranza (2014) and Qian (2008) follow a similar reasoning in exploring the deficit of female children in, respectively, India and China. Women are assumed to have a comparative advantage (and hence a higher relative value) in rice as against wheat production in the first case, while in the second done the relevant dichotomy is between tea and orchard production. On a related line, Voigtländer and Voth (2013) argue that the diffusion of cattle-raising in Middle Ages Britain, a typically female job, increased the opportunity cost of women's work and thus the age of marriage, with long-lasting consequences on economic growth in the early modern period, and thus ultimately on the Industrial Revolution (Broadberry et al, 2014).

These works share several problems. First, they have to rely on contemporary evidence. Galor and Ozak infer historical yields from the GAEZ data-base of the FAO, which estimates potential yields in each area of the world, given the environment, the modern technology (with different levels of inputs), and the needs of modern varieties of plants and animals. Alesina et al (2013) collect information on the use of plough and women's participation in agriculture from ethnographic studies on pre-industrial (mostly African) societies in the first half of the 20th century. Both papers rely on contemporary surveys, such as the World Value Survey, for data on the time preference and the beliefs about the 'rightful' role of women. Needless to say, we do not have and in all likelihood we will never have measures of cultural beliefs in the past, and thus it will never be possible to prove, or disprove, that they determined the current ones. Second, these works simply impose ex ante the comparative advantage of women in the production of a given crop, generally relying on qualitative and/or ethnographic data[1]. In doing so, they generally restrict their analysis to a given pair of operations (the plough and hoe) or to a couple of groups of products (typically wheat and corn, but also wheat and rice, tea and fruits, cereals and cattle), avoiding simultaneously taking into account the whole range of relevant alternatives.

In this paper we address these shortcomings by focusing on a key testable implication of the argument by Alesina et al. (2013). This latter can be summed up in four propositions: i) the environment determined the optimal food crop, wheat or corn (maize); ii) corn could be hoed, but wheat had to be ploughed and ploughs needed too much physical strength to be operated by women; iii) thus the (constrained) 'choice' of the food-crop determined the women's role in 'traditional' agricultural society; and iv) the role of women in 'traditional' economy shaped cultural beliefs about the proper role of women in the workforce. We focus on the third proposition, by directly estimating the relationship between product mix and the gender ratio (the ratio between female and male workers) in Italy around 1930 with a newly compiled set of data. By then, the Italian agriculture was still backward enough to be considered traditional but the country was advanced enough to produce detailed statistics which we use here for the first time. This allows us to expand the portfolio of crops considered to the whole set of available products. We identify the gender intensity of each product ex post, i.e., as it is revealed by the data, rather than imposing it ex ante. In so doing, we provide the

[1] The role of plough agriculture in Alesina et al. (2013) is derived from the hypothesis advanced by Ester Boserup in 1970, based on a small sample of village studies (Boserup, 1970).

first systematic study of the relationship between product composition and gender roles in traditional agriculture. The case of Italy is the more interesting because, as Alesina et al. (2013) admit, ‘the lack of variation in traditional plough use within Europe implies that Boserup’s hypothesis and our empirical analysis cannot explain existing difference in gender role beliefs within Western Europe (and its offshoots)’ [p.488]. We do find substantial differences in the gender participation to agriculture, which, as posited by Alesina et al (2013), depend on the crop mix. We also find that the simple dichotomy between wheat and corn explain only a small portion of the gender division of labour in traditional European agriculture because cereals accounted for a smallish proportion of a widely diversified output.

We start by presenting some evidence on the gender ratio and product mix in traditional agriculture since the mid-19th century. We show that the gender ratio differed a lot across countries and within Italy and that it changed a lot in time (Section Two) and that food-crops accounted for at most a quarter of total output of Italian agriculture (Section Three). Section Four puts forward a very simple model of gender-specific demand and supply for work in agriculture. We combine an economy producing two goods with three factors of production, male labour, female labour and land, with a standard household time-allocation model in the spirit of Becker (1965) and subsequent elaborations. Women are assumed as productive as men in household chores, but less productive in agriculture, with a product-specific gap, for any given level of technology. Plausible parameters of the utility function can reproduce the standard division of labor in traditional agriculture, with men working in agriculture and women dividing their time between the household and the fields. In this framework, the amount of female work for the market, and thus the gender ratio in agriculture, depends on the product mix. Ceteris paribus, it is positively related to the share of ‘female’ products - i.e. products which feature a smaller male/female productivity gap. We describe our empirical strategy and our sources in Section Five, we present the main results in Section Six and we test their robustness in Section Seven. Section Eight concludes.

2) The gender ratio in ‘traditional’ agriculture

In theory, the gender ratio should be measured with the number of hours worked, but historical comparable data, from population censuses, are available only for the number of workers (Table 1)

Table 1

Gender ratios in the world

	ca. 1850	ca. 1860	ca. 1870	ca. 1880	ca. 1890	ca. 1900	ca. 1910	ca. 1920	ca. 1930	ca. 1938
Egypt							0.04	0.17		0.20
South Africa							1.02	1.29		0.40
Argentina					0.21		0.09			0.06
Brazil										0.16
Canada					0.02		0.02	0.02		0.02
Cuba								0.02		0.02
Chile								0.11		0.07
Mexico						0.01	0.02	0.01		0.01
Peru										2.29
USA						0.10	0.11	0.11	0.10	0.06
Venezuela										0.07
India						0.44	0.47	0.47	0.39	
Japan								0.78		1.03
Philippines										0.40
Taiwan								0.43		0.50
Thailand										0.99
Turkey									0.50	
Austria								0.54		
Belgium	0.50		0.53	0.57	0.42	0.40	0.37	0.29	0.28	
Bulgaria							0.96	1.07	1.04	
Czechoslovakia								0.46	0.72	
Denmark			0.99	1.00	0.98	0.39	0.27	0.17	0.28	0.29
Finland				0.38		0.32	0.58	0.71	0.75	0.84

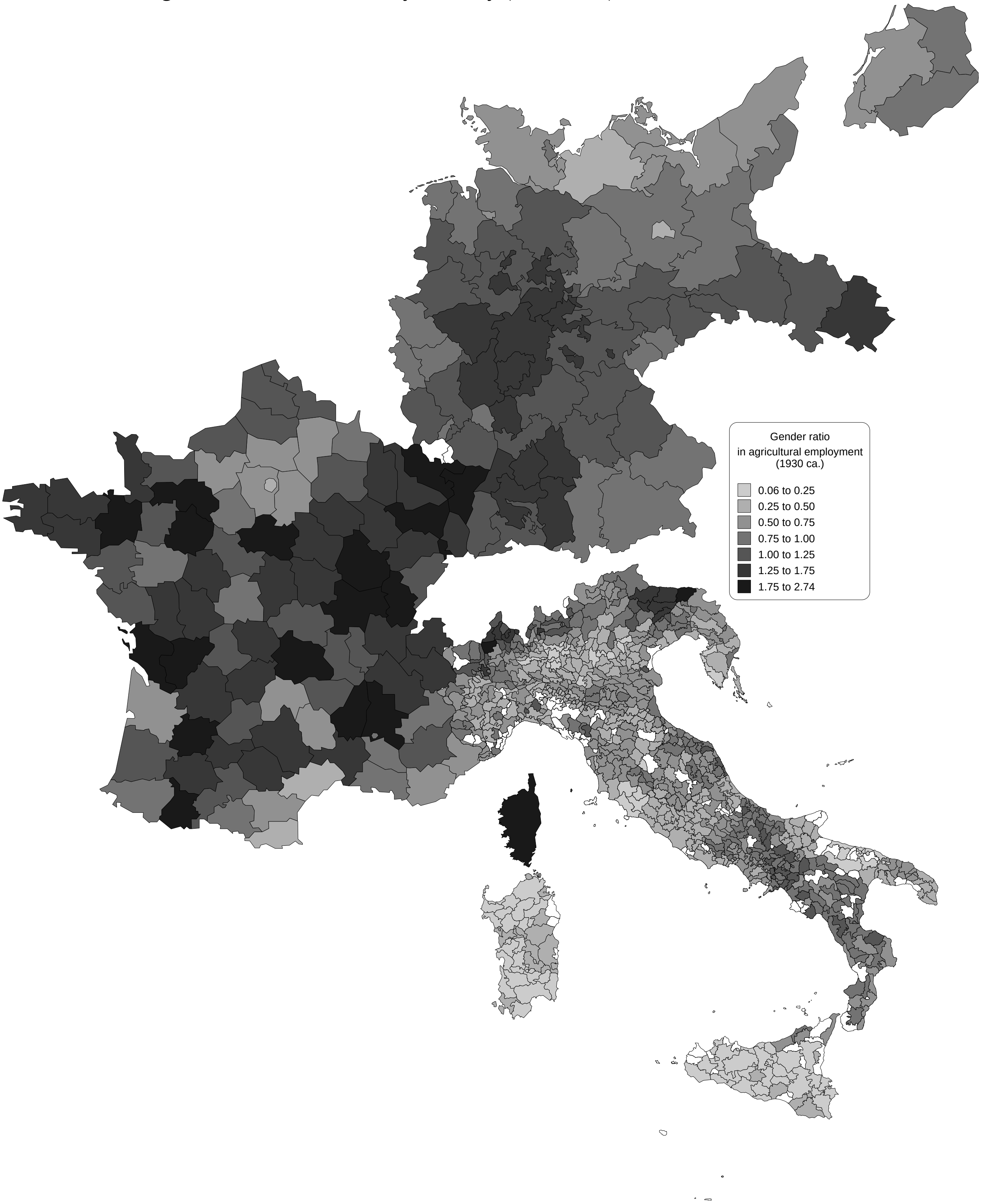
Germany				0.44	0.50		0.87	1.04		1.21
Greece								0.13	0.46	
Hungary				0.27	0.37	0.43	0.29	0.42	0.30	
Ireland	0.13		0.15	0.11			0.08			
Italy		0.61	0.58	0.60		0.62	0.65	0.61	0.60	0.63
Netherlands	0.45	0.20			0.16	0.16	0.21	0.16	0.20	
Norway			0.08		0.29	0.25	0.17	0.17	0.11	
Poland								0.99	0.80	
Portugal					0.45	0.20	0.30	0.69		0.18
Romania							0.99		1.03	
URSS						0.12			1.00	
Spain				0.23	0.20	0.19	0.09	0.08		0.06
Sweden		0.30	0.43	0.45	0.43		0.34	0.31	0.30	
Switzerland				0.36		0.20	0.27	0.25	0.14	0.08
Yugoslavia									0.58	
United Kingdom			0.08		0.05	0.08	0.08	0.09	0.06	
Australia						0.08	0.03	0.02	0.04	0.05
New Zealand						0.04	0.07	0.06		0.04
Number	3	3	7	10	12	18	25	30	21	24
Average ratio	0.36	0.37	0.41	0.44	0.34	0.24	0.34	0.39	0.46	0.40
SD	0.17	0.17	0.31	0.23	0.24	0.16	0.32	0.36	0.32	0.53

Source: Mitchell on line except USA (Historical Statistics 1975 series D 213 and D 230) and Italy (Table2).

The range of variation by country is huge and there are some sizeable changes in time (notably in Switzerland). Some of these variations might reflect differences in the definition of agricultural employees between censuses of different countries and/or of the same country in different years, but this problem however should not affect ratios in the same country in the same year. Yet Map 1 shows that there were substantial differences within large countries of Western Europe in the late 1920s[2].

[2] We consider the highest level of disaggregation available in the sources, the department for France and the Prussian Government Districts (Regierungsbezirke) and other minor administrative divisions (Landesteile, either small states like Mecklenburg-Schwerin or subdivisions of states other than Prussia, like Saxony's Kreishauptmannschaften) for Germany. The data for France, from a large Inquiry on Agriculture in 1929 (Statistique agricole de la France, 1936), and for Italy (described below) consider both full-time and part-time employment, while those for Germany, from the 1925 Occupational Census (Statistik des Deutschen Reichs, 1928-1929) consider only full-time work.

Map 1
Gender ratios in agriculture: France, Germany and Italy (1925-1930).



The coefficients of variation of ratios in France and Germany are rather high, respectively 0.358 and 0.248, even if the data refer to middle-sized administrative territorial units, where local differences might compensate. In France, the gender ratios ranged from figures below 0.75 in most of Languedoc and in Provence in the South as well as in Île-de-France and Picardy in the North, to values larger than 2 in departments as disparate as Ardeche along the Rhône, Sarthe in the North-west, Loiret in the Loire valley, Moselle (in Lorraine) and Jura along the Alps. In Germany, the lowest gender ratios were found across the Baltic Sea, as well as in the large urban centers (a common feature of the three countries), with a national minimum of 0.43 in Mecklenburg-Schwerin, while the ratio exceeded 1 in the South-West and in central districts around Hessen.

The coefficient of variation of ratios in Italy (0.507) is higher than in France or Germany, but the difference may reflect the level of detail of the data. In fact, they refer to the so-called ‘zona agraria’ (agricultural zone), which were expressively designed to be homogeneous from the point view of environment and agricultural specialization. Italy was divided in 787 of such zones, with an average area of 39,418 hectares and average population of around 53,000 inhabitants (44,000, if we exclude large cities with more than 100,000 inhabitants). We estimate three different versions of the ratio – in the map we plot our preferred measure, which includes part-time workers, at 25% of a full time equivalent[3]. The ratios were very low (often below 0.2) in Sicily, Sardinia and in continental latifundia areas, such as Apulia and the Tuscan Maremma, but also in the hillsides and plains north of the Po of Lombardy and Western Venetia. They were relatively high (close to or above 1) in most of the Alpine belt, in the Southern Apennines, in the Abruzzi and in the Marches. In general, the southern half of the Po Valley displayed consistently higher gender ratios than the Northern half.

Unfortunately, there are no historical data on employment by agrarian zone before 1930, and thus one has to resort to the data by region, painstakingly reworked by Vitali (1968) to make them homogeneous across censuses. Two points stand out (Table 2). First, the ratios were not too dissimilar within Centre-North (with coefficients of variation typically around 0.10), and all differences concentrated in the South (with coefficients between 0.45 and 0.55). Second, with few exceptions, the gender ratios changed little in over seventy years.

Table 2.

Gender ratios in Italy, 1861-1936

	1861	1871	1881	1901	1911	1921	1931	1936	Cumulated Change
Piedmont	0.80	0.72	0.84	0.84	0.89	0.83	0.78	0.77	-0.03
Liguria	0.73	0.72	0.71	0.80	0.76	0.78	0.74	0.75	0.01
Lombardy	0.61	0.62	0.67	0.70	0.75	0.62	0.62	0.64	0.03
Veneto		0.72	0.68	0.71	0.72	0.69	0.73	0.81	0.10
Emilia	0.68	0.64	0.61	0.69	0.73	0.71	0.71	0.72	0.04
Tuscany	0.67	0.70	0.60	0.69	0.68	0.67	0.72	0.71	0.04
Marche	0.75	0.79	0.73	0.81	0.82	0.79	0.83	0.82	0.07
Umbria	0.89	0.65	0.60	0.68	0.69	0.66	0.75	0.74	-0.15
Latium		0.47	0.49	0.44	0.48	0.55	0.66	0.69	0.22
Abruzzi	0.69	0.51	0.64	0.80	0.87	0.74	0.79	0.80	0.11
Campania	0.67	0.65	0.69	0.76	0.86	0.75	0.74	0.73	0.06
Puglie	0.54	0.43	0.36	0.33	0.36	0.35	0.23	0.26	-0.27
Basilicata	0.70	0.53	0.71	0.81	0.84	0.72	0.70	0.75	0.05
Calabria	0.57	0.41	0.45	0.68	0.80	0.75	0.65	0.72	0.14

[3] The two other measures omit part-time workers, referring to full-time employment among members of farmers’ households or to full time employment among all agricultural workers (cf. for details Appendix A). The coefficients of correlation with our preferred measure are respectively 0.786 and 0.97. We have no evidence on whether there were systematic differences in the number of days of full-time work per year across the country, although according to the data in Arcari (1936) there were no such systematic differences in the number of hours of work per working day during the period under scrutiny.

Sicily	0.18	0.17	0.29	0.14	0.13	0.13	0.12	0.12	-0.06
Sardinia	0.08	0.04	0.10	0.06	0.04	0.06	0.09	0.11	0.03
Italy	0.61	0.58	0.60	0.62	0.65	0.61	0.60	0.63	0.02
Average	0.61	0.55	0.57	0.62	0.65	0.61	0.62	0.63	0.02
SD	0.22	0.20	0.19	0.24	0.25	0.22	0.23	0.23	

Source: 1861 and 1871 our elaborations from MAIC 1861 and 1871 . 1881 ff Vitali 1968

Hence Table 2 shows that the gender ratio in agriculture was remarkably persistent before 1930. Did these patterns persist over time even after women moved outside agriculture as the main employment sector? Map 2 suggests that this may have been the case.

Map 2
Gender ratios in Italy by province in traditional agriculture (1930) and in the present-day economy (2011).

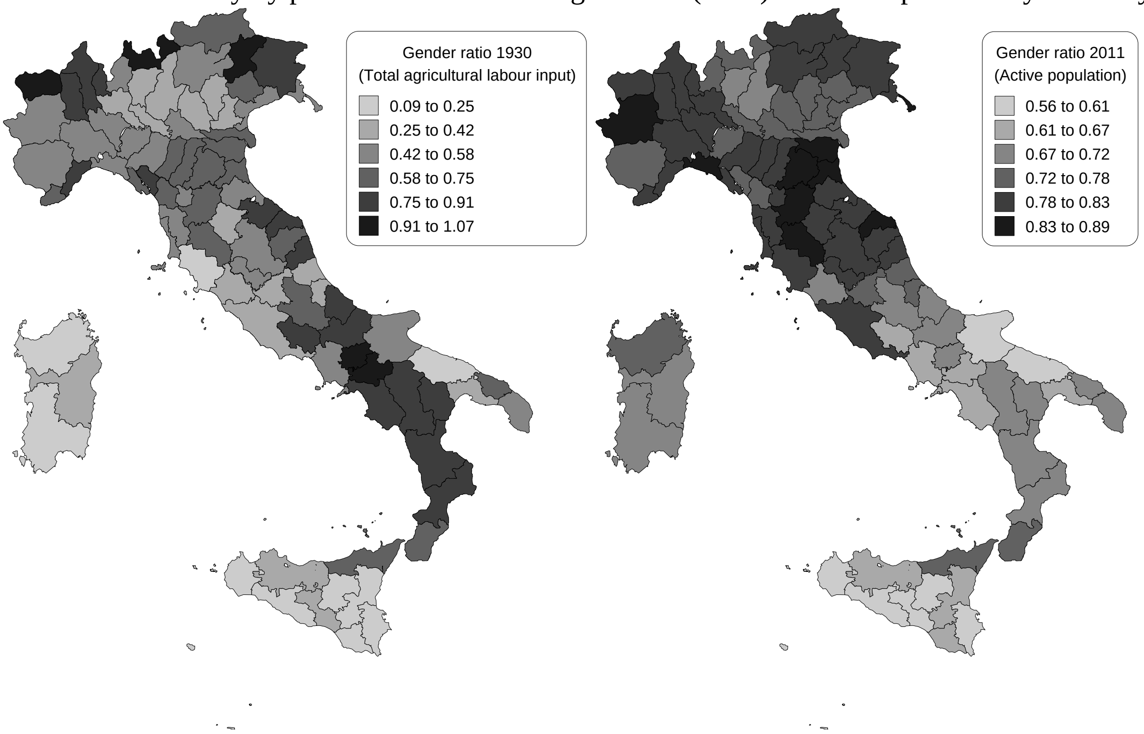


Table 3 confirms this impression with a simple OLS regression: the economy-wide gender ratios by province in 2011 comes out to be positively and significantly related to the gender ratios in agriculture in 1930, after controlling for the population-wide gender ratio, for the distribution of employment by sector and for the location of the province. Clearly this persistence cannot be explained by the crop mix. In 2011, agriculture was no longer the largest sector in any of the 89 provinces, while in 1930 it was the main source of income for over half the population in 605 out of 787 zone agrarie and for more than two thirds of inhabitants in 340 of them. It is thus tempting to attribute this persistence to cultural factors, à la Alesina et al (2013), but we will not speculate further on this. We will rather focus on the determinants of the gender ratio in 1930 agriculture.

TABLE 3:
LONG-RUN PERSISTENCE OF GENDER ROLES
IN TRADITIONAL AGRICULTURE

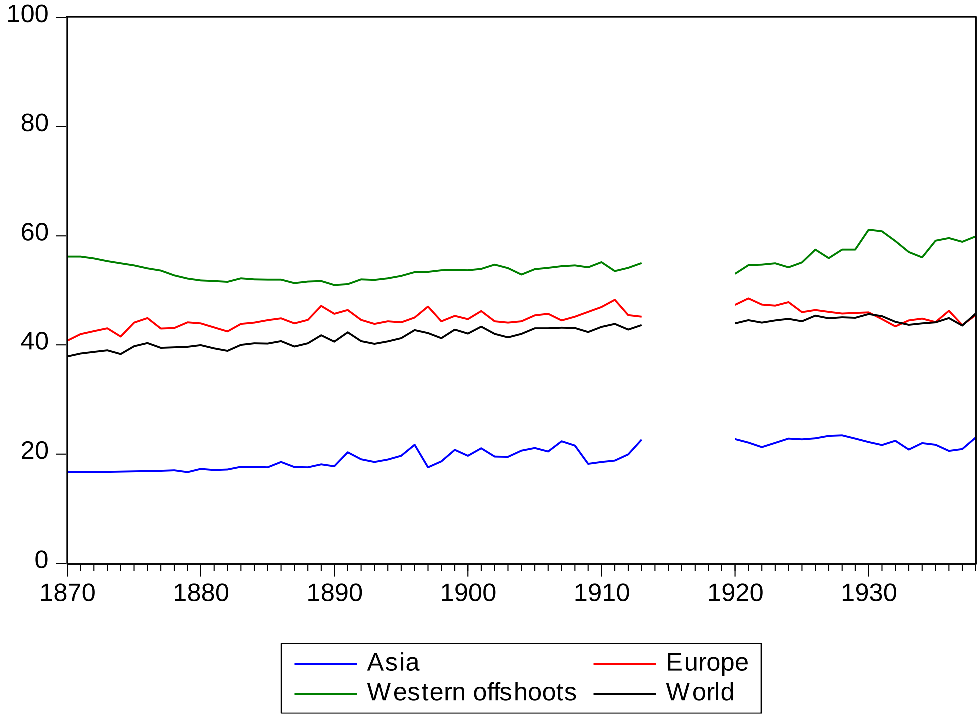
Dependent Variable:	Log of Gender ratio in 2011			
	(Active population)		(Employed population)	
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
Log of Gender ratio in 1930 agriculture	0.104***	0.053***	0.083***	0.037***
	(0.021)	(0.015)	(0.018)	(0.011)
Sex rate (2011)		1.092***		0.865***
		(0.383)		(0.324)
% Industrial employment (2011)		0.319		0.215
		(0.239)		(0.187)
% Services employment (2011)		0.411		0.291
		(0.276)		(0.216)
% Business owners and craftsmen (1931)		3.329***		2.542**
		(1.249)		(0.986)
% Merchants (1931)		-3.810*		-3.348**
		(1.974)		(1.623)
% Blue collars (1931)		-0.192		-0.152
		(0.145)		(0.119)
% Low skill services (1931)		4.311***		3.925***
		(1.180)		(0.962)
% Defence (1931)		0.249		0.084
		(0.498)		(0.400)
% White collars (1931)		-0.163		-0.140
		(0.989)		(0.788)
% Liberal arts and Church (1931)		-4.373*		-3.810*
		(2.389)		(1.983)
% Well-to-do (1931)		-3.483		-2.879
		(2.498)		(1.975)
% Non-professional conditions (1931)		-0.204		-0.213
		(0.192)		(0.155)
North		0.026		0.031*
		(0.020)		(0.017)
South		-0.119***		-0.102***
		(0.026)		(0.022)
Constant	-0.225***	-1.699***	0.768***	-0.341
	(0.018)	(0.464)	(0.015)	(0.389)
N. of obs.	89	89	89	89
F-statistic	24.53	25.37	22.34	33.21
R-squared	0.231	0.826	0.204	0.844

Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels.

3) The product mix in 'traditional' agriculture

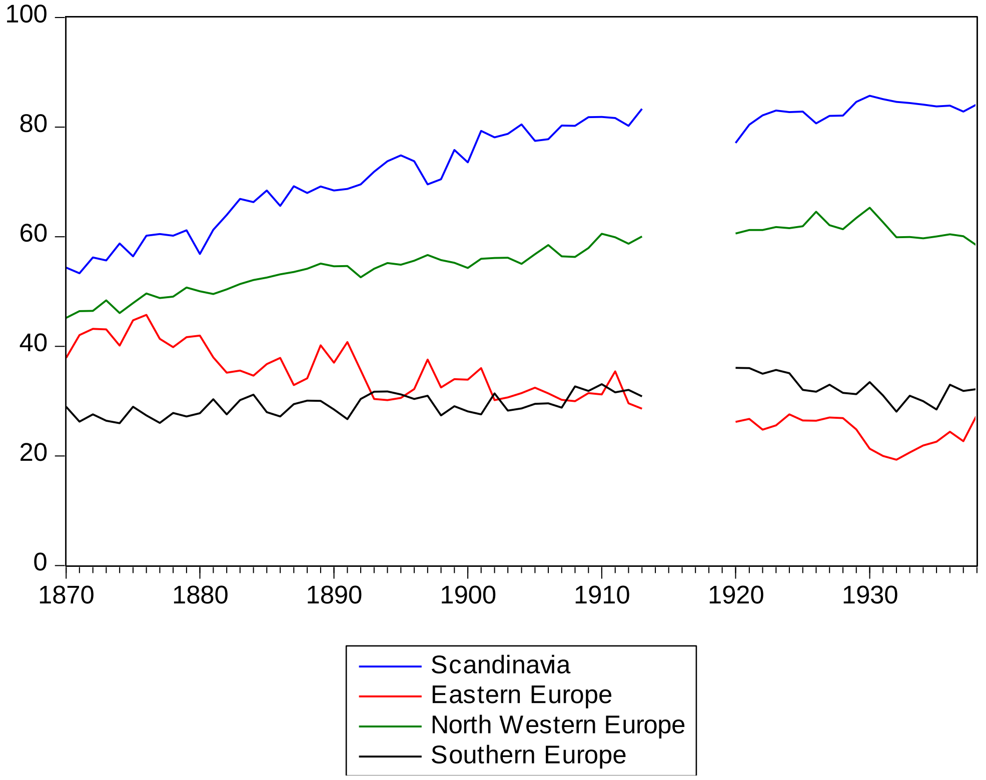
There is not a simple index of the composition of agricultural production, as the gender ratio. In fact, agriculture produced literally hundreds of different goods, which could be aggregated in dozens of different ways. However, the only available measure for a large number of countries is the share of livestock on total gross output (total production less re-uses for seeds and feed). Figure 1a plots series by continent from a compilation of data for 25 countries, accounting for about two thirds of world agricultural output (Federico 2004)

Figure 1
Share of livestock on gross output, by continent, 1870-1938



As early as 1870, livestock products accounted for slightly less than two fifths of world output, with substantial differences by country, from 10.4% in Japan to 67.1% in Uruguay. In the long run the share of livestock increased by some percentage points, to 45%, as a result of economic growth and possibly of the increase in wages, as livestock was relatively labour-intensive. The share increased in the Western Offshoots and even more in Asia (from about 17% to about 22%), while it remained constant in Europe, in spite of substantial changes within the continent (Figure 2).

Figure 2
Share of livestock on gross output in Europe

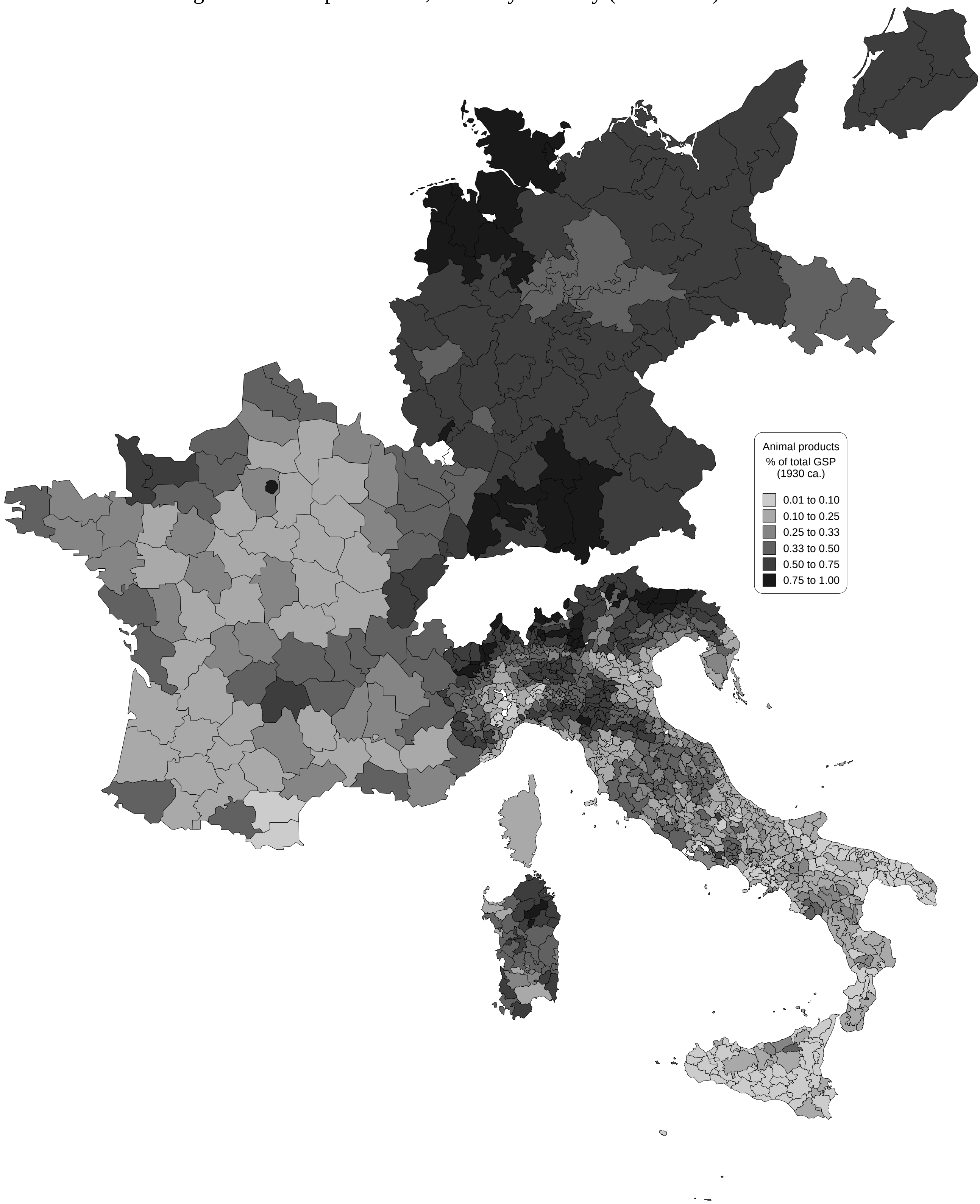


Differences were large even within each major country, as Map 3 shows[4].

Livestock production accounted for over a half of output in most of Germany, and for over three quarters in the South and in the plains close to Holland and Denmark. France and Italy featured wider differences. In France, the share was higher in the North-Western Atlantic area and in the mountain regions of the Massif Central and of the Alps, lower in the South West and Centre. In Italy, cattle raising was very important in the plains of Lombardy and Emilia, while Sardinia specialized in sheep raising and the Appenines and the rest of the North had a higher share of pigs.

[4] The level of geographical detail is comparable to Map 1. We have estimated the gross output in Italy in 1929-1930 (see below for sources and references), while for France we rely on the already quoted agricultural survey for 1929 (Statistique Agricole de la France, 1936) and for Germany we rely on an estimate for 1928-1929 by the Institut für Konjunkturforschung (Wochenberichte des IfKF, 1929). Product coverage and definition of output differ somewhat across countries. Italian data do not include poultry (and hence we have excluded it from the numerator, but not from the denominator, in the other two countries). French data include meat, wool and cow milk but not sheep and goat milk and refer to the whole vegetable production, including re-uses (but omitting the value of pastures). Thus, they are likely to underestimate the share of livestock. German data exclude vegetables and minor animal products such as wool or ovine meat (but they include sheep milk). On balance they are more likely to overestimate than to underestimate the share of livestock.

Map 3
Livestock Share of Agricultural Output: France, Germany and Italy (1928-1930).



The share of livestock is surely a lower bound of the proportion of products escaping the plough-hoe dichotomy, because the rest of output included industrial crops and tree-crops. To highlight this point, Table 4 groups the estimates of 101 agricultural products by Federico (2000) in thirteen categories, which we will use in our econometric analysis. All food-grains accounted for between one sixth and one fourth of total

GSP, with a maximum in 1938, when wheat growing was heavily protected as part of the autarky policy. Wine was the most important product of Italian agriculture in all other benchmark years.

Table 4
Shares in Italian gross output, constant prices.

	1891	1911	1938	1951
Wheat	18.14	15.98	23.44	16.83
Corn	4.64	3.27	3.11	2.71
Other cereals and pulses	4.06	3.30	3.45	2.95
Beef	5.86	6.61	8.35	8.78
Cow milk	4.08	6.20	7.68	8.25
Ovine products	2.55	2.83	2.20	2.33
Goat products	0.50	0.74	0.62	0.80
Pork	3.53	5.02	4.02	4.63
Silkworm	2.81	2.54	0.75	0.57
Vegetables and industrial products	7.62	8.64	7.73	7.91
Fruits	5.73	6.77	6.11	7.20
Olive oil and by products	6.31	4.63	2.77	5.55
Wine, grapes and by-products	24.41	23.23	19.41	21.70
Wood	2.52	2.31	1.82	1.76
Poultry	7.24	7.93	8.54	8.02

Each group of products required different productive strategies, which may entail quite different labour requirements, and therefore employment possibilities, for women.

4) The model

Our economy is endowed with a given amount of land, T, and produces two different agricultural goods, A and B (or, without loss of generality, two different operations within the production cycle of a single aggregate agricultural product). Both are produced with a Cobb-Douglas production function employing land, T, and labour, L, with different factor elasticities, α_A, β_A, α_B, β_B and with a product-specific environmental and technological parameter (E_A and E_B, respectively):

(1) $$p_A Y_A = p_A {L_A}^{\alpha_A} {T_A}^{\beta_A} E_A$$

(2) $$p_B Y_B = p_B {L_B}^{\alpha_B} {T_B}^{\beta_B} E_B$$

The landowner chooses the profit-maximizing allocation of factors between the production of good A and B, and in equilibrium the marginal product of labour and land must be the same. The input of labor L can be supplied by males, L_M, or females, L_F. For simplicity, we use the male work per unit of time and thus male wages as the numeraire and we express female work as a product-specific fraction of male labor input, ρ. This parameter measures the elasticity of substitution between male and female work, which differs across products ($\rho_A \neq \rho_B$) because each product needs a different mix of tasks (ploughing, milking, reaping etc.) and males and females have different competitive advantage in performing them. We thus rewrite the production functions as:

(1') $$p_A Y_A = p_A (L_{MA} + \rho_A L_{FA})^{\alpha_A} {T_A}^{\beta_A} E_A$$

(2') $$p_B Y_B = p_B (L_{MB} + \rho_B L_{FB})^{\alpha_B} {T_B}^{\beta_B} E_B$$

The landowner pays to labour a wage equal to the value of its marginal product. He is indifferent between employing males or females, so his only considerations in that matter are purely economic. Since the marginal product of female labour is a fraction of the marginal product of male labour, the landowner will accordingly reduce the wage offered to women. Since there is free mobility between the production of good A and good B, the price of generic labour is equal throughout the whole economy. Consequently, the male wage w_M is uniform and equal to the value of the marginal product of male labour in the production of good A and of good B.

(3) $$p_A \alpha_A (L_{MA} + \rho_A L_{FA})^{\alpha_A - 1} {T_A}^{\beta_A} E_A = w_M$$

(4) $$p_B \alpha_B (L_{MB} + \rho_B L_{FB})^{\alpha_B - 1} {T_B}^{\beta_B} E_B = w_M$$

The landowner is willing to pay women a female wage that is equal to the marginal product of females' labour, which is a fraction ρ of the marginal product of male's labour

(5) $$\rho_A p_A \alpha_A (L_{MA} + \rho_A L_{FA})^{\alpha_A - 1} {T_A}^{\beta_A} E_A = w_{FA}$$

(6) $$\rho_B p_B \alpha_B (L_{MB} + \rho_B L_{FB})^{\alpha_B - 1} {T_B}^{\beta_B} E_B = w_{FB}$$

Since the landowner is indifferent between employing females or males, (3) and (5) imply

(7) $$\rho_A w_M = w_F = w_{FA}$$

But, by the same token,

(8) $$\rho_B w_M = w_{FB} < \rho_A w_M = w_{FA}$$

Consequently, the female wage w_F that the landowner is willing to pay is the corresponding fraction of the male wage. Males can be employed indifferently in the production of the two goods, but this is not the case for female labour, as long as $\rho_A \neq \rho_B$. We assume $1 > \rho_A > \rho_B$ and in this case, females will be employed in the production of A. If $w_F = \rho_B w_M$, women could be employed in the production of good A at a female wage lower than the marginal product of female labour in A. Competitive forces will drive wages upwards towards $w_F = \rho_A w_M$, when it will be profitable for the landowner to substitute female labour for male labour in the production of good B at a rate ρ_B. Thus, in equilibrium, differences in the productive structure will shape the prices paid for different sorts of human labour and, hence, the gender ratio. Our assumption about relative productivity by gender reflects the reality of traditional agricultures, but it is not strictly necessary. If women were more productive in one or both activities (i.e. $\rho_A > 1$ and/or $\rho_B > 1$), their participation rate to agriculture would exceed the rate for men, but still there would be a gendered division of labour as long as $\rho_A \neq \rho_B$.

We model the supply of labour by assuming the economy to be formed by N equal households, each household being formed by a man and a woman. Each household has a joint utility function defined over the consumption of market goods C and household goods H. Hence we abstract from intra-household bargain for the time being. The value of market goods, C, is equal to the earnings of the household, which are obtained from working in the market at the ongoing wage rates. The value of the household goods is equal to the time used in their production, H. Each individual is endowed with T units of time, which are pooled at the household level. Under these circumstances, the household maximizes its utility U(C,H), subject to the budget constraint defined by (exogenous) market wages by allocating time H to household chores and 2T-H to market employment. We assume that men and women are equally productive in household activities. Given the wage differentials between males and females, we obtain a standard-like household kinked budget (Figure 3). One can better interpret Figure 3 by beginning from the point of maximum consumption of the household good (H=2T) and minimum consumption of the market good (C=0), a point where the household devotes all its labour force to household work. Given our assumptions about the elasticity of substitution in agriculture and thus on wages, women have comparative advantage in the production of the household good. That is, the household will achieve a larger set of consumption bundles (C,H) by starting selling male working time to the market at the wage rate w_M. Since the opportunity cost of one unit of time is w_M in this region, the budget constraint is defined by $C + w_M H = w_M 2T$. If only males work for the market, the household can achieve the level C_1 ($C_1 = w_M T$) of consumption of goods. It can increase its consumption by selling up to T units of female labour to the market at the (lower) wage rate, w_F, and thus the budget constraint in this region becomes $C+w_FH=w_FT+w_MT$. If the household sells all the women time on the market (having H=0), it will achieve the highest feasible level of consumption $C_2=w_MT+w_FT$. Thus, considering that $w_F=\rho_A w_M$, the household economy faces the problem:

Max U(C,H) s.t. $C+w_MH=w_M2T$ if H>T and $C+\rho_A w_M H=\rho_A w_M T+w_M T=w_M T(1+\rho_A)$ if $H\leq T$

In principle, such a problem allows three solutions: (i) the woman works entirely for the household while the man works in part for the household and in part for the market ($C<C_1$), (ii) the woman works entirely for the household and the man works entirely for the market ($C=C_1$) and (iii) the woman divides her time between working for the household and for the market while the man works entirely for the market (($C<C_1$).

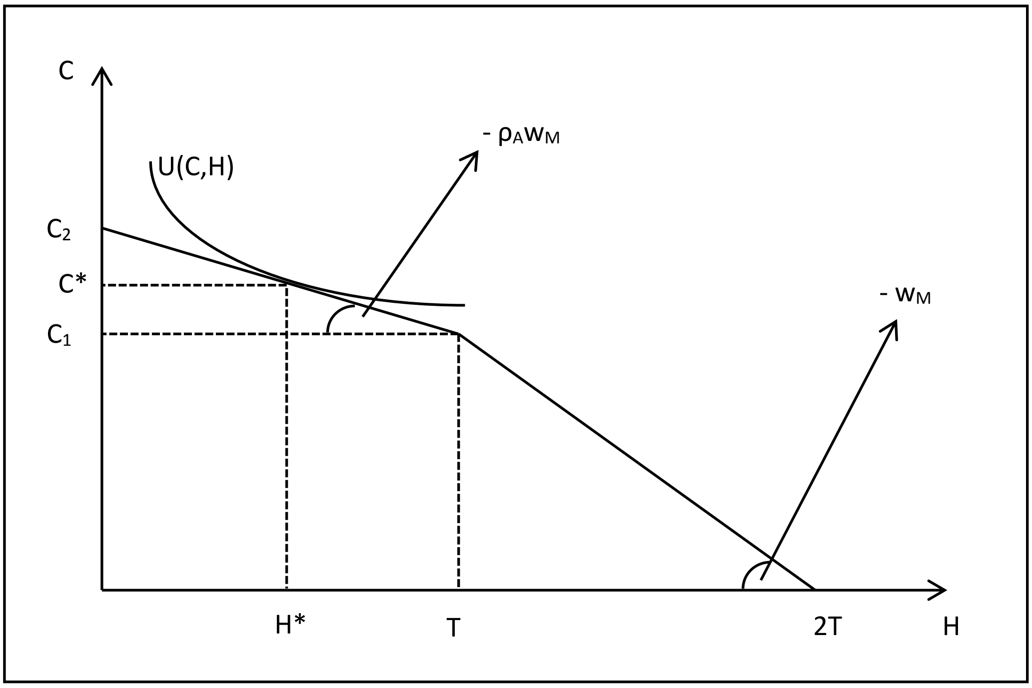
We assume a Cobb-Douglass utility function $U(C,H)=C^\delta H^\varepsilon$, with $\varepsilon+\delta=1$. In equilibrium, the optimal amount devoted to work in the household obtained from solving the household maximization problem is

$H^*= w_M\varepsilon T(1+\rho_A)/w_F=\varepsilon T(1+\rho_A)/\rho_A$

We choose parameters to get a solution of the third type – i.e. that H<T. This entails imposing $\rho_A>\varepsilon/(1-\varepsilon)$. If $\rho_A\leq\varepsilon/(1-\varepsilon)$, women do not work and all market labour is supplied by men. If the parameters are such that women supply some market work, $\delta H^*/\delta\rho_A<0$. Increasing the elasticity of substitution between male and female labour with a Cobb-Douglas utility function increases relative females wages, leading to a reduction of household production and an expansion of market female work. Hence, agricultural technology determines the gendered division of labour.

In equilibrium, the equal N households supply the total quantity of labour demanded by the landowner so that w_M clears the labour market. Given w_M, ρ_A determines the gender ratio. Females will be allocated to the production of good A, while males will be allocated to the production of goods A and B until the market is cleared[5]. Hence, an increase in the production of good A will increase the gender ratio, as will do an increase in the elasticity of substitution between male and female labor.

Figure 3
The household choice



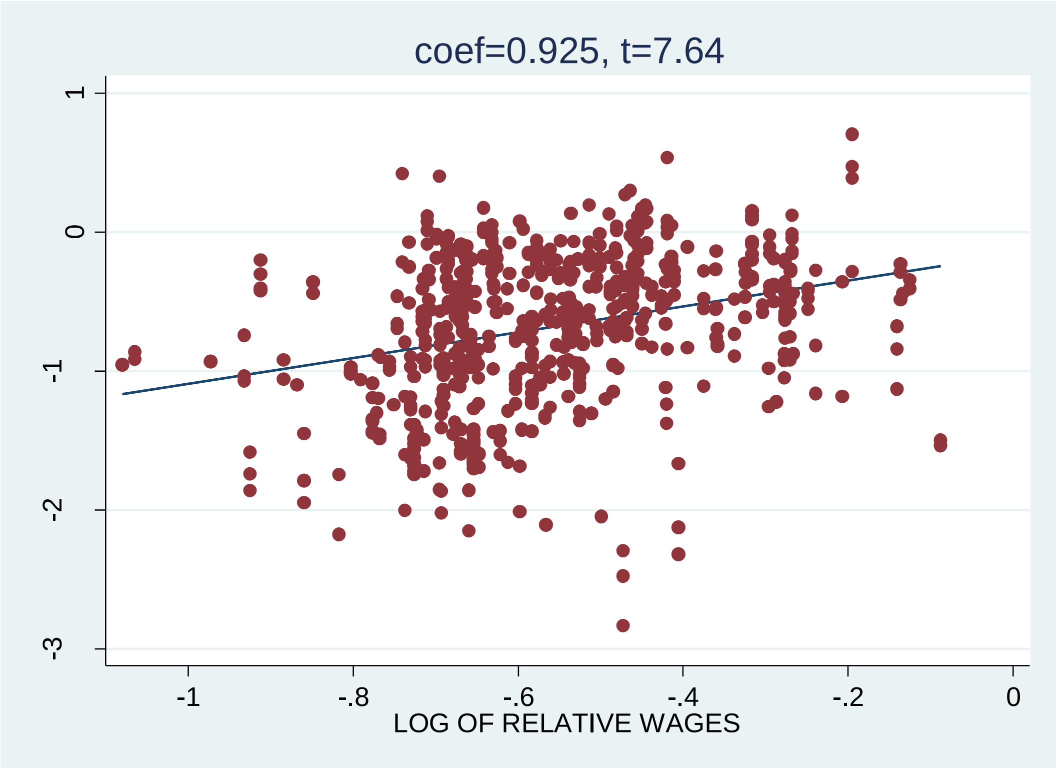
[5] No household will be willing to make women work in the market at a wage rate $w_F=\rho_B w_F$, since the budget constraint defined by this female wage is inferior to the one defined by $w_F=\rho_A w_F$.

Hence, for any given technology, changes in the composition of output (i.e., in the relative importance of labour devoted to the production of A as against B) shape gender ratios. Of course, technological change would affect the choices of agents insofar it changes the elasticity ρ. This is not a problem for our analysis which refers to a single year. We have just to assume that the crop-specific elasticities were similar across the country – i.e. that the production technologies were similar (and similarly known) around the country in 1930. This assumption seems plausible given the historical record.

5) Data and estimation strategy

As a preliminary step, we check that relative wages were actually positively correlated with gender ratios. We rely on an average of monthly data on hourly wages by 'regione agraria' (agrarian region) which the ISTAT started to publish in 1930[6]. The wage ratio is thus far from perfect, but the correlation with the gender ratio is nevertheless quite high, with an elasticity around 1 (Figure 4).

Figure 4



Hence, our parameter choice in the model is empirically relevant. This result confirms a basic implication of our model – women's employment was relatively higher where there was a relatively higher demand for their work, which in turn translated into higher relative wages. We now show that the former ultimately depended on the crop mix by running a regression of the following type:

(9) $LnG = a + b_i \sum R_i + c\mathbf{X} + \varepsilon$

where G is the log of the gender ratio (female/male occupation), R_i a measure of the relevance of the i-th product and **X** a set of controls. We run it for about 700 agrarian zones, as for other some of the data are missing. We measure R_i, with the log of one plus the ratio of gross output of the i-th product to the male

[6] There were about 200 'regioni agrarie' each including roughly three agrarian zones. We drop months when the source does not report either male or female wages.

labour input[7]. Thus, the coefficients b_i can be interpreted as the percentage change in the gender ratio (or a % change in female labour input given the male labour input) brought about by a 1% increase in the output of the i-th product relative to total male labour input. In our most extended analysis, we consider fifty products, including all relevant ones except eggs and poultry (8.54% of gross output in 1938). We define as (predominantly) 'male' any product with a significant and negative coefficient, (predominantly) 'female' any product with a positive and significant coefficient and 'gender neutral' any product with a not significant coefficient, irrespective of the sign.

The set **X** includes three sets of controls, with data at agrarian zone level from the 1931 population census (ISTAT 1931-1935):

i) Demographic variables which are intended to capture features of the households which may affect the labour supply. The list includes a) the ratio of women per men in total population, or sex rate, which can differ from one because of migration; b) the share of adults (over 15 years old) over the total population, which depends on fertility and possibly on migratory flows; c) the size of agricultural households; d) the overall literacy rate and e) the gap between female and male literacy rates, defined as the ratio of the former over the latter.
ii) Tenancy variables, which are intended to capture the effects on labour allocation of the supervision costs of different access to land. The population census classifies the agricultural population according to the status of the household head, distinguishing owners of land from four categories of contract-holders (sharecroppers, tenants, wage labourers and mixed contracts). We measure the effect of ownership with the share of members of owners household on total agricultural population and then the effect of different contracts with the share(s) of tenants, sharecroppers and wage labourers on total population of agricultural contract-holders (with mixed contracts as the omitted category).

iii) Labour market variables, which are intended to capture the opportunity-cost of agricultural employment. We proxy the non-available data on total non-agricultural occupation by agrarian zone with the data on the number of members of households classified according to the occupation of the head. The two measures are highly correlated at provincial level[8]. We reproduce the classification from the census in 11 professional conditions: business owners, merchants, craftsmen, blue collars, low-skilled services, soldiers (including militia-men), army officers, employed in liberal arts and in the Church, non-working landowners and well-to-do (*sic* in the census) and non-professional conditions (pensioners, convicted, non-working women being family heads, individuals without profession). We take into account the pulling power of neighbouring agrarian zones by adding the total non-agricultural population of all other zones weighted with the distance from the relevant agrarian zone.

We expect the sex ratio to be positive, the adult share and the household size to be positive as well if fewer children reduce the demand for household work and/or if there are economies in the provision of the household good. A negative and significant coefficient for literacy implies that females in (comparatively) more literate households were less likely to work in agriculture: it would be tempting to interpret such a result as evidence of more investment in their children. A similar interpretation may be attached to a negative sign for the literacy gap, since an increase of the variable implies female literacy rates getting closer to male's: females comparatively more literate than their male partners were less likely to work in agriculture, everything else (in particular their partners' literacy) being constant. As a general rule, we expect the gender

[7] We estimate the output by agrarian zone in 1930 for fifty products, which accounted for 81% of total gross output in 1938, using mostly official sources, such as the 1929 Agrarian Cadastre (ISTAT 1932-1937) the 1930 Livestock Census (ISTAT 1933, 1934 a and b) and the agricultural statistical bulletin (BMSAF 1931). See for details Martinelli (2014).

[8] The coefficients of correlation between the shares on total workforce (from the censuses) and on heads only (obtained by summing up our data by agrarian zone) are 0.851 for business owners and craftsmen, 0.923 for merchants, 0.903 for blue collars, 0.944 for low skill services and white collars, 0.826, for soldiers and officers, 0.774 for liberal arts and the clergy, 0.770 for the well-to-do and 0.542 for non-professional conditions. This latter coefficient is strikingly high, as one would expect very few people in condition (mostly non-working women) to be household heads.

ratio to be negatively related to the size of the non-agricultural population, which increased the demand for female work.

The model assumes the product mix to be independent from the supply of female work, but this assumption may not hold in practice. Thus, we re-estimate equation (9) with instrumental variables. Even assuming all controls to be exogenous, we would as many instruments as products and fifty instruments are simply not available. Thus, in the IV equation we group products in thirteen categories, four crops (wheat, corn, other cereals and pulses and vegetables and industrial crops), five livestock products (beef, cow milk, sheep products, goat products and pork), three Mediterranean tree products (wine, olive oil and fruits) and silkworms. We use as instrument for Mediterranean products and silkworms the value of the stock of trees in the late 1920s, estimated by Martinelli (2014) with data from the 1929 Agrarian Cadastre (ISTAT 1932-1937). Likewise, we use as instrument for livestock products the number of animals in 1908, as reported in the 1930 Livestock Census (ISTAT, 1933)[9]. All these instruments are expressed in per male input terms. For field crops we resort to environmental variables – the average altitude of the agrarian zone, the average rainfall in summer, the average temperature in January and the average temperature in June[10].

6) The results

The most detailed data on the gender bias (or lack of it) by product can be obtained from the OLS regression (Statistical Appendix, Table 1) At a first glance, controls seem to add comparatively little to the explanatory power of the regression (compare cols.2 and 1 and the R2), although some of them are significant. Anyway, we will postpone the discussion of their effect to the results of the IV estimate. As expected, the joint F-test test for all products is highly significant – i.e. the composition of output did affect the gender ratio. Table 5 sums up the key results.

Table 5
The gender classification of agricultural product

	Number of Products	% of Total Output	Most Relevant
Male-Positive Products	11	39%	Wheat Cow milk
Gender-Neutral Products	31	46%	Wine Oil
Female-Positive Products	8	15%	Corn Beef

The share of ‘female’ products may be slightly undervalued, as according to all anecdotal evidence eggs and poultry were mostly tended by women. The overall classification of products tallies only in part with the received wisdom. From one hand, as posited by Alesina et al. (2013), wheat is a male product and corn a female one[11]. A careful survey on work in an admittedly small sample of large farms in the Po Valley (Bandini 1935 pp. 261-282) shows gender ratios of 0.53 for wheat and 1.23 for corn. Actually, plough was used to break the soil for both products but wheat required only a further harrowing and reaping with sickle, a tiring male job, while corn needed other rounds of hoeing and corncobs were picked and cleaned by hand (Cuppari 1870 pp.122-124, Niccoli 1898: 355-358, 363-364, Niccoli and Fanti 1941 pp.552-555). In

[9] The census counted only the number of animals and thus implicitly, we assume that in each zone the animal productivity (e.g. milk yields by cow) remained constant from 1908 to 1930, relative to the national average. We extract the number of animals in the former Austro-Hungarian territories from the 1910 Austrian census (Österreichische Statistik, Neue Folge, 1917).

[10] We compute the altitude for an agrarian zone weighting the altitude of its municipalities by area from data of the Agrarian Cadastre (ISTAT, 1932-1937) and the weather data from observation on rainfall by over 4000 stations and on temperature from around 800 stations, published in Annali Idrologici.

[11] In the same line as Alesina et al (2013), but focusing now on the relative importance of wheat over rice, Carranza (2014) explains the demographic deficit of girls across rural India, arguing that it was driven by differences in the economic value of female work. Our results are consistent with her results, since a shift from wheat production to rice production would increase the gender ratio, despite rice being gender-neutral in our OLS specification.

contrast, our results about livestock do not fit the simple distinction between horn and corn, which imply a positive coefficient (Voigtländer and Voth 2013). The raising of small animals, sheep, pigs or goats, comes out as gender-neutral, and, although the aggregate coefficient for cattle-raising is positive and significant at 10% (Table 2 bis), the coefficients for its main products, beef and cow milk, have opposite signs and are both significant. This result is puzzling because they are joint productions: cows produce milk only to feed calves, which sooner or later must be slaughtered. We hypothesize that milk results a male product because most of the Italian milk was produced by highly specialized farms in the plain of Piedmont, Lombardy, Emilia and Venetia. About four fifths of the cows in these areas were classified as milk cows, and the technical evidence suggests that they were fed more and better than ordinary cows in the rest of the country in order to increase their milk production (Reggiani 1908: 217-246 Niccoli and Fanti 1941 pp.331-332, Borgioli 1947: 216-217 Tassinari 1945: 853-859). The high quality fodder was grown in specialized, often irrigated, meadows and harvesting and transporting hay was a heavy male task (Tassinari 1945 pp.250-260). Indeed, the gender ratio for meadows according to Bandini (1935) was as low as 0.20. We will bring some quantitative evidence to buttress this hypothesis in the next Section. A similar reasoning may explain the negative coefficient of silkworm raising (Table 2, S.A.): tending the worms was traditionally a female task, but cultivating mulberries and cutting and transporting their leaves to feed the worms was a male task. Last but not least, our analysis shows that Mediterranean products, hitherto neglected in the literature, were mostly ‘gender-neutral’, with few (and possibly spurious) exceptions among fruits. The technical literature suggests a clear division of labour for wine (Tassinari 1945: 379-411). Planting and pruning vines were heavy and fairly specialized male tasks, pruning male, but gathering and first processing of grapes were comparatively light jobs, suited to females. The division of labor for olive and other tree crops was similar, with the notable exception of processing olives, which was outsourced to specialized firms.

How robust are these results to the endogeneity bias? We report the results for IV in Table 2 (Statistical Appendix), adding an OLS regression with a matching grouping of products for comparative purposes. The aggregation increases somewhat the precision of the estimate, as it reduces the statistical noise from geographically very concentrated and/or poorly measured products (e.g. fruit) and also possibly the multi-collinearity. Indeed, five out of seven strictly comparable coefficients are greater than in the extended OLS specification (Table 1, col. 2). The IV estimate confirms by and large the main results, with a couple of noteworthy changes [12]. The coefficients for pork and fruit are negative and significant, although only at 10%, and as a consequence, the total share of ‘male’ products increases by about ten points, to 49% and that of ‘gender-neutral’ products shrinks to a third. Second, the coefficients are substantially higher than in the OLS estimates. For instance, the elasticity for wheat is double the coefficient of the ‘compact’ OLS regression (Tab 2, col.2) and four times higher the coefficient of the baseline regression (Tab. 1, col 2). The elasticities for beef and cow milk are very high, but they would compensate as long as cattle-raising was not specialized. In fact, re-running the regression (table 2 bis, Statistical Appendix) with one single variable for both products yields a joint coefficient of 0.119 (significant at 1%). Thus, aggregate cattle-raising would be a female job, as goat raising, while, as said, pig-raising was ‘male’ and sheep-raising ‘gender-neutral’.

The IV estimates strongly downplays the relevance of factors other than the product mix. The coefficient of the sex rate is positive as expected, but no other demographic variable is significant, nor is significant any tenancy variable. Some of the coefficients of the labor market variables are significant and plausibly signed: a 10% higher share of workers in low-skilled services on population, which included the housemaids, corresponds to a 0.5% lower gender ratio. The contribution to total variation of gender ratio is however modest: an increase in one standard deviation in low-skilled services employment would reduce the gender ratio by ca. 0.038 points at its mean (from 0.516 to 0.478). A battery of joint significance tests for groups of variables (product mix, tenancy, labor market and socio-demographic variables) shows that tenancy variables

[12] The Kleibergen-Paap test shows that the model is identified and that our endogenous regressors are jointly relevant. Angrist-Pischke first stage F-statistics (not shown here but available upon request) reject in all cases at the 1% the null that any single individual regressor is under- or weakly identified. Endogeneity tests for the products whose significance changes after running IV estimation (swine meat, goat products and fruit increases, while vegetables and industrial products collapses) reject the null that such variables can be treated as exogenous.

was the only group never being statistically significant. In a nutshell, tenancy may have affected the gender ratio only indirectly via the crop mix, while other non-agricultural socio-economic-demographic variables have had some direct effect. Anyway, this latter seems very limited if compared with the impact of product mix (Table 6).

Table 6
The effect of product mix on gender ratio: IV estimates

Change in Gender ratio caused by an increase in one standard deviation in the production per male of…		Gender ratio after taking into account the effect at its mean (0.516)
Wheat	**-0.157**	**0.359**
Corn	**0.232**	**0.749**
Other cereals and pulses	**0.181**	**0.698**
Bovine products	**0.075**	**0.591**
Ovine products	-0.007	0.510
Goat products	**0.090**	**0.606**
Swine products	**-0.077**	**0.439**
Silkworm	**-0.057**	**0.459**
Vegetables and industrial products	0.010	0.526
Fruits	**-0.031**	**0.486**
Oil, olives and by-products	-0.032	0.484
Wine, grapes and by-products	0.018	0.534

Notes: Products whose coefficients are statistically significant at least at the 10% level in Table 2 bis (Statistical Appendix) are in bold.

We compute the effect of a standard deviation increase in production (left-hand column) by multiplying the coefficient by the standard deviation of the variable, adding the result to the mean value of the dependent variable (-0.661) and transforming back from logarithms. For instance, an increase in one standard deviation of the production of wheat per male would reduce the log of gender ratio by -0.363 –i.e. from -0.661 to -1.024- and the actual gender ratio by -0.157 points. The right-hand column simply computes the gender ratio after the increase. As one can notice, the effect is substantial, even if the initial shock is comparatively modest: raising the production of wheat per male from the minimum (no production) to the maximum (9.925) found in the sample would cause the gender ratio to fall by about 0.91 points. Similarly, an increase in one standard deviation in the production of corn per male leads to an increase in the gender ratio from its mean (0.52) to 0.75, whereas a similar increase in the production of other cereals and legumes raises the gender ratio to 0.70. Regarding animal productions, an increase in one standard deviation in the production of pork reduces the average gender ratio towards 0.4, while increasing aggregate bovine production raises it towards 0.59. Finally, even accepting as good the (not statistically significant) coefficients of two of the most representative products of Mediterranean agriculture, wine and oil, changes in their production would lead only to minor changes in the gender ratio (to 0.53 and 0.48, respectively). Of course, one cannot have all these increases contemporarily: given the fixed amount of land, any increase must be compensated by a decrease in some other production.

7) Robustness checks.

In this Section, we deal with three specific issues, the measurement of the gender ratio, the endogeneity of the stock of trees and livestock stock and the unexpectedly different signs of the milk and beef coefficients.

7.1 As said, our preferred measure of the gender ratio includes an estimate of part-time employment which we obtain by redistributing provincial data between the agrarian zones of the province. This procedure might yield biased data and thus we check the results by re-running the regressions with two alternative measures of gender ratio for full time workers only (ISTAT, 1939b). The first alternative variable considers only members of family farmers (owner-occupiers, tenants and sharecroppers), while for the second we add an estimate of full-time wage workers our agrarian zone estimate of wage-workers full-time employment obtained combining original provincial variables. We first reproduce the results of Table 1 using these two alternative dependent variables in Table 3 and then the results of Table 2 in Table 4 (all in the Statistical Appendix). The exercise shows very small differences in the magnitudes of coefficients or in their levels of statistical significance, which we attribute to the lower precision with which these alternative definitions measure the actual gender ratio.

7.2 One might argue that the instruments for tree-crops and livestock in our baseline IV estimate are not really exogenous. By definition, the stock of trees in the 1920s or the number of animals in 1908 cannot depend on the condition of labour market in 1930, but in theory they might reflect some unspecified factor (a cultural belief?) which affected also the allocation of labour by crop in 1930. We do not have any real evidence of such a factor, but we test the robustness of our estimate by running an alternative, 'bare-bones' IV specification with only purely physical instruments, surely exogenous to any human activity. This radical strategy comes at a price, since we are forced to further consolidate the products in four groups only - wheat, other field crops, livestock products and tree crops. We instrument them with temperature in December, winter rainfall, altitude and latitude. Our first-stage statistics reveal that our instruments are relevant and strong. Signs and significance of the coefficients in both the OLS and IV specification are fully in line with our previous findings (Table 5, Statistical Appendix). Wheat remains a steadily male-positive product. Other field crops (capturing the effect of corn, pulses and other cereals) and livestock (where the effect of beef prevails) are female-positive ones. Even the slight reduction in livestock significance in the IV estimate is not surprising given the different signs of the individual products that form this aggregate variable. Tree crops have a smaller positive coefficient, which in the IV analysis turns out to be not statistically significant. Results show without any sort of doubt that the product mix determined the gender ratio in traditional agriculture. At the same time, a comparison with our benchmark analysis shows how much of the complexity of traditional agriculture do we lose by aggregating products with productions functions exhibiting too different elasticities of substitution between male and female work.

7.3 We test our hypothesis about the negative coefficient of milk by using two features of specialized cattle raising. First, high-yielding cows were too valuable to be used as draft animals. Second, as a specialized activity, intensive milk production entailed some minimum economies of scale. The 1930 Livestock Census (ISTAT 1934a and b) reports data about the share of cows not used for agricultural works by agrarian region and about the distribution of cows by size of the herd by agrarian zone[13]. We use these variables in two different specifications, either as substitutes for the cow milk variable or as controls. In the former specification we expect both to be negative and significant as cow milk, while in the latter we expect them to partially or totally capture the effect of specialization in milk production. We also expect them not to affect the coefficient of meat. The results support these predictions (Table 6, S. A.). Both variables are a good proxy for cow milk production, and they affect only marginally the coefficients for bovine meat. The addition of the two variables as controls drastically reduces the coefficient of cow milk and in some cases makes it not significant. Thus, standard cattle raising was largely a female-positive activity, but turning the herd into a specialized milk-producing unit required increasing levels of inputs, which in turn reduced its female-intensity.

8) Conclusion

[13] Just as an example, in Milan and Cremona, the two provinces with the highest density of cattle per arable land (around 100 animals per hectare), just 2% and 1% of the whole stock of cows was somehow employed in agricultural works, as against a national average of 42%. Correspondingly, they were also the two provinces with the highest yields per cow in the country (respectively, around 30 and 28 liters).

We can sum up our result in a sentence: Alesina et al (2013) highlight an important stylized fact, but they hugely oversimplify the problem. They may be right if one interprets their work either in a very broad meaning (product mix affects the gender ratio) or in a very narrow one, insofar as they correctly classify wheat as a mostly male and corn as a mostly female crop. On the other hand, they are wrong because they focus on two products only, while Italian (and European) agriculture featured a wide range of products, including a substantial number of gender-neutral ones. Thus, mapping from product mix to the aggregate gender ratio is possible but much more complex than they assume. In this paper, the first systematic study of gender roles in traditional European agriculture, we have identified the gender intensity of several different groups of products. Hence, we hope these findings to be useful to a broad range of scholars.

Furthermore, the product mix was not fixed neither in the range of possible choices, nor in the actual selection of products. The so-called Colombian exchange let Europeans know corn, potato and tomato (and Americans the horse). According to our estimates, corn and tomatoes were 'female' products, and thus ceteris paribus their introduction must have increased the gender ratio and thus the female participation to gainful employment. The spread of maize and, to a lesser extent, of silkworm-raising since the late 17th century changed deeply Italian agriculture (Malanima 2002:126-129 and Malanima 2009:136-137, Battistini 2003), but the composition of output, and thus the gendered division of labour kept changing later (Table 4). Last but not least, the demand of labor was affected by product-specific technological change: for instance, mechanization after World War Two (Federico 2005) greatly reduced the need for strength in ploughing and thus the comparative advantage of males.

Our work does not tackle directly the alleged relation between gender ratio in agriculture *and* past or current beliefs, nor, strictly speaking, disprove the results by Alesina et al (2013), which, as said, exclude Europe. In principle, one can still claim that cultural beliefs created during the pre-historical specialization were so strong as to persist in spite of all subsequent changes in product mix, or that Europe is an exception. Yet, by the same token, the product mix shaped gender roles in subsequent periods as well. Gender roles in 2011 Italian economy happen to be correlated with gender roles in 1930s Italian agriculture, determined by the 1930s product composition. Whether, and which share of, present-day gender roles have their roots in prehistoric rather in the much closer and still traditional 1930s agriculture is an open question that requires further research. In any case, we do think to have proved that the reality of traditional agriculture is more complex, and historically interesting, than portrayed in their interpretation.

APPENDIX. Gender ratios across 1930's Italy – Sources and methods.

While the importance of correctly measuring agricultural employment was of obvious relevance in a country where agriculture was the first sector in terms of employment up to 1951, census officials were highly dissatisfied with official census returns. The main source of discontent was precisely female agricultural employment[14]. Population Censuses were believed to consistently under-register female employment. In order to deal with these shortcoming, Vitali (1968) re-estimated the official figures, refining the procedure first outlined by Coletti (1925). Vitali's procedure, though generally accepted by scholarship, cannot be applied at a level of disaggregation lower than region for lack of data. Given the reduced number of Italian regions, we cannot rely on Census figures for an analysis like the one we want to pursue here.

Fortunately, we can rely on an additional set of sources that exactly match our purposes: one that was generated by the Italian Statistical Office (ISTAT) in order to specifically deal with the long-lived problem of mismeasurement of female's employment and the related one of taking into account the part-time nature of a relevant share of the labor inputs to agriculture. The 1930 Census of Agriculture, the first one of such a nature in Italy, was carried out by the ISTAT in agreement with the International Agricultural Association. The Italian 1930 Census of Agriculture was thus intended to be part of the First World Census of Agriculture, whose prospective contents were coordinated by the IAA. The census program consisted in three parts: a farm census, a livestock census and an agricultural professional census (specifically addressed at ascertaining the true magnitude of the agricultural labour force). Eventually, the ISTAT published the livestock census in 3 volumes (ISTAT, 1933, 1934a and 1937) and the farm census in 2 (ISTAT, 1935a, 1936a), as well as 2 complementary volumes on local agrarian measurement units (1936b) and a census of land reclamation works (1934b). Unexpected financial cuts (see ISTAT to the census' program reduced the scope of the elaboration of the data gathered. but the main victim was the rural population census whose complete elaboration and publication was abandoned altogether. Yet, the ISTAT published some pieces of information that, put together, constitute the most complete historical source on labour input in traditional agriculture prior to WWII.

The first piece of information can be found in the "summary and provisional" (sic) returns of the agricultural professional population census (part of the rural population census) published by the ISTAT in the March 1931 issue of its official agricultural statistical bulletin (BMSAF, 1931). There we can find at the provincial level the number of males and females having respectively agriculture as a "principal occupation" and as a "secondary occupation". The data were not revised as they were intended to be, owing to the aforementioned budget cuts. According to these provisional data, the 1931 population census underestimated women employed in agriculture by at least as much as 1,200,000 individuals (see Table 1). Considering female temporary employment the underestimate was much larger. Conversely, males having agriculture as a principal occupation (which, for simplicity, we may call "full-time employed in agriculture") were ca. 10% less than the population census would suggest. Probably males (young ones, elder or non family-heads in general) working only part time in agriculture but living in a predominantly agricultural household were registered as active in agriculture, owing to the even smaller shares in their incomes of activities other than agriculture. A geographically disaggregated comparison between the 1931 and the 1930 censuses confirms that these differences were structural and to be found all over Italy, although with varying intensity. A comparison with the 1936 population census (which was considered to have registered better female employment than the 1931 one) seems to confirm these interpretations and, indirectly, the reliability of the provisional figures from the 1930 agricultural professional census.

[14] Another, though related, source of discontent was the difficulty of correctly classifying the active population in agriculture in several subcategories according to their professional status (owner cultivators, sharecroppers, wage workers, etc.).

Table 1

	1931 Population Census		1930 Agricultural Census (Agricultural Professional Census)						1936 Population Census	
	Males	Females	Males (P)	Females (P)	Males (T)	Females (T)	Males (P+T)	Females (P+T)	M	F
North	2915	759	2786	1200	692	1623	3478	2824	2792	1133
Center	1170	319	1126	563	191	518	1317	1081	1179	506
South	1595	434	1454	854	206	525	1660	1380	1554	720
Islands	862	24	691	134	119	230	811	364	803	67
Italy	6544	1538	6058	2752	1208	2897	7266	5649	6328	2428

Notes: All figures in thousands. 1931 Population Census from ISTAT (1934c). 1930 Agricultural Census from BMSAF (1931). 1936 Population Census from ISTAT (1939a) (P)=Permanently employed (agriculture as principal occupation). (T)= Temporarily employed (agriculture as a secondary occupation).

It is impossible to know how different the (never processed) definitive data would look from these provisional ones. Yet, the ISTAT regarded them as representative enough to be mentioned as a “reliable source showing the extent of the underestimation of female agricultural employment” in the 1931 population census, as reported in the General Report of the 1931 Population Census (ISTAT, 1935b, p. 104). accepting the 1.2 million figure as a lower bound of female employment underestimation. Moreover, according to the ISTAT (1935b, p. 106), the agricultural professional census was carried out in such a different way from the population censuses that mistakes were minimized from its very inception. But, more importantly for our purposes, there is no element suggesting that provisional results were biased in any way with respect to relative male and female numbers. The only potential problem may be related to misclassifications of individuals having agriculture as their principal or secondary employment. But here, again, the ISTAT (1935b. p. 107) was pretty clear: the professional census defined principal and secondary employment in such a way that mistakes due to misclassification could only be expected “in very modest measure”. An individual was defined as having agriculture as principal employment if he or she worked more than 100 days a year in agricultural tasks and agriculture was his or her main source of income or the working activity where he/she spent most of his/her time. An individual was defined as having agriculture as secondary employment if he or she worked more than 20 days a year in any agricultural task, including among them taking care of poultry, a pig or working in a home garden.

The cited statements are very remarkable when considering that they were published in official documents by a national statistical office that was critically reviewing the definitive returns of a population census and referred to “provisional” data.

All the above mentioned elements suggest that the data at the provincial level published in BMSAF (1931) constitute a very reliable measure of labour inputs in agriculture, especially when seen under a relative rather than an absolute perspective.

The second piece of information we rely on for our estimate was published in 1939, with the name “Representative inquiry on the family farming families” (*Indagine rappresentativa sulle famiglie contadine imprenditirci*). The “Representative inquiry” was an attempt of the ISTAT to display a sample of the wealth of information collected years before in the context of the Agricultural Census of 1930 and remained unpublished. The item that the ISTAT choose to highlight was the composition of familiar employment in the family farms of the country. regardless of the contractual arrangements of the farm (thus all farms operated by small owners. working tenants and sharecroppers). Family farms were explicitly defined as all farms below 50 hectares. The ISTAT processed the Agricultural Census returns of over one million such family farms all around the country, covering over four million hectares. This giant sample was equal to 25% of the whole underlying population of family farms and of 26.6% of their total area, so it can be considered highly representative. The sample was selected by processing all the returns of a given number of municipalities chosen so that their economic and agricultural features could be considered representative of all the municipalities of the agrarian zone to which they belonged. Unfortunately we don’t know which municipalities the published data refer to (something that may have enlarged our sample even more). Data were thus published at the agrarian zone level. although for 89 agrarian zones out of 787 no data at all were published. All data were published as coefficients in per hectare terms. These coefficients were published in two long tables. The first one (ISTAT, 1939, Table IV, p. 53-116) presents the number of male and female members per hectare of the family farm full-time employed in the family farms (*occupati stabilmente nei lavori dell'azienda*). For each agrarian zone, we are given a total and also more specific data for 7 different intervals of farm size. Another part of the table also specifies the number of such members of family farms being older than 15 (always in per hectare terms). Another long table (ISTAT, 1939, Table V, p.118-182) provides information about the members of family farms part-time employed in the family farm (*occupati saltuariamente nei lavori dell'azienda*), always in per hectare terms and with farm-size breakdown. Applying these coefficients to the area of farms below 50 hectares from the 1930 Agricultural Census (ISTAT, 1935a) we can obtain the absolute numbers of all these variables.

Some of these data cannot serve our purposes. In particular, we cannot rely on part-time employment of family farmers in family farms since we cannot be sure that this people wasn't employed during the remaining part of the year in other farms, so they may have actually been wage workers working full- or part-time in agriculture, despite part of the year they helped in the family farm. This claim is confirmed by a comparison of the absolute numbers derived from combining the Indagine and the Agricultural Census with data on part-time employment published in BSAMF (1931). According to BMSAF (1931) there were 1.2 million males and 2.9 million females actually employed part-time in agriculture. Multiplying the total agrarian zone coefficients on part-time employment per hectare by the area of farms below 50 hectares from the 1930 Agricultural Census (ISTAT, 1935a), the Indagine points out to 2.4 million males and almost 4 million females part-time employed in their family farms. This excess is remarkable, especially taking into account that the data from the Indagine do not cover all agrarian zones.

Fortunately, we can rely on the other table, whose coefficients imply that there were 3.83 million males and 1.3 million females full-time employed in their family farms. This figure for males (that underestimates the absolute total because of the lacking agrarian zones) is 64% of all males full-time employed in agriculture as reported in BMSAF, a magnitude very close to the 65% of family-heads employed in agriculture reported in the population census of 1931 as being family farmers. Yet there are reasons to believe that these figures actually overestimate full-time employment in family farms. The main reason is that the agricultural census registered as farms what were actually micro-plots of wage workers. Indeed, according to the 1930 Agricultural Census there were over 900.000 "farms" smaller than 0.5 hectares (21% of all farms) that covered less than 200.000 hectares (just 0.7% of the all farmland). Farms between 0.5 and 1 hectare were another 14% of all farms (over 580.000) accounting for 1.7% of all farmland. That is, more than one third of the 4.2 million economic units registered as "farms" were to a large extent economically irrelevant. A comparison of these figures with the numbers in the population census is striking. According to the 1931 Population Census there were 3.9 million families whose family head was employed in agriculture. Of them, 2.54 million families had a "farmer" (either an owner operator, a tenant or a sharecropper) as a family head, while 1 million families had a wage worker and another 0.39 million families had family heads employed in agriculture with different contractual arrangements (basically, specialized wage workers). The sum of the two last categories is very close to the number of micro-farms reported in the Agricultural Census. Hence, it is possible that some of these workers were employed in their micro-plots only a part of the year (say, 105 days, thus qualifying as "full-time employment") but worked the remaining part of the year in other farms as wage workers (say, 120 days or so, or less but earning the lion's share of their incomes from this alternative source). This suspicion is confirmed by the fact that in some provinces the total of full-time employed obtained using the data in the Indagine is above the total full-time employed as in BMSAF (1931). something conceptually impossible. We used farm-size-specific coefficients (7 for every agrarian zone) rather than agrarian zones totals but the problem persisted[15]. A solution to properly estimate "actual" family farmers is to cut all estimates below a very low threshold, say .5 or 1 hectares. A more refined way to estimate the actual number of farmers is to set a different threshold for every agrarian zone, relying on the

[15] The provinces affected were Aosta, Torino, Imperia, Savona, Bergamo, Como, Varese, Belluno, Arezzo, Livorno and Lucca.

total number of families whose family head was a farmer (owner, tenant or sharecropper) and consider only the area of a number of farms smaller than 50 hectares in the Agricultural Census equal to the number of farming families. Hence we can apply farm-size specific coefficients from the Indagine to this truncated distribution[16]. The “deleted” workers are not eliminated form full-time employment, but are assigned to the category of wage workers full-time employed according to the following procedure.

Once we have obtained the “true” number of males and females of family farms permanently employed, we can use the provincial sum of these agrarian zone data in order to obtain figures of full-employment in agriculture for wage workers, both male and female, by difference with the provincial total number of full-time employed from BMSAF (1931) [17]. The latter was duly reduced in order to take into account the in the Indagine not all provinces had data on all of their agrarian zones. In doing so, we used as the reduction factor the number of families whose family head was employed in agriculture at the agrarian zone level (“agricultural families”).

After doing so, we estimated the number of wage workers full-time employed in agriculture at agrarian zone level by distributing the provincial figure according to the same variable[18].

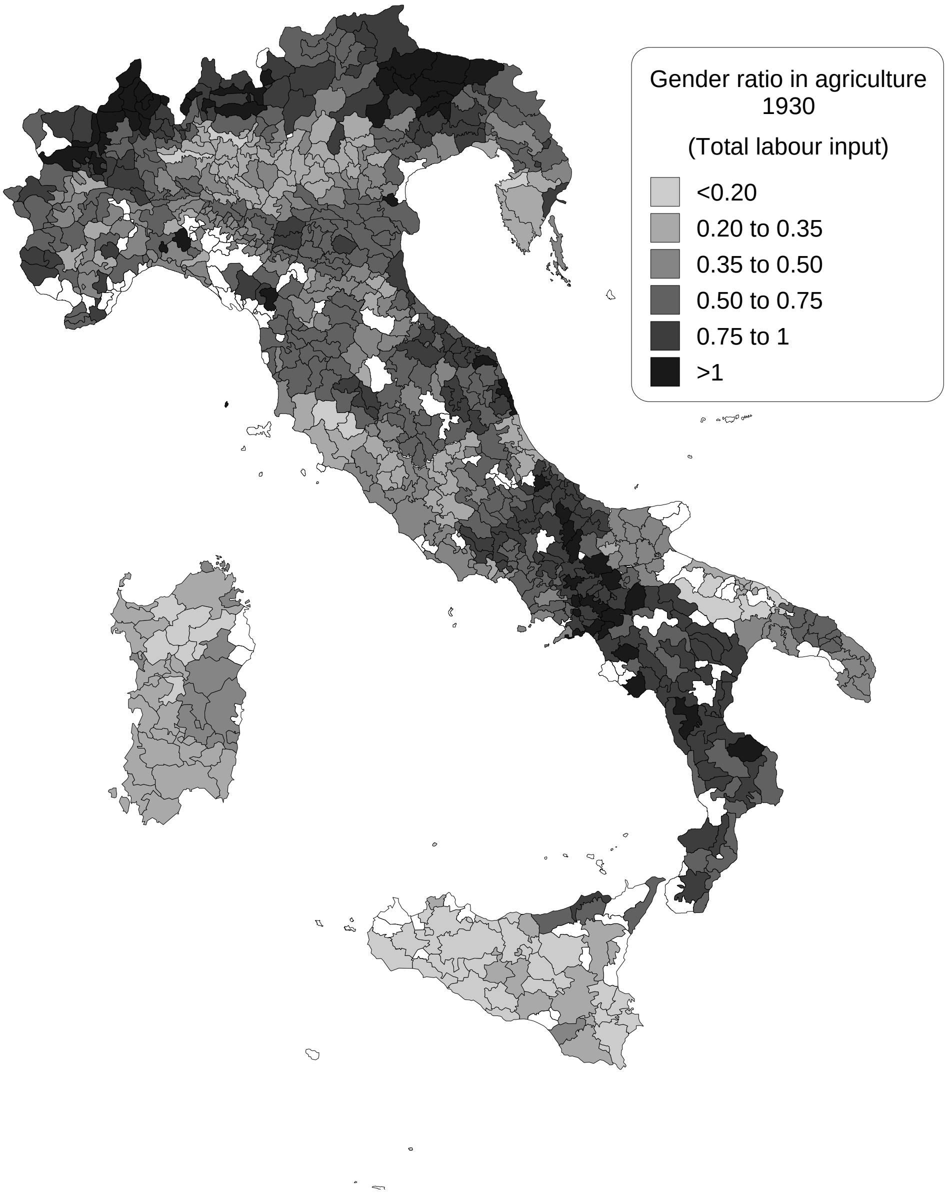
Finally, we distributed provincial figures on part-time employment from BMSAF (1931) among agrarian zones, always according to agricultural families, assuming that within the province the opportunities to engage in part time employment were similar for every agricultural family. This implies assuming similar opportunity costs within a province, and hence rather integrated local labour markets (without need to assume national ones).

Following this procedure, we were able to produce an estimate at the agrarian zone level of males and female full-time and part-time employed in agriculture. It provides the best approximation at the lowest level of geographical disaggregation we can achieve given data availability to the gender composition of the agricultural labor force. The following map reproduces it.

[16] The gender ratios of the “original” and the “adjusted” figures are strongly correlated, with a correlation coefficient of 0.9685, so this procedure cannot be a source of artificial distortion of the gender ratio.

[17] The difference turned out to be negative both for men and women for the province of La Spezia, where just one agrarian zone had data from the Inquiry. The difference is to be explained by differences between the agrarian zone farm-size distribution and the provincial one as well as by the differences in full-time employment between the two units of analysis. Hence, for this agrarian zone I simply assumed that there were no wage workers full-time employed. For the provinces of Arezzo and Livorno female wage workers presented the same problem (in both cases involving very small negative numbers), and a similar procedure was followed.

[18] An alternative to this criterion is to use families whose family head was a wage worker. Since we assumed that some farmer families had members working as wage workers, we preferred the former procedure.


Gender ratio in agriculture
1930
(Total labour input)
<0.20
0.20 to 0.35
0.35 to 0.50
0.50 to 0.75
0.75 to 1
>1

REFERENCES:

Arcari, Paola Maria (1936), “Le variazioni dei salari agricoli dalla formazione del regno al 1933” in *Annali di Statistica*, Serie VI, Vol. XXXVI.

Bandini, Mario (1935), *Caratteri e problemi della risicoltura Italiana*, INEA, Rome.

Battistini Francesco (2003) *L’industria della seta in Italia nell’età moderna* Bologna: Il Mulino

Becker, Gary (1965) “A Theory of the Allocation of Time”, *Economic Journal*, Vol. 75 n. 299, pp-493-517.

BMSAF (1931), *Bollettino Mensile di Statistica Agraria e Forestale*, March issue, Rome.

Boserup, E. (1970), *Woman's Role in Economic Development*, London.

Borgioli, Elvio (1947), *Zootecnia speciale* - 3rd ed.,1st 1939, Florence.

Broadberry, Stephen, Campbell, Bruce, Klein, Alexander and Van Leuween, Bas (2014), *British Economic Growth 1270-1870*, Cambridge University Press, Cambridge.

Carranza, Eliana. 2014. "Soil Endowments, Female Labor Force Participation, and the Demographic Deficit of Women in India." *American Economic Journal: Applied Economics*, 6(4): 197-225.

Coletti, Francesco (1925), *La Popolazione rurale in Italia e i suoi caratteri demografici, psicologici e sociali*, Federazioni Italiana dei Consorzi Agrari, Piacenza.

Cuppari Pietro (1870), *Manuale dell'agricoltore*, Barbera, Firenze.

Deconinck, Koen and Verpoorten, Marijke (2013) "Narrow and Scientific Replication of 'The Slave Trade and the Origins of Mistrust in Africa'", *Journal of Applied Econometrics*, Vol. 28, No. 1, pp. 166-169.

Federico, Giovanni (2000), “Una stima del valore aggiunto in agricoltura”, pp. 3-112 in Rey, G.M., 2000.

Federico, Giovanni (2004), “The growth of world agricultural production, 1800-1938”, *Research in Economic History*, 22, pp.125-181.

Federico, Giovanni (2005), *Feeding the World. An Economic History of Agriculture, 1800-2000*, Princeton University Press.

Galor, Oded and Özak, Ömer (2015), "The Agricultural Origins of Time Preference," CESifo Working Paper Series 5211, CESifo Group Munich.

Guiso, Luigi, Sapienza, Paola and Zingales, Luigi (2013) “Long-term persistence”, EIEF Working Paper.

Hansen, Casper Worm, Jensen, Peter Sandholt and Skovsgaard, Christian Volmar (2015), “Modern gender roles and agricultural history: the Neolithic inheritance”, *Journal of Economic Growth*.

ISTAT (1932-1937), *Catasto Agrario del Regno d'Italia 1929*, 95 provincial volumes, Rome.

ISTAT (1933), *Censimento Generale dell’Agricoltura 19 Marzo 1930, Volume I - Censimento del Bestiame, Parte II – Tavole*, Rome.

ISTAT (1934a), *Censimento Generale dell’Agricoltura 19 Marzo 1930, Volume I - Censimento del Bestiame, Parte I - Relazione Generale*, Rome.

ISTAT (1934b), *Censimento Generale dell’Agricoltura 19 Marzo 1930, Censimento delle Bonifiche Idrauliche di 1ª Categoria*, Rome.

ISTAT (1934c), *VII Censimento Generale della Popolazione 21 Aprile 1931, Volume IV, Parte Seconda-Tavole*, Rome.

ISTAT (1931–1935), *VII Censimento Generale della Popolazione 21 Aprile 1931, Volume III, Fascicoli Provinciali*, 95 provincial volumes, Rome.

ISTAT (1935a), *Censimento Generale dell'Agricoltura 19 Marzo 1930, Volume II - Censimento delle Aziende Agricole, Parte II – Tavole*, Rome.

ISTAT (1935b), *Censimento Generale della Popolazione 21 Aprile 1931, Volume IV, Parte Prima-Testo,* Rome.

ISTAT (1936a), *Censimento Generale dell'Agricoltura 19 Marzo 1930, Volume II - Censimento delle Aziende Agricole, Parte I - Relazione Generale*, Rome.

ISTAT (1936b), *Censimento Generale dell'Agricoltura 19 Marzo 1930, Volume IV – Misure Locali per le Superfici Agrarie*, Rome.

ISTAT (1937), *Censimento Generale dell'Agricoltura 19 Marzo 1930, Volume I - Censimento del Bestiame, Parte III – Classificazione degli Allevamenti Animali per Ampiezza*, Rome.

ISTAT (1939a), *VIII Censimento Generale della Popolazione 21 Aprile 1936, Volume IV – Professioni, Parte Seconda – Tavole, A) Agricoltura*, Rome.

ISTAT (1939b), *Indagine rappresentativa sulle famiglie contadine imprenditrici*, Rome.

Malanima Paolo (2002) *L'economia italiana. Dalla crescita medioevale alla crescita contemporanea*, il Mulino, Bologna.

Malanima Paolo (2009) *Pre-modern European economy* Brill, Leiden.

Martinelli, Pablo (2014) "Von Thünen South of the Alps: Access to Markets and Interwar Italian Agriculture", *European Review of Economic History*, 18, pp. 107–143.

MAIC (1861) Ministero di agricultura, industria e commercio, *Censimento della popolazione del Regno al 31 dicembre 1861* Barbera Firenze 1867

MAIC (1871) Ministero di agricultura, industria e commercio, *Censimento della popolazione del regno d'Italia al 31 dicembre 1871* Stamperia reale Roma 1874-1876

Niccoli Vittorio (1898) *Economia rurale, estimo e computisteria* UTET, Turin.

Niccoli, Vittorio and A. Fanti (1941) *Prontuario dell'agricoltore* Hoepli, Milano.

Nunn, Nathan and Wantchekon, Leonard (2011), "The Slave Trade and the Origins of Mistrust in Africa", *American Economic Review*, 101(7): 3221-52.

Österreichische Statistik, Neue Folge (1917), Volume 5, *Die Ergebnisse der Viehzählung vom 31. Dezember 1910 in den im Reichsrate Vertretenen Königreichen und Ländern*, Vienna.

Olsson, Ola and Paik, Christopher (2015), "Long-Run Cultural Divergence: Evidence from the Neolithic Revolution", Working Papers in Economics, University of Gothenburg.

Qian, N. (2008), "Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance", *Quarterly Journal of Economics*, 123.

Reggiani E. (1908) *La produzione del latte*, Hoepli, Milan.

Rey, G.M. (ed.), 2000, *I conti economici dell'Italia 3.2. Il valore aggiunto per il 1891, 1938 e 1951*, Laterza, Roma-Bari.

Statistique Agricole de la France Publiée par le Ministère de l'Agriculture, Direction de l'Agriculture (1936) *Résultats généraux de l'enquête de 1929*, Paris.

Statistik des Deutschen Reichs (1928-1929), Volumes 403, 404 and 405, *Berufszählung. Die berufliche und soziale Gliederung der Bevölkerung in der Ländern und Landesteilen*, Reimar Hobbing, Berlin.

Tassinari Giuseppe (1945) *Manuale dell' agronomo*, REDA, Rome.

Vitali, Ornello (1968), *La popolazione attiva in agricoltura attraverso i censimenti italiani*, Istituto di Demografia, Università di Roma, Rome.

Voigtländer, Nico, and Voth, Hans-Joachim (2013), "How the West "Invented" Fertility Restriction" *American Economic Review*, 103(6): 2227-64.

Wochenberichte des Instituts für Konjunkturforschung, IfKF (1929), *Regionale Unterschiede der Landwirtscaftlichen Einnahmen*, Nr. 13, Berlin.

STATISTICAL APPENDIX.

TABLE 1:
EFFECTS OF CROP MIX ON THE GENDER RATIO
IN AGRICUTURAL EMPLOYMENT

Dependent Variable:	Ln (Female Labour Input /Male Labour Input)		
	OLS (1)	OLS (2)	% of Total Output
Wheat	-0.088***	-0.064***	22.65%
	(0.019)	(0.020)	
Corn	0.086***	0.050***	3.32%
	(0.015)	(0.014)	
Rye	0.031***	0.033***	0.44%
	(0.012)	(0.011)	
Barley	0.007	0.025	0.17%
	(0.018)	(0.016)	
Rice	0.006	0.003	1.95%
	(0.011)	(0.011)	
Broad bean	0.027	0.041**	0.56%
	(0.019)	(0.019)	
Bean	-0.007	0.007	0.76%
	(0.012)	(0.012)	
Pea	0.012	0.017	0.07%
	(0.018)	(0.016)	
Lentil	-0.042*	-0.058***	0.05%
	(0.022)	(0.019)	
Chickpea	-0.051***	-0.050***	0.16%
	(0.017)	(0.016)	
Lupine	-0.001	-0.015	0.09%
	(0.017)	(0.017)	
“Cicerchia”	0.052*	0.077***	0.01%
	(0.029)	(0.028)	
Bovine meat	0.233***	0.142***	7.89%
	(0.039)	(0.041)	
Swine meat	-0.019*	-0.011	6.55%
	(0.011)	(0.011)	
Ovine meat	-0.041	-0.083	0.76%
	(0.084)	(0.083)	
Goat meat	0.237**	0.250**	0.19%
	(0.107)	(0.114)	
Cow milk	-0.185***	-0.078**	9.50%
	(0.030)	(0.033)	
Sheep milk	0.004	0.046	0.63%
	(0.066)	(0.063)	
Goat milk	-0.142	-0.213**	0.39%
	(0.101)	(0.108)	
Wool	0.012	0.021	0.87%

	(0.059)	(0.059)	
Silkworm	-0.022*	-0.021*	1.49%
	(0.011)	(0.011)	
Sugar beet	0.023*	0.024*	1.34%
	(0.013)	(0.014)	
Tobacco	0.006	-0.002	0.63%
	(0.010)	(0.010)	
Linen	-0.048*	-0.059**	0.02%
	(0.026)	(0.025)	
Hemp	0.017	0.011	1.07%
	(0.011)	(0.011)	
Potato	0.027**	0.017	2.25%
	(0.013)	(0.013)	
Asparagus	-0.026	-0.031	0.12%
	(0.022)	(0.022)	
Artichoke	-0.017	-0.007	0.23%
	(0.015)	(0.015)	
Cabbage	-0.024**	-0.017	0.96%
	(0.011)	(0.011)	
Cauliflower	-0.025*	-0.020	0.45%
	(0.014)	(0.013)	
Onion and garlic	0.017	0.013	0.37%
	(0.013)	(0.013)	
Tomato	0.038***	0.028**	1.21%
	(0.013)	(0.013)	
Cardoons, fennels and celeries	0.010	0.005	0.26%
	(0.015)	(0.015)	
Oranges	-0.004	-0.002	1.31%
	(0.021)	(0.019)	
Mandarins	-0.001	0.003	0.15%
	(0.031)	(0.030)	
Lemons	-0.021	-0.018	1.59%
	(0.026)	(0.024)	
Apples	0.039**	0.025	1.48%
	(0.015)	(0.015)	
Pears	0.010	0.012	0.89%
	(0.018)	(0.017)	
Cherries	-0.037***	-0.027**	0.48%
	(0.012)	(0.011)	
Peaches	-0.057***	-0.036***	1.17%
	(0.014)	(0.013)	
Apricots	-0.009	0.013	0.18%
	(0.021)	(0.020)	
Plums	-0.018	-0.021	0.20%
	(0.016)	(0.016)	
Almonds	-0.035**	-0.036**	1.95%
	(0.014)	(0.014)	

Walnuts	0.022	0.002	0.51%
	(0.013)	(0.013)	
Hazelnuts	-0.003	0.017	0.30%
	(0.016)	(0.015)	
Figs	0.117***	0.093***	0.45%
	(0.017)	(0.017)	
Carobs	-0.043	-0.041	0.12%
	(0.031)	(0.029)	
Quinces and Pomegranates	-0.027	-0.048*	0.02%
	(0.026)	(0.025)	
Oil, olives and by-products	-0.008	-0.022*	6.07%
	(0.012)	(0.012)	
Wine, grapes and by-products	-0.001	0.001	15.75%
	(0.013)	(0.012)	
Literacy rate		0.308	
		(0.296)	
Literacy Gender Gap		-1.458***	
		(0.330)	
Sex rate		1.411***	
		(0.154)	
Adult rate		1.452***	
		(0.408)	
Access to landownership		0.070	
		(0.122)	
Sharecropping contracts		0.013	
		(0.163)	
Wage contracts		0.263	
		(0.169)	
Tenancy contracts		0.005	
		(0.163)	
Agricultural family size		0.013	
		(0.030)	
Business owners		0.921	
		(1.264)	
Merchants		-0.776	
		(1.227)	
Craftsmen		-1.097	
		(0.986)	
Blue collars		0.151	
		(0.231)	
Low-skill services		-4.965**	
		(2.212)	
Soldiers		3.372***	
		(1.113)	
Officers		29.379**	
		(11.481)	
White-collars		-0.918	

		(1.396)
Liberal arts and Church		12.809***
		(4.235)
Well-to-do		3.008
		(2.662)
Non-professional conditions		-4.442***
		(1.471)
Access to non -agricultural markets		0.000
		(0.000)
Constant	-0.863***	-2.536***
	(0.213)	(0.570)
Number of obs	698	698
F-statistic	20.49	25.9
R-squared	0.530	0.6323

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels.

TABLE 2:
EFFECTS OF CROP MIX ON THE GENDER RATIO IN AGRICUTURAL EMPLOYMENT
(CONSOLIDATED GROUPS OF PRODUCTS)

Dependent Variable:	Ln (Female Labour Input /Male Labour Input)				
	OLS (1)	OLS (2)	IV (2^{nd} Stage) (3)	IV (2^{nd} Stage) (4)	% of Total Output
Wheat	-0.162***	-0.105***	-0.281***	-0.244***	22.65%
	(0.016)	(0.016)	(0.049)	(0.042)	
Corn	0.135***	0.056***	0.230***	0.179***	3.32%
	(0.013)	(0.014)	(0.060)	(0.065)	
Other cereals and Pulses	0.046***	0.058***	0.232***	0.165*	4.26%
	(0.013)	(0.012)	(0.083)	(0.089)	
Bovine meat	0.282***	0.170***	0.611***	0.618***	7.89%
	(0.037)	(0.037)	(0.185)	(0.160)	
Cow milk	-0.246***	-0.109***	-0.581***	-0.506***	9.50%
	(0.029)	(0.033)	(0.122)	(0.132)	
Ovine products	-0.004	-0.006	-0.060	-0.023	2.26%
	(0.016)	(0.016)	(0.038)	(0.032)	
Goat products	0.053***	0.017	0.091***	0.097**	0.58%
	(0.016)	(0.019)	(0.041)	(0.044)	
Swine meat	-0.007	0.006	-0.076**	-0.076**	6.55%
	(0.011)	(0.011)	(0.035)	(0.036)	
Silkworm	-0.016	-0.014	-0.018	-0.027	1.49%
	(0.011)	(0.011)	(0.029)	(0.021)	
Vegetables and industrial products	0.041***	0.029**	-0.031	0.004	8.90%
	(0.014)	(0.013)	(0.069)	(0.075)	
Fruits	-0.013	-0.004	-0.044	-0.039*	10.79%
	(0.012)	(0.011)	(0.032)	(0.020)	
Oil, olives and by-products	-0.001	-0.014	0.000	0.000	6.07%
	(0.009)	(0.010)	(0.015)	(0.017)	
Wine, grapes and by-products	-0.007	0.003	0.012	0.016	15.75%
	(0.012)	(0.012)	(0.026)	(0.025)	
Literacy rate		0.524*		-0.060	
		(0.299)		(0.536)	
Literacy Gender Gap		-1.841***		-0.073	
		(0.342)		(0.775)	
Sex rate		1.514***		1.014***	
		(0.160)		(0.270)	
Adult rate		1.689***		1.130	
		(0.444)		(0.690)	
Access to landownership		0.192*		-0.086	
		(0.104)		(0.183)	
Sharecropping contracts		-0.099		0.015	
		(0.164)		(0.247)	
Wage contracts		0.044		0.442	
		(0.177)		(0.270)	

Tenancy contracts		-0.189		0.082
		(0.171)		(0.213)
Agricultural family size		0.033		0.116
		(0.025)		(0.084)
Business owners		1.852		1.131
		(1.298)		(1.818)
Merchants		-0.596		0.329
		(1.432)		(1.691)
Craftsmen		-0.060		0.332
		(1.051)		(1.300)
Blue collars		0.275		-0.062
		(0.236)		(0.327)
Low-skill services		-4.363*		-6.941**
		(2.520)		(2.848)
Soldiers		3.432***		-0.944
		(0.795)		(1.430)
Officers		34.235***		41.334**
		(12.951)		(19.650)
White-collars		-2.428		-1.800
		(1.536)		(2.173)
Liberal arts and Church		20.031***		18.556***
		(4.400)		(6.201)
Well-to-do		3.854		6.826*
		(2.750)		(3.693)
Non-professional conditions		-9.203***		-6.968***
		(1.418)		(1.743)
Access to non -agricultural markets		0.000		0.000
		(0.000)		(0.000)
Constant	-0.771***	-2.833***	-0.338	-3.559***
	(0.228)	(0.546)	(0.581)	(0.944)
Number of obs	698	698	698	698
F-statistic	27.73	29.14	13.77	19.14
R-squared	0.351	0.525	0.010	0.291
First-stage statistics				
Underidentification test (Kleibergen-Paap rk LM statistic)			14.236	18.950
Chi-sq(1) P-val			0.0002	0.000
Weak identification test (Kleibergen-Paap rk Wald F statistic)			1.461	1.569

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels. Excluded instruments: altitude, temperature in January, temperature in June, summer rainfall, cattle in 1908 per male, milk yields*cow stock in 1908, pigs stock in 1908 per male, ovine stock in 1908 per male, goat stock in 1908 per male, value of vines per male, value of olive trees per male, value of mulberries per male, value of other trees per male.

TABLE 2 BIS:
EFFECTS OF CROP MIX ON THE GENDER RATIO IN AGRICUTURAL EMPLOYMENT
(CONSOLIDATED GROUPS OF PRODUCTS AND CONSOLIDATED BOVINE PRODUCTS)

Dependent Variable:	Ln (Female Labour Input /Male Labour Input)	
	OLS	IV (2nd Stage)
	(1)	(2)
Wheat	-0.102***	-0.239***
	(0.016)	(0.045)
Corn	0.055***	0.196***
	(0.015)	(0.070)
Other cereals and Pulses	0.053***	0.217**
	(0.012)	(0.098)
Bovine products	0.046*	0.119**
	(0.026)	(0.051)
Ovine products	0.006	-0.008
	(0.015)	(0.032)
Goat products	0.003	0.107**
	(0.019)	(0.049)
Swine meat	0.013	-0.086**
	(0.011)	(0.041)
Silkworm	-0.013	-0.053**
	(0.011)	(0.023)
Vegetables and industrial products	0.037***	0.013
	(0.013)	(0.081)
Fruits	0.000	-0.035*
	(0.011)	(0.021)
Oil, olives and by-products	-0.019**	-0.022
	(0.010)	(0.016)
Wine, grapes and by-products	0.003	0.020
	(0.012)	(0.027)
Literacy rate	0.488	-0.259
	(0.302)	(0.562)
Literacy Gender Gap	-2.059***	-0.958
	(0.348)	(0.698)
Sex rate	1.571***	1.214***
	(0.162)	(0.275)
Adult rate	1.985***	2.350***
	(0.469)	(0.774)
Access to landownership	0.164	-0.327
	(0.105)	(0.207)
Sharecropping contracts	-0.032	0.577**
	(0.163)	(0.243)
Wage contracts	0.032	0.606**
	(0.180)	(0.300)
Tenancy contracts	-0.189	0.167
	(0.174)	(0.228)

Agricultural family size	0.032	0.196**
	(0.025)	(0.095)
Business owners	2.044	2.537
	(1.305)	(1.843)
Merchants	-1.093	-2.122
	(1.461)	(1.883)
Craftsmen	-0.155	0.066
	(1.062)	(1.345)
Blue collars	0.265	-0.175
	(0.238)	(0.356)
Low-skill services	-3.663	-4.966*
	(2.549)	(2.870)
Soldiers	3.953***	-0.836
	(0.808)	(1.470)
Officers	32.651**	41.391**
	(13.285)	(20.159)
White-collars	-2.475	-2.483
	(1.571)	(2.256)
Liberal arts and Church	20.386***	23.968***
	(4.459)	(6.516)
Well-to-do	2.785	2.195
	(2.676)	(3.529)
Non-professional conditions	-9.304***	-6.878***
	(1.450)	(1.802)
Access to non -agricultural markets	0.000*	0.000
	(0.000)	(0.000)
Constant	-2.862***	-4.552***
	(0.568)	(1.010)
Number of obs	698	698
F-statistic	30.09	19.76
R-squared	0.515	0.223
First-stage statistics		
Underidentification test (Kleibergen-Paap rk LM statistic)		19.505
Chi-sq(1) P-val		0.000
Weak identification test (Kleibergen-Paap rk Wald F statistic)		1.730

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels. Excluded instruments: altitude, temperature in January, temperature in June, summer rainfall, cattle in 1908 per male, milk yields*cow stock in 1908, pigs stock in 1908 per male, ovine stock in 1908 per male, goat stock in 1908 per male, value of vines per male, value of olive trees per male, value of mulberries per male, value of other trees per male.

TABLE 3:
EFFECTS OF CROP MIX ON THE GENDER RATIO
IN AGRICULTURAL EMPLOYMENT
(ALTERNATIVE MEASURES OF GENDER RATIO)

Dependent Variable:	Ln of gender ratio (full-time employment in farmers' families)	Ln of gender ratio (full-time employment)
	OLS	OLS
	(1)	(2)
Wheat	-0.171**	-0.081**
	(0.077)	(0.032)
Corn	0.085*	0.062***
	(0.051)	(0.023)
Rye	0.076*	0.055***
	(0.043)	(0.020)
Barley	0.033	0.043*
	(0.068)	(0.025)
Rice	-0.043	-0.008
	(0.040)	(0.018)
Broad bean	0.179**	0.065**
	(0.070)	(0.030)
Bean	0.012	0.005
	(0.040)	(0.019)
Pea	0.123**	0.019
	(0.060)	(0.026)
Lentil	-0.148*	-0.077**
	(0.082)	(0.031)
Chickpea	-0.058	-0.066***
	(0.063)	(0.024)
Lupine	0.067	0.000
	(0.064)	(0.028)
Cicerchia	0.055	0.101**
	(0.119)	(0.046)
Bovine meat	0.299*	0.174***
	(0.160)	(0.066)
Swine meat	0.044	-0.017
	(0.040)	(0.018)
Ovine meat	-0.200	0.005
	(0.310)	(0.146)
Goat meat	0.977**	0.397**
	(0.390)	(0.181)
Cow milk	0.054	-0.111**
	(0.129)	(0.053)
Sheep milk	-0.146	0.018
	(0.226)	(0.109)
Goat milk	-0.895**	-0.322*
	(0.368)	(0.171)

Wool	0.269	-0.053
	(0.212)	(0.096)
Silkworm	-0.056	-0.042**
	(0.040)	(0.018)
Sugar beet	0.077*	0.044*
	(0.047)	(0.023)
Tobacco	-0.019	-0.010
	(0.034)	(0.017)
Linen	-0.188*	-0.137***
	(0.103)	(0.050)
Hemp	0.090**	0.010
	(0.037)	(0.017)
Potato	0.047	0.020
	(0.052)	(0.021)
Asparagus	-0.028	-0.059
	(0.069)	(0.039)
Artichoke	0.076	0.006
	(0.065)	(0.022)
Cabbage	-0.036	-0.042**
	(0.037)	(0.017)
Cauliflower	-0.048	-0.020
	(0.047)	(0.020)
Onion and garlic	0.065	0.021
	(0.049)	(0.021)
Tomato	0.045	0.032
	(0.047)	(0.022)
Cardoons, fennels and celeries	-0.006	0.017
	(0.064)	(0.024)
Oranges	-0.081	0.003
	(0.099)	(0.029)
Mandarins	0.356**	-0.013
	(0.144)	(0.045)
Lemons	-0.248**	-0.029
	(0.102)	(0.037)
Apples	0.083	0.052**
	(0.071)	(0.023)
Pears	-0.025	0.012
	(0.067)	(0.027)
Cherries	-0.005	-0.045***
	(0.048)	(0.017)
Peaches	-0.096*	-0.060***
	(0.055)	(0.022)
Apricots	0.032	0.028
	(0.090)	(0.033)
Plums	-0.035	-0.024
	(0.055)	(0.025)
Almonds	-0.150***	-0.050**

	(0.057)	(0.024)
Walnuts	-0.012	-0.005
	(0.054)	(0.021)
Hazelnuts	-0.018	0.011
	(0.055)	(0.024)
Figs	0.054	0.135***
	(0.063)	(0.025)
Carobs	0.151	-0.068*
	(0.101)	(0.040)
Quinces and Pomegranates	-0.298**	-0.057
	(0.132)	(0.040)
Oil, olives and by-products	-0.041	-0.041**
	(0.051)	(0.020)
Wine, grapes and by-products	-0.003	0.010
	(0.051)	(0.019)
Literacy rate	0.818	0.446
	(1.245)	(0.478)
Literacy Gender Gap	-4.406***	-2.164***
	(1.420)	(0.510)
Sex rate	2.691***	1.715***
	(0.534)	(0.240)
Adult rate	4.254**	1.909***
	(1.846)	(0.621)
Access to landownership	0.554	-0.099
	(0.496)	(0.203)
Sharecropping contracts	1.726***	0.075
	(0.616)	(0.256)
Wage contracts	1.519**	0.337
	(0.642)	(0.264)
Tenancy contracts	0.690	0.059
	(0.595)	(0.264)
Agricultural family size	-0.027	-0.034
	(0.113)	(0.049)
Business owners	0.029	2.256
	(6.698)	(1.989)
Merchants	-6.666	-1.129
	(5.134)	(1.906)
Craftsmen	-4.062	-2.515
	(3.872)	(1.542)
Blue collars	1.240	0.322
	(0.864)	(0.387)
Low-skill services	-2.727	-6.029*
	(8.527)	(3.330)
Soldiers	-15.532***	-19.389***
	(3.879)	(1.943)
Officers	147.994***	77.373***
	(53.069)	(19.079)

White-collars	-9.716	-3.702
	(6.169)	(2.280)
Liberal arts and Church	36.209**	24.012***
	(14.595)	(7.084)
Well-to-do	-5.297	7.243*
	(12.549)	(4.175)
Non-professional conditions	-9.934	-6.047**
	(6.400)	(2.614)
Access to non -agricultural markets	0.000	0.000
	(0.000)	(0.000)
Constant	-7.210***	-2.605***
	(2.388)	(0.938)
Number of obs	698	698
F-statistic	28.96	26.39
R-squared	0.5625	0.5961

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels.

TABLE 4:
EFFECTS OF CROP MIX ON THE GENDER RATIO
IN AGRICULTURAL EMPLOYMENT
(ALTERNATIVE MEASURES OF GENDER RATIO
AND CONSOLIDATED GROUPS OF PRODUCTS)

Dependent Variable:	Ln of gender ratio (full-time employment in farmers' families)		Ln of gender ratio (full-time employment)	
	OLS	IV (2nd Stage)	OLS	IV (2nd Stage)
	(1)	(2)	(3)	(4)
Wheat	-0.278***	-0.678***	-0.132***	-0.296***
	(0.066)	(0.174)	(0.027)	(0.063)
Corn	0.155***	0.874***	0.066***	0.163
	(0.053)	(0.256)	(0.022)	(0.100)
Other cereals and Pulses	0.144***	-0.031	0.082***	0.204
	(0.046)	(0.366)	(0.019)	(0.129)
Bovine meat	0.431***	1.830***	0.204***	0.760***
	(0.141)	(0.581)	(0.058)	(0.231)
Cow milk	-0.032	-1.111**	-0.152***	-0.680***
	(0.119)	(0.479)	(0.050)	(0.189)
Ovine products	-0.005	-0.027	-0.006	-0.043
	(0.063)	(0.125)	(0.024)	(0.046)
Goat products	-0.037	0.129	0.041	0.163***
	(0.080)	(0.180)	(0.029)	(0.060)
Swine meat	0.082**	-0.322**	0.005	-0.086*
	(0.039)	(0.153)	(0.017)	(0.051)
Silkworm	-0.046	-0.141*	-0.039**	-0.042
	(0.038)	(0.076)	(0.017)	(0.032)
Vegetables and industrial products	0.103**	0.062	0.037*	0.016
	(0.049)	(0.270)	(0.020)	(0.108)
Fruits	-0.025	-0.043	0.004	-0.049*
	(0.039)	(0.081)	(0.019)	(0.028)
Oil, olives and by-products	-0.028	0.029	-0.035**	-0.023
	(0.041)	(0.065)	(0.016)	(0.026)
Wine, grapes and by-products	0.030	-0.072	0.013	0.023
	(0.047)	(0.099)	(0.019)	(0.035)
Literacy rate	1.694	-2.974	0.873*	0.524
	(1.205)	(2.077)	(0.478)	(0.823)
Literacy Gender Gap	-4.422***	3.600	-2.686***	-1.072
	(1.433)	(2.746)	(0.529)	(1.220)
Sex rate	2.936***	-0.061	1.882***	1.228***
	(0.581)	(1.175)	(0.246)	(0.380)
Adult rate	5.016**	6.408**	2.353***	1.674*
	(2.012)	(2.957)	(0.703)	(0.965)
Access to landownership	1.094***	-0.147	0.034	-0.324
	(0.410)	(0.748)	(0.174)	(0.279)
Sharecropping contracts	1.405**	1.859*	-0.042	0.068

	(0.633)	(1.058)	(0.244)	(0.349)
Wage contracts	1.109	2.704**	0.038	0.451
	(0.699)	(1.085)	(0.267)	(0.376)
Tenancy contracts	0.174	0.870	-0.183	0.127
	(0.624)	(0.874)	(0.266)	(0.296)
Agricultural family size	0.027	0.041	0.011	0.109
	(0.093)	(0.342)	(0.040)	(0.120)
Business owners	0.888	-5.228	3.513*	2.783
	(6.360)	(8.385)	(2.048)	(2.714)
Merchants	-5.085	-4.046	-0.988	-0.559
	(5.645)	(7.298)	(2.230)	(2.430)
Craftsmen	0.184	2.271	-0.620	-0.451
	(4.269)	(5.566)	(1.631)	(1.848)
Blue collars	1.566*	-0.260	0.475	0.030
	(0.885)	(1.293)	(0.389)	(0.469)
Low-skill services	-1.379	-6.171	-4.991	-8.123**
	(8.920)	(10.079)	(3.792)	(4.135)
Soldiers	-16.050***	-24.995***	-18.697***	-24.605***
	(2.798)	(5.929)	(1.400)	(2.099)
Officers	185.490***	168.236**	83.536***	95.454***
	(50.163)	(79.025)	(20.762)	(28.516)
White-collars	-12.793**	-4.865	-5.719***	-5.271*
	(5.935)	(8.201)	(2.460)	(3.199)
Liberal arts and Church	54.739***	42.889*	34.640***	33.709***
	(15.211)	(23.467)	(7.086)	(9.406)
Well-to-do	-12.274	1.247	7.703*	12.571**
	(13.638)	(14.975)	(4.078)	(5.363)
Non-professional conditions	-26.616***	-19.268***	-12.996***	-10.600***
	(5.811)	(6.923)	(2.375)	(2.848)
Access to non -agricultural markets	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-10.099***	-10.479***	-3.321***	-3.542**
	(2.430)	(3.776)	(0.890)	1.395)
Number of obs	698	698	698	698
F-statistic	43.16	17.22	46.23	52.56
R-squared	0.474	0.183	0.491	0.359

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels. First stage statistics are the same as in table 2.

TABLE 5:
EFFECTS OF CROP MIX ON THE GENDER RATIO
IN AGRICULTURAL EMPLOYMENT
("BARE-BONES" SPECIFICATION)

Dependent Variable:	Ln (Female Labour Input /Male Labour Input)		
	OLS	OLS	IV (2nd Stage)
	(1)	(2)	(3)
Wheat	-0.128***	-0.097***	-0.329***
	(0.013)	(0.015)	(0.063)
Other field crops	0.135***	0.129***	0.424***
	(0.022)	(0.022)	(0.095)
Livestock products	0.093***	0.139***	0.367*
	(0.027)	(0.023)	(0.207)
Tree crops	0.026*	0.035***	0.136
	(0.015)	(0.012)	(0.107)
Literacy rate		0.621**	-0.187
		(0.270)	(0.568)
Literacy Gender Gap		-2.381***	-2.067***
		(0.322)	(0.437)
Sex rate		1.574***	1.119***
		(0.150)	(0.317)
Adult rate		1.579***	0.015
		(0.431)	(1.023)
Access to landownership		0.358***	0.187
		(0.101)	(0.308)
Sharecropping contracts		-0.076	0.766**
		(0.162)	(0.387)
Wage contracts		-0.061	0.343
		(0.179)	(0.384)
Tenancy contracts		-0.269	0.343
		(0.168)	(0.348)
Agricultural family size		0.025	-0.022
		(0.022)	(0.043)
Business owners		2.141	1.341
		(1.352)	(2.281)
Merchants		-1.695	-1.293
		(1.469)	(2.945)
Craftsmen		-0.077	0.307
		(1.044)	(1.419)
Blue collars		0.113	-0.977*
		(0.222)	(0.517)
Low-skill services		-3.540	-6.118*
		(2.445)	(3.331)
Soldiers		2.248***	-7.567**
		(0.719)	(2.921)
Officers		40.208***	60.190**
		(12.461)	(26.598)

White-collars		-2.871*	-3.664
		(1.514)	(2.286)
Liberal arts and Church		20.451***	19.565***
		(4.431)	(6.198)
Well-to-do		2.449	-6.472
		(2.705)	(5.556)
Non-professional conditions		-9.578***	-5.215**
		(1.475)	(2.123)
Access to non -agricultural markets		0.000	0.000
		(0.000)	(0.000)
Constant	-1.523***	-3.517***	-4.205**
	(0.280)	(0.486)	(1.644)
Number of obs.	698	698	698
F-statistic	30.91	41.99	18.22
R-squared	0.166	0.507	0.176
Underidentification test (Kleibergen-Paap rk LM statistic)			16.652
Chi-sq(1) P-val			0.000
Weak identification test (Kleibergen-Paap rk Wald F statistic)			4.277

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels.

TABLE 6:
THE DIFFERENTIAL EFFECT OF
CATTLE RAISING VS SPECIALISED INTENSIVE MILK PRODUCTION,
FURTHER EVIDENCE

Dependent Variable:	Ln (Female Labour Input /Male Labour Input)				
	50 products				
	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)
Bovine meat	0.142***	0.069***	0.097**	0.088***	0.143***
	(0.041)	(0.026)	(0.041)	(0.028)	(0.040)
Cow milk	-0.078**		-0.030		-0.060*
	(0.033)		(0.034)		(0.033)
% Non-working cows		-0.348***	-0.323***		
		(0.090)	(0.095)		
% Cow stock in large herds				-0.355***	-0.329***
				(0.112)	(0.114)
Other products	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Number of obs.	698	698	698	698	698
F-statistic	25.9	26.82	26.19	25.1	24.89
R-squared	0.632	0.6393	0.629	0.6364	0.638

	13 groups of products				
	OLS	OLS	OLS	OLS	OLS
	(6)	(7)	(8)	(9)	(10)
Bovine meat	0.170***	0.072***	0.138***	0.096***	0.178***
	(0.037)	(0.026)	(0.038)	(0.027)	(0.037)
Cow milk	-0.109***		-0.074**		-0.094***
	(0.033)		(0.035)		(0.033)
% Non-working cows		-0.300***	-0.245**		
		(0.088)	(0.095)		
% Cow stock in large herds				-0.356***	-0.324***
				(0.107)	(0.108)
Other products	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Number of obs.	698	698	698	698	698
F-statistic	29.14	29.31	28.26	28.15	27.1
R-squared	0.525	0.528	0.531	0.5282	0.5329

Notes: All products expressed as Ln(1+Value of Gross Saleable Production of the Product/Male Labour Input). Robust standard errors in brackets. ***, ** and * denote significance at the 1, 5 and 10% levels.

DESCRIPTIVE STATISTICS

Variable	Obs.	Mean	Std. Dev.	Min	Max
Gender ratio	698	-0.661	0.546	-2.833	1.006
Wheat	698	6.607	1.519	0.000	9.925
Rye	698	1.617	1.898	0.000	6.893
Barley	698	1.549	1.377	0.000	5.710
Corn	698	4.188	1.887	0.000	7.880
Rice	698	0.455	1.587	0.000	9.493
Oranges	698	0.752	1.695	0.000	10.035
Mandarins	698	0.284	0.857	0.000	6.863
Lemons	698	0.430	1.261	0.000	9.121
Apples	698	3.100	1.922	0.000	8.376
Pears	698	3.123	1.555	0.000	7.059
Cherries	698	2.053	1.721	0.000	7.214
Peaches	698	2.190	1.714	0.000	7.416
Apricots	698	0.498	0.992	0.000	7.850
Plums	698	1.274	1.332	0.000	6.485
Almonds	698	1.407	2.122	0.000	8.574
Walnuts	698	1.832	1.780	0.000	7.459
Hazelnuts	698	0.454	1.228	0.000	7.408
Figs	698	1.497	1.732	0.000	7.171
Carobs	698	0.166	0.791	0.000	7.222
Quinces and Pomegranates	698	0.260	0.732	0.000	5.982
Sugar beet	698	0.835	1.829	0.000	8.288
Tobacco	698	1.122	1.803	0.000	7.408
Linen	698	0.212	0.591	0.000	5.614
Hemp	698	0.642	1.469	0.000	8.125
Oil, olives and by-products	698	3.176	2.932	0.000	8.967
Wine, grapes and by-products	698	5.940	1.719	0.000	10.824
Broad bean	698	2.063	1.846	0.000	6.706
Bean	698	2.694	1.701	0.000	6.624
Pea	698	0.570	1.055	0.000	5.346
Lentil	698	0.406	0.956	0.000	5.431
Chickpea	698	1.138	1.400	0.000	6.242
Lupine	698	0.575	1.165	0.000	5.320
Cicerchia	698	0.232	0.612	0.000	3.650
Potato	698	3.978	1.772	0.000	8.665
Asparagus	698	0.343	0.863	0.000	5.958
Artichoke	698	0.663	1.366	0.000	6.698
Cabbage	698	2.302	1.950	0.000	7.940
Cauliflower	698	1.260	1.632	0.000	8.864
Onion and garlic	698	1.338	1.586	0.000	7.418
Tomato	698	2.218	2.002	0.000	8.288
Cardoons, fennels and celeries	698	1.052	1.449	0.000	7.105
Bovine meat	698	5.818	1.049	0.910	10.244
Swine meat	698	4.873	1.888	0.000	9.019

Ovine meat	698	3.171	1.544	0.000	6.836
Goat meat	698	2.013	1.276	0.078	8.375
Cow milk	698	5.727	1.285	0.773	10.290
Sheep milk	698	2.964	1.523	0.000	6.811
Goat milk	698	2.493	1.458	0.100	9.470
Wool	698	3.340	1.535	0.000	7.326
Silkworm	698	2.250	2.202	0.000	6.800
Bovine products	698	6.507	1.136	1.295	10.960
Ovine products	698	4.199	1.654	0.000	7.891
Goat products	698	2.872	1.497	0.171	9.759
Vegetables and industrial products	698	5.369	1.430	0.000	9.967
Fruits	698	5.159	1.759	0.000	10.092
Other cereals and Pulses	698	4.576	1.387	0.000	9.499
Vines	698	6.073	1.800	0.000	11.078
Olive trees	698	1.907	1.817	0.000	5.962
Mulberries	698	1.214	1.515	0.000	5.307
Other trees	698	2.237	1.216	0.000	6.110
Cattle 1908	698	0.721	0.410	0.025	4.178
Pigs 1908	698	0.356	0.244	0.000	1.535
Ovines 1908	698	0.935	0.772	0.000	3.925
Goats 1908	698	0.401	0.487	0.000	5.021
Cow milk production in 1908	698	2.155	0.996	0.000	6.663
Altitude	698	492.485	465.714	1.330	2602.291
Temperature in January	698	4.566	3.908	-10.804	12.034
Temperature in June	698	19.453	3.156	5.226	23.692
Summer rainfall	698	190.736	135.033	3.300	740.250
Literacy rate	698	0.769	0.159	0.375	0.990
Sex rate	698	1.065	0.128	0.349	2.076
Adult rate	698	0.860	0.033	0.649	1.189
Access to landownership	698	0.431	0.233	0.047	0.985
Sharecropping contracts	698	0.251	0.238	0.000	0.905
Wage contracts	698	0.428	0.182	0.037	0.933
Tenancy contracts	698	0.172	0.162	0.000	0.860
Agricultural family size	698	5.076	0.948	3.218	9.950
Business owners	698	0.035	0.016	0.004	0.123
Merchants	698	0.051	0.018	0.013	0.131
Craftsmen	698	0.047	0.017	0.000	0.115
Blue collars	698	0.155	0.108	0.004	0.575
Low-skill services	698	0.017	0.011	0.000	0.103
Soldiers	698	0.006	0.016	0.000	0.409
Officers	698	0.001	0.002	0.000	0.017
White-collars	698	0.025	0.025	0.002	0.200
Liberal arts and Church	698	0.014	0.006	0.004	0.048
Well-to-do	698	0.009	0.006	0.000	0.058
Non-professional conditions	698	0.040	0.017	0.005	0.142
Access to non -agricultural employment	698	96601.370	32068.060	40174.210	294770.600

Notes: Gender ratio is expressed as ln(Female labour input/male labour input). All product variables, as well as the value of trees and animal stock in 1908, are expressed as ln(1+GSP/male labour input).