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Women and Part-Time Farming: Understanding Labor Supply Decisions in Italian Farm Households

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The pronounced gender gap in Italian agriculture is reflected by lower levels of female labor force participation, labor supply and managerial positions in the farm sector, coupled with their higher incidence of part-time work. The objective of the paper is to investigate the drivers of farm holders' labor supply decisions while controlling for gender differences. Using micro-data from the Italian agricultural business survey (REA), this study employs a random effects ordered probit over the period 2002-2009. The results highlight significant gender differences in labor market responses. In particular, farm size and livestock systems are found to increase the on-farm labor supply of male farm holders, reflecting the role of men in the farm and gender differences in ownership, control and decision making over productive resources. The diverse impact of farm subsidies on labor supply may suggest the presence of credit constraints in female-operated households, preventing the capitalization of subsidies into fixed assets.

Keywords: on-farm labor supply, part-time farming, gender-gap in agriculture, Italy.

JEL codes: Q12, J22, J16, J43.



1. Introduction

Despite general growth in female employment in the European Union (EU), women continue to lag behind men in labor force participation. Especially in rural areas, and in those more remote regions, women are under-represented in the labor market. In Italy, the gender employment gap is one of the most pronounced in the EU and, in predominantly rural areas, the difference between women's share in the total population and the economically active population is the largest, equivalent to almost 10 percentage points in 2009 (European Commission, 2012). Although the promotion of gender equality is high on the political agenda¹, significant gender gaps are found in the EU, especially in rural areas, in terms of employment (difference between labor market participation rates), pay (difference between earnings), and decision-making (representation of women in decision-making processes and positions).

The participation of women is even lower in agriculture, which still remains largely a man's world. This is mainly attributed to gender roles, which become key determinants for the allocation of responsibilities and resources within the household (FAO, 2011)². Whereas men are generally more active in the labor market (Bojnec and Dries, 2005) and predominantly in agricultural decision-making, women are assumed to specialize in household related tasks. Due to child care and family responsibilities, women are often characterized by lower rates of farm participation and farm labor supply (Rizov and Swinnen, 2004). Therefore, the distinction between part-time and full-time employment is often a consequence of gender differences. In this respect, the gender dynamics within the farm household are deep-rooted in the European folk song "farmer in the dell" (the farmer in the dell, the farmer takes a wife, the wife takes a child, etc.), where the role of men as farmers and that of women as child bearers is repeated (Meinzen-Dick, 2013).

¹ Gender equality is enshrined in the Charter of Fundamental Rights of the EU and in the Universal Declaration of Human Rights of the United Nations. It has also been reinforced in the framework of the Millennium Development Goals, with the objective to 'promote gender equality and empower women'.

² Gender refers to the social roles and identities associated with what it means to be a man or a woman. Gender roles do change over time, and they can be changed through social action and policy.

Motivated by the gender gap in agriculture, the main objective of the study is to explore the drivers of Italian farm holders' labor supply and empirically test whether significant gender differences exist in such labor decisions. In particular, the empirical analysis compares male- and female-operated farm households and explores the following questions: (i) is there a correlation between farm holders' and spouses' labor decisions? (ii) what is the relationship between pluriactivity and part-time farming, i.e. how does the off-farm wage affect the amount of labor supplied on the farm? (iii) how important are farm structural characteristics? (iv) what is the impact of policy variables, i.e. farm subsidies, on the farm holders' on-farm labor supply decisions?

The remainder of the paper is organized as follows. The next section discusses the gender gap in Italian agriculture. This is followed by the theoretical framework, which is outlined in section 3. The methodology and data used are presented in section 4 and section 5 respectively. The estimation results are discussed in section 6, and section 7 concludes.

2. Gender Gap in Italian Agriculture: Part-time Employment and Decision-Making

An important feature of the Italian labor market, common to all EU countries, is the much larger share of females in part-time employment in comparison to males, representing respectively 31.8 per cent and 7.4 per cent of the total employment (15-64 years) in 2013 (Eurostat, LFS). On one hand, part-time employment can be seen as an attempt to balance paid employment with domestic responsibilities, so that higher female employment rates can be observed despite the reduced career prospects. On the other hand, this could reflect the gender gap in employment, since the primary role of women is commonly seen as being wives and mothers, and thus involved in the running of the family and household related tasks. As a consequence, the time burden of these unpaid activities may constrain women engagement in the labor market, especially in those more remote and rural areas, which often lack of infrastructure and child care facilities.

As supported by the statistical evidence, this gender gap is more pronounced in the agricultural sector. Based on the 2010 Italian Agricultural Census (ISTAT), Figure 1 shows the number of days worked on the farm by Italian farm holders. The gender difference in labor supply is quite pronounced. Although part-time farming is a predominant feature in Italy, with over 85 per cent

of farm holders supplying labor on a part-time basis, this trend is more accentuated for female farm holders, accounting for 92.5 per cent. The definition of full-time employment is based on the Eurostat and corresponds to 1,800 annual hours, equivalent to 225 working days of eight-hours each, unless the national provisions governing contracts of employment are indicated.

(Figure 1 about here)

As summarized in Table 1, the role of women in agriculture seems to be more linked to household production than actual decision-making and management of the farm business. Despite improvements over time, in 2010 only a third of farm holders in Italy were females, although women comprise around 43 per cent of both regular farm labor force and family labor.

(Table 1 about here)

Moreover, farm size and economic performance differ across male- and female-operated farms, with the latter being on average smaller in terms of physical size, such as utilized agricultural area (UAA), and economic size, i.e. standard output (SO).

Low levels of educational attainment characterize both male and female farm holders, with 17.5 per cent of farm holders with secondary education and 6 per cent with tertiary education. Specific agricultural training accounted for an even lower share, equivalent to 5.3 per cent for men and 1.5 per cent for women (2010 Italian Agricultural Census, ISTAT). To some extent, these gender differences may suggest that women end up as farm managers without much formal training and perhaps without choosing an agricultural career in the first place (European Commission, 2012).

Consistent with the gender gap in Italian agriculture, this study investigates whether gender differences are also reflected in farm holders' labor supply decisions. The conceptual framework is presented in the next section.

3. Theoretical Framework

The farm-household model, following Singh et al. (1986), serves as a framework for studying farm holders' labor supply decisions. Based on neoclassical assumptions, the model integrates agricultural production, consumption and labor supply decisions into a single conceptual framework and provides insights into the driving forces behind such decisions in a behavioral sense. Labor supply decisions are viewed within the framework of household utility

maximization. Assuming a competitive labor market, the farm household, and for simplicity the farm holder³, is assumed to maximize a utility function over consumption (C) and leisure (L)⁴, subject to time, income and production constraints:

$$\text{Max } U = U(C, L; H, Z_h) \quad (1)$$

where H is a vector of personal variables and Z_h is a vector of characteristics of the household. Total time endowment (T) is allocated between farm work (F), off-farm work (O), and leisure (L):

$$T = F + O + L \quad (2)$$

where $F, O \geq 0$ and $L > 0$. Total consumption is subject to the income constraint, which comprises net farm income (farm output PQ minus the costs of production IX), off-farm wages (W) and exogenous wealth, or unearned income (V):

$$C = PQ - IX + WO + V \quad (3)$$

where Q is the quantity of output produced by the farm and P is its price; X is the vector of purchased inputs, including farmland services and hired labor, and I is the vector of their prices. Lastly, on-farm labor is dependent on the production function, which imposes the final constraint on the household utility maximization:

$$Q = f(F, X; H, Z_f) \quad (4)$$

where total production is a function of farm labor and the quantity of purchased inputs.

³ The household is assumed to act as a single decision maker, i.e. from the perspective of the household head. The theoretical framework can also be extended to a collective approach, where the household's decisions are the result of a bargaining process between household members.

⁴ In the household model, leisure denotes home time not spent in market labor supply and thus includes 'pure' leisure as well as household work (Apps and Rees, 1997).

The efficiency of farm production depends on personal characteristics of human capital, as well as a vector of farm specific characteristics (Z_f).

Hence, the farm household, in order to maximize household welfare, is faced by a simultaneous decision over the quantity of consumption goods to purchase, the hours of farm and off-farm work to supply, and the quantity of purchased farm inputs. The optimal levels of farm and off-farm employment are obtained by solving the Kuhn-Tucker conditions, and thus by equating the marginal rate of substitution between consumption and leisure to the market wage and to the marginal value product of farm labor.

A key factor in determining the time allocation decisions of farm workers is the wage rate, which represents the opportunity cost of leisure. In the neoclassical model, an increase in the wage rate has an unpredictable effect on labor supply decisions due to two opposing effects: it can lead individuals to work more, due to higher returns of work time (substitution effect), or it may lead to work less time, since the same amount of income can be earned by working less and thus more leisure time can be afforded (income effect). In line with the significant share of family-workers in the sector, both the farm income and the off-farm wage will affect individuals' decisions of labor supply. On the other hand, an increase in the unearned income will only lead to an income effect, causing the individual to work less.

Furthermore, special attention has been given to the impact of subsidies on farmers' income and their labor allocation. In this respect, there is no predictable effect of farm subsidies on labor supply, apart from increasing the marginal value of farm labor, increasing household wealth and reducing income variability (Hennessy and Rehman, 2008). This is also supported by the mixed empirical findings in the literature, so that, from a theoretical point of view, it seems crucial to recognize the way these payments are viewed by the household (Ahearn et al., 2006). Coupled payments, dependent on the level of production, are often considered as an increase in the farm wage, whereas decoupled payments, not related to the level of production, can be viewed as unearned income.

4. Empirical Methodology

The on-farm labor supply decisions of Italian farm holders are modelled through a random effects ordered probit, based on a balanced sample for the period 2002-2009. The dependent

variable, of an ordinal categorical nature, measures the daily number of hours supplied by the farm holder on the farm, where the respective four outcomes are: 0 hours, < 4 hours, 4-8 hours, and > 8 hours⁵. The latent linear response model can be specified as:

$$y_{it}^* = \beta' x_{it} + \delta_i + \varepsilon_{it}, \quad \text{for } i = 1, \dots, N; t = 2002, \dots, 2009 \quad (5)$$

where x_{it} is a set of observed variables, β' are the parameters to be estimated, and δ_i is the individual-specific and time-invariant random component. The error term ε_{it} is decomposed into an unobservable individual specific effect (μ_i), which is time-invariant, and a remainder disturbance (v_{it}), which varies with individuals and time:

$$\varepsilon_{it} = \mu_i + v_{it} \quad (6)$$

The latent nature of the dependent variable necessitates the assumption of a random effect⁶. In the random effects model the explanatory variables x_{it} are assumed to be independent of the individual effect μ_i and the remainder disturbance v_{it} , for all individuals i and time t (Baltagi, 2008).

The four ordered outcomes are modelled to arise sequentially as the latent variable y_{it}^* crosses progressively higher thresholds (Cameron and Trivedi, 2010), or cut points a_1, \dots, a_{k-1} , where k is the number of possible outcomes. In general, for a k -alternative ordered model, the following is defined:

$$y_{it} = j \quad \text{if } a_{j-1} < y_{it}^* \leq a_j, \quad \text{for } j = 1, \dots, k \quad (7)$$

where j represents a specific outcome. The observed ordinal responses can be summarized as:

$$\begin{aligned} y_{it} = 1 & \quad \text{if } y_{it}^* \leq a_1 \\ y_{it} = 2 & \quad \text{if } a_1 < y_{it}^* \leq a_2 \\ y_{it} = 3 & \quad \text{if } a_2 < y_{it}^* \leq a_3 \\ y_{it} = k & \quad \text{if } a_{k-1} < y_{it}^* \end{aligned} \quad (8)$$

⁵ These outcomes are the results of data availability.

⁶ One of the advantages of the random effects model, as opposed to a fixed effects model, is the possibility to capture the effect of time-invariant covariates and thus estimate their parameters.

Therefore, for very low y_{it}^* , labor supply is zero; for $y_{it}^* > a_1$, the number of hours increases up to 4 hours; for $y_{it}^* > a_2$, labor supply increases further to 4-8 hours; and lastly for $y_{it}^* > a_3$, labor supply is over 8 hours. The regression parameters β' and the $k - 1$ thresholds parameters are obtained by maximising the log likelihood with $p_{itj} = \Pr(y_{it} = j)$. The sign of the regression parameters determines whether the latent variable, y_{it}^* , increases with the regressor. Hence, when β_j is positive, then an increase in x_{itj} necessarily increases the probability of being in the highest category ($y_{it} = k$), which is equivalent to the farm holder working more than 8 hours on the farm. This implicitly decreases the probability of being in the lowest category ($y_{it} = 1$), of working 0 hours. In order to explore whether substantial gender differences in labor supply decisions exist, the model is estimated separately for male and female farm holders, such that $i = m, f$.

5. Data

5.1. Data Source and Variables

This study is performed on data from the Italian agricultural business survey (Indagine REA - Risultati Economici delle Aziende agricole), collected by the Italian National Institute for Statistics (ISTAT). The annual survey investigates the economic results of farms and their multifunctionality, through the off-farm income of households involved in agricultural production. The REA started in 1997 and is now integrated with the European FADN-RICA network, carried out by the Italian National Institute for Agricultural Economics (INEA). The survey is the main source of micro-data for holdings of any dimensions⁷ and the random sample is a representative of the Italian agriculture, stratified according to the geographical region, type of farming and economic size.

The working sample used for the empirical analysis consists of an eight-wave balanced panel, covering 3,564 Italian agricultural holdings for the period 2002-2009. As mentioned in the previous section, the dependent variable measures the number of hours supplied on farm (daily average) by the farm holder. The explanatory variables comprise some personal characteristics of

⁷ The reference population includes all agricultural holdings of at least one hectare of UAA or below one hectare and with turnover of more than 2,066 €.

the farm holder, such as age, gender and marital status, consistent with human capital and life-cycle considerations. A limitation of the study is the impossibility to control for the educational attainment and specific agricultural training of farm holders, as these are missing from the survey.

The correlation between farm holder and spouse is examined through their on-farm labor supply (hours) and their participation in off-farm employment (dummy). The household size, measured by the number of family members⁸, is supposed to affect the labor supply of farm holders via their demand for home time and consumption (Kimhi, 1996; Kimhi, 2000). The age of family members is also missing from the survey – accounting for the presence of children, especially young children < 6 years, would have improved the analysis, most likely drawing significant differences between male and female farm holders.

Several farm characteristics are used as control variables. These include family labor working full-time on the farm (excluding the holder and the spouse)⁹, the presence of hired labor, the physical size of the farm (UAA in hectares), the type of farming (crops, livestock, mixed), the share of own consumption in total output (as a proxy for market integration to distinguish between commercial holdings and subsistence farms), and the presence of on-farm diversification activities (i.e. agritourism, contractual work, aquaculture, maintenance of the landscape). The geographical location of the farm is expressed in terms of altitude (plain, hill, mountain) and region at the European NUTS-1 level (North-West, North-East, Centre, South, Islands).

Lastly, financial characteristics concern the amount of income received in off-farm employment (€), the presence of unearned income such as pension or capital income, and the amount of total farm subsidies (Common Agricultural Policy and other regional payments) received by the agricultural holding¹⁰. For a detailed definition of the variables included in the analysis see Table 2.

⁸ Household size accounts for the total number of people living in the same household. This information is captured through the presence of holder, spouse and number of family members supplying any labor on-farm and/or receiving any off-farm income.

⁹ Family labour is measured in full-time units (weighted index based on the number of hours supplied on farm). This allows controlling for those family members who supply only few hours on the farm.

¹⁰ Due to data inconsistencies it is not possible to accurately disentangle farm payments into coupled, decoupled, and others (set-aside, new investments, organic farming, etc.).



(Table 2 about here)

5.2. Explorative Statistics

The summary statistics of the explanatory variables are presented in Table 3, where male- and female-operated farms account for 77 and 33 per cent respectively of the full sample. The t-test on the equality of the means across the two sub-samples suggests that, in the majority of the cases, the difference in the means is significant at the 1 per cent.

Around half of the Italian farm holders are aged 55 and over, with male farm holders displaying a larger share for the oldest age group (65 and over). Male spouses are generally more active in the labor market than female spouses, in both on farm and, especially, off-farm activities. Female farm holders generally operate smaller farms, with an average of 16 ha compared to almost 27 ha for male-operated farms, and exhibit higher levels of own consumption. The lower labor inputs utilized in female-operated farms concern both full-time family labor and particularly hired labor. Although over 70 per cent of farm production is concentrated on crops, female-operated farms present even a larger share of crop systems, and a lower share of livestock, in comparison to male-operated farms.

Farms are generally located in the hills although female-operated farms are also found in the mountains with male-operated farms more common in the plains. The participation of farm holders in off-farm employment is generally low and represents only 10 per cent of the sample. This figure is generally larger for males, who also exhibit higher levels of off-farm income. Similarly, the level of farm subsidies is significantly higher in male-operated farms and average 11,530 €, in comparison to 6,160 € in female-operated farms.

(Table 3 about here)

The distribution of farm holders by gender and on-farm labor supply is presented in Table 4. Despite the large majority of farm holders supplying 4-8 hours of daily labor on the farm, equivalent to around 73 per cent of the total sample, gender differences in labor supply are quite pronounced. Part-time employment (less than 4 hours) is more common for female farm holders (17 per cent compared to 10 per cent for males), whereas male farm holders have a higher incidence of daily labor supply over 8 hours (16 per cent compared to 11 per cent for females).

(Table 4 about here)



The negative correlation between women and labor supply is also clear from Figure 2, on the gender composition across different labor outcomes. In particular, the share of females among farm holders working more than 8 hours is less than half of the respective share among those working 0 hours (16.7 versus 38.64 per cent). Hence, not only males represent the great majority of farm holders in Italy in running the farm business, but they are also more active in the labor market, according to their labor supply on the farm.

(Figure 2 about here)

In order to test whether there are significant gender differences in the determinants of labor supply, the empirical model has been estimated separately for male and female farm holders. The discussion of the results follows in the next section.

6. Estimation Results

Table 5 reports the empirical results for the determinants of Italian farm holders' on-farm labor supply. The findings suggest that some significant gender differences exist in their labor market responses.

Age displays the expected non-linear relationship, in line with life-cycle considerations. Older individuals are more likely to work longer hours on the farm, with a turning point in between 25-34 years for males and 35-44 for females, after which their labor supply diminishes gradually. This age-related difference on the labor market is consistent with women's fertility and childbearing. Married operators are also found to work less hours per day, especially in the case of female farm holders.

A positive linear relationship exists between the on-farm labor supply of farm holder and spouse, implying a complementarity in on-farm activities. This is marginally stronger in female-operated households. The spouse's off-farm participation is also found to have a positive impact on the farm holder's labor supply, although it is statistically significant only in male-operated households. Hence, both labor market contributions from the female spouse, i.e. on-farm labor but also off-farm employment, are found to increase holders' labor supply on the farm.

Household size has a negative impact on the on-farm labor supply of farm holders, *ceteris paribus*, as the increased availability of family labor is assumed to reduce farm participation of



the household head (Kimhi, 1994; Rizov and Swinnen, 2004)¹¹. Full-time family labor is found to be a complement to the holder's labor input, for both males and females¹². Similarly, the presence of hired labor is positively associated with on-farm labor supply in female-operated farms. In this respect hired labor was expected to be a substitute for both male and female farm labor (Benjamin and Kimhi, 2006). In contrast, the physical farm size, in hectares, appears to be a positive determinant of labor supply, although statistically significant only for males. This could partly suggest different capacities of absorbing labor. Since female holders generally operate smaller farms, these may be too small to absorb more hours of labor.

Livestock production, in comparison to crops, is positively related to the on-farm labor supply of male farm holders. Overall, livestock systems are more labor intensive and may require special labor requirements, particularly when considering dairy farming, whereas crop production is more seasonal. Due to higher specialization, low seasonality and lower risk in dairy farming (Sumner, 1982), a higher demand for family labor is required in these activities, as good substitutes are not available (Kimhi, 1994). The gender difference in the statistical significance level may be a consequence of men's control over livestock resources.

Moreover, higher levels of own consumption are likely to reduce on-farm labor supply, suggesting that market integration increases the likelihood of working longer hours on the farm. On the other hand, the presence of on-farm diversification does not have a significant impact on labor supply decisions.

In line with expectations, farm location constitutes an important determinant of labor supply. Overall, farm holders are found to work less hours in mountain areas, in comparison to their counterparts in the plains, although this impact is only significant in the case of males. This may reflect different labor intensities across activities, lower input use in less favored areas and overall better farming conditions in the lowland due to geology and climate. As also argued by Kimhi (1994), farms in the mountains are generally associated with lower farm participation and with part-time work, due to the lower profitability of agriculture in these regions. Geographical location, which is strictly related to climate and farm structure, reveals similar patterns for males and females. Overall, farm holders are found to work longer hours in the North-West, followed

¹¹ Due to data limitations it is not possible to control for individuals' age and for those below working age.

¹² Full-time family labor controls for family members working only few hours on the farm. Hence, the negative results for household size (substitute) and the positive for family labor (complement) are not in contradiction.



respectively by the Centre, South, North-East and lastly the Islands. The different patterns in labor supply reflect regional agri-environmental conditions as well as time allocated to off-farm employment.

Financial characteristics are also important determinants of labor supply decisions, where high levels of off-farm income are found to reduce the number of hours on farm. Nonetheless, this relationship is not perfectly linear and displays differences based on gender. An interesting result concerns the positive sign of the first off-farm income band ($< 2,000$ €) for both males and females. This shows that a minimal level of extra income is instead associated with a higher labor supply on the farm, particularly for females. This may suggest that this extra income can be invested in farm inputs or other assets which are complementary to the role of farm holders in farm production. In this context, previous studies show that income from off-farm activities is a crucial strategy for continuing farming and for farming survival (Glauben et al., 2006; Breustedt and Glauben, 2007). The results in this study suggest that, not only participation, but also the level of off-farm income needs to be controlled for when examining the likelihood of preserving farming activities, and thus the amount of time allocated on the farm.

As discussed in the theoretical framework, the presence of unearned income, such as pension, capital and other revenues, has a negative effect on farm labor supply, due to income effect. Similarly, farm subsidies are found to have a negative impact on the number of hours worked on-farm. Despite the similar magnitude and sign of the estimated coefficients, the result is only statistically significant for males. The negative results can be a consequence of farm holders investing more heavily in physical capital and substituting capital for labor (Goetz and Debertin, 1996). In this respect, the not significant results for females could reflect their lower likelihood to invest in physical capital, due to high risk aversion or credit constraints, as the amount of subsidies received is significantly lower in female-operated farm households.

A priori, farm subsidies are assumed to increase the marginal value of farm labor, and thus, are equivalent to an increase in the wage rate. Thus, based to the neoclassical model, farm holders are driven by an income effect. Similarly, if these payments are viewed as an increase in unearned income, this can only lead to an income effect, leading individuals to work less.

In reality, the empirical evidence on the impact of farm subsidies on labor allocation is rather mixed and inconclusive, which may be the consequence of the heterogeneity across countries and various policy measures (see Tocco et al., 2014).

(Table 5 about here)

7. Conclusions

This study emphasizes the gender gap in Italian agriculture, suggesting that women continue to lag behind men in employment, specific education, managerial positions and decision-making. Although part-time farming is a predominant feature of Italian agriculture, female farm holders' labor supply is significantly lower compared to their male counterparts. To some extent, this trend can be explained by gender differences, as the role of women and their allocation of time, in terms of responsibilities and resources, remains within the household.

Using micro-data from the Italian agricultural business survey (REA) over the period 2002-2009, the paper investigates the drivers of farm holders' on-farm labor supply. The findings highlight significant gender differences in labor market responses. First of all, there is a positive relationship between labor supply decisions of holder and spouse, indicating complementarity in on-farm production, with a stronger correlation in female-operated farm households. Secondly, the relationship between pluriactivity and part-time farming is not perfectly linear and displays differences across genders. High levels of off-farm income are found to reduce the number of hours supplied on-farm, although a minimal level of off-farm income is associated with higher labor supply, especially for females. In the context of the previous literature exploring whether pluriactivity, and thus part-time farming, can be regarded as a stable condition or as a step in the way out of agriculture, the results suggest that not only off-farm participation, but also the level of off-farm income, needs to be taken into account.

Thirdly, farm structural characteristics represent important determinants of labor supply. In particular, larger farms and livestock systems are positively associated with the amount of on-farm labor supplied by male farm holders. This suggests that special labor requirements, higher specialization and technology are strictly related to the role of men in the farm, and thus reflects gender differences in ownership, control and decision making over productive resources. Lastly, the negative impact of farm subsidies on male farm holders' labor supply can be a consequence



of investing more heavily in physical capital, and thus, of the substitution of capital for labor. Since the level of subsidies is generally lower in female-operated households, this could reveal the presence of credit constraints, preventing the capitalization of subsidies into fixed assets.

In order to close the gender employment gap in agriculture, and enhance women's position in decision-making, emphasis should be placed on the differences in the resources available to men and women. Hence, a better understanding on the gender roles in agriculture is essential for the design of efficient policies aimed at increasing agricultural productivity, promoting economic growth, and achieving economic and social development goals (FAO, 2011). For instance, it would seem necessary to reflect on the provision of services in rural areas, especially under three main directions: childcare, specific education and training, and credit. Childcare facilities and better infrastructure would reduce the time devoted to domestic and household related duties, leading to a more active engagement of women in the labor market. Specific agricultural education and training would enhance women's skills and their competitiveness in agriculture. In particular, entrepreneurial and managerial skills would support women in running the farm business and performing at decision-making positions. Last but not least, the socio-economic status of women can be improved through better access to credit.

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Table 1. Gender distribution of labor in agriculture, 2005-2010

	2005		2010	
	Males	Females	Males	Females
Sole holder working on the farm				
Number of people	1,180,680	518,790	1,071,850	531,850
Share (%)	69.5	30.5	66.8	33.2
Family labor force				
Number of people	1,862,750	1,264,700	1,825,720	1,403,830
Share (%)	59.6	40.4	56.6	43
Regular labor force				
Number of people	1,980,240	1,299,180	1,944,280	1,448,420
Share (%)	60.4	39.6	57.3	42.7
Regular non family labor force				
Number of people	117,490	34,480	118,560	44,590
Share (%)	77.3	22.7	72.7	27.3

Source: Own calculations based on the Farm Structure Survey (FSS), Eurostat (2010).

Table 2. Definition of variables

Variable	Definition
Personal characteristics	
Age: 17-24	1 if farm holder is 17-24 years old; 0 otherwise
Age: 25-34	1 if farm holder is 25-34 years old; 0 otherwise
Age: 35-44	1 if farm holder is 35-44 years old; 0 otherwise
Age: 45-54	1 if farm holder is 45-54 years old; 0 otherwise
Age: 55-64	1 if farm holder is 55-64 years old; 0 otherwise
Age: 65-100	1 if farm holder is 65-100 years old; 0 otherwise
Married	1 if farm holder is married; 0 otherwise
Family characteristics	
On farm spouse : 0 hours	1 if the spouse works 0 hours on-farm; 0 otherwise
On farm spouse : < 4 hours	1 if the spouse works <4 hours on-farm; 0 otherwise
On farm spouse : 4-8 hours	1 if the spouse works 4-8 hours on-farm; 0 otherwise
On farm spouse : > 8 hours	1 if the spouse works >8 hours on-farm; 0 otherwise
Off-farm spouse	1 if spouse works off-farm; 0 otherwise
HH size	Number of family members living in the household
Farm characteristics	
Family labor units ^α	Weighted index for family labor input (excluding farm holder and spouse)
Hired labor	1 if hired labor is present on farm; 0 otherwise
Farm size	Utilized agricultural area (hectares)
Crops ^β	1 if type of farm is crops; 0 otherwise
Livestock ^β	1 if type of farm is livestock; 0 otherwise
Mixed ^β	1 if type of farm is mixed; 0 otherwise
Own consumption	Ratio of own consumption to total output
Farm diversification ^γ	1 if farm has any farm diversification activities; 0 otherwise
Plain	1 if farm is located in the plains; 0 otherwise
Hill	1 if farm is located in the hills; 0 otherwise
Mountain	1 if farm is located in the mountains; 0 otherwise
North-West	1 if farm is in the North-West NUTS-1 region; 0 otherwise
North-East	1 if farm is in the North-East NUTS-1 region; 0 otherwise
Centre	1 if farm is in the Centre NUTS-1 region; 0 otherwise
South	1 if farm is in the South NUTS-1 region; 0 otherwise
Islands	1 if farm is in the Islands NUTS-1 region; 0 otherwise
Financial characteristics	
Off-farm income: none	1 if farm holder earns 0 euro in off-farm employment; 0 otherwise
Off-farm income: < 2,000 €	1 if farm holder earns < 2,000 euro in off-farm employment; 0 otherwise
Off-farm income: 2,001-5,200 €	1 if farm holder earns 2,001-5,200 euro in off-farm employment; 0 otherwise
Off-farm income: 5,201-10,000 €	1 if farm holder earns 5,201-10,000 euro in off-farm employment; 0 otherwise
Off-farm income: > 10,000 €	1 if farm holder earns > 10,000 euro in off-farm employment; 0 otherwise
Unearned income	1 if farm holder receives any pension or capital income; 0 otherwise
Subsidies	Total amount of subsidies received (10,000 euro)

Notes: (α) The weighted index for family labor input is based on the number of hours worked on farm and has the following weights: > 8 hours = 1 unit, 4-8 hours = 0.75 unit, < 4 hours = 0.25 unit, 0 hours = 0 unit. (β) The type of farm is classified in CROPS: specialist field crops, specialist horticulture, specialist permanent crops, mixed cropping; LIVESTOCK: specialist grazing livestock, specialist granivore, mixed livestock; MIXED: mixed crops-livestock. (γ) Farm diversification is present if the farm has revenues from any of the following: agritourism, contractual work using equipment of the holding, aquaculture, maintenance of the landscape.

Table 3. Descriptive statistics by gender

Variable	Males Mean value	Females Mean value	Difference	T-test p-value
<i>Personal characteristics</i>				
Age: 17-24	0.004	0.003	0.001	0.441
Age: 25-34	0.056	0.051	0.005	0.125
Age: 35-44	0.179	0.189	-0.010*	0.063
Age: 45-54	0.222	0.249	-0.027***	0.000
Age: 55-64	0.244	0.257	-0.013**	0.034
Age: 65-100	0.296	0.251	0.044***	0.000
Married	0.405	0.405	0.000	0.960
<i>Family characteristics</i>				
On farm spouse : 0 hours	0.618	0.612	0.006	0.349
On farm spouse : < 4 hours	0.066	0.095	-0.029***	0.000
On farm spouse : 4-8 hours	0.278	0.256	0.021***	0.001
On farm spouse : > 8 hours	0.038	0.037	0.001	0.606
Off-farm spouse	0.043	0.135	-0.092***	0.000
HH size	1.874	1.777	0.097***	0.000
<i>Farm characteristics</i>				
Family labor units	0.269	0.183	0.086***	0.000
Hired labor	0.370	0.253	0.117***	0.000
Farm size	26.934	16.620	10.314***	0.000
Crops	0.704	0.767	-0.063***	0.000
Livestock	0.230	0.178	0.052***	0.000
Mixed	0.066	0.055	0.011***	0.001
Own consumption	0.072	0.121	-0.048***	0.000
Farm diversification	0.044	0.032	0.013***	0.000
Plain	0.330	0.201	0.129***	0.000
Hill	0.439	0.523	-0.084***	0.000
Mountain	0.231	0.276	-0.045***	0.000
North-West	0.189	0.218	-0.029***	0.000
North-East	0.300	0.193	0.108***	0.000
Centre	0.140	0.173	-0.033***	0.000
South	0.286	0.357	-0.071***	0.000
Islands	0.085	0.059	0.025***	0.000
<i>Financial characteristics</i>				
Off-farm income: none	0.883	0.923	-0.041***	0.000
Off-farm income: < 2,000 €	0.008	0.007	0.000	0.715
Off-farm income: 2,001-5,200 €	0.007	0.009	-0.002	0.184
Off-farm income: 5,201-10,000 €	0.032	0.022	0.010***	0.000
Off-farm income: > 10,000 €	0.070	0.038	0.032***	0.000

Unearned income	0.236	0.237	-0.001	0.805
Subsidies	1.153	0.616	0.537***	0.000
Observations	22,027	6,485		

Notes: Levels of significance: ***1%; **5%; *10%.

Table 4. Sample frequencies regarding on-farm labor supply

Farm holders	Hours worked on farm				Total
	0	< 4	4 - 8	> 8	
Males	235 (1.07)	2,026 (9.2)	16,160 (73.36)	3,606 (16.37)	22,027 (100)
Females	148 (2.28)	952 (14.68)	4,662 (71.89)	723 (11.15)	6,485 (100)
Total sample	383 (1.34)	2,978 (10.44)	20,822 (73.03)	4,329 (15.18)	28,512 (100)

Notes: Numbers in brackets represent percentages of farm holders within each sub-sample, respectively males, females and total sample.

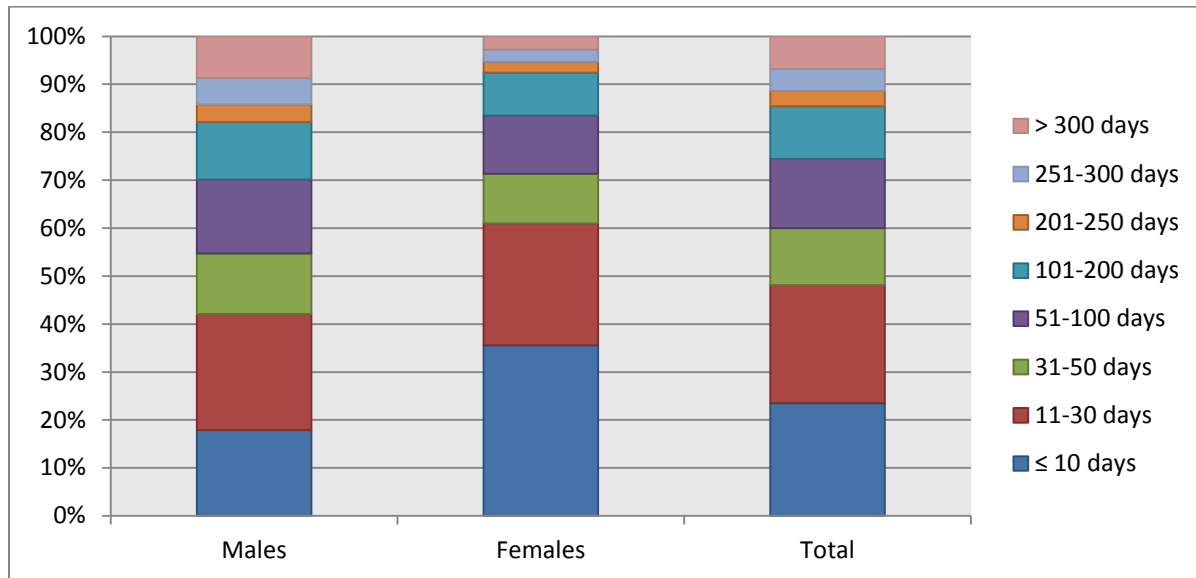
Table 5. Estimate results of on-farm labor supply: random effects ordered probit

Variable	Hours on farm	
	Males	Females
Age: 17-24	0.489** (0.205)	0.414 (0.368)
Age: 25-34	0.597*** (0.0686)	0.353*** (0.120)
Age: 35-44	0.441*** (0.0498)	0.434*** (0.0849)
Age: 45-54	0.351*** (0.0457)	0.382*** (0.0775)
Age: 55-64	0.172*** (0.0396)	0.240*** (0.0686)
Married	-0.410*** (0.0811)	-0.960*** (0.148)
On farm spouse : < 4 hours	0.125 (0.0788)	0.474*** (0.141)

On farm spouse : 4-8 hours	0.757*** (0.0750)	1.310*** (0.138)
On farm spouse : > 8 hours	2.932*** (0.0980)	3.631*** (0.179)
Off-farm spouse	0.267*** (0.0617)	0.0106 (0.0729)
HH size	-0.217*** (0.0246)	-0.265*** (0.0412)
Family labor units	0.505*** (0.0387)	0.535*** (0.0734)
Hired labor	0.0220 (0.0283)	0.158*** (0.0568)
Farm size	0.00104*** (0.000367)	0.000520 (0.000948)
Livestock	0.115*** (0.0428)	0.0178 (0.0750)
Mixed	0.0230 (0.0569)	0.0119 (0.0988)
Own consumption	-0.741*** (0.0697)	-0.713*** (0.0981)
Farm diversification	0.00574 (0.0628)	0.157 (0.135)
Hill	-0.0690 (0.0467)	-0.0492 (0.0846)
Mountain	-0.292*** (0.0523)	-0.0286 (0.0928)
North-East	-0.241*** (0.0566)	-0.789*** (0.0988)
Centre	-0.223*** (0.0678)	-0.403*** (0.100)
South	-0.240*** (0.0568)	-0.438*** (0.0837)
Islands	-0.494*** (0.0775)	-0.874*** (0.136)
Off-farm income: < 2,000 €	0.317*** (0.119)	0.808*** (0.221)
Off-farm income: 2,001-5,200 €	-0.490*** (0.123)	-0.629*** (0.195)
Off-farm income: 5,201-10,000 €	-0.429*** (0.0673)	-0.293** (0.142)
Off-farm income: > 10,000 €	-0.751*** (0.0523)	-0.250** (0.115)
Unearned income	-0.289*** (0.0345)	-0.296*** (0.0593)
Subsidies	-0.0154*** (0.00478)	-0.0156 (0.0186)
Observations	22,027	6,485

Notes: Standard errors in parentheses. Levels of significance: ***1%; **5%; *10%.

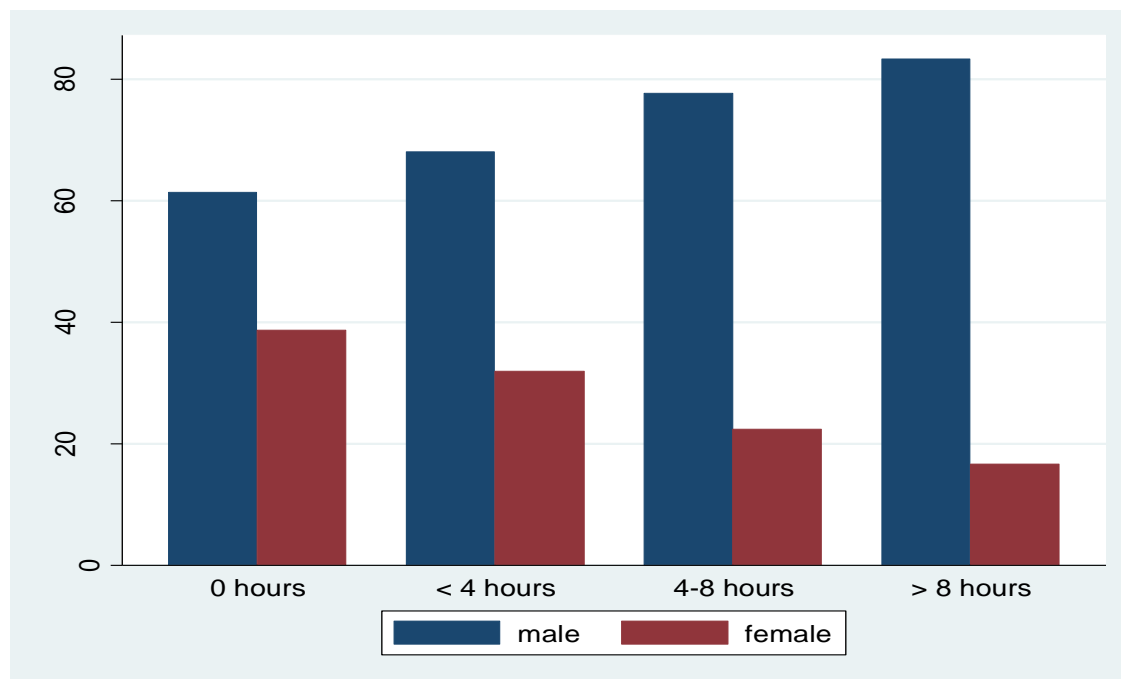
Figure 1. Number of work days supplied on-farm by Italian farm holders, 2010



Note: Work days are reported as standard eight-hour work days.

Source: Own figure based on the 2010 Italian Agricultural Census (ISTAT).

Figure 2. Gender composition by number of hours worked on farm



Source: Own figure based on the Italian agricultural business survey (Indagine REA), ISTAT.