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Trends in family labour, hired labour and contract work on French fieldcrop farms: the role of agricultural policies

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Abstract

This article analyses the factors driving the evolution of on-farm labour use, including own family labour, hired labour and contract work, in French fieldcrop farms during 1990-2007. Particular attention is given to the level and type of agricultural support. The increase in the farm labour force over the years is due to increases in hired labour and contract work which are complements for each other rather than substitutes, and complement for family labour. Crop area payments and Single Farm Payments discourage the demands of different labour types, while agri-environment, less favoured area and investment payments favour all types of labour.

Keywords: farm labour, hired labour, contract work, agricultural policies, France

JEL: J23, J43, Q12, Q18

1. Introduction

This article aims to analyse the trends in on-farm labour use, including own family labour, hired labour and contract work, and to assess the factors driving their evolution in France during 1990-2007. The role of agricultural policies, particularly their level and type of support, on the demand for hired labour and contract work and on the supply of on-farm family labour, is assessed. While a farmer's or a household's time allocation decisions between on- and off-farm work have been largely studied in the literature (e.g. Benjamin and Kimhi, 2006; El-Osta et al., 2008), decisions regarding the type of labour used on farm have rarely been investigated despite the fact that off-farm employment participation may be constrained by the possibility of substituting external labour for own labour.

Existing studies on factors behind the demand for hired labour point to the role played by global trends in farm labour productivity and mechanisation, and by farm and household characteristics and environment, such as farm size, wages, other input prices, the farm

household's education and the number of children in the household (Bhati, 1980; Benjamin et al., 1996; Kanwar, 1999; Benjamin and Kimhi, 2006; Blanc et al., 2008). However, the issue of contract work, that is to say contracting a company for specific and one-off tasks (also called outsourcing) has not received much consideration by researchers yet, although it is becoming increasingly common on farms worldwide owing to its greater flexibility (Lee and Sivananthiran, 1996; Smart, 1997; Devey et al., 2007). This paper therefore makes a substantial contribution to the literature on farms' input use decisions.

An additional contribution of this paper to the literature is the investigation of the role of agricultural policies on labour use, which has, to our knowledge, never been investigated. The evolution towards more and more decoupled policies raises the question of whether the farm labour structure will be modified in the future, which would in turn shape the rural economy. Some studies indicate that the share of hired labour in total farm labour in developed countries has increased over the last decades (Blanc et al., 2008). On the other hand, as several studies show, the introduction of decoupled payments decreases the incentives to produce and therefore may have a negative effect on the use of production factors. The question is then which type of on-farm labour is affected first by the reduction in labour use. According to Schmitt (1991) and Beckmann (2000), the institution of family farming is competitive because of the lower transaction costs within families compared with external labour. This argument might lead to the hypothesis that farms would save external labour before they would restrict the use of their own labour. The paper explores the relationship between the three types of on-farm labour with the help of a farm household model. Determinants of hired labour and contract labour demands and of on-farm family labour supply are then investigated using a simultaneous equation system applied to farm-level data for the period 1990-2007. Such a period enables the three reforms of the Common Agricultural Policy (CAP) (1992, 2000, 2003) to be captured – in particular the introduction of decoupling through crop area and livestock direct payments in 1992, and the implementation of the more decoupled instrument, the Single Farm Payment (SFP), based in France on an historic scheme.

The paper is structured as follows. The next section develops the conceptual model. Section 3 describes the data and the methodology used. Section 4 presents the results, and section 5 concludes.

2. Modelling the farm household behaviour and farm labour decisions

The household objective function is represented by a household's utility function $U(.)$ which depends positively on a consumption aggregate (I) and on leisure (Le) with the usual convexity properties (equation (1)). In particular, the increase in consumption decreases its own marginal utility and increases the marginal utility of leisure. Leisure is the difference between the total available time of household members (T) and the time that household members actually spend in remunerated activities (equation (3)). On-farm (L_f) and off-farm (L_o) remunerated activities are distinguished.

Consumption is constrained by the incomes from these activities. On-farm and off-farm activities provide the farm income. The latter is represented by a restricted profit function $RP(.)$ which depends on the annual input and output prices (p), on different fixed production factors (X), and on the different types of labour sources: that is to say, hired labour (HL) and contract labour (CL), minus the cost functions of each labour source $C(HL, w_{HL}, w_{CL}, Z)$ and $C(CL, w_{HL}, w_{CL}, Z)$ (with w_{HL} and w_{CL} the prices respectively of hired and contract labour, and Z the farm location characteristics encompassing the local conditions of its physical, economic and institutional environment), plus the farm subsidies (s) and off-farm income (I_o) (equation (2)). For hired labour, the cost not only depends on the labour market's price but also on local institutional characteristics entailing transaction costs. Costs of hired labour are nil when there is no hired labour. The same remarks hold for the contract work. Family labour is used on the farm according to a household internal equilibrium that depends on the trade-off between leisure and work and on the trade-off between on-farm and off-farm work.

In the model off-farm income (I_o) and off-farm labour supply (L_o) are assumed to be exogenous.

The farmer's programme of household utility maximisation is given by equations (1), (2), (3), (4), (5):

$$\underset{L_f, HL, CL}{Max} U(I(L_f, HL, CL), Le(L_f, HL, CL)) \quad (1)$$

Subject to

$$I(L_f, HL, CL) = RP(L_f, HL, CL, X, p) - C(HL, w_{HL}, w_{CL}, Z) - C(CL, w_{HL}, w_{CL}, Z) + s + I_o \quad (2)$$

$$L_f + Le(L_f, HL, CL) = T - L_o \quad (3)$$

$$HL \geq 0 \quad (4)$$

$$CL \geq 0 \quad (5)$$

Solutions for each type of labour demand (HL^* and CL^*) and supply (Lf^*) are given by equations (6):

$$\begin{aligned} Lf^*(T, Lo, Io, s, wHL, wCL, Z, X, p) &> 0 \\ HL^*(T, Lo, Io, s, wHL, wCL, Z, X, p) &\geq 0 \\ CL^*(T, Lo, Io, s, wHL, wCL, Z, X, p) &\geq 0 \end{aligned} \quad (6)$$

The derived demands for and supply of each labour source used on farm are calculated from this farm household model. The result is a simultaneous equation system where the different types of labour demands depend on each other. Hired labour (HL^*) and contract work (CL^*) may be censored variables, while used family labour (Lf^*) is not because it defines the farm household.

Analytical results regarding the expected effect of price or subsidy changes can be derived under particular conditions, such as a fully elastic supply of hired labour. The uncertainty of the farm income may also be investigated. However, the main aim of this theoretical framework is to specify a structural econometric model in order to identify the determinants of each type of labour use.

3. Data and methodology

3.1. Description of the variables and expectations

Farm-level data are extracted from the French Farm Accountancy Data Network (FADN) database for the period 1990-2007. Only fieldcrop farms are considered in this paper. The farms selected correspond to the European standard classification Type of Farming 1; that is to say, they derive at least 66 percent of their gross margin from cereals and other fieldcrops.

On-farm family (Lf) and hired labour (HL) are measured in Annual Working Units (AWU), corresponding to the number of annual full-time equivalents (one AWU represents 2,200 hours). Contract labour (CL) is not measured. Only the annual expenditure (ECL) on such labour ($ECL^* = wCL.CL^*$) is known. The price of hired labour (wHL) is measured by the wage per paid AWU. For farms that do not employ hired labour, the (virtual) price of hired labour is assumed to be the estimated value of the local market labour price. The latter is calculated as the predicted value from the Ordinary Least Squares (OLS) regression of the

sample farms' labour wage on yearly dummies and on localisation dummies: i) 20 dummies for the French administrative regions; ii) two dummies for location in mountainous Less Favoured Areas (LFA) and in non LFA, respectively; the reference is that the location is in a plains LFA; iii) two dummies for location at an altitude below 300 meters and at an altitude between 300 and 600 meters, respectively; the reference is location at an altitude above 600 meters. The price of contract labour (w_{CL}) cannot be calculated from the sample, as the number of hours of such labour is not available. The proxy used is not a farm-specific price, but a regionally-varying yearly price which is in fact the regional price index for contract labour, with base 1990.

The price of other inputs and outputs (p) includes the price of one input, namely land, and the prices of three outputs, namely the price of wheat, the price of other cereals and the price of oilseeds. The price of land is calculated as the rental per hectare (ha) of rented land for those farms using external land. For the other farms, the virtual price of land is assumed, estimated in the same way as in the case of the price of hired labour explained above. For outputs, the prices are calculated from the farms' revenue from the relevant crop divided by the quantity produced. Outliers, arising from time-lags between sales and payments, are excluded. For farms not producing such crops, the virtual price is assumed, estimated in the same way as for the price of hired labour and the price of rented land.

The role of agricultural policies is investigated firstly with the help of specific time period dummies accounting for the various reforms: 1990-1994, 1995-1999, 2000-2005 and 2006-2007. The break between the first two periods is 1995, since although the first CAP reform was decided in 1992, it was only fully implemented in France in 1995; similarly, although the last CAP reform dates from 2003, it was only implemented in France in 2006 and thus the break between the last two periods is 2006. Three dummies are included in the model for the periods 1995-1999, 2000-2005 and 2006-2007. The first period 1990-1994 is, therefore, the benchmark period (no decoupling) against which the other reform periods are compared. Secondly, the effect of agricultural policy support is analysed using subsidy variables (s). In the model, subsidies received by farms are separated into various pillar 1-type and pillar 2-type categories of subsidies: SFP area payments, payments to crop area ('crop subsidies'), payments to livestock headage ('animal subsidies'), agri-environmental subsidies, subsidies to farms situated in LFA, and subsidies to farm investment. In order to avoid capturing size effects, all subsidies are divided by the farm utilised agricultural area (UAA) and therefore represent the average subsidy per ha received by each farm. Also, in order to check for any

effect that varies depending on the policy reform, subsidies are divided into periods; for example, the variable ‘crop subsidies per ha 90-94’ represents the amount of payments to crop area received by the farms per ha of UAA during the period 1990-1994. For SFP, the period is always 06-07, since they were introduced in 2006 in France. For agri-environment subsidies, the period 90-94 is omitted as such payments were only introduced in 1995. Finally, the animal subsidies and the LFA subsidies are included as a variable for the full period, as it is not expected that their effect varies during the period for fieldcrop farms.

The fixed production factors (X) are proxied by the UAA in ha. The other explanatory variables (Z) include:

- farm technology proxied by the UAA in ha under irrigation;
- the share of rented land in total UAA;
- the legal status of the farm: two dummies representing partnerships and companies, respectively; the reference being individual farms;
- the age of the head of the farm;
- the education of the head of the farm: two dummies representing lower-secondary and higher-secondary education completed; the reference being only primary education completed;
- localisation variables: regional dummies, LFA dummies and altitude dummies as explained above in the regressions of the price of hired labour, the price of rented land, and the price of outputs.

All value variables are deflated by the national consumer price indices, with base 1990.

The following influences of the diverse explanatory variables are expected. The labour prices are expected to have a negative influence on their respective labour demand, since labour is considered to be a normal good. The influence of the price of one type of labour on another type of labour is expected to be positive, as the different labour forces are potentially substitutes for each other. The price of land is expected to negatively influence the labour demands as land and labour are both necessary for farming activities. The output prices are expected to have a positive impact on labour use, since higher expected revenues give incentives to expand the farm operations. Larger farms and farms using irrigation are expected to use more labour in general, owing to the increased need of labour. There is no expectation about the influence of the share of rented land. Regarding the legal status, individual farms are expected to use less own labour than partnerships or companies as they can supply less, but there is no expectation about the use of external labour. It is expected that

family labour work more on farms held by older farmers and that these farms employ more external labour, to help the farmers in heavy tasks. More educated farmers are expected to work less on-farm as they may participate more in better paid off-farm activities, and use cheaper external labour to replace them on the farm. There is no expectation about the influence of localisation (LFA, altitude) on labour demand. Regarding the subsidies, there is no *a priori* expectation regarding the effect of the various types of subsidies, except for investment subsidies which are expected to decrease the demands of labour owing to labour-saving technological change.

3.2. Descriptive statistics of the data

Table 1 presents descriptive statistics of the data used.

Table 1. Descriptive statistics of the fieldcrop farms' sample for the whole period 1990-2007

	Mean	Standard deviation	Minimum	Maximum
UAA (ha)	118.3	76.7	1.4	774.4
Total labour use (AWU)	1.71	1.20	0.75	41.0
Total output produced (Euros)	144,356	99,413	2,872	1,503,594
Total SFP (Euros)	2,820	10,029	0	157,346
Total crop subsidies (Euros)	26,153	23,896	0	255,760
Total animal subsidies (Euros)	1,182	3,600	0	121,818
Total agri-environmental subsidies (Euros)	298	1,544	0	58,494
Total LFA subsidies (Euros)	59	519	0	28,586
Total investment subsidies (Euros)	399	2,555	0	104,195
UAA under irrigation (ha)	10.4	28.1	0	553.9
Share of rented UAA (percent)	81.2	26.0	0	100
Price of rented land (Euros per ha)	112.6	88.7	0	5,609.8
Price of wheat (Euros per ton)	110.3	35.4	53.0	798.8
Price of other cereals (Euros per ton)	188.5	121.3	34.5	999.2
Price of oilseeds (Euros per ton)	295.6	136.5	49.9	998.7
Age of head of farm (years)	46.0	9.5	17.0	91.0
Hired labour (AWU)	0.37	1.01	0	38.0
Family labour (AWU)	1.34	0.56	0	6.4
Total expenditure on contract labour (Euros)	6,968	10,063	0	280,233
Approximated contract labour (AWU)	0.64	1.10	0	63.0
Price of hired labour (Euros per hour)	5.3	1.3	0	78.7
Price of contract work (regional index with base 1990)	118	18	77	155
Number of observations over the period	35,089			

Source: authors' own calculations based on the French FADN database.

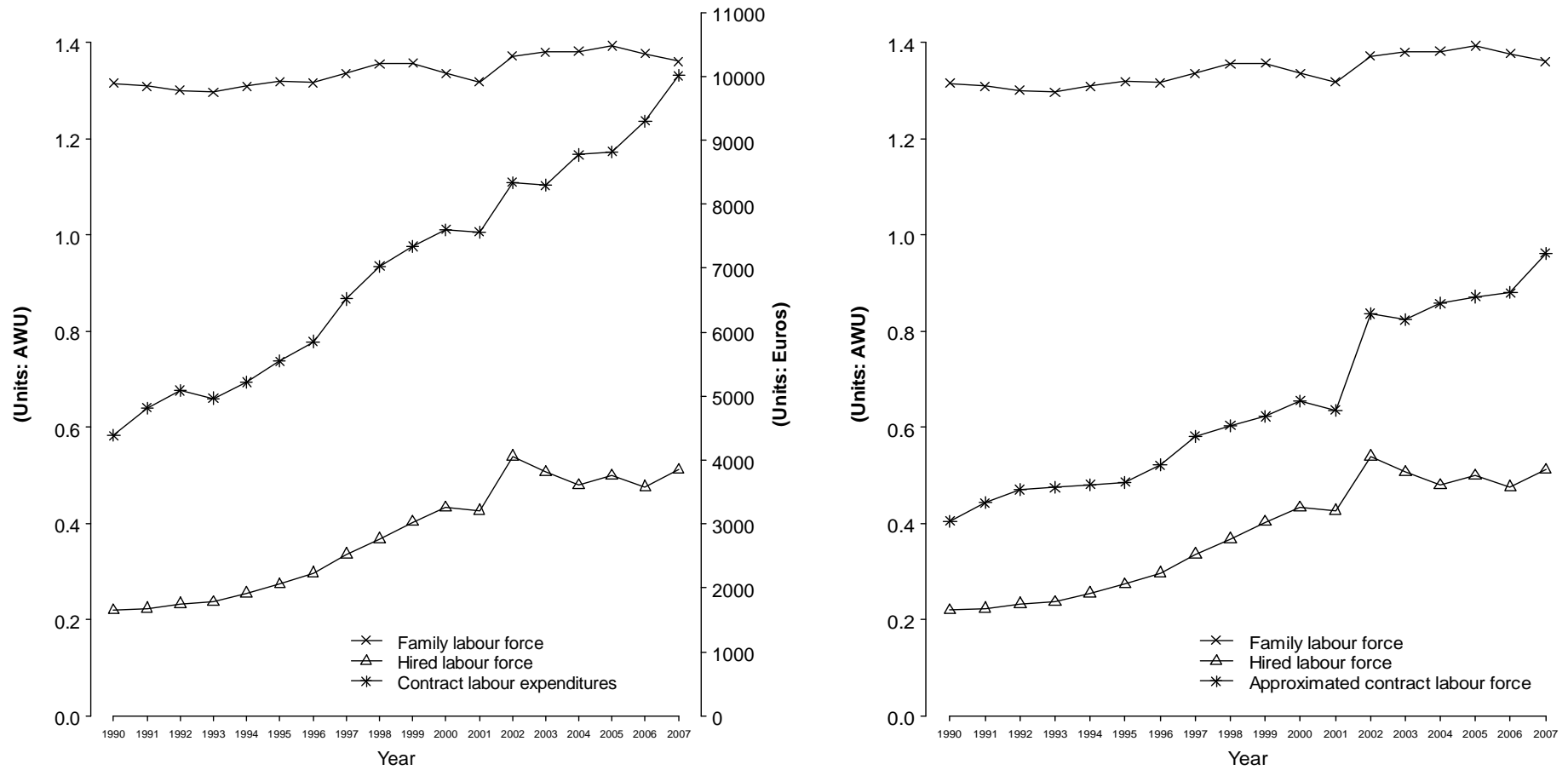
Note: the descriptive statistics for the prices of hired labour, rented land, wheat, other cereals and oilseeds, are those after having assigned the virtual (estimated) price to farms for which the price was missing. All values are deflated with the consumer price index with base 1990.

Over the whole period, the FADN fieldcrop farms on average operated 118 ha of UAA and used 1.71 AWU. The FADN sample is slightly biased comparing with data from the latest Census (in 2000) in France on professional farms: the latter use on average 101 ha and 1.79 AWU. During 1990-2007, crop area payments ('crop subsidies') were the main type of subsidies received by the sample's farms (26,153 Euros per farm per year on average), while LFA subsidies were the smallest (59 Euros per farm per year on average).

Hired labour and family labour used are 0.37 AWU and 1.34 AWU on average. The share of hired labour in total labour (hired plus family) is on average 13 percent for the whole sample during the period studied, and 34 percent for those farms using hired labour. 63 percent of the farms in the sample do not employ hired labour. Less than 1 percent do not use contract labour. The cost of contract labour is 6,968 Euros per farm per year on average. In order to have a range of comparison with the family and hired labour forces, the total expenditure spent on contract labour was divided by the average price of hired labour calculated for the sample as described above. This gives an approximation of the number of hours, and thus of the number of AWU (one AWU being equivalent to 2,200 hours) of the contract labour used by the farms. The approximated number of AWU of contract labour is 0.64 per farm per year on average for the whole period. This reveals that French fieldcrop farms use 1.7 times as much contract labour as hired labour. If a virtual total labour were calculated for each farm, including the hired labour force, family labour force and contract labour force, then the average total labour on farms would be 2.4 AWU, and the share of contract labour in this total labour would be 23 percent, while it would be 10 percent for hired labour.

Figure 1 pictures the evolution of the three different labour forces during the period studied. Regarding contract labour, in the left panel it is shown as the expenditures spent on this labour as measured in the database used, while in the right panel it is represented in approximated quantity that it to say in terms of the number of AWU for this type of labour calculated as explained above. The figure shows that own labour has only slightly increased during the period, while both external labour uses have largely increased. All types of labour experienced a marked decrease in 2001, but a strong jump in 2002.

Figure 1. Evolution of the three types of on-farm labour during the period considered 1990-2007



Source: authors' own calculations based on the French FADN database.

Note: family labour force, hired labour force and approximated contract labour force are in AWU, while contract labour expenditures are in Euros.

3.3. Econometric specification

To design the econometric specification, IHL and ICL denote the latent variables associated with the observed hired labour (HL^*) and to the contract work annual expenditure (ECL^*) respectively. When one of the latent variables is negative, its corresponding observed variable is nil because of its censure. In the sample used, the observed contract work is never censored (most of the farms use such labour) although its distribution is highly asymmetric. As a consequence, ICL is useless. For the estimation, a logarithm transformation of ECL^* , denoted cL^* , is used to fit its asymmetric distribution better. Thus, in the estimated model of cL^* the logarithmic transformation of the price of contract work is used instead of the absolute value of the price. This implies that the own price elasticity of contract work is given by $(\beta_{wCL} - 1)$, where β_{wCL} is the estimated parameter associated with the logarithmic transformation of the price of contract work $\log(wCL)$ in the estimated model of cL^* .

It is assumed that the three variables IHL , cL^* and Lf^* are distributed according to a trinomial normal cumulative function. The deterministic part is a linear function of the explanatory variables of a vector x that gathers a constant term and the observed above-mentioned determinants $(T, Lo, Io, s, wHL, wCL, \log(wCL), Z, X, p)$. The observations are assumed to be independently and identically distributed. The sample's likelihood is calculated using φ_3 , the joint density function of the reduced and centred trinomial normal distribution. Referring to equation (6) and taking into account that CL^* is uncensored, there are two types of observations: farms with hired labour and farms without hired labour. Accordingly, the sample's likelihood $L(\cdot)$ is provided by equation (7). Subscript j refers to the j -th observation for each variable while the Greek letters are the parameters to be estimated.

$$\begin{aligned}
 (IHL_j, cL^*_j, Lf^*_j) &\approx N(x_j\beta, x_j\alpha, x_j\gamma, \sigma_1^2, \sigma_2^2, \sigma_3^2, \rho_{12}, \rho_{13}, \rho_{23}) \\
 L(IHL^*_j, cL^*_j, Lf^*_j, \beta, \alpha, \gamma, \sigma_1^2, \sigma_2^2, \sigma_3^2, \rho_{12}, \rho_{13}, \rho_{23}) &= \\
 \prod_{j/HI^*=0} &\left(\int_{u_1=-\infty}^{u_1=-x_j\beta/\sigma_1} \varphi_3(u_1, ((cL^*_j - x_i\alpha)/\sigma_2), ((Lf^*_j - x_i\gamma)/\sigma_3), \rho_{12}, \rho_{13}, \rho_{23}) du_1 \right) \\
 \prod_{j/HI^*>0} &\left(\varphi_3(((HL^*_j - x_i\alpha)/\sigma_2), ((cL^*_j - x_i\alpha)/\sigma_2), ((Lf^*_j - x_i\gamma)/\sigma_3), \rho_{12}, \rho_{13}, \rho_{23}) \right)
 \end{aligned} \tag{7}$$

The parameters β , α , γ , ρ and σ are then estimated by the maximum likelihood estimator. Several explanatory variables identified as potential key determinants were not retained in the final model based on convergence and significance criteria.

4. Results

Table 2 presents the econometric results. They reveal that the price of contract labour significantly influences the demand for contract labour. The positive estimate in the regression of contract labour may be misleading, but as explained above, the direct elasticity of price on the demand of contract work is $(0.1896-1)$ that is to say (-0.8104) . This negative effect was expected according to the microeconomic framework. This means that contract labour is a normal good. The price of hired labour significantly influences the demand for hired labour and the demand for family labour, both negatively, and the squared price significantly influences both variables as well, both positively. This finding confirms the expectation that hired labour is a normal good whose demand is negatively linked to its price, but the effect is fading with higher prices. Moreover, the positive and significant effect of the interaction term between the price of hired labour and the UAA, on the demand for hired labour, reveals that the negative price effect is decreasing with farm size; in other words, larger farms' hired labour demand is less affected by an increase in this labour price. As for the negative effect of the hired labour price on family labour, it suggests that both types of labour are complements rather than substitutes. This partly conforms to Benjamin et al.'s (1996) finding that hired labour was complementary to male own labour (and substitute to female own labour) on French farms using data from the 1988 Agricultural Census. However, it is in opposite of results provided by Benjamin and Kimhi (2006) using data from the 2000 French Agricultural Census who find that hired labour is substitute for male and female own labour, and in opposite of results provided by Blanc et al. (2008) who also found that hired labour and family labour are substitutable with data from the French 1988 and 2000 Agricultural Censuses. Our findings therefore suggest that farms surveyed for the French FADN behave differently than the farms' population in the country.

The price of land has a positive effect on both types of external labour (contract and hired), indicating that such labour acts as a marginal substitute for land. This might mean that specific intensive activities require specific tasks to be carried out by external labour sources. Regarding the output prices, in general they show a positive influence on the three labour demands as expected, except for a negative significant impact of the price of oilseeds on hired labour.

Farm size proxied by the total UAA has a positive effect on both types of external labour, which is intuitively plausible. As for the technology proxy, namely the UAA under irrigation, its positive effect on all labour demands confirms that such technology requires additional

labour. The share of rented land positively influences all three types of labour, maybe revealing the need for labour in order to produce and be able to pay rentals. The results regarding the legal status dummies indicate that partnerships use more own labour than companies and also than individual farms (the benchmark); this may reveal the availability of own labour (partnerships have more own labour than companies). Companies use more hired labour, while partnerships outsource more. The age of the head of the farm has a positive effect on all types of labour, indicating the need for more labour in general to help on older farmers' holdings as expected. Regarding the education dummies (the benchmark is primary education at most), heads of farms with higher education use more external labour (both contract and hired labour), but use less own labour. This is highly plausible owing to the higher opportunity costs of well-educated farmers to work off-farm. As for the localisation dummies, farms located in mountainous LFA use more hired labour and more own labour, compared to farms located in the plains LFA and in non-LFA. This may reflect the difficult agro-climatic conditions that necessitate more labour on the farm. Farms at higher altitudes use more contract labour but less hired labour, maybe because hired labour is in short supply in these areas.

Finally, the last part of the discussion concerns the policy reform periods and the subsidies. The period dummies indicate that, compared to the benchmark period 1990-1994, in general the use of contract labour and hired labour largely increased, while the use of own labour slightly decreased. More precisely, the demands for external labour largely increased in the first reform period (1995-1999); that is to say following the introduction of the first decoupled payments. Regarding own labour, the decrease was triggered by Agenda 2000 (period 2000-2005). Looking more deeply at the various types of support, the results indicate that crop subsidies decrease all types of labour, in particular during the periods 1996-1999, that is to say straight after the introduction of the CAP area payments linked to specific crops. Animal subsidies over the whole period increase the use of own labour and contract labour. As for SFP, it has a negative impact on own labour and hired labour, and no significant impact on contract work. Agri-environmental subsidies clearly favour the use of external labour during the whole period, but have no significant influence on family labour. Finally, investment subsidies increase the resort to external and own labour during the whole period, except for a slight negative influence on contract work demand during 1990-1994.

Table 2. Econometric results: estimates and significance levels

	Log of contract labour cost	Hired labour	Family labour
Intercept	5.3171 ***	-2.7144 ***	0.7401 ***
Price of contract labour	0.1896 **	-0.0026 *	-0.0003
Price of hired labour	0.0056	-0.1740 ***	-0.0145 ***
Price of hired labour squared		0.0023 ***	0.0003 ***
UAA × Price of hired labour		0.0007 ***	
Price of land	0.00057 ***	0.0046 ***	
Price of wheat	-0.0036	0.0058	0.0018 *
Price of other cereals	0.0053 ***	0.0154 ***	0.0018 ***
Price of oilseeds	0.0023 ***	-0.0024 ***	0.0012 ***
UAA	0.0045 ***	0.0057 ***	
UAA irrigated	0.0066 ***	0.0012 ***	0.0006 ***
Share of rented land	0.0016 ***	0.0020 ***	0.0006 ***
Dummy partnership	0.2209 ***	0.1456 ***	0.6526 ***
Dummy company	0.0307 ***	0.5062 ***	0.3792 ***
Age of head of farm	0.0015 **	0.0142 ***	0.0070 ***
Dummy lower-secondary education	0.1142 ***	0.1483 ***	-0.0173 ***
Dummy higher-secondary education	0.2554 ***	0.3300 ***	-0.0708 ***
Dummy non LFA		0.2148 ***	0.0063
Dummy LFA mountain		0.3608 ***	0.0900 ***
Dummy altitude <300m	0.3890 ***	-0.3376 **	
Dummy altitude 300-600m	0.3307 ***	-0.3511 **	
Dummy period 95-99	0.378 ***	0.8512 ***	0.0886 ***
Dummy period 00-05	0.208 ***	0.2757 ***	-0.1131 ***
Dummy period 06-07	0.189 **	0.3660 ***	-0.0202
Crop subsidies per ha 90-94	-0.00007	-0.0005 **	
Crop subsidies per ha 95-99	-0.0011 ***	-0.0025 ***	-0.0004 ***
Crop subsidies per ha 00-05	-0.00006	-0.00004	
Crop subsidies per ha 06-07	0.0007	0.0013	-0.0006 **
Animal subsidies per ha 90-07	0.0029 ***	-0.0041 ***	0.0009 ***
SFP per ha 06-07	0.0003	-0.0013 ***	-0.0005 ***
Agri-environment subsidies per ha 95-99	0.0054 ***	0.0057 *	0.0003
Agri-environment subsidies per ha 00-05	0.0036 ***	0.0040 ***	0.0002
Agri-environment subsidies per ha 06-07	0.0027 **	-0.0005	0.0006
LFA subsidies per ha 90-07	-0.0010	0.0067 ***	0.0016 ***
Investment subsidies per ha 90-94	-0.0001 *	0.0002 *	
Investment subsidies per ha 95-99	0.0010 ***	0.0014 ***	0.0001
Investment subsidies per ha 00-05	0.0017 ***	0.0040 ***	0.0004 ***
Investment subsidies per ha 06-07	0.0004 **	-0.0001	0.0001
Number of observations		35,089	
Log likelihood		-115,338	
Correlation contract labour - hired labour		0.207 **	
Correlation contract labour - family labour		0.010 **	
Correlation hired labour - family labour		-0.066 ***	

Source: authors' own calculations based on the French FADN database.

Note: ***, **, * represent significance at 1, 5, 10 percent. Price of contract labour in logarithmic form is in the estimation of log of contract labour cost. Results for regional dummies not shown.

5. Conclusion

This paper investigates French fieldcrop farms' use of various types of labour during the period 1990-2007. The first contribution is to explore the determinants of the three types of labour used on farm and in particular that of contract labour, an issue neglected by research so far. The second contribution is the particular emphasis on the role of agricultural policy reforms and subsidies on on-farm labour demands. It is well-known that agricultural support distorts farmers' decisions, but their role on labour decisions has only been investigated so far in regard to the trade-off between on-farm and off-farm family labour.

The database used is the French FADN database. It is assumed to contain the results of the labour market equilibriums at the farm levels. The estimation of a system of three equations, including a censored model, reveals that some significant explanatory variables (such as farmer's age) clearly reflect some determinants of the external labour demands and own labour supply, while some others (such as the farm location in mountainous areas) may reflect the local labour supply characteristics. The first main finding is that contract labour and family labour are substitutes, as are hired labour and family labour. The second main finding concerns the effects of the different types of farm subsidies on labour demands. Crop area payments and the recently introduced SFP clearly discourage the different labour demands, while the pillar 2 subsidies, namely agri-environment, LFA and investment payments, favour on farm labour. Contract labour is particularly (positively) affected by agri-environment and investment payments, suggesting the need to resort to a flexible labour force for implementing agri-environmental schemes and new technology.

Considering the family labour demand, several key determinants are unknown because they are not registered in the database used. These would be, for example, the total available labour force of the farm household, the household labour force allocated to off-farm work, and off-farm revenue. For this reason, it was assumed here that farm labour decisions are determined by farmland availability, either family-owned land or rented land. This assumption is probably very questionable. Although rented land derives from a land market that is highly imperfect and rigid, it might be an endogenous variable which is affected simultaneously by both family and hired labour. Further research in this area is needed.

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