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Key Issues in Agricultural Labour Markets

A Review of Major Studies and Project Reports on Agriculture and Rural Labour Markets

ABSTRACT

This paper provides a synthesis of the empirical literature on the key issues in agricultural and rural labour markets since the 1960s, drawing mainly upon studies from the United States and the European Union, but also including relevant material from developing countries. The contribution of this meta-analysis lies in its unique structure as it covers the main research questions that have been addressed in the literature and includes the most cited papers from the American Journal of Agricultural Economics, Journal of Agricultural Economics, European Review of Agricultural Economics and Agricultural Economics as well as other reports and EU-funded projects. Each research question is accompanied by a tabular summary that classifies the individual studies according to the methodology and the variables employed. The heterogeneous conditions across countries, the different research questions and methodologies, and the type of data employed have sometimes led to conflicting results. Nevertheless, by comparing the results, it is possible to assess the significance and the direction of the determinants of rural labour allocation and its adjustments, and thus contribute to a better understanding of the functioning of rural labour markets. Lastly, by recognising the importance of the institutional framework, the paper provides useful policy insights.

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Barbara Tocco, Sophia Davidova and Alastair Bailey*

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1. Introduction

Well functioning factor markets are a crucial condition for the competitiveness and growth of agriculture and for rural development to ensure the determination of efficient wages, employment and the efficient allocation of scarce resources. In the past century, and especially since the entry into the European Union, economies in Europe have been experiencing a deep restructuring of their agricultural sector, with important consequences for the factor markets. In particular, the labour market has been subject to several adjustments that have led to an outflow of labour from agriculture. Since rural labour markets are central to the determination of the allocation of labour, the efficient functioning of the rural labour market is, therefore, extremely important for the income and development of people residing in rural areas.

Several policy programmes have been designed and applied to agriculture. For example, the most important EU policy, the Common Agricultural Policy (CAP), was created to provide farmers with a reasonable standard of living, although it has often been subject to criticism due to the economic distortions created and high budgetary costs. Some scholars have advocated that farm subsidies have reduced the outflow of labour from rural areas and represent incentives to remain in the agricultural sector. In spite of this, there has been a significant out-migration of labour from the agricultural sector. Other researchers have shown that, although these payments have affected the pace of this process, agricultural policy transfers have not halted it in a long-term perspective. Moreover, the integration of rural areas in general labour markets can contribute significantly to rural incomes, and to the competitiveness of farms and the agricultural sector as a whole.

As suggested in the literature, many economies are characterised by imperfect rural labour markets, due to transaction costs and structural impediments, which result in a sub-optimal allocation of labour, lower income of workers and thus constrained rural development. To the extent that rural development is the key objective for improving people's living conditions and their income, well functioning rural labour markets are an essential prerequisite for both traditional agricultural economies and for service-based rural economies (Kancs et al., 2009a). Therefore, it is crucial to gain insights into the functioning of rural labour markets, by looking at the determinants of rural labour allocation and its adjustments.

In order to understand and describe the functioning of the labour market in rural areas it is crucial to define the institutional framework and, thus, recognise the main variables of interest, for instance: i) the structure of employment, i.e. the size of the labour force, the quality of human capital, the share of labour employed in agriculture, the mobility of labour, demographic measures of the labour force; ii) the legal framework and regulations which govern the rural labour market, including employment protection, trade unions, types of contracts, wage policies, etc. and iii) the different policies that characterise the labour market, including subsidies and other payment schemes (Teagasc, 2011). As proper

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institutions are crucial for the well functioning of labour markets, several studies have focused on the impact of economic and institutional reforms on the labour market. Long-term efficiency gains and sustainable rural development are conditional upon effective institutional reforms (Dries and Swinnen, 2002).

To this purpose, this survey reviews the main studies and reports which have dominated and influenced the literature on rural labour markets since 1960s. The paper provides a synthesis of results of previous research to contribute to a better understanding on the functioning of agricultural and rural labour markets. Due to the extensive literature on the subject, the reference list is not exhaustive; nonetheless, the studies selected provide a representative set of results and include the most frequently cited papers. The geographical dimension encompasses mainly studies from the United States and the European Union (EU), although a few studies from developing countries have also been included for completeness, where specific insights of relevance to the situation in the EU are present. The main screened journals include: *American Journal of Agricultural Economics*, *Journal of Agricultural Economics*, *European Review of Agricultural Economics*, *Agricultural Economics*, in addition to which other journals, reports, presentations, books, chapters in edited books and previous EU funded projects have been used for this review.

For a clear synthesis of the contributions to the literature on the rural labour market, it has been necessary to disentangle the numerous research questions and organise them in different sub-questions in order to allow comparisons. The empirical review commences with a brief review of the theoretical models and empirical specifications, which are provided to contextualise the results. Therefore, each research question is accompanied by tabular summaries organised by author, year, and location, which highlight the direction, i.e. the signs, of the significant determining factors (displayed in bold in the text).

This paper is structured as follows: section 2 provides a definition for the 'rural' dimension and emphasises the main features which characterise rural labour markets. Section 3 is concerned with the supply of labour and its adjustments in rural areas. The studies collected provide insights on the determinants of inter-households and intra-household labour supply decisions, including the push- and pull-factors of labour migration, the responses to changes in macroeconomic environment (e.g. the process of economic transition) as well as changes in policies (such as the CAP support scheme), and the role of non-income factors. Section 4 continues with the demand for labour in rural areas in relation to farm production. The structure of the farm, the characteristics of production and the differences in agricultural productivity are also discussed and some empirical evidence is presented. Section 5 concludes.

The results provide insights on the functioning of the agricultural market and on the policy environment; this information is useful for the subsequent WPs in the project and provides valuable insights for policies that aim at improving structural development in the agricultural sector.

2. The rural spatial dimension

In order to understand the functioning of rural labour markets, it is necessary to define what is meant by 'rural'. Although there is not a conventional definition which provides an exact description of the term, the rural dimension is usually defined by comparing it with its opposite dimension, i.e. the urban dimension. The latter, is usually characterised by the superior access to financial, physical, human and social capital, which implies lower rates of labour productivity in the rural sector. As Wiggins and Proctor (2001) point out, the term 'rural' refers to things of the countryside: "rural areas constitute the space where human settlement and infrastructure occupy only small patches of the landscape, most of which is dominated by fields and pastures, woods and forests, water, mountain, and desert" (pp. 427-428). A few stylised facts are commonly acknowledged in describing rural areas: (i) relative abundance of land and other natural resources, which are immobile; hence, rural areas are usually the location for farming; (ii) distance between rural settlements and cities, which

implies high costs of movement; (iii) relative poverty of many of the inhabitants, as average incomes are lower in rural areas than in towns and cities, with the exception of some rural areas in North-West of Europe. Nonetheless, there are a few spatial dimensions of rural development, which are important to take into account. The proximity and access to cities as well as the amount and quality of natural resources provide a subdivision of the rural sector into 'peri-urban', 'middle-countryside' and 'remote areas' (Wiggins and Proctor, 2001). In this respect, many studies focusing on the allocation of labour in rural areas acknowledge the heterogeneity of the rural dimension and thus often include locational variables, which aim to capture the impacts of access to and availability of employment opportunities, as well as dummy variables to account for the agricultural potential, such as the lower potential in mountainous regions or less irrigated areas.

The characteristics of areas bring out some specific features that characterise rural labour markets as opposed to urban labour markets. Johnson (1991) emphasises the limitations of residing in rural areas by outlining the individuals' occupation/residential choice paradigm: the choice of farming involves a very severe restriction on residential choice, while the choice of a farm residence greatly reduces family's employment opportunities across sectors. Moreover, the geographical dispersion of agriculture as an industry and its rural location away from other industries increases the costs of obtaining information about non-farm jobs and diminishes the probability of household mobility to switch industries (Huffman, 1977). It is, however, worth noting that agriculture is not the only sector engaged in the rural economy although it often dominates employment, particularly as remoteness increases. As several studies on agriculture and rural labour markets have emphasised, the descriptive statistics are self-explanatory: the agricultural sector, in comparison to industry and service sectors, is characterised by high age of agricultural workers (Bojnec et al., 2003; Bojnec and Dries, 2005; Van Herck, 2009), as well as low level of education attainment, with a significant proportion of the population having no more than a primary education. These factors are very important as they define the low level of human capital of the agrarian sector, and thus constrain the supply of skilled labour from this sector (Goodwin and Holt, 2002; Huffman, 1977)[1].

The process of economic development is associated with a declining share of agriculture in total employment: there has been a massive movement of people out of agriculture throughout the world, with a decline in both the absolute level and the relative importance of farm employment especially in Europe (Breustedt and Glauben, 2007), and in the United States (Barkley, 1990). The integration of farm and non-farm labour markets, which has been triggered by economic growth and technological change, in terms of improved communication and transportation systems, has allowed a reallocation of labour by farm residents from farm to off-farm work. The expansion of communication systems to rural areas, which led to a better access to knowledge and ideas, and the reduced cost of transportation, have decreased the transaction costs of resource adjustments and have been accompanied by a more efficient allocation of people in the rural labour market.

Nonetheless, agriculture remains an important source of income for many rural households, particularly in the poorest and least developed regions (Kancs et al., 2009a).

3. Labour supply and labour adjustments in rural areas

3.1 The farm-household model

The empirical evidence on the factors determining labour allocation in rural areas is based on microeconomic decision models within the framework of a farm-household model. The model, based on neo-classical assumptions, integrates agricultural production, consumption,

[1] Constraints and limitations of a rural economy, on both supply and demand side, are addressed in another Deliverable for this project (D8.2).

and labour supply decisions into a single framework. The typical farm household is assumed to derive utility from total consumption (C) and leisure (L), which vary according to exogenous individual characteristics, such as human capital variables and general household characteristics (H), as well as locational characteristics (Z), such as labour market conditions:

$U = U (C, L, H, Z)$.

The household is maximising utility levels of consumption and leisure, dependent on individual and other characteristics, subject to the constraints of time, income, and farm production. Total time endowment (T) is allocated between off-farm work (O), farm work (F), and leisure (L) [2], so that:

$T = O + F + L$.

Total consumption in value terms (consumption of goods times the price P_c) is constrained by the budget constraint, determined by off-farm income (off-farm work O times the market wage W), net farm income (the value of farm output P_fY_f minus the costs of production I_fX_f) and exogenous household wealth (V), also known as non-earned income, so that:

$CP_c = WO + (P_fY_f - I_fX_f) + V$.

The off-farm wage is assumed to reflect individual human capital characteristics as well as labour market conditions:

$W = W (H, Z)$.

Lastly, since agricultural activities are characterised by decreasing marginal returns, on-farm labour is dependent on the production function, which imposes the final constraint on the household's utility maximisation:

$Q = f (F, X_f ; H, Z_f)$,

where total production is a function of farm labour (F) and the quantity of purchased inputs (X_f), including farmland services and hired labour; the efficiency of farm production depends on human capital characteristics (H) as well as other exogenous farm specific characteristics (Z_f).

The theoretical framework hereby outlined is the general one, assuming the household acts as a single decision maker. Several studies have limited the analysis to the perspective of the household head, i.e. the farm operator, the farm owner, the farm holder (Huffman, 1980; Sumner, 1982; Jensen and Salant 1985; Kimhi, 1994; Bojnec and Dries, 2005; Juvančič and Erjavec, 2005; Hennessy and Rehman, 2008). Other studies have focused instead on a collective approach, where a multi-person household makes decisions as a result of a bargaining process between household members. This latter approach has the advantage of being able to take into account intra-household decisions as well as inter-household ones (Kancs et al., 2009a), and to model the interaction of preferences of farmers and their families. When applying the collective approach, each variable (off-farm and on-farm labour, leisure, wage, human capital characteristics) is decomposed into two different ones, one concerning the farm operator (^{O}), and the other concerning his spouse (^{S}). Therefore, the farm household utility is represented by the following:

$U = U (C, L^o, L^s; H^o, H^s, Z)$.

Some authors have estimated separate models for both the farm operator and the spouse and have compared the direction and the magnitude of the factors affecting their decisions (Rosenzweig, 1980; Corsi and Findeis, 2000; Goodwin and Holt, 2002; Fall and Magnac, 2004), whereas others have assumed husband's and wife's decisions to be jointly determined

[2] The traditional neoclassical labour-leisure analysis assumes that utility levels are depicted by combinations of consumption and leisure bundles (Borjas, 2005). In the household model, leisure cannot be interpreted as 'pure' leisure, but it broadly refers to home time, thus including specialisation in home production (Apps and Rees, 1997).

within the household framework. According to the latter approach, introduced by Huffman and Lange (1989), the decisions of the husband (and the probability of a likely event to occur) are affected by some of the spouse's characteristics, and *vice versa* (Gould and Saupe, 1989; Findeis et al., 1991; Tokle and Huffman, 1991; Ahearn et al., 2006; Benjamin and Kimhi, 2006).

3.2 Labour allocation decisions

The optimal levels of farm and off-farm employment are obtained by solving the first order conditions, and by equating the marginal rate of substitution between consumption and leisure to the market wage and to the marginal product in farming (Rizov and Swinnen, 2004). A similar approach consists in equalising the marginal values of time devoted to different but competing activities and equalising them to their relevant opportunity costs (Sumner, 1982). Therefore, the aggregate sectoral labour supply is given by the aggregate decisions of rural households.

A key factor in determining the time allocation decisions of the farm household 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 labour supply decisions due to two opposing effects: it can cause the individual to work more, due to the higher return of work time (substitution effect), or it may lead to work less time, because the same amount of income can be earned by working less and thus more leisure time can be afforded (income effect). Which effect dominates will determine the impact on the hours/days allocated to work. On the other hand, as predicted in the theory, an increase in non-labour income (or the so-called non-earned income) will only lead to an income effect, causing the individual to work less. In the context of rural labour markets, not only the wage rate, but also other financial variables affect individuals' decisions of labour supply, such as farm subsidies, government transfer payments, social benefits, and other fringe benefits. Special attention has been given to the impact of subsidies on farmers' income and their labour allocation. Several studies have distinguished between coupled payments, which are connected to production, and decoupled ones, which are not related to the current production decisions. Therefore, it is important to recognise the way these contributions are viewed by the household, i.e. if considered as an increase in the farm wage (coupled) or as non-labour income (decoupled) (Ahearn et al., 2006).

The vast empirical literature has mainly focused on the determinants of labour adjustments in rural areas and on the allocation decisions across activities. The starting point for any empirical investigation has been provided by the two-sector model of rural-urban migration by Todaro (1969) and Harris and Todaro (1970), where individuals are predicted to migrate if the expected urban-rural income differential exceeds migration costs, where the expected income in the urban sector equals the market wage times the probability of finding employment. Therefore, the choice of occupation is determined by the utility differential from the two sectors (agriculture and non-farm employment), minus the transaction costs, i.e. the inter-sectoral relocation costs: the search costs of finding employment and the costs of the loss of the agricultural skills (Kancs et al., 2009b; Van Herck, 2009). The costs of switching jobs as well as the probability of finding another job depend on individual human capital characteristics, such as age and education of the individuals, as well as regional and economic conditions, such as the degree of urbanisation and local employment conditions. As households' decisions stem from the maximisation of utility derived from income and non-income factors, changes in labour policies and institutional reforms (such as privatisation, liberalisation, restructuring, etc.) also affect the opportunity cost of labour and are therefore included as determinants of labour adjustments.

The number of workers staying in or switching to agriculture determines the aggregate agricultural labour supply. On the other hand, the off-farm labour supply function is an excess supply function, as it can be interpreted as the aggregate rural labour supply function less the demand function for farm labour (Huffman, 1980).

3.3 Empirical issues

The results from the empirical literature are dependent on the specification of the model and on its assumptions, and the characteristics of the data employed. The most important differences in empirical specifications worth mentioning concern the following:

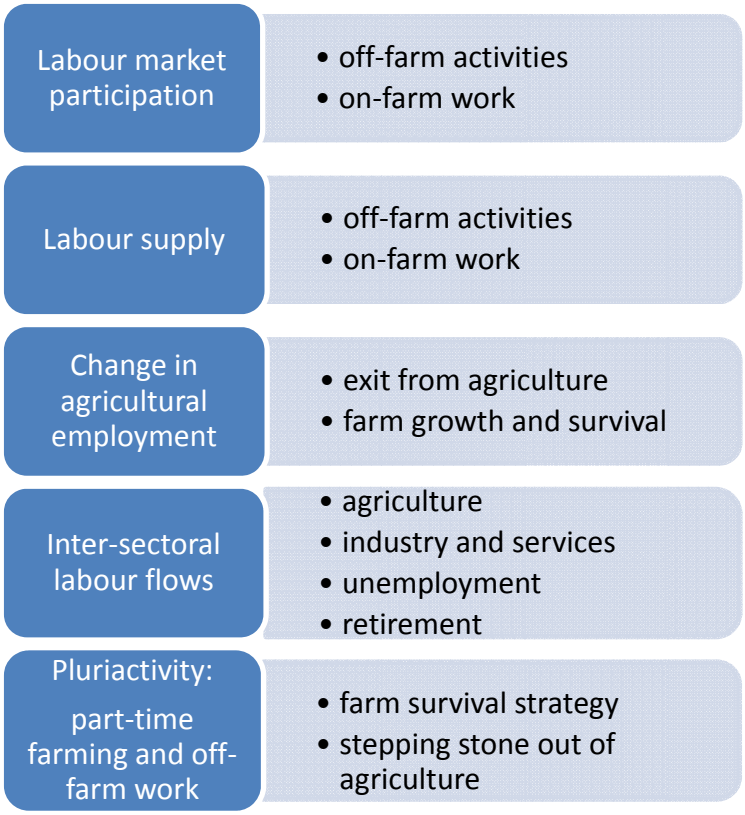
- Dependent variable (discrete versus continuous choice): one of the main issues concerns the specification of the dependent variable (labour supply) which has been treated either as a discrete binary choice (participation versus non-participation), and thus estimated with probability models such as probit or logit, or as a continuous choice (measuring the number of hours or days supplied in the labour market), analysed through a tobit model or Heckman procedure. Although several studies employ both methods, to measure first the participation and then the allocation choice of labour, it will be necessary to distinguish among these two specifications in outlining the results. The continuous choice model implies a richer structure and is more data demanding, whereas the discrete choice model is more simplified and can account for transactions costs (Kancs et al., 2009a). Due to data limitations, this latter approach has often been preferred when dealing with transition economies, such as the Central and Eastern European countries (CEECs).
- Household model (single decision maker versus collective approach): whereas the majority of the studies focus only on the farm operator or examine separately the time allocation decisions of operator and spouse (using probit or logit models), other studies have instead recognised the different preferences of individuals and have examined the intra-household decisions. By employing bivariate probit models, husband's and wife's decisions are assumed to be jointly determined within the household framework. According to this latter approach, introduced by Huffman and Lange (1989), the decisions of the husband (and the probability of a likely event to occur) are affected by some of the spouse's characteristics, and *vice versa* (Gould and Saupe 1989; Findeis et al., 1991; Tokle and Huffman 1991; Ahearn et al., 2006; Benjamin and Kimhi 2006).
- Study level (farm-household versus aggregate): the farm household model approach, relying on micro-level data, has been extensively used in the literature in particular to explain labour adjustment patterns as dependent on the characteristics of the farm and the farm household. The disadvantage of such approach is that it focuses on the individual level, and therefore cannot take into account the impact of the general economic conditions as well as agricultural policy. On the other hand, studies which employ national, regional, or county aggregate data allow to analyse the effect of policy changes, since information over a longer time period and for different regions is available (Goetz and Debertin, 1996; Glauben et al., 2003; Breustedt and Glauben, 2007).
- Data (cross-section versus panel): most of the studies have relied on static cross-sectional data to analyse labour adjustments, due to either data constraints or to fit a preferred model specification, whereas others have employed panel data in order to incorporate the dynamic aspects of labour supply. Few examples include: Gould and Saupe (1989), who choose to use panel data due to the inability of the cross-section to analyse the response of labour supply to changes in the wage rates; Weiss (1999) who uses panel data to investigate some aspects of structural change (farm survival and farm growth); Kimhi (2000), who rejects the standard cross-sectional model (myopic model) in favour of the life-cycle model. Laslty, Corsi and Findeis (2000) attempt to assess the unexplained persistence in a labour state, which strictly relies on the adoption of panel data. The authors point out the importance of using longitudinal panel data since these provide a better understanding of the behaviour of individuals within farm households, as their reactions can be easily observed over time.
- Household production and consumption decisions (separable versus non-separable): when household production decisions are separable (recursive) from the household's consumption and labour allocation decisions, separate equations can be estimated;

most of the studies have imposed the separability structural assumption and have focused on the demand for and on the supply of labour off-farm and/or on-farm. Alternatively, when household decisions are not separable (non-recursive), production, consumption and labour allocation equations should be estimated as one system, i.e. simultaneously (Huffman, 1991)[3]. The authors who have tested the separability hypothesis have not obtained consistent results: Lopez (1984) has rejected the recursive assumption using aggregate Canadian data, whereas Benjamin (1992), in regards to households in rural Java, could not reject it.

3.4 The main research questions and the variables employed

The labour supply literature, accounting for the rural and agricultural sector, has provided some insights on the driving factors behind labour allocation decisions. In order to compare the reviewed studies and discuss the results? it will be worth classifying the empirical literature according to the investigated thematic areas. Figure 1 provides a summary, in bullet point form, of the questions raised in the rural labour supply literature, which represent the main areas of investigation according to which the surveyed studies have been classified. These include participation in the labour market (off-farm as opposed to on-farm), the amount of labour supplied in both activities (in terms of hours/days), the inter-sectoral labour flows (in particular among agriculture, industry and services, unemployment, and retirement), the change in agricultural employment (the determinants for leaving the agricultural sector as opposed to staying), and the role of pluriactivity (providing part-time off-farm work can be interpreted either as a farm survival strategy or as a stepping stone out of agriculture).

Figure 1. The Main Research Questions



[3] Some discussion and empirical evidence on the simultaneous labour supply and demand decisions of farm households are presented in section 4.3.

The main research questions, expressed by the dependent variables, are accompanied by tabular summaries (Tables 1 to 7), organised by author, year, and location, as well as the main factors which have been identified to affect labour allocation decisions. The tables highlight the direction, i.e. the signs, of the significant determinants found in previous studies and allow some comparisons across the results[4]. As outlined in the theoretical framework, the supply side of the rural labour market is determined by factors such as individual characteristics, household characteristics, farm specific characteristics, as well as locational characteristics, including labour market conditions, which enter the utility function and the budget constraints as exogenous variables. The main exogenous factors which have been identified to affect the decision to participate in the off-farm labour market are listed according to the following categories:

- *Individual characteristics*: age, education, experience, gender, marital status, race
- *Family characteristics*: presence of children, age of children, household size
- *Farm production characteristics*: farm size (in hectares), farm economic size (standard gross margin), farm output, farm income, farming system, capital stock, land ownership, farm structure, on-farm diversification activities, farm productivity, etc.
- *Financial characteristics and other benefits*: non-labour income, farm subsidies, social benefits, fringe benefits, non-pecuniary benefits
- *Locational and labour market characteristics*: employment conditions, access to jobs, distance to urban centre, population density, urbanisation index, regional location, etc.

3.5 Labour market participation

The vast array of studies focusing on labour market participation has mainly been concerned with explaining the determinants of off-farm market participation of farmers (Table 1), whereas only few have examined the determinants of on-farm participation of rural household (Table 2). The common specification has focused on the individual level (farm-household) as opposed to the aggregate/sectoral level. Moreover, whereas the majority of studies has employed cross-sectional data, other authors have argued that panel data give a better understanding of the behaviour of individuals within farm households as their reactions over time can be observed (Corsi and Findeis, 2000). Their findings suggest that previous off-farm labour state is relevant in off-farm labour participation decisions, due to 'true state dependence', i.e. the probability of being in a current state depends on the previous state. According to the authors, true state dependence would also explain "a certain rigidity in off-farm labour adjustment and the tendency of individuals to remain in the same employment situation" (Corsi and Findeis, 2000, p. 148). The results are summarised below.

3.5.1 Off-farm participation

A. Individual characteristics. The **age** and **age squared** variables capture the quadratic life-cycle effect as labour market participation is first increasing and then decreasing with age; when only age is present, the negative coefficient implies that younger individuals are more likely than older farmers to work off the farm. **Education** and **work experience**, also known as the human capital variables, reflect the individual's stock of human capital. There are both direct and indirect effects on the off-farm labour participation (Lass et al., 1991). Although human capital enhances an individual's performance and productivity in farm operations, increasing the shadow value of labour, it also has a similar effect on off-farm labour, via the increased off-farm wage. Empirical evidence shows that the latter effect dominates. Moreover, several studies have split the education and experience variables into their sub-components: agricultural specific, general, or off-farm related. As expected, agricultural specific human capital is associated with a lower probability of participating in

[4] For simplicity and coherence the variables reported in the tabular summaries and discussed in the paper are only those significant at the 5% level or above.

the off-farm labour market, due to the associated loss of human capital. On the other hand, a higher off-farm related education and work experience would result in a higher probability in off-farm market participation. In addition to this, some studies have found that the impact of education increases the probability of off-farm participation relatively more for spouses than for farm operators (Tokle and Huffman, 1991; Corsi and Findeis, 2000), and others, recognising the jointness in the decisions of farm operators and spouses, have looked at the cross-person education effects; the findings suggest that increasing the education of one spouse would cause a reduction in the probability that the other spouse works off-farm (Huffman and Lange, 1989; Gould and Saupe, 1989; Tokle and Huffman, 1991; Benjamin and Kimhi, 2006). An additional proxy for human capital used in empirical studies is the **number of years spent in the country** for those who immigrated (Ahituv and Kimhi, 2002), which is also related to a higher probability in off-farm market participation. Other individual characteristics include: **gender**, as being a man reduces the probability of off-farm participation due to the lower level of mobility compared to women (Juvančič and Erjavec, 2005), and **marital status**, as being married would increase off-farm participation. Lastly, those individuals who already worked off the farm are more inclined to participate in the off-farm market, due to **true state dependence** (Corsi and Findeis, 2000).

B. Family characteristics. **Household size**, i.e. the number of individuals in the household, is positively related to off-farm participation. In larger households, due to the tight budget constraint, the need for extra income is greater. When negative, this variable may imply increased value of at-home time, as it is generally supported for the operator's spouse (Ahearn et al., 2006). The presence of **children** is typically associated with lower off-farm participation, in particular in the presence of young children (age < 6). This effect is stronger for women, whereas for men the presence of children is sometimes associated with greater off-farm participation. The **employment of the spouse** is positive for both men and women, indicating complementarity in their decisions: the participation in off-farm activities of a husband/wife increases the probability of off-farm employment of his/her spouse, and similarly on-farm work of one spouse results in a lower probability of off-farm participation for the other spouse (Findeis et al., 1991).

C. Farm production. F**arm size, farm economic size**, **farm output**, and **farm income** indicate that higher farm profits and large scale of farm operation appear to exhibit a negative influence on the probability of engaging in off-farm work. The same consideration holds when there is **land ownership,** when the farm was included in a **structural improvement** programme which enhanced its productivity, and for a farm with large **capital stock**. In these regards, Ahituv and Kimhi (2002) stressed the importance of treating farm capital as endogenous in labour market participation decisions. The empirical results suggest that capital increases the marginal productivity of labour on the farm as demonstrated by the farm capital investments which, enhanced by heavily subsidised credit, reduced the attractiveness of off-farm work to Israeli farmers during the 1970s. In general, the results suggest that off-farm employment is most prevalent among families operating small and modest sized farms. At the same time, the **farming system**, i.e. the agricultural production structure which likely affects the seasonal demand for on-farm labour, is correlated with the probability of off-farm participation: labour-intensive activities which require special labour requirements, such as dairy operations, imply lower participation in off-farm work. Moreover, if the farm is part of a **partnership**, the probability of off-farm participation is lower, as more labour is supplied on the farm (Benjamin and Kimhi, 2006).

D. Financial characteristics and other benefits. Income from non-work sources (**other income**) is generally negatively related to off-farm participation, as predicted by the neoclassical theory, although it was found positive in some studies. For example, Goodwin and Holt (2002) found that asset returns and remittances were positively correlated with the off-farm participation decisions of Bulgarian farm households, as higher income households have more opportunities for off-farm employment. **Social benefit programmes**, pecuniary and in-kind benefits (pensions, unemployment compensation, disability payments, maternity benefits, social assistance payments, in-kind benefits for food, medicine,

transportation, etc.) were found to be negatively associated with off-farm participation, as they provide incentives to stay out of the labour force. The empirical evidence over the impact of farm subsidies on labour allocation decisions is ambiguous. A priori, **farm subsidies** would imply a greater participation in on-farm labour and thus a lower participation in off-farm activities; the surveyed studies, which have focused at the household level, have generally confirmed this theory. Nevertheless, several studies have distinguished between subsidies that are **coupled** to production, and thus to farm earnings, which would lead to lower off-farm participation (Benjamin and Kimhi, 2006), and those which are **decoupled** from production, which would instead increase off-farm participation (Hennessy and Rehman, 2008). The results appear to confirm that payments which are coupled to production increase the marginal value of farm labour, whereas those decoupled from production do not affect the marginal value of farm work, but are instead considered as an increase in household wealth and, therefore, boost the income effect in the labour supply problem. Nonetheless, other authors, on a sample of US farm households for the period 1996-9, have instead found that subsidies, coupled or decoupled, are associated with lower off-farm participation (Ahearn et al., 2006), which clearly confirm the expectations due to the income effect.

E. Locational and labour market characteristics. The demand for labour is represented by labour market conditions. **Employment growth**, **job availability**, and high **costs of living**, which are proxies for labour demand growth, are associated with a higher probability of off-farm participation, whereas high **unemployment** has the opposite effect. In this context, Tokle and Huffman (1991) have distinguished among expected shocks and unexpected shocks, and found that **expected unemployment** is instead associated with a higher off-farm participation. Intuitively, higher **off-farm earnings** (the ratio of non-farm to farm income) and lower **agricultural output prices** imply a higher probability of off-farm participation. Moreover, locational variables have been used to measure the impact of access and availability to employment opportunities, as well as the agricultural potential of specific regions, such as fertile regions as opposed to areas with unfavourable conditions for agricultural production, or mountainous areas. In these regards, several proxies have been used, such as a distance variable to the closest city or urban centre, which implies that a greater **distance**, reflected in more commuting time as well as higher movement costs, is associated with lower off-farm participation. Similar conclusions can be drawn for farms in more **rural** and **remote** areas, and in areas unfavourable for agriculture (**aggravated areas**). **Locational dummies** (north, south) have also reflected the rural heterogeneous conditions within the same country and across regions. The reviewed studies of off-farm labour market participation are summarised in Table 1.

Table 1. The Determinants of Off-Farm Labour Market Participation

				Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics				
Authors	**Location and Year**	**Methodology**	**Decision Maker**	**Individual**	**Family**	**Farm Production**	**Financial and Other Benefits**	**Locational / Labour Market**
Huffman (1980)	US farm households: Iowa, North Carolina, Oklahoma, 1964	logit	farm operator	age (+), age2 (-) education (+)	childen: age < 5 (-)	farm output (-)		
Sumner (1982)	Illinois farmers, 1971	probit	farm operator	age (+), age2 (-) education (+) experience: off-farm (+), agricultural (-)		farming system: dairy (-) crop and livestock (+)	other income (-)	distance (-), distance2 (+) regional dummies (N, S)
Huffman and Lange (1989)	Iowa farm husband-wife households, 1977	bivariate probit	jointness in the decisions of farm operator and spouse	education (+) cross-person education (-)*O farm experience (-)	childen: age < 6 (-) children (-)*S	longer crop growing season (-)*O farm income (-)		isolated farms (-) distance (-)
Gould and Saupe (1989)	Wisconsin married farm women, 1983 and 1987	bivariate probit	jointness in the decisions of farm operator and spouse	education (+) cross-person education (-) non-farm training (+)	childen: age < 6 (-)	farming system: dairy (-)		
Findeis, Lass, and Hallberg (1991)	Pennsylvania family farms, 1986-87	probit	separate models for farm operator and spouse	age (+), age2 (-) education (+)* S	children (+) *O childen: age < 5 (-)*S employment of the spouse (+)	farming system: dairy (-)*O livestock (+)*O farm size (-)		employment (+) employment growth (+)
Tokle and Huffman (1991)	US farm and rural-non farm couples, 1978-82	bivariate probit	jointness in the decisions of farm operator and spouse	age (+), age2 (-) education (+), S > O cross-person education (-)	children: age < 6 (-)*S children (-)*S			employment growth (+) expected unemployment (+) cost of living (+) agricultural output prices (-)
Kimhi (1994)	Israeli moshav farm owners (farm cooperatives), 1971, 1975, 1981.	multinomial logit	farm owner	education (+)	household size (+)	farm land holdings (-) farm capital stock (-) farming system: dairy (-)		
Corsi and Findeis (2000)	Pennsylvania farmers and spouses, 1985-86 and 1991	probit	separate models for farm operator and spouse	age (+), age2 (-) education (+), S > O	childen: age < 5 (-)*S	farm size (-) farming system: dairy (-)		non-farm/farm income (+)*O job availability (+)*S
Ahituv and Kimhi (2002)	Israeli moshav family farms (cooperative villages), 1971 and 1981	multinomial probit	farm operator	age (+), age2 (-) education (+) years in the country (+)	household size (+)	farm size (-) farm capital stock (-)		
Goodwin and Holt (2002)	Bulgarian farm households, 1995	probit and single index	separate models for farm operator and spouse	age (-) education (+) off-farm experience (+)	household size (+) children (-)		other income (+)*O social benefit payments (-)	rural (-)
Juvančič and Erjavec (2005)	Slovenian farm households, 1991-2000	probit	farm holder	age (+), age2 (-) education: general (+), agricultural (-) gender (men) (-) married (+) previous off-farm employment (+)	household size (+)	farm economic size (-)		unemployment (-) population density (-) aggravated areas (-)
Ahearn, El-Osta, and Dewbre (2006)	US farm operators, 1996 and 1999	bivariate probit	jointness in the decisions of farm operator and spouse	age (+), age2 (-) education (+)	household size (-)*S	farm income (-) farming system: dairy (-)	government transfer payments (-), coupled and decoupled	
Benjamin and Kimhi (2006)	French family farms, 2000	multinomial logit	jointness in the decisions of farm operator and spouse	age (+), age2 (-) education: general (+), agricultural (-) cross-person education (-)*S	children (-) household size (+)	farm economic size (-) partnership (-) structural improvement (-)	farm subsidy (-)*O (conditional on earnings)	
Hennessy and Rehman (2008)	Irish farms, 2002	probit	farm operator	age (+), age2 (-)	household size (+)	farm income (-) farm size (-) farming system: dairy (-)	other income (-) unpaid family labour (-) decoupled payments (+)	

Notes: *O and *S refer respectively to the operator of the farm and to its spouse

3.5.2 On-farm participation

A. Individual characteristics. Participation in on-farm labour increases with **age** up to a certain point, after which participation decreases. **Education** has a non-linear effect: at very low levels, increasing education is associated with a higher likelihood of on-farm participation, whereas at high levels it reflects a lower participation, indicating the higher opportunity cost associated with farming as more off-farm opportunities are available. On the other hand, specific **agricultural education** and **farm experience** are associated with on-farm participation. **Cross-person agricultural education** effects imply that a higher agricultural education of the farm operator is associated with a lower on-farm participation of his spouse, implying substitutability between the farm labour inputs of the male and the female (Benjamin and Kimhi, 2006). **Gender** (being a man) increases the likelihood of being engaged in farming.

B. Family characteristics. A large number of members in the household (**household size**) is negatively associated with male and female farm labour participation due to a substitution effect of farm labour input, therefore increasing the farm couple's participation in the off-farm market (Benjamin and Kimhi, 2006). The **number of children** (in the family farm) is generally associated with on-farm participation, whereas the presence of **young children** (age < 6) is associated with less on-farm labour participation by spouses, due to their time spent in child care and general home activities (Benjamin and Kimhi, 2006).

C. Farm production characteristics. On-farm participation is positively related to the **economic size of the farm**, the volume of **machinery** and **livestock**, **land ownership**, and the presence of **on-farm diversification activities.** If the farm was included in a **structural improvement** programme, and thus is likely to be more productive, it requires more labour inputs due to scale effects. **Partnership farms** tend to have instead a lower rate of women farm-participation, as the female specialises in household tasks.

D. Financial characteristics and other benefits. **Arm subsidies**, conditional on earnings, are likely to increase rents, and are thus positively associated with on-farm labour (Benjamin and Kimhi, 2006), whereas **non-labour income** has the inverse effect, as leisure is a normal good.

E) Locational and labour market characteristics. **Access to markets** and reduced **distance to urban** centres are associated with less on-farm participation, indicating more incentives for off-farm employment. Lastly, in the case of Hungarian households, the use of **regional dummies** allowed Rizov and Swinnen (2004) to conclude that household heads appear to be more dependent on the **agricultural characteristics** of the regions rather than by variations in regional unemployment, whereas for the household as a whole, **unemployment** significantly increases on-farm participation.

Table 2. The Determinants of On-Farm Labour Participation

				Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics				
Authors	**Location and Year**	**Methodology**	**Decision Maker**	**Individual**	**Family**	**Farm Production**	**Financial and Other Benefits**	**Locational / Labour Market**
Rizov and Swinnen (2004)	Hungarian rural households, 1998	two-stage Heckman	household head and household as a whole	age (+), age2 (-) education (+), education2 (-) farm experience (+)*T gender (men) (+)	household size (-)*O	machinery (+) livestock (+) land ownership (+)	other income (-)	access to market (-) distance (+) agricultural regions (+) unemployment (+)*H
Benjamin and Kimhi (2006)	French family farms, 2000	multinomial logit	jointness in the decisions of farm operator and spouse	agricultural education (+) cross-person agric. education (-)*S farm experience (+)	children: age < 6 (-)*S children (+)*S household size (-)*S	structural improvement (+) diversification on farm (+) partnership (-)*S economic farm size (+)	farm subsidy (+) (conditional on earnings)	

Notes: *O and *S refer respectively to the operator of the farm and to its spouse

*H and *T refer respectively to the head of the household and to the household as a whole

3.6 Labour supply

The empirical results categorised in this section stem from studies in which supply functions were estimated. As outlined in the theoretical framework, the amount of labour supplied, in terms of working hours or days, is conditional on the farm production function, on the utility function and on the wage rate. The major determinants which are usually endogenously determined within the system are the off-farm wage and farm output. In regards to farm production, two different approaches have been employed to model labour supply decisions: a first method consists in the estimation of a production function, to generate a predicted value, in terms of output or profit, which is then used as independent variable in the labour supply function (Huffman, 1980). A second approach, which is that most commonly used, relies on the estimation of the labour supply function as a reduced form, thus incorporating the exogenous factors that affect farm production in the labour supply function. The determination of the off-farm wage rate and considerations on the estimation of farm output are looked at more closely in section 4, dedicated to the demand for labour. As before, the exogenous factors determining labour supply are classified according to the various characteristics: individual, family, farm production, financial and other benefits, locational and labour market. The response to an off-farm wage change is also included in the synthesis of results, as well as the impact of farm output and profit, summarised in the farm production characteristics.

3.6.1 Off-farm labour supply

A) Wage effect. Despite the ambiguous effect of an increase in the wage predicted by the neoclassical theory, the studies reviewed support a strongly positive supply elasticity with respect to **wage**, where the substitution effect outweighs the income effect, i.e. as the market wage increases, more off-farm labour is supplied. Huffman and Lange (1989) have found that there seems to be even a stronger wage elasticity when both the operator and the spouse work off-farm. On the other hand, in an empirical study of Indian rural households, Rosenzweig (1980) found that the cross-person wage effect is negative for spouses, implying that a higher wage inducing the farm operator to supply more off-farm labour will be accompanied by less off-farm labour supplied by the spouse. The author also finds, as expected, a backward bending supply curve for both individuals, as after a certain threshold the supply of off-farm labour would decrease, due to the prevalence of the income effect.

B) Individual characteristics. **Age** has a negative effect, meaning that younger individuals are more inclined to supply a higher level of off-farm labour. **Education** has a mixed effect: on one hand, it increased off-farm labour supply (Huffman, 1980; Goodwin and Holt, 2002), and, on the other hand, it reduces it, as education also increased on-farm productivity (Rosenzweig, 1980; Jensen and Salant, 1985). According to Huffman and Lange (1989), education increases off-farm labour supply when both individuals work off-farm, and it reduces it in the specific case of spouses, whereas Sumner (1982) finds that a wife's additional education reduces the male's off-farm labour supply. The results that emerge from a simultaneous estimation of labour supply and production decisions of farm households would suggest that education increases both off-farm labour supply and on-farm labour supply, although the impact on the first is substantially larger (Lopez, 1984). The variables capturing **experience** and **training** have the predicted effects, as they increase labour supply when they are related to off-farm activities, and they reduce labour supply when they are agriculture related.

C) Family characteristics:.The presence of more **members in the household** appears to be associated with more off-farm labour supply, due to the necessity of providing additional income for family consumption. The presence of **children** appears to have an ambiguous effect on labour supply, displaying at times the opposite sign to what is found in market participation decisions. However, the age of children matters for the effect and in the case of women, young children tend to reduce the supply of off-farm labour.

D) Farm production characteristics. Variables related to farm profits and farm output (**farm size**, **farm income**, **output prices**, **on-farm labour returns**, **farm land**, **cropping efficiency**) are all negatively correlated to off-farm labour supply. On the other hand, a larger **scale of operation** can allow more off-farm labour supply from spouses. Although this may seem counterintuitive, the scale of operation is similar to cooperative farming, which permits greater off-farm employment opportunities (Goodwin and Holt, 2002). An important contribution to the literature has been advanced by Mishra and Goodwin (1997), who recognised the importance of including **farm income variability** in the set of variables, as a greater amount of off-farm labour is supplied when there are risks associated with farming. This supports the proposition that risk and uncertainty play an important role in individuals' labour allocation decisions: greater risk in agricultural activities is expected to shift out the supply of off-farm labour, whereas rural areas with more diversified or stable agricultural production are associated with less off-farm employment.

E) Financial characteristics and other benefits. **Other income** is generally associated with less total labour supply, although some studies have found opposing results (Goodwin and Holt, 2002). Mishra and Goodwin (1997) find that the impact of **farm subsidies** is negatively associated with the amount of labour supplied off-farm, whereas in the case of **decoupled payments** Hennessy and Rehman (2008) find an opposite effect. Individuals who receive large **social benefits** are associated with less labour supply, as found for off-farm labour marker participation, whereas **fringe benefits** provided in the off-farm labour market (for example, paid holidays and sick leave, health insurance, pension plans and life insurance) induce more labour supply, as they have similar effects to a wage increase (Jensen and Salant, 1985) and have a prevailing substitution effect. Lastly, individuals are found to supply more off-farm labour as their debt to assets ratio (**leverage**) increases (Mishra and Goodwin, 1997).

F) Locational and labour market characteristics. Not many locational variables have been used and/or have been found to be significant in explaining off-farm labour supply, probably because these variables are more important in explaining market participation rather than the amount of labour supplied. Nonetheless, households in more **rural** and remote areas are negatively associated with off-farm labour supply, due to the distance and costs associated with it.

The results of off-farm labour supply studies are summarised in Table 3.

3.6.2 On-farm labour supply

Since the focus of the surveyed studies is mainly on farm households, where agriculture is the main occupation, the research questions typically concern participation and labour supply in off-farm activities. Therefore, the determinants of on-farm labour supply stem from studies that look at labour decisions of rural households (Rizov and Swinnen, 2004), that are interested in specific aspects of on-farm work, such as the preference and taste for farming (Fall and Magnac, 2004), or that analyse labour supply and production as simultaneous decisions (Lopez, 1984). The results of these studies are presented (Table 4).

Table 3. The Determinants of Off-Farm Labour Supply (Hours/Days of Work)

					Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics				
Authors	**Location and Year**	**Methodology**	**Decision Maker**	**Wage effect**	**Individual**	**Family**	**Farm Production**	**Financial and Other Benefits**	**Locational / Labour Market**
Huffman (1980)	US farm households: Iowa, North Carolina, Oklahoma, 1964	weighted least squares	farm operator	wage (+)	education (+) agricultural extension (+)	childen: age < 5 (+)			
Rosenzweig (1980)	Indian rural households, 1970-1	two-stage least squares and tobit	separate models for farm operator and spouse	wage (+) backward bending cross-person wage (-)*S	education (-)		farm land holdings (-)*S irrigated land (-)*S	other income (-)*S	good weather (-)*S
Sumner (1982)	Illinois farmers, 1971	two-stage least squares	farm operator	wage (+), strong elasticity substitution effect	farm training (-) farm experience (-) wife's education (-)				
Lopez (1984)	Canadian agricultural census divisions, 1970	full information maximum likelihood, simultaneous labour supply and production		wage (+)	education (+)		output prices (-) on-farm labour returns (-)	other income (-)	
Jensen and Salant (1985)	US farm families: Mississippi and Tennessee, 1981	ordinary least squares	farm operator	wage (+)	education (-)			fringe benefits (+) other income (-)	
Huffman and Lange (1989)	Iowa farm husband-wife households, 1977	ridge regression	jointness in the decisions of farm operator and spouse	wage (+), stronger elasticity when both work off-farm	education (+), when both work off-farm education (-)*S	childen: age < 6 (-), when both work off-farm childen: age < 6 (+), if only one works off-farm	longer crop growing season (+)*O		
Mishra and Goodwin (1997)	Kansas farmers and spouses, 1992	tobit	labour supply decisions of farmers and spouses are NOT jointly determined		experience: off-farm (+), agricultural (-) extension education programme (-)	childen (-)*S, (+)*O	farm income variability (+)*O farm size (-)*O cropping efficiency (-)*O	leverage (debts/assets) (+) government farm payments (-)	
Goodwin and Holt (2002)	Bulgarian farm households, 1995	tobit and semiparametric conditional least squares	separate models for farm operator and spouse		age (-) education (+) off-farm experience (+)	household size (+) childen (-)	operation scale (+)*S	other income (+) social benefit payments (-)	rural (-)
Hennessy and Rehman (2008)	Irish farms, 2002	ordinary least squares	farm operator				farm income (-)	other income (-) unpaid family labour (-) decoupled payments (+)	

Notes: *O and *S refer respectively to the operator of the farm and to its spouse

Table 4. The Determinants of On-Farm Labour Supply (Hours/Days of Work)

				Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics				
Authors	**Location and Year**	**Methodology**	**Decision Maker**	**Individual**	**Family**	**Farm Production**	**Financial and Other Benefits**	**Locational / Labour Market**
Lopez (1984)	Canadian agricultural census divisions, 1970	full information maximum likelihood, simultaneous labour supply and production		education (+)* (off>on)		on-farm labour returns (+) output prices (+)	other income (-)	off-farm wage rate (-)
Fall and Magnac (2004)	French farm households, 1992	two-stage least squares	separate models for farm operator and spouse	education (-)*S	household size (-)*S children (-)*S father was/is a farmer (+) cross-person father (-)	land acreage (+)*O, (-)*S		
Rizov and Swinnen (2004)	Hungarian rural households, 1998	two-stage Heckman	household head and household as a whole	age (+), age2 (-) education (+), education2 (-) gender (men) (+)	household size (-)*O, (+)*H	land ownership (+) machinery (+) livestock (+) buildings (+)*H	other income (+)	

Notes: *O and *S refer respectively to the operator of the farm and to its spouse
*H and *T refer respectively to the head of the household and to the household as a whole

A) Individual characteristics. Farm labour increases with **age** but only up to a certain point, after which, it decreases. **Education** also appears to have a non-linear effect: at low levels of education, an increase in schooling increases farm labour, but higher levels of education are associated with less on-farm labour and a shift towards off-farm activities. The education of women is generally negatively associated with farm labour, and on average **men** supply more hours of labour to on-farm activities.

B) Family characteristics. A high **number of members** present in the household is estimated to be associated with more on-farm labour from the household as a whole (Rizov and Swinnen, 2004), and with less on-farm labour from the operator, probably due to the increased need for off-farm earnings for maintaining the family or due to constraints in the on-farm labour opportunities. Moreover, the presence of **children** is associated with lower on-farm labour from women, due to child care and home responsibility. Interestingly, Fall and Magnac (2004) find that the **occupation of fathers** is an important determinant of on-farm labour supply decisions. An individual whose father was/is a farmer usually supplies more labour, and the cross-effect is negative for both operators and spouses.

C) Farm production characteristics. As expected, **land size**, **machinery** and **buildings**, **livestock** and **land ownership** are all positively associated with more on-farm labour, and are more significant for male operators rather than their spouses. At the same time, **on-farm labour returns** and **farm output prices** are positively associated with labour supply on the farm.

D) Financial characteristics and other benefits. **Other income** has an ambiguous effect. According to Lopez (1984) non-labour income is associated with less labour supply, both on-farm and off-farm, due to its income effect. On the other hand, although other-income has a negative effect on on-farm participation, if the household decides to engage in farming, access to non-labour income relaxes the liquidity constraint, allowing on-farm investment to build a more intensive or larger farm, and thus inducing more labour supply. As recognised by Rizov and Swinnen (2004), if the ability to borrow in financial markets is constrained by credit market imperfections, non-labour income plays an important role in the decisions of labour allocation in farming activities.

E) Locational and labour market characteristics. As expected, the **off-farm wage** rate is negatively associated with labour supply in on-farm activities, as a high market wage would imply more incentives to work off-farm.

3.7 Change in agricultural employment

During the 20th century, in Europe as well as in the United States, there has been a decline in both the absolute level and the relative importance of farm employment (Breustedt and Glauben, 2007). The massive movement of people out of agriculture has been accompanied by the reallocation of labour by farm residents from farm to off-farm work. The previous sections have focused on the empirical findings concerning the determinants of off-farm labour market participation and the amount of labour supplied to off-farm activities. Economic growth and technological change have facilitated the integration of farm and non-farm labour markets, due to improved communication and transportation systems, which has resulted in a widening of the range of off-farm work opportunities to farm residents (Huffman, 1977). The structure of the farm and the characteristics related to farm production, as well as the labour market conditions, are the main factors which have been found significant in explaining the change in agricultural employment. The studies summarised in Table 5 concern the change in agricultural employment, and include the determinants for leaving the agricultural sector as well as those important to farm stability and survival[5].

[5] The results summarised in Table 5 encompass two different specifications of the dependent variable, analysing opposing outcomes: 1. the determinants for leaving the agricultural sector (the probability of

A) Individual characteristics. The non-linear effect of **age** implies that younger individuals are more likely to move out of agriculture altogether, but at a higher age (around 44 years for western European farmers) they are estimated to have a higher probability to stay in the sector (Breustedt and Glauben, 2007). Individuals with a higher level of **education** and who are **actively searching for a job** are more likely to exit agriculture towards off-farm employment, whereas specific **agricultural education** is associated with higher expectations of continuing farming. Being a **man** and being **married** reduce the probability of leaving the agricultural sector, possibly due to a higher immobility as compared to women and single individuals respectively. On the other hand, Pietola et al. (2003), examining the impact of early retirement programmes on elderly Finnish farmers in the years 1993-8, found that married farmers have instead a higher probability of retiring earlier than single farmers, suggesting that couples are more inclined to move away from agricultural activities.

B) Family characteristics. The number of members in the family (**household size**) is generally associated with a higher probability of staying in agriculture. As confirmed by several studies, the presence of a **successor** is a positive determinant for farm survival and growth (Weiss, 1999; Glauben et al., 2003). In particular, when the productivity and income generated on farm are high, there is a greater probability of transferring the farm operations rather than closing down (Pietola et al., 2003). Moreover, living in **traditional households,** i.e. in households made up of three or more generations, increases the expectations of continuing farming (Pfeffer, 1989).

C) Farm production characteristics. F**arm earnings**, **livestock**, **land area**, **farm buildings** and **farm economic size**, measured by the standard gross margin, are related to a high probability in being involved in farming, due to the sunk costs associated with quitting. Livestock can be also considered as a proxy for wealth, which can be used as a collateral for credit, hence important to overcome credit imperfections (Kancs et al., 2009b). On the other hand, **crop production**, compared to other farming systems, is usually associated with a higher probability of leaving the sector. **Land ownership** has been generally found to be negatively associated with leaving the agricultural sector, due to the close emotional tie with the family and the business (Breustedt and Glauben, 2007). As in the case of livestock, the owned land can also work as collateral for credit, which would imply a smaller outflow of family labour from agriculture. Nonetheless, in other studies this variable was positively associated with exit rates from agriculture, probably towards retirement, as farmers would receive additional income from selling or leasing out land, in particular when off-farm employment opportunities are limited (Glauben et al., 2003). **Individual farms**, in comparison to corporate farms, have been found to be positively related to the probability of staying in agriculture and negatively associated with flows out of the sector. Social capital links connected with family farms represent a source of income and food security. With particular reference to transition economies, agriculture has performed a buffer role against high levels of general unemployment at the beginning of the transition process (Swinnen et al., 2001; Dries and Swinnen, 2002). By the same token, farm families may be more attached to the agricultural sector, possibly reinforced by the non-pecuniary benefits, e.g. the autonomy in their work, or as a security against redundancy (Bojnec and Dries, 2005). When family links exist, laid off workers from the off-farm market are more inclined to return to agriculture. Moreover, the presence of **on-farm diversification** activities also appears to be important for the decision to remain in the agricultural sector. Lastly, a **part-time farming** dummy variable has often been used in these studies yet this has generated some controversy. Some authors have emphasised the importance of income earned in off-farm work, as being crucial for the survival of the farm (Kimhi, 2000), others have criticised the dimension of part-time farming claiming that it represents a stepping stone out of agriculture

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exit or change in agricultural employment) and 2. the determinants of farm growth and survival (the probability of staying in agriculture or the increase in labour employed in the sector). Therefore, the studies looking at the latter outcome are characterised by the notation: *STAY. When there is no notation, the specification of the dependent variable is akin to the labour flows out of agriculture.

(Pfeffer, 1989). The empirical findings support this ambiguity: some authors have found that part-time farms, compared to their full-time counterparts, have a lower expectation of continuing farming, with lower probabilities of both survival and expansion (Pfeffer 1989; Weiss, 1999; Bojnec et al., 2003). On the other hand, other studies have shown that part-time farms are associated with lower farmers' exit rates, as income from off-farm employment has a stabilising effect on total household income (Glauben et al., 2003) and on structural change in agriculture (Breustedt and Glauben, 2007). These last findings would confirm that off-farm work is a 'stable situation' (Kimhi, 2000).

D) Financial characteristics and other benefits. The effect of **subsidies** appears ambiguous. Breustedt and Glauben (2007), focusing on Western European farmers from 12 EU countries during the years 1993-97, have found that farm payments have been associated with a higher likelihood of staying in the sector, as they lead to increased profitability. According to others studies, both **coupled and decoupled** subsidies are associated with a higher probability of exit from agriculture. The empirical evidence would suggest that US farmers are more likely to invest subsidy revenues in labour-saving capital equipment, such as farm machinery and equipment than in additional labour, thus substituting capital for labour (Goetz and Debertin, 1996). Larger farm payments during the 1980s were accompanied by higher rates of population loss from rural counties and, despite the higher land prices resulting from the capitalisation of farm subsidies into fixed assets, they failed to prevent out-migration. An important consideration in analysing the impact of subsidies and other agricultural policies concerns the study level, i.e. farm household or aggregate. In general, the studies focusing at the household level usually confirm the positive effects of subsidies on the probability of remaining in agriculture. On the other hand, other studies have found that, when looking at a more aggregate level, regions with higher subsidies are associated with lower on-farm work and a higher probability of out-migration, in part due to the fact that greater total subsidies accrue to large farm holders, thus excluding a large share of smaller family farms. This specification is extremely important as it does not only look at the beneficiaries of the payments but it includes the total population, including also smaller scale family farms. Empirical evidence from 25 EU countries, for the period 2005-6, confirms these results. The second order effects induced by the CAP suggest that subsidies are capitalised in farm inputs, such as land; moreover, an unequal distribution of these payments would lead to a decrease, in relative terms, in the net income of those farmers receiving less than the average subsidies compared to a situation where there are no subsidies. Therefore, subsidies that accrue to large farmers would in fact make it easier to buy out smaller farms, accelerating the exit rates from agriculture and associated structural change in the sector (Van Herck, 2009). Moreover, Pietola et al. (2003) find that higher **retirement benefits** have accelerated the rate of exit from the agricultural sector, in particular for lower income farmers. Especially when there is **uncertainty over the continuation of the early retirement programme**, the probability of exit is doubled. Lastly, Van Herck (2009) examines the impact of non-pecuniary agricultural benefits and finds that being **self-employed** in agriculture and being part of a **farm family** would lead to lower exit rates from agriculture. The reasons behind include the fact that the autonomy, the independence, and the pride associated with business ownership are valuable to farmers.

E) Locational and labour market characteristics. Regions with **unfavourable agricultural conditions** are associated with higher exit rates, whereas higher **land prices** and **farm output prices** reduce the probability of leaving the sector. At the same time, in the case of exit from agriculture, higher farm output prices increase the probability of transferring the farm to a new entrant or successor. A **positive shock to revenue** decreases the likelihood of ending farm activities, whereas it increases the probability of transfer to a new entrant (Pietola et al., 2003). Conditions in the off-farm labour market represent an important pull-effect out of the agricultural sector. High **wages** and **off-farm employment** rate, greater **off-farm opportunities,** higher **growth in other sectors** and a large **population density** increase the probability of leaving the sector (Barkley, 1990; Dries and Swinnen, 2002; Breustedt and Glauben, 2007; Van Herck, 2009). On the other hand, Glauben et al. (2003) found that greater **population density** reduces exit rates, probably meaning that

urban areas have undergone greater structural changes in the past than rural areas. By the same token, Goetz and Debertin (1996), focusing more general on the rural population change in US counties (1980-90), have found that **off-farm employment** and **off-farm income** have had a stabilising impact on preserving rural areas and reducing the rates of out-migration. More **hours of work** spent on the farm are positively related to the probability of staying in agriculture, whereas residing in a **new member state** (NMS) has a positive effect on the probability of leaving the agricultural sector, as the social and economic reforms which occurred during the period of accession to the EU significantly changed employment alternatives (Van Herck, 2009). In this context, Swinnen et al. (2001) focus on the impact of institutional reforms on labour adjustments during the transition period. Taking a sample of seven transition countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia) during the years 1988-95, they find that **privatisation** has led to reductions in employment in agriculture, as it introduced hard budget constraints for the farms and reduced government and worker bargaining power in labour allocation. On the other hand, the **shift to individual farms** has caused an increase in agricultural employment, as the gains in labour efficiency and the substitution effects due to improved labour governance of individual farms outweighed the losses of scale economies during the transition period. **Price and trade liberalisation** in agriculture, measured by the change in the terms of trade, have led to a reduction in the profitability of agricultural production and thus to a decrease in agricultural employment. Moreover, price and trade liberalisation has also led to changes in the **relative price of labour vis-a-vis other inputs**, causing a substitution effects among inputs, and increasing the demand for labour due to the increased prices of other inputs. Countries with **higher income** (as a proxy for social welfare) are also associated with greater outflows of labour from agriculture. Lastly, the movements of labour out of agriculture triggered by higher growth in other sectors are severely constrained by the presence of structural impediments. As noted by Dries and Swinnen (2002) for the case of Poland during transition (1991-98), poor physical infrastructure, and most importantly, low levels of human capital entail mobility costs which represent **structural impediments** to the outflow of the farm labour force. Lastly, **regional dummies** show significant differences in exit rates within the same country, due to inequalities in terms of farm productivity, earnings in off-farm occupations, labour demand, etc. For example, Glauben et al. (2003), concentrating on Western Germany counties (1991-99), find that regions with a higher distribution of part-time farmers and on-farm diversification activities manifest lower rates of exit, whereas regions with higher GDP and more off-farm employment opportunities are associated with higher exit rates.

Table 5. Change in Agricultural Employment: The Determinants of Exit from Agriculture versus the Determinants of Farm Growth and Survival

				Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics				
Authors	**Location and Year**	**Dependent Variable**	**Methodology**	**Individual**	**Family**	**Farm Production**	**Financial and Other Benefits**	**Locational / Labour Market**
Pfeffer (1989)	Federal Republic of Germany, family farms, 1980	expected stability of full- and part-time farms (expectation variable in probability terms) * STAY	logit		traditional household (+)	part-time (-) farm economic size (+)*FT farm earnings (+)		unfavourable regions (-)
Barkley (1990)	US farmers, 1940-85	change in agricultural employment (%)	ordinary least squares					non-farm returns/farm returns (+) non-farm labour force/farm labour force (+) price of land (-)
Goetz and Debertin (1996)	US rural counties, 1980-90	rural population change (log) * STAY	ordinary least squares			farm land and buildings (+) livestock (+)	federal farm programme payments (-)	off-farm employment (+) off-farm income (+) rural earnings (+) urban earnings (-)
Weiss (1999)	Upper Austrian farm households, 1980, 1985, 1990	farm survival and growth (dummy and log respectively) * STAY	two-stage Heckman	age(+), age2 (-) agricultural education (+) married (+) gender (men)(+)	successor (+) household size (+)	livestock (+) part-time farm (-)		
Swinnen, Dries, and Macours (2001)	7 Transition countries' agricultural labour 1988-95	change in labour employed in agriculture (%) * STAY	ordinary least squares and two-stage least squares			individual farm (+)		privatisation (-) shift to individual farms (+) price and trade liberalisation (-) agricultural wage/input price index (-) agricultural wage/off-farm wage (+) income (GNP per capita) (-)
Dries and Swinnen (2002)	Polish farmers, 1991-98	change in labour employed in agriculture (%) * STAY	generalised least squares and ordinary least squares			individual farm (+)		privatisation (-) price and trade liberalisation (-) growth in other sectors (-) structural impediments (-) regional dummies
Bojnec, Dries, and Swinnen (2003)	Slovenian agricultural labour market, 1993-99	labour flows from agriculture (probability dummy)	probit	age (-), age2 (+) education (+) gender (men) (-) married (-) actively searching for job (+)		part-time farm (+) farm size (-) individual farm (family farm) (-)		
Glauben, Tietje, and Weiss (2003)	Western Germany counties, 1991-99	relative change in farm numbers (log) * STAY	ordinary least squares	age > 45 (-)	successor (+)	farm size (+) owned land (-) dairy and cattle (+) pig production (+) on-farm diversification (+) part-time farm (+)		population density (+) GDP per head counties (job opportunities) (-) regional dummies
Pietola, Väre, and Lansink (2003)	Finnish elderly farmers, 1993-98	exit through an early retirement programme (probability of exit and close = C, probability of exit and transfer = T)	switching mulltinomial probit and simulated maximum likelihood method (GHK)	age (-) married (+)		land area (-) C , (+) T forest area (-)	retirement benefits (+) uncertainty retirement programme (+) C, (-) T	regional dummies output prices (+) T positive shock to revenue (-) C, (+) T
Bojnec and Dries (2005)	Slovenian agricultural labour force, 1994-99	labour flows out of agriculture, (probability)	multinomial logit	age (-), age2 (+) education (+) married (-)		individual farm (family farm) (-)		hours of work (-) public sector (-)
Breustedt and Glauben (2007)	Western European farmers, 110 regions, 12 EU countries, 1993-97	net relative decrease in farm numbers	ordinary least squares	age > 44 (-)	household size (-)	farm economic size (-) livestock (-) crop production (+) part-time farm (-) owned land (-)	subsidy payments (-)	agricultural output prices (-) population density (+) unemployment rate (+)
Van Herck (2009)	EU-25 farmers, 2005-6	exit from agriculture (probability dummy)	logit	age (+) agricultural education (-) gender (men) (-) married (-)		livestock (-) cereal crops (+)	subsidies (coupled and decoupled) (+) non-pecuniary agric. benefits: self-employment (-) family worker (-)	off-farm wage (+) population density (+) NMS (+) employment alternatives (+)

Notes: *FT refer to full-time farmers, when non specified the variables refer to both full-time and part-time (Pfeffer, 1989)

*C and *T refer respectively to the probability of exit and close down the farm and to the probability of exit and transfer the farm operation to a successor (Pietola, Väre, and Lansink, 2003)

*STAY refers to the specification of the dependent variable including those studies which examine the determinants of farm growth and survival, the probability of staying in agriculture, and the increase in labour employed in agriculture (when not specified the dependent variable refers to the probability of exit or more generally to labour flows out of agriculture)

3.8 Inter-sectoral labour flows

In addition to examining the determinants of labour flows out of agriculture, some authors have also focused on the destination of these flows, mainly towards the industry or services sector, unemployment or out of the labour force (retirement). At times, the latter two options (unemployment and retirement) have been treated as a unique group, in order to estimate the different factors leading to sectoral employment switching. It has also been the case that some studies have looked at the decision to switch from the industry and services sector towards agricultural employment as opposed to become unemployed or to retire. In order to combine the direction of the variables employed, we classify the empirical work on the basis of the probability or likelihood of entry (instead of exit) in the desired sector (agriculture, industry or services, unemployment, retirement), with the purpose of drawing some more general conclusions (Table 6). The superscripts next to each significant variable indicate the study from which it has been extracted.

A) Agriculture. **Younger** (due to their lack of experience), **less educated**, and **married** individuals are generally more likely to move to the agricultural sector. More **hours of work**, being part of a **family farm** and being engaged in **pluriactivity** increase the likelihood of moving to the agricultural sector, whereas being **self-employed** and working in the **public sector** reduce this probability.

B) Industry and services. **Younger** and more **educated** (as more mobile and flexible), **non-married** individuals are likely to move to the industry and services, whereas specific **agricultural education** is negatively associated to their probability of leaving agriculture. At the same time, farmers with **livestock** production face greater sunk costs in respect to **cereal** farmers and are therefore less likely to move towards industry and services[6]. Being **self-employed** in farming and being part of a **family farm** reduces the likelihood to move towards industry and services, whereas **decoupled subsidies** have also been associated with a higher probability of sectoral switching. Lastly, individuals living in a **densely populated area** are also more inclined to move to industry and services.

C) Unemployment. **Younger**, **non-married** individuals, with less **general** and **agricultural specific education**, have the higher probability of ending up unemployed, whereas being a **man** reduces this likelihood. All the variables describing specific job characteristics are negative: more **hours of work**, working in the **public sector**, being **self-employed** (in either industry and services or agriculture), having social connections with the **family farm**, being engaged in **pluriactivity**, are all negatively related to becoming unemployed. Whereas living in a **densely populated area** and in a **new member state** may increase the probability of not finding employment.

D) Retirement. **Older**, **less educated**, **non-married**, and **women** are more likely to retire. On the other hand, having **land ownership** and being engaged with **livestock** production reduce the probability to flow from agriculture into retirement. Similar to the flows towards unemployment, more **hours of work**, working in the **public sector**, being **self-employed** (in either industry and services or agriculture), having social connections with the **family farm**, being engaged in **pluriactivity**, are all negatively related to the decision to retire. Regions with higher **farm subsidies**, especially those **coupled** to production, have been found to be positively associated with decisions to retire from the labour force. This might be due to second-order effects where some farmers receive less than the average subsidy, due to the substitution of labour by capital, and/or because other larger farmers decide to buy out those farmers that are about to exit (Van Herck, 2009). Those unemployed individuals living in a **densely populated area** and those in a **new member**

[6] The reason could also be that the demand for labour in farms with livestock is a-seasonal compared to cereals production, meaning that job search in an off-season would be limited. At the same time, this would also imply less chance to have experienced another sector on a part-time basis.

state may be more inclined to retire or exit the labour force, likely due to a perceived low probability of finding further employment.

In general, retirement also depends to a great extent on the different retirement regulations for farmers, which vary significantly across EU Member States. In this respect, Pietola et al. (2003) analyse the factors that determine the timing and type of exit from farming of elderly farmers with particular focus on the effect of early retirement programmes in Finland. Their findings would suggest that farmers' decisions to retire respond very elastically to the level of retirement benefits.

Table 6. The Determinants of Inter-Sectoral Labour Flows Towards Agriculture, Industry and Services, Unemployment, Retirement

Sector	Individual	Farm Production	Financial and Other Benefits	Locational / Labour Market
Agriculture	age (-) c education (-) c married (+) c		hours of work (+) c self-employment (-) c public sector (-) c pluriactivity (+) c family farm (+) c	
Industry and Services	age (-) a,b education (+) a, b agricultural education (-) a married (-) a	livestock (-) a cereals (+) a	subsidies, decoupled (+) a self-employment (-) a family farm (-) a	density (+) a
Unemployment	age (-) a,c education (-) a,c agricultural education (-) a gender (men) (-) a,c married (-) a,c		self-employment (-) a,c family farm (-) a hours of work (-) c public sector (-) c pluriactivity (-) c	density (+) a NMS (+) a
Out of Labour Force (Retirement)	age (+) a,c education (-) a,c gender (men) (-) a,c married (-) c	land ownership (-) a livestock (-) a	subsidies, coupled (+) a self-employment (-) a,c family farm (-) a hours of work (-) c public sector (-) c pluriactivity (-) c	density (+) a NMS (+) a

Notes: [a] Van Herck (2009). EU-25 farmers, 2005-6. Driving forces out of agriculture towards: 1. industry and services, 2. unemployment, 3. out of labour force.
[b] Bojnec, Dries, and Swinnen (2003). Slovenian agricultural labour market, 1993-99. Flows from agriculture towards: 1. industry and services or 2. unemployment or retirement.
[c] Bojnec and Dries (2005). Slovenian agricultural labour force, 1994-99. Determinants of flows from industry and services into: 1. agriculture, 2. unemployment, 3. retirement.

3.9 Part-time farming: A farm survival strategy or a stepping stone out of agriculture?

Many farmers divide their time between farming and off-farm work: between 20 and 50 percent of farmers, in both developed and less developed economies, also work off the farm (Kimhi, 1994). Much like the process of migration, part-time farming has become an increasingly important phenomenon in the sector. Therefore, some authors have questioned whether this situation is a stable one. In particular, whereas some studies have shown that earnings through off-farm work are a crucial strategy for continuing farming activities and thus for farm survival (Glauben et al., 2003; Breustedt and Glauben, 2007), others have claimed that part-time farming is a stepping stone out of agriculture, as the expectations of part-time farmers, compared to their full-time counterparts, are lower in terms of continuing farming activities (Pfeffer 1989; Weiss, 1999; Bojnec et al., 2003). According to the latter studies, part-time farmers may manifest a higher likelihood of exit from agriculture and might be simply constrained in their willingness to migrate. These conclusions have been drawn by looking at the sign of the part-time dummy used as explanatory variable in the analysis over the change in agricultural employment (Table 5). It is clear that the empirical

literature has not provided an unambiguous answer over the role of part-time farming, but has simply widened the debate, as the results appear to be mixed and inconclusive.

Pfeffer (1989) and Kimhi (1994, 2000) are the main authors which have included the condition of part-time farming in the dependent variable. The former attempted to evaluate the expected stability of full-time and part-time farms in the Federal Republic of Germany during the 1980s. Farmers were asked to self express their expectations for the future, and these data helped generate the finding that part-time farmers have lower expectations of continuing farming in both short and long run, compared to their full-time counterparts. The latter has instead looked at the determinants of part-time farming versus specialisation in either farming or off-farm work (Kimhi, 1994), and subsequently at the determinants of full-time versus part-time off-farm work decisions (Kimhi, 2000). According to Kimhi, the main constraint in answering such question is the inappropriateness of the data. Even when using panel data, an exit from farming would imply exit from the panel. In this regard, his studies focus on Israeli Moshav communities, which are forms of cooperatives of individual farms which represent a rather unique data set to address this question. This is because although farmers decide to quit agriculture, they still retain ownership of the farm due to the specific institutional framework, so that the model includes the potentially reversible decision to work on the farm. Kimhi's results are summarised in Table 7.

The explanatory factors for supplying part-time work on the farm, as opposed to specialisation in either farming or off-farm activities, are the following (Kimhi, 1994): **age**, which has a negative sign, implying that younger farmers are more inclined to work part-time, whereas older farmers tend to specialise in farm activities. **Distance** to town, as a proxy for travel costs, is also negative, as it reduces the probability of part-time work, meaning that farmers in remote areas are more inclined to work full-time on the farm.

By the same token, off-farm specialisation is also preferred to part-time work, especially when the wage and the benefits in the off-farm market are higher and more than compensate for the travel costs. In **mountain regions**, there is a higher tendency to become part-time farmers, due to the lower profitability of these areas, which imply the need for alternative sources of income. Nonetheless, the local conditions in these areas are more difficult and often present constraints to off-farm opportunities. The low **terms of trade in agriculture**, which declined significantly in the years under analysis, are positively correlated to the probability of working part-time, and negatively to the probability of full-time work on the farm. Furthermore, the number of **family members working full-time** on the farm, the **land size**, and the **farm capital** stock, as proxies for farm labour demand, have a stronger negative effect on the probability of working full-time off the farm than on the probability of working part-time; the same holds for **livestock farms** (Kimhi, 2000).

More importantly, in the latter study the author rejects the myopic model (i.e. the standard cross-sectional model) in favour of the life-cycle model, implying that farmers are forward-looking, as they take into account the future implications of off-farm work decisions when making their farm-management decisions[7].

The results would suggest that farmers tend to work full-time off the farm when their prospects of exit from farming are low, implying that off-farm work is a stable long-run combination with farming. Nonetheless, the drawn conclusions are specific to Israeli Moshav communities, where the high institutional cost of formally leaving the farm provides a justification for the persistence of farming with a full-time off-farm job, meaning that the results cannot be generalised to all countries but do provide some interesting insights into labour supply preferences in more extreme conditions.

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[7] As the author points out "capital investments are perhaps more forward-looking than other farm-management decisions" (Kimhi, 2000, p. 45). In a subsequent paper, Ahituv and Kimhi, (2002) examine the endogeneity of farm capital investment in farmers' labour allocation decisions, which is presented in section 4.

Table 7. The Determinants of Part-Time Farming (as Opposed to Specialisation in Farming or Off-Farm Work)

			Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics			
Authors	**Location and Year**	**Dependent Variable**	**Individual**	**Family**	**Farm Production**	**Locational / Labour Market**
Kimhi (1994)	Israeli moshav farm owners (farm cooperatives), 1971, 1975, 1981	part-time farming (part-time versus specialisation in either farming or off-farm work)	age (-)			distance (-) mountain regions (+) terms of trade (+)
Kimhi (2000)	Israeli moshav family farms (cooperative villages) 1971, 1981	full-time versus part-time off-farm work		family members full-time on farm (-)	land size (-) farm capital (-) livestock (-)	

4. Labour demand and farm production

4.1 Off-farm labour demand: the wage offer function

In the previous section dedicated to the supply side adjustments of labour in the rural sector, it has been possible to see how time allocation decisions are based on the marginal returns that each activity offers. Off-farm employment does not only depend on the characteristics of the individual, but also on locational variables and on the characteristics of the labour market, which represent the labour demand conditions. Off-farm labour demand, in terms of the offered wage and the number of job opportunities, has often been accounted for when analysing off-farm labour supply. For instance, wage equations have been estimated in several studies to provide predicted wages, or potential wages, for individuals who do not participate in the off-farm market or when wage values are not available from the data. As outlined in the theoretical framework, the off-farm wage is assumed to reflect individual human capital characteristics (H) as well as labour market conditions (Z), so that:

$W = W(H, Z)$.

Therefore, the hourly off-farm wage received by farm owners and spouses, have been regressed on human capital characteristics, as well as labour market characteristics. The results, which are summarised in Table 8, show that increasing marketable human skills (education, vocational training, age and experience) shift upward the labour demand curve or off-farm wage function.

Table 8. The Determinants of Off-Farm Labour Demand (Wage)

			Exogenous Characteristics	
Authors	**Location and Year**	**Dependent Variable**	**Individual**	**Locational / Labour Market**
Sumner (1982)	Illinois farmers, 1971	$\log_e$ (hourly wage)	experience (+) education (+)	regional dummies distance to nearest city (-)
Jensen and Salant (1985)	US farm families: Mississippi and Tennessee, 1981	$\log_e$ (hourly wage)	age (+), age2 (-) education (+) race (white) (+)	
Gould and Saupe (1989)	Wisconsin married farm women, 1983 and 1987	$\log_e$ (hourly wage)	work experience (+) education (+)	unemployment rate (-)
Huffman and Lange (1989)	Iowa farm husband-wife households, 1977	$\log_e$ (hourly wage)	experience (+) education (+), S > O	regional dummies (west, east)
Tokle and Huffman (1991)	US farm and rural-non farm couples, 1978-82	$\log_e$ (hourly wage)	experience (+), exp2 (-) education (+), S > O race (white) (+)	expected employment growth (+), O > S expected unemployment(+), O > S share of service jobs (+) *O cost of living (+), O > S urban share (+) *O locational amenities (climate) (-)
Fall and Magnac (2004)	French farm households, 1992	$\log_e$ (hourly wage)	age (+) education (+)	

Notes: *O and *S refer respectively to the operator of the farm and to its spouse

An additional year of **education** significantly increases the off-farm wage, and the increase is relatively higher for spouses compared to farm operators. **Experience** and **age** are also

expected to increase the wage, although their effect is non-linear. The positive impact of the **race** dummy would suggest that, mainly in the US, discriminatory factors are important, as white people have higher wages on average compared to non-white workers. Particularly important are the conditions of the labour market. **Regional dummies** indicate the different labour market conditions across the rural space. A higher **urban** share of the population, higher **costs of living**, a high **share of service jobs**, **closeness to the urban centre** and **expected employment growth** are positively related to the wage rate, whereas the **unemployment rate** has a negative effect. When unemployment is anticipated, the effect is reversed due to compensating wage differentials (Tokle and Huffman, 1991). Lastly, differences in **local amenities**, proxied by climate conditions, affect the wage rate.

In general, residents of different areas may supply different levels of off-farm work because their time costs of non-farm work differ, and because labour demand conditions are different among markets (Hearn et al., 1996). For example, rigidities in the labour market significantly constrain the supply of off-farm labour, whereas a large and diversified economy which offers jobs with flexible hours offers instead more opportunities for off-farm employment. Hence, marginal values of off-farm work and optimal levels of off-farm income are determined by the local characteristics of the economy. On the other hand, when off-farm job opportunities are low and/or labour demand conditions get worse, non-farm families can also be 'pushed' or 'pulled' into farming, due to the attractiveness of the farming lifestyle (Findeis et al., 1991).

4.2 Farm labour demand: the production function

Since labour demand is a derived demand, i.e. a demand derived from the demand for the final product, in this case agricultural outputs, in order to understand its functioning it is necessary to look at the farm production function. As outlined in the farm-household model, the production function can be simply expressed as:

$Q = f(F, X_f)$,

where the main arguments are farm labour (F) and purchased inputs (X_f), including farmland services and hired labour. In its broader extension, farm production is a positive function of farm work, intrinsic ability, farm-specific human capital, physical capital, fixed inputs (including land), purchased inputs and a stochastic exogenous productivity shock (Ahituv and Kimhi, 2002). The final output produced by the farm-household, and thus the demand for labour, is strictly dependent on the following (Kancs et al., 2009a):

1. the production technology, which determines the labour intensity within the farm;
2. the expected profits from selling the produced output (output prices), which are subject to the type of competition within the sector; and
3. the relative prices of the factors of production (input prices), which determine the specific factor intensities based on the specialisation of the firms.

The production technology of the farm determines the amount of labour needed in production. For example, a labour-saving technological innovation, which may decrease the labour/capital ratio, might lead to a decrease in farm labour demand[8]. The efficiency of farm production depends on human capital characteristics (H) as well as other exogenous farm specific characteristics (Z_f). In this case, the production function can be represented by:

$Q = f(F, X_f ; H, Z_f)$.

As increasing agricultural extension enhances the efficiency of farm production, the demand for farm work may shift up or down, depending on the human time-saving nature of information (Huffman, 1980).

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[8] Some authors have argued that technical change leads to labour saving processes and thus entails the redundancy of farm labour (Glauben et al., 2003).

The structure of the farm and its production characteristics, in particular its size, specialisation, and productivity, are important determinants of the demand for on-farm labour. The input prices faced by farmers may vary according to the size of their holdings (if there are marketing economies of scale present in the economy), implying that input utilisation and output/input ratios may be related to the farm size. Whereas *a priori*, larger farms require more labour than smaller farms in total, it is also true that larger operations exploit their economies of scale, which lead to lower average unit costs of production, and thus less labour input per unit of output. Moreover, farm specialisation is not the same across farms, but it is often related to the structure of the farm organisation. The type of structure, whether it is a family farm, a producer cooperative, or a corporate farm, influences the demand for on-farm labour. For example, family farms tend to specialise in labour-intensive activities in comparison to corporate farms, which instead, due to their superior access to land, finance, physical and social capital, focus more on capital intensive production. As Dries and Swinnen (2002) pointed out, while analysing the reasons for labour adjustments in Poland during transition (1991-98), the large labour outflows from agriculture were associated with large scale corporate farms, whereas family farms played a buffer role in absorbing labour during transition.

4.3 Production and consumption of farm households: simultaneous labour supply and demand decisions

As Findeis et al. (1991) point out, when labour time is reallocated from farming/household work to off-farm employment, the operation of the farm, in terms of the enterprises selected and the farm inputs purchased, may adjust accordingly. The extent to which the organisation of the farm changes in response depends on several factors, such as the characteristics of the off-farm job, whether it is part-time, full-time, seasonal, or year-round, the availability of other family or hired labour to substitute for those engaged in off-farm activities, etc.

The majority of the empirical studies in the rural labour literature have relied on the assumption of perfect competition, which indicates that farm production decisions are separable from household consumption decisions. These studies have treated the characteristics of farm production as exogenous factors in the labour allocation decisions of farmers. As argued by Lopez (1984), farm households' utility and profit maximisation decisions are not likely to be independent and thus labour supply and production decisions should be analysed simultaneously[9]. Lopez's results suggest that **education** has a negative effect on farm output, as it reflects the alternative and more profitable investment opportunities outside agriculture. An increase in the **off-farm wage**, leading to a decline in the on-farm labour supply, would cause a contraction in output supply. Lastly, an increase in **non-labour income**, which is associated with a decrease in on-farm labour supply, would imply a decline in farm output. Hence, the contraction in the scale of production, in terms of farm output supply and farm labour input demand, would confirm the author's assumption that changes on the consumption side do have an impact on the production side. Similarly, Phimister and Roberts (2002) consider the impact of off-farm work on input and output intensities and on the structure of farm output. The employment of panel data allows the authors to estimate a model which takes into account both unobserved heterogeneity and the simultaneity in farm households' decisions of farm production and off-farm work. The results, based on Scottish farm households for the period 1997-2000, suggest that farm operators' decisions to work off-farm do have an impact on on-farm production: an increase in off-farm participation induces a decline in the input use and is associated with a change in the enterprise mix. On the other hand, the off-farm participation decisions of spouses do not seem to affect production decisions. In relation to the endogeneity issue, whereas spouses' off-farm work decisions are found to be exogenous to production decisions, there is some evidence that farm operators' off-farm labour decisions and farm production decisions are

[9] The author tested the hypothesis that utility and profit maximisation decisions are independent (on aggregated agricultural census divisions in Canada, 1970) and could reject it.

simultaneous. Lastly, Ahituv and Kimhi (2002) have recognised that farm capital investment is in fact endogenous to labour market participation decisions, and thus farm management decisions and labour allocation decisions must be analysed simultaneously. The authors find that **full-time farmers** invest relatively more in physical capital than part-time farmers, who instead invest more in their human capital or off-farm experience. As a consequence, farms operated by full-time farmers seem to be more productive. As more **educated workers** have higher capital stocks, physical capital and human capital appear to be complements in farm production. **Large farms** are also associated with higher capital, meaning that land and capital appear to be complements in production. The most important conclusion concerns the strong negative association between off-farm work and capital accumulation. In general, two possible effects might occur: a substitution effect, if capital deepening releases labour from farm production and thus increases off-farm labour supply, and an expansion effect, if capital increases the marginal productivity of on-farm labour. The results, based on Israeli farmers during the 1970s, suggest that the latter effect dominates, implying that family labour and farm capital are complements in farm production.

4.4 The farm structure and the demand for hired labour

The amount of labour which is demanded in the agricultural sector, and in particular in farm activities, depends on the structural organisation of the farm. The most common classification within the literature relies on a dual farm structure (Schnicke et al., 2007), where farms can be generally classified under two categories, namely small family farms and large, factory-style corporate farms[10]. The family unit has been the dominant organisation in farming since the earliest days of agriculture (Allen and Lueck, 1998) and it represents the dominant form of agricultural organisation in the US and in most developed countries; in most western countries, the dominance of family farms in agriculture has been strengthened by a greater decline in hired labour input relative to family labour (Schmitt, 1991). Small farms, run by a farm operator, are usually dependent on family labour; this family labour can also be employed in off-farm activities if off-farm returns are higher than those on farm. Additional labour can be hired on a seasonal basis, such as in the peak season, and/or in substitution of family labour. On the other hand, large corporate farms rely entirely on hired labour, including the management, which is employed on a year basis and receives a single wage rate.

A few studies have examined the demand for hired labour in family farms, and have found a strong correlation with the human capital variables of the farmers and with the farm production characteristics (Table 9). The human capital variables are positively associated with the decisions to hire labour. The positive sign of **general education**, implies that educated individuals are more inclined to seek off-farm employment, reducing their on-farm work, and thus require hired labour for their farm (substitution effect), whereas **agricultural education**, would suggest that educated farmers are more efficient and can afford to hire more labour and dedicate themselves in managerial tasks, or even to more leisure time (income effect) (Benjamin and Kimhi, 2002). **Training** and **farm experience** have similar effects. The higher the **number of family members** in the farm, the lower dependence on hired labour. On the other hand, **larger farms** and **partnership farms** are more dependent on hired labour. Receiving a **farm subsidy**, conditional on farm production, encourages farm work by family members, and thus reduces the demand for hired labour. A **structural improvement** on the farm, which implies a higher productivity or a larger scale of production, is associated with a higher demand for labour, and thus in the case of family farms, more hired labour. This effect has also been confirmed by Bardhan (1984) who found that **technological yield-increasing** or land improvements factors (such as irrigation, fertilisation, etc.) are likely to increase the use of hired labour, by

[10] Small farm partnerships fall between family farms and large, factory-style corporate farms (Allen and Lueck, 1998). In order to allow better comparisons, this section will mainly refer to these two most common farm organisational structures.

increasing the marginal product of labour. Nonetheless, these productivity shifts can be labour-increasing or labour-saving, thus labour demand is not always positively associated with technological shocks.

Table 9. The Determinants of Hired Labour in Family Farms

		Significant Explanatory Variables: Exogenous Factors Listed According to the Characteristics			
Authors	**Location and Year**	**Individual**	**Family**	**Farm Production**	**Financial**
Bardhan (1984)	farms in Indian regions, early 1970s	education (+)	family members (-)	farm size (+) technological improvement (+)	
Benjamin and Kimhi (2006)	French family farms, 2000	general education (+) agricultural education (+) training (+) farm experience (+)	family members (-)	structural improvement (+) partnership farm (+) farm size (+)	farm subsidy (-) (conditional on earnings)

4.5 The shadow value of farm labour

The neoclassical theory predicts that labour is employed to the point where its marginal revenue product equals the real cost of labour, where the marginal revenue product of labour is defined as the change in output multiplied by the output price resulting from hiring an additional worker, holding constant the quantities of all other inputs. An important characteristic related to labour, especially in agriculture, concerns the law of diminishing returns: as more workers are added to a fixed capital stock (thus to a fixed quantity of land and machines), the gains from specialisation decline and therefore the marginal productivity of workers also declines (Borjas, 2005). Moreover, agriculture is a long and discontinuous operation, thus the wage received for farm work is not constant, but the production function imposes a constraint on the utility maximisation of the farm household.

As argued by Bardhan (1984), in regards to the peasant labour market in rural India, the 'competitive wage-equals-marginal-productivity theory' does not take into account the observed persistence of involuntary unemployment and does not recognise the monopsony power which the employer often comes to exert in the village. The weather dependence also implies that operations are seasonal which lead to inter-season adjustments in labour hiring: the higher demand for labour during peak seasons leads to various formal or informal labour-tying arrangements. For example, during the lean season, the employer might pay tied labour more than its marginal product, to ensure a dependable supply of labour in the peak season (Bardhan, 1979). Contrary to the theory of a constant wage in agriculture, estimations on a sample of rural West Bengal casual agricultural workers suggest that the farm wage is sensitive to demand and productivity factors. In particular, the wage is positively associated with the **village irrigation dummy**, the **agricultural development index** of the district, the **age** of worker (due to the higher productivity of experienced workers) and the **busy season**, whereas it is negatively associated with the **slack season** and with the **unemployment rate** in the village. Other considerations concern **women**, who receive lower wages than men, which could be due to the physical strength needed in some agricultural operations as well as to the fact that they are more concerned with household activities and, thus, represent irregular suppliers of labour. Lastly, the **number of dependents per earner** in the family is positively correlated to the farm wage, due to the lower recruitment costs.

The implicit wages (w*) in agriculture, equal to marginal revenue productivities, have been estimated through a conditional profit function (R_a), which relates farm profits to the labour input used (hours of work = H) in agricultural production. Thus, the specification implies that:

$w* = \frac{\partial Ra}{\partial \mathrm{H}}$ (Fall and Magnac, 2004).

Fall and Magnac (2004) find, on a sample of French households for the year 1992, that the marginal labour productivities are positive and that agricultural incomes differ significantly

across regions. In general, a high profit function is associated with the **husband's education**, probably due to his managerial abilities, and with more **intensive farming practices**. Moreover, constant returns to scale with respect to labour and land cannot be rejected, which can be explained by the quite large standard errors.

The estimation of shadow wages, or marginal products of farm labour, is particularly important for understanding labour supply and demand choices of farm households. The shadow wage method, applied especially in studies on developing countries, consists of estimating an agricultural production function, from which the marginal products (or shadow wages) of labour are derived, so that the total hours worked on and off the farm by family labour are regressed on the shadow wage rates (Skoufias, 1994). Focusing on Indian rural households for the period 1975-79, Skoufias (1994) estimates a Cobb-Douglas production function with family male and female labour hours and hired male and female labour hours specified as heterogeneous inputs. The results suggest that family female labour seems to have a larger effect on output compared to family male labour, probably due to the nature of the operations performed by family females. More importantly, family labour has a larger effect on output than hired labour, which can be explained in terms of the stronger incentives faced by the former. The next paragraph provides a discussion of the literature on the transactions costs associated with hired labour and on the differences in labour productivity.

4.6 Labour heterogeneity: differences in labour productivity

When dealing with labour markets in agriculture, and when estimating the productivity in production, it is particularly important to acknowledge the heterogeneous nature of the labour force, thus distinguishing among gender composition (man/woman), human capital level (skilled/unskilled), seasonality of tasks (peak/slack season), type of labour (family/hired), etc. To avoid biased results, it is crucial to consider the impact of labour heterogeneity on the labour markets and on agricultural productivity.

In the literature, the differences in the composition of the labour force, in terms of personal characteristics, such as gender and human capital, are usually taken into account. The level of human capital, measured by education (general or agriculture-related), as well as working experience (on-farm and off-farm), is one of the most recurrent variables within the literature on rural labour allocation and is a very important factor in explaining the productivity of labour, as a greater skill level is associated with higher marginal product of labour, *ceteris paribus*.

In terms of the seasonal variation in agricultural production, Nath (1974) recognises the importance to account for different seasonal labour inputs, i.e. labour used in the busy season and labour used in the slack season, which should enter the production function as separate inputs: $Y = Y(L_b, L_s, \dots)$. Although this specification is mainly relevant for less developed countries due to labour market imperfections, it is generally applicable for agricultural sectors characterised by crop production and which require labour-intensive techniques. In the Indian Punjab sample, for the year 1967-68, he found that the busy-season marginal product of labour, constituted by permanent labour, i.e. family and hired labour, and casual hired labour, is positive, whereas the slack-season marginal product of labour, constituted only by permanent labour, is zero. The differences in the marginal products of labour would imply that productivity is subject to the labour inputs required in the different seasons.

The rejection of labour homogeneity in on-farm activities entails the distinction between family and hired labour. As Benjamin and Kimhi (2006) pointed out, whereas some studies have considered hired and family labour as perfect substitutes, having total labour, family plus hired, as a single input ($L = L^F + L^H$), other studies have simply not dedicated special attention to hired labour when analysing farmers' time allocation decisions. Nonetheless, several authors have pointed out that the different productivities of these two labour inputs, which may be due to several factors such as differing incentives, the type of activities carried out, including supervisory and management functions, the different composition of labour,

i.e. male versus female, adult versus child and skilled versus unskilled, and so forth, likely play an important role in determining the marginal product of labour. For example, Deolalikar and Vijverberg (1987) have tested the hypothesis of perfect substitutability between family and hired labour in agricultural production, which would imply that these labour inputs have identical effects on output. The results, from both Indian and Malaysian rural households, respectively for the years 1974-75 and 1976-77, point to a very low elasticity of substitution, indicating a strong evidence of labour heterogeneity. In particular, they find that family labour is less productive than hired labour in both samples and justify this result in terms of seasonality in the use of family and hired labour, i.e. due to differences in the nature and timing of the tasks performed. Since hired labour is mainly used in harvesting activities, which are busy or peak seasons, the marginal product of labour tends to be high, whereas family labour, being used in both peak and slack seasons, presents a lower annual marginal productivity. Therefore, since agricultural activities present a low substitutability, family and hired labour are also characterised by a low elasticity of substitution. The other explanation for labour heterogeneity, significant in the Malaysian sample, concerns the fact that family labour is involved to a greater extent in management and supervisory tasks than hired labour, which may also have relevance to European farmers in some environments.

On the other hand, other studies have interpreted the differences in productivity between family and hired labour in terms of the transactions costs related to recruiting, monitoring and supervising hired workers. In general, labour markets in all economies are subject to transaction costs. These costs are the consequence of imperfect and asymmetric information which leads to adverse selection and moral hazard problems. In labour markets, adverse selection arises when workers have better or more complete information than their employers. In particular, employers may not know their employees productivity with certainty because their work defining attributes are not easily observable. When individual work effort is not completely observable and when the worker is not the residual claimant of profits generated, moral hazard occurs, as incentives to shirk arise. As a result, transactions costs include the costs of search, negotiation, bargaining, screening, enforcement and supervision (Key et al., 2000). In an environment where labour markets are well functioning, information on workers and employers is more available, and contracts are more easily enforced, thus, transaction costs are lower. On the other hand, rural areas, which are often characterised by segmented labour markets with weak communication and transportation networks, and where institutions such as labour law and employment assistance mechanisms are either relatively weak or not in place, are characterised by high transaction costs (De Silva et al., 2006).

In the specific context of agricultural labour markets, family farms using only family labour do not suffer from moral hazard problems, whereas when labour is hired, farms must invest in monitoring and supervision. At the same time, adverse selection problems are particularly important for corporate farms, which rely almost entirely on hired labour, and which must thus invest in recruiting and monitoring mechanisms. Therefore, transaction costs are increasing with farm sizes and with the number of hired workers per farm so that, due to these costs, hired labour input must be considered as an imperfect substitute for family labour even when executing the same tasks. The rejection of perfect substitutability between family and hired labour was also confirmed by Frisvold (1994), who tested the hypothesis on a rice-growing village in India for the years 1981-82 and 1984-85. Controlling for seasonal differences in labour productivity, as suggested by Nath (1974) and Deolalikar and Vijverberg (1987), the author tested directly the impact of supervision on the 'effort' of hired labour (effective labour input). Supervision was found to be necessary to increase hired labour productivity, as operating at less than maximum labour efficiency, or in other words reducing supervision intensity, would lead to output losses.

As Schmitt (1991) pointed out, the relative low transaction costs of family labour compared to hired workers have to be seen as the most decisive factor affecting the economic stability of family governance in agriculture. The main reasons for low transaction costs in family farms can be summarised in the following bullet points (Pollak, 1985, pp. 585-6): i) incentives -

advantages arise because family members have claims on family resources; ii) monitoring - economic activity and family relationships are interconnected and integrated; iii) altruism and caring - affectional family relationships limit opportunistic behaviour and iv) loyalty - fulfilling family obligations and maintaining individual reputation are important factors within the family.

Although several authors have claimed an inverse farm size-productivity relationship in developing countries, due to the lower labour costs faced by smaller farms, Gorton and Davidova (2004) find that there is no clear cut evidence of a clear superiority of one organisational type, i.e. of family farms being more efficient for all farming activities than corporate farms, as far as CEECs are concerned. As a matter of fact, despite the high monitoring costs due to shirking incentives of hired workers, corporate farms still face lower capital costs and thus are more capital intensive. In this context, Feder (1985) recognises the importance of supervision in determining labour productivity, as hired labour is generally more efficient in terms of the output produced when subjected to more supervision. On the other hand, family members, who are more motivated and thus perform tasks with maximum effort, perform a supervisory role with respect to hired workers. Therefore, the relation between farm size and productivity depends on the output elasticity with respect to 'effective' labour and thus on labour effort elasticity with respect to supervision. In general, as suggested by Allen and Lueck (1998), farms face a trade-off between the gains from specialisation and monitoring costs so that, when there is a large number of tasks, when specialisation is important, and when monitoring costs are low, corporate farms are optimal; on the other hand, when production is more spatially diffused and labour is not easy to monitor, the organisational structure of the farm family is the optimal one. Livestock production, and in particular dairy operations, present a good example of specialisation for large corporate farms (which are also more capital intensive), whereas arable farming, more difficult to supervise and monitor, is usually performed by family farms. However, some of the NMS show a different pattern: livestock farms rely mainly on family labour while crop farms use a higher share of hired labour. Empirical research on productivity in transitional economies would suggest that individual private farms specialising in livestock production are more efficient than large corporate farms in crop production. Latruffe et al. (2005) claim that this might be due to less intensive livestock technologies applied in these countries during transition.

Principal-agent problems can be solved through contract or compensation systems which aim to motivate the hired worker to act in the farm owner's interests in order to prevent, or minimise, free-riding problems. Such compensation systems are difficult to implement in agriculture (Schmitt, 1991) although changes in the external environment and internal structures can reduce these problems (Gorton and Davidova, 2004). For instance, when rural unemployment is high, the costs of being caught shirking and being fired are higher and, thus, provide higher incentives for hired workers.

An important contribution has been provided by De Silva et al. (2006), who address the relationship between institutional conditions and supervision. For a sample of Philippine rice farmers for the year 1994, the authors find that the probability to supervise is positively associated with the distance to the nearest market and negatively associated to the level of urbanisation and to good road conditions, meaning that higher information costs and more remote rural areas increase the need to supervise hired labour. At the same time, the fixed costs of supervision raise a distinction between time-rate contracts, which require substantial supervision, and piece-rate contracts, which provide a self-enforcing mechanism that substitutes for direct supervision. Moreover, a higher wage is associated with a higher probability and intensity of supervision, whereas a close personal relationship between the worker and the employer requires a lower need for supervision. Therefore, the intensity of supervision is positively associated with transaction costs. Improving access to markets will reduce the transaction costs of labour contracts, reducing the need for direct supervision and enabling farmers to intensify their labour input in either on-farm work or in off-farm activities. As also observed by Bardhan (1984), labour contracts and agrarian institutions are

important mechanisms to address the principal-agent problem. In comparison to wage contracts with time-rates which need costly monitoring and supervision, sharecropping presents a better option in offering more incentives to workers. Nonetheless, since the tenant gets only a fraction of their contribution to the output produced, moral hazard problems still occur, which could be eliminated with fixed-rent tenancy. In these regards, when rural markets are not well functioning, government intervention is justified, for instance in changing property rights, in redistributing assets, and in delivering information (Sadoulet and de Janvry, 1995).

5. Conclusions

The purpose of this survey was to review the literature on rural labour markets since 1960s with a view to shedding light on the key issues which characterise labour markets in both agriculture and in rural areas more generally. In doing so, we have been mindful that the labour market is likely to be important in determining the level of return to, and the allocation of, labour in rural areas and therefore to the welfare of rural inhabitants, whether they be members of farm households or not.

In the case of farm household members, the results in the literature suggest that labour allocation between on-farm tasks and off-farm employment is quite elastic and appears to be heavily determined by the individual's personal characteristics, the characteristics of the household's farm and to conditions in the macroeconomic environment. The farm-household theory has allowed researchers to combine into a unitary framework agricultural production, consumption and labour supply. Here the separability of production and consumption has been the subject of much debate and has been rejected in several studies on the grounds of imperfect competition, as well as the potential heterogeneity of labour inputs. In particular, the distinction between family and hired labour has been highlighted as these inputs have been found to be imperfect substitutes for each other. The results from the surveyed studies have covered several aspects, including the time allocation decisions of individuals, the supply of labour on- and off- the farm, mobility decisions, inter-sectoral labour adjustments, pluriactivity, structural change, the determination of off-farm wages, the production function and the demand for on-farm labour, the differences in farm structure and the dependence on hired labour, the differences in labour productivity, to mention a few. Nonetheless, the heterogeneous conditions across countries, the different research questions and methodologies, and the type of data employed have created some inconsistent results. A case to point here is the rather mixed estimates for the impact of subsidies on the allocation of farm household labour, where the literature presents contradictory results.

The present survey has also emphasised the presence of a series of market failures and market imperfections (Benjamin, 1992; Sadoulet and de Janvry, 1995; Key et al., 2000; Rizov and Swinnen, 2004), as well as structural impediments and constraints (Dries and Swinnen, 2002; Schnicke et al., 2007) which characterise rural labour markets. On the supply side, poor physical infrastructure and low human capital endowment constitute important impediments to labour mobility and, thus, to an efficient allocation of labour. On the demand side, moral hazard and adverse selection entail transaction costs in labour hiring and labour supervision. The poorer the infrastructure and the less competitive the marketing systems, the less information is available and the more risky are the transactions (De Janvry et al., 1991). Therefore, in order to gain a deeper understanding on the negative effects of these market imperfections, it will be necessary to proceed with a more focused review, which will be the topic of Deliverable 8.2: "Supply and Demand Side Limitations affecting the Structure of Agriculture and Rural Economy in General". Since these problems are important they are expected to prevent the rural labour market from finding efficient outcomes for rural people.

The high costs of movement which are associated with rural markets, and which may be exacerbated for farm families if the market for land is underdeveloped or inefficient[11], and the distance between rural settlements and cities, entail limitations in the occupation/residential choice of individuals. The choice of farming involves a very severe restriction on residential choice for all members of the farm household. The literature suggests that the choice of a farm residence greatly reduces family's employment opportunities across sectors (Johnson, 1991). In this sense, rural households are 'trapped' in their labour decisions; hence, well functioning rural labour markets coupled with better employment opportunities in rural areas are extremely important for the income and development of people residing in rural areas.

In order to strengthen rural labour markets, a few policy prescriptions have been advocated in the literature: create jobs in rural areas, especially those complementary with agricultural activities in terms of skill requirements and seasonal labour demand, and support education through extensive programmes to address low levels of human capital in rural areas. Investments in education and human capital would improve the quality of labour and would increase its mobility, reducing labour market mismatch and facilitating the move towards a more efficient labour adjustment (Bojnec et al., 2003). At the same time, it is fundamental to support rural infrastructure, in order to encourage rural businesses and to increase the accessibility of jobs to rural residents (Johnson, 1991), and to provide job-specific training programmes to rural residents.

[11] We argue that this could be an important factor to be taken under analysis. This issue could be further investigated in other studies of the project.

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Comparative Analysis of Factor Markets for Agriculture across the Member States

245123-FP7-KBBE-2009-3

The Factor Markets project in a nutshell

Title	Comparative Analysis of Factor Markets for Agriculture across the Member States
Funding scheme	Collaborative Project (CP) / Small or medium scale focused research project
Coordinator	CEPS, Prof. Johan F.M. Swinnen
Duration	01/09/2010 – 31/08/2013 (36 months)
Short description	Well functioning factor markets are a crucial condition for the competitiveness and growth of agriculture and for rural development. At the same time, the functioning of the factor markets themselves are influenced by changes in agriculture and the rural economy, and in EU policies. Member state regulations and institutions affecting land, labour, and capital markets may cause important heterogeneity in the factor markets, which may have important effects on the functioning of the factor markets and on the interactions between factor markets and EU policies. The general objective of the FACTOR MARKETS project is to analyse the functioning of factor markets for agriculture in the EU-27, including the Candidate Countries. The FACTOR MARKETS project will compare the different markets, their institutional framework and their impact on agricultural development and structural change, as well as their impact on rural economies, for the Member States, Candidate Countries and the EU as a whole. The FACTOR MARKETS project will focus on capital, labour and land markets. The results of this study will contribute to a better understanding of the fundamental economic factors affecting EU agriculture, thus allowing better targeting of policies to improve the competitiveness of the sector.
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Partners	17 (13 countries)
EU funding	1,979,023 €
EC Scientific officer	Dr. Hans-Jörg Lutzeyer