DIRECTORATE FOR FOOD, AGRICULTURE AND FISHERIES
COMMITTEE FOR AGRICULTURE

Working Party on Agricultural Policies and Markets

AGRICULTURAL POLICY REFORM AND FARM EMPLOYMENT

This is the final version of a study which was carried out under the Programme of Work for 1999/2000 adopted by the Committee for Agriculture and endorsed by the Trade Committee.

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Agricultural policy reform has an impact on farmer’s decision making. This includes both labour supply decisions and labour demand for farming. The net impact of agricultural policy reform on agricultural employment is not obvious. This is a concern of policy makers and it is the objective of this report. The report identifies main farm employment trends in OECD countries that include a relative decline in agricultural employment with parallel increases in hired labour and off-farm work. These trends seem to be governed by technological changes, general changes in the labour market and demographic changes. The potential impact of agricultural policy reform on farm employment, farm exit and underemployment are analysed with reference to the relevant empirical literature.

The report was drafted by Jill Findeis (Penn State University) on the basis of three papers reviewing the empirical literature on farm employment in NAFTA countries, by Jill Findeis, in European countries, by Christoph Weiss (University of Kiel), and in Japan, by Katsuhiro Saito (University of Tokyo), as well as a conceptual paper by Jesús Antón (OECD).
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AGRICULTURAL POLICY REFORM AND FARM EMPLOYMENT

Introduction

Declines in farm employment have been observed in most developed countries in the post World War II era. In this period, the numbers of farms, farm operators and farm households have steadily declined, and off-farm employment or pluriactivity among farm households is now common (Barkley, 1990; Hallberg, Findeis and Lass, 1991). The hired farm workforce has similarly witnessed declines in size in many countries. The overall trend in the majority of developed countries is toward increasing labour productivity, with significantly less employment in production agriculture (Gardner, 1992; Bryden and Bollman, 2000). In developing economies, patterns of labour utilisation in the agricultural production sector vary widely, but even in these countries there is debate about long-term trends that point to eventual declines in agricultural employment, rather than labour absorption (Jayasuriya and Shand, 1986; Coxhead, 1992).

Recent changes in farm policy (e.g. 1992 CAP reform and Agenda 2000 in the European Union and the 1996 FAIR Act in the US) are likely to influence farm employment. Several effects are possible. First, policy can affect the likelihood that a farm household will continue farming or not. Alternative policies can contribute to reductions in the numbers of farms and farm households, or reduce or retard rates of farm exit. Policies may also differentially affect entry into farming, encouraging or discouraging entry of new farm households. The overall impact of farm policy on farm numbers depends on the relative rates of farm exits and entries, and the direction and magnitude of impacts are likely to be policy-specific.

A second policy effect is adjustment of labour on existing farms. Changes in policy may lead to farm labour adjustment: more or less labour may be supplied by farm households to farming as a result, and/or adjustments in employment of hired farmworkers may occur. Policy reform can indirectly contribute to adjustment of labour into nonfarm employment, thereby reducing underemployment of labour in farming and increasing farm household income (Olfert, 1992). Alternatively, less nonfarm employment may be observed as more farm household labour is utilised in the farm operation to enhance net farm income.

This report focuses on labour adjustments at the farm level, with particular emphasis on the impacts of policy reform on farm household labour decisions. The report is presented in four sections. Section I provides a discussion of trends in farm employment in the OECD countries. Section II then presents economic theory relevant to farm household labour decisions. The agricultural household model (farm household model or FHM) used in many empirical studies of farm household decisions is presented and discussed, with consideration of the effects of imperfect labour markets. Using the farm household model, the likely effects of alternative policies are assessed for different types of farms: Type I farms where households allocate time both to off-farm work and farming, Type II farms that allocate all time to farm work on own farm, and Type III farms that hire additional labour to meet on-farm labour requirements (and may have off-farm work). Specific policies analysed in the FHM framework include reductions in price supports, use of direct income support, and a combination of both policies. Section III
then reviews recent evidence concerning the determinants of labour adjustments into nonfarm work and farm entry/exit behaviours, based on empirical studies in North America, Europe and Japan. Finally, Section IV summarises the report and assesses the implications for farm policy.

I. Trends in labour utilisation on farms in the OECD Member countries

Three important trends related to agricultural employment have been broadly observed in most developed economies in the post World War II period. First, many countries have witnessed declines in the proportion of their total employed labour force engaged in farming (Table 1). Farms have declined in numbers and labour allocated to farming as measured by Full-Time Farmer Equivalents (FFE) has declined as well. As shown in Figure 1, the declines have occurred broadly across most of the selected OECD countries and within all countries comprising the European Union. Only Australia, New Zealand and the United States have not experienced recent declines in farm sector employment measured on a Full-Time Farmer Equivalent (FFE) basis.

Second, an increasing proportion of farm work is now being done by hired farmworkers (Table 2). This trend has been observed in most developed economies. For example, in the European Union countries (EU-15), hired labour averaged 26.2% of the total farm workforce over the 1986-90 period. This per cent increased to 30.9% on average for 1991-95 and to 31.5% by 1996-97. In the OECD-22 countries, hired farm labour comprised an average 28.1% of the agricultural workforce over the period 1986-90; by 1996-97 the hired workforce percentage had increased to 34.3%.

Finally, there is now a greater prevalence of nonfarm employment and pluriactivity among farm households, and a corresponding greater dependence on nonfarm income by farm households in most developed economies (Fuller, 1990, 1991; Hallberg, Findeis, and Lass, 1991; Bryden, Bell, Gilliatt, Hawkins and MacKinnon, 1992; Bollman, 1994; Post and Terluin, 1997). In part, this trend reflects movement of farm women into the off-farm labour force, a trend consistent with overall increases in women’s participation in paid work in many economies. Increases in nonfarm employment also reflects the growing prevalence of multiple job-holding by the principal farm operator (Hallberg et al., 1991).

These trends can be attributed to changes in technology, in the demographic composition of farm households, and in the broader economy that influence the returns to labour, both in farming and in nonfarm work. New agricultural technologies have been largely labour-saving (Binswanger, 1974; Antle, 1986; Huffman and Evenson, 1989; Kang and Maruyama, 1992). The new technologies have led to higher rates of labour productivity and a reduced need for labour inputs in the farm sector (Gardner, 1992; Ahearn, Yee, Ball and Nehring, 1997). Declines in labour demand attributable to technological change have reduced employment of both farm family members and hired farmworkers. Scale economies have also resulted in larger (and correspondingly fewer) farms in many countries.
### Table 1. Agriculture employment as a percentage of total civilian employment

<table>
<thead>
<tr>
<th>Country</th>
<th>Average 1986-90</th>
<th>Average 1991-95</th>
<th>Average 1996-97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>8.2</td>
<td>7.2</td>
<td>7.0</td>
</tr>
<tr>
<td>Belgium</td>
<td>2.8</td>
<td>2.5</td>
<td>2.4</td>
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<tr>
<td>Denmark</td>
<td>5.6</td>
<td>5.0</td>
<td>3.8</td>
</tr>
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<td>Finland</td>
<td>9.6</td>
<td>8.2</td>
<td>7.0</td>
</tr>
<tr>
<td>France</td>
<td>6.5</td>
<td>5.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Germany(^1)</td>
<td>3.9</td>
<td>3.6</td>
<td>3.2</td>
</tr>
<tr>
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<td>21.3</td>
<td>20.3</td>
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</tr>
<tr>
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<tr>
<td>Turkey</td>
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<td>44.3</td>
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\(^1\) Unified Germany, since 1991. n.a.: not available.

Source: OECD Labour Force Statistics. The agricultural sector includes not only agriculture, but also hunting, forestry and fishing.
Figure 1. Agricultural employment growth in selected 24 OECD countries


The lower demand for farm labour largely attributable to technological change has been coupled with growth in nonfarm employment opportunities due in part to expansion of population into traditionally agricultural regions, at least in some regions. Growth in off-farm job opportunities, increased access to off-farm jobs and higher off-farm wages (relative to on-farm marginal returns to labour) serve to absorb underemployed farm household labour when it exists, increasing the incomes earned by farm households. At the same time it is important to recognise that macroeconomic developments influence farm households not only by affecting farm prices but by affecting the nonfarm economy to an increasingly greater extent than has been true in the past. To the extent that such developments contribute to a higher (relative) off-farm wage, labour supplied by farm households to external labour markets will increase. However, as pointed out in Barkley (1993), the recent trend in rural regions of developed economies may be toward a less competitive advantage relative to urban areas and toward a greater degree of vulnerability to global economic change. In either case, the extent to which the off-farm wage changes relative to the returns to labour in farming will influence flows of farm household labour into or out of off-farm labour markets.

Finally, demographic change has affected trends in agricultural employment. Average family sizes today are generally smaller than in the past. Fewer children can mean that fewer grown (farm) children and their families later enter farming. Fewer children can also mean less pressure to subdivide farms among grown children, a change that can lead to maintenance of larger farms and a greater dependence on hired farm labour. This can occur on farms of all sizes: large farms may need to hire in labour, especially during peak labour periods, that was previously supplied by family members, and small farms may decide to hire in labour if farm families are small and off-farm employment results in higher returns to farm family labour off-farm. The higher average educational attainment levels observed among farm household members today in some economies also can influence the allocation of labour resources, with higher-educated farm household labour being replaced by lower-skilled hired labour. Among farm women in particular, higher average education levels, advances in labour-saving technologies in the home, and smaller family sizes have contributed to the trend toward more farm women working off-farm (Rosenfeld, 1985).
<table>
<thead>
<tr>
<th>Country</th>
<th>Average 1986-90</th>
<th>Average 1991-95</th>
<th>Average 1996-97</th>
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</table>

¹ Unified Germany, since 1991. n.a.: not available.

Source: OECD Labour Force Statistics. Includes, not only agriculture, but also hunting, forestry and fishing.
**Issues relevant to policy reform**

Given the significant adjustments in agricultural employment that have occurred due to technological, macroeconomic, and demographic change in the OECD countries, three important questions arise in this era of policy reform. Each of these questions is raised below.

**Question 1: Is agricultural policy reform likely to affect unemployment levels in some countries or regions?**

In most OECD countries, the weight of agriculture in total employment is small. In 1996-97 only 4.9% of employment in the European Union and 2.7% in the United States was in the farm sector. There are, however, some OECD countries with a more significant proportion of employment in the farm sector: 42% in Turkey, 23% in Mexico, 21% in Poland and 20% in Greece (Table 1). In the remaining OECD countries, only very large agricultural employment shocks would have a significant effect on aggregate unemployment. Nevertheless, farm employment may be concentrated in some regions, making the employment adjustment after agricultural policy reform more difficult and with a larger social cost. This may be especially true in countries or regions with very high rates of unemployment. That is why employment adjustment is a relevant issue for several OECD countries, including those with a very small proportion of employment in agriculture.

The way Question 1 is formulated should not be interpreted as assuming that the employment adjustment required will necessarily lead to higher unemployment. An agricultural policy reform package may have effects both on farm production decisions — affecting farm labour demand — and on consumption decisions — affecting the labour supply of farm households. Question 1 focuses on the aggregate net effect on supply minus demand of labour; i.e. on the excess supply of labour or unemployment. In this report, the question will not be answered by measuring the effects of reform on total agricultural employment. There could be changes in farm household labour that are not translated into additional demand or supply in the labour market. For example, a direct payment to a farm household may lead the household to reduce the labour employed on the farm in equal proportion to the increase in household leisure time.

The way Question 1 is formulated also does not take into account the fact that the magnitude of the employment adjustment that must take place is not the only element determining the size of a potential policy problem. A large employment adjustment in agriculture will be less of a problem if unemployment rates are low and labour markets are efficient in reallocating labour across sectors. In addition, the employment adjustment could be facilitated by new employment created in other sectors attracting labour resources released from agriculture. This depends on how labour markets as a whole work and the ease with which labour resources are reallocated.

**Question 2: Is agricultural policy reform likely to affect the number of households that enter or leave the farm production sector?**

This question focuses in part on the number and size of the farms leaving agricultural production entirely. Policy makers are often concerned with this issue from a different perspective than for Question 1. It is not the potential need to reallocate labour that is key here, but the potential effects of farm households quitting the sector on landscape or rural development. If quitting farming occurs to a significant extent and is concentrated in certain regions, Question 2 is especially relevant.

To a certain degree, Question 2 is included in Question 1 — exiting is nothing but an extreme case of reducing labour demand for farming. However, the decision to quit may be *qualitatively* different from the decision to reduce the intensity of production. Policy measures may influence both kinds of
decisions in different ways, especially if policy measures do not only influence the marginal returns from farming. This is the case of direct payments. Therefore, Question 2 differs from Question 1 not only because of the different concerns involved, but because the kind of behaviour may be different relative to different policy changes. The decision to quit the sector is related to expectations regarding future returns of current production. The evaluation of these expected future returns depends crucially on farmers’ understanding of the way agricultural policies are decided.

**Question 3:** Is agricultural policy reform likely to affect the level of underemployment in agriculture?

Underemployment is defined as all labour used in farm production with a marginal return that is below its return in other sectors of the economy. There is an extensive literature addressing underemployment in agriculture. Sen (1966) defined surplus labour in agriculture in a more restrictive way, already pointing towards this concept. Many researchers in developing and developed economies have found that the implicit return to farm labour is often well below any reference wage for the whole economy. This situation corresponds exactly with the concept of underemployment. It is more likely to occur whenever the farm is “isolated” from outside labour markets through significant transaction costs.

**Question 3** is to a certain extent complementary to **Question 1**. Besides measuring the magnitude of the employment adjustment required in the farm sector, it is important to assess the efficiency of use of those labour resources that remain in agriculture. That is, the question is now: “To what extent will policy reform increase the efficient use of labour in the farm sector?”

Each of the three policy-relevant questions can be explored from the standpoint of economic theory, using the farm household model described below.

### II. Theoretical model and expected policy impacts

#### Farm household model

Agricultural household decisions can be analysed using the farm household model (FHM) that provides an understanding of production, consumption, and labour decisions of farm households. Both labour supply by farm households and labour demand by farms can be understood and analysed using this model. The FHM has been widely applied in empirical studies in both developed and developing economies.

The farm household model is an extension of the simple household consumption-leisure decision model in which household members maximise total utility of the household, which is constrained by the household’s income and total time endowment. That is, household members are assumed to jointly decide upon the level of goods and services consumed by the household and quantities of leisure time (or what Huffman, 1991 refers to as “home time”) enjoyed by household members, so as to maximise the joint utility of the household within a single time period. Total consumption of goods and services and leisure is constrained by the household’s budget (total labour and nonlabour income) and by the total time available for work and leisure. To provide income for consumption goods and services, some household members typically have to work for pay, constraining the time available for leisure. Therefore, trade-offs exist between the consumption of goods and services, on the one hand, and leisure or “home time”. The simple household consumption-leisure decision model can be written:
maximise \( U = U(C_h, T_h; H_h, Z_h) \) \( \frac{\partial U}{\partial \Omega} > 0, \frac{\partial^2 U}{\partial \Omega^2} < 0, \) \( \Omega = C_h, T_h \) \hspace{1cm} (1)

subject to
\( \overline{T} = T_m + T_h \) (household time constraint) \hspace{1cm} (2)
\( P_h C_h = w_m T_m + V \) (household full-income constraint) \hspace{1cm} (3)

where
\( U \) = joint household utility function, which is a function of the quantity of goods and services consumed by the household \( (C_h) \) and total leisure (or “home time”) \( (T_h) \), given the human capital of household members \( (H_h) \) and other household and location-related characteristics \( (Z_h) \)
\( \overline{T} \) = total time endowment of household
\( T_m \) = total work time of household
\( P_h \) = price of consumption goods and services
\( w_m \) = market wage
\( V \) = exogenous income (i.e. nonlabour or “passive” income derived from nonfarm assets including stocks, bonds, and savings, as well as transfer payments).

In this basic model, the market wage \( (w_m) \) is determined in the labour market by labour demand and supply. The market wage \( (w_m) \) is influenced by the household’s human capital \( (H_m) \), as well as by local labour market characteristics \( (Z_m) \) and job characteristics \( (J_m) \) (Huffman, 1991). That is,
\( w_m = w_m(H_m, Z_m, J_m) \) \hspace{1cm} (4)

This basic model has been modified in a number of different ways to study interesting problems. One modification or extension has been to include the household’s economic “production” activities in the basic model, i.e. to analyse decisions related to self-employment. The farm household model is this type of model, with farming being the self-employment activity. The farm household model incorporates one or more agricultural production function(s) into the model, so that farm output and input decisions can be assessed. The FHM allows determination of (1) farm output supply, (2) demand for farm inputs, including hired farm labour demand, (3) demand for consumption goods, (4) demand by households for leisure (“home time”), and (5) off-farm labour supply. Time allocated to farming by household members can also be determined, as the difference between the household’s total time endowment and the quantity of time allocated to the off-farm labour market plus the time allocated to leisure. Following Huffman (1991), the model can be written as follows:

maximise \( U = U(C_h, T_h; H_h, Z_h) \) with \( \frac{\partial U}{\partial \Omega} > 0, \frac{\partial^2 U}{\partial \Omega^2} < 0, \) \( \Omega = C_h, T_h \) \hspace{1cm} (5)

subject to
\( \overline{T} = T_o + T_f + T_o, \) with \( T_o \geq 0, T_f > 0, T_o > 0 \) \hspace{1cm} (6)
\( P_h C_h = P_f F(T_f, X_f; H_f, Z_f) - P_x X_f + w_m(H_m, Z_m, J_m) T_m + V \) \hspace{1cm} (7)

where, in addition to those variables already defined for the simple model:
\( T_o \) = total time allocated to off-farm work by the farm household
\( T_f \) = total time allocated to farming by the farm household
\( P_f \) = output price for farm commodities sold
\( F \) = farm production function, which is a function of the time allocated to farming \( (T_f) \) and other farm inputs \( (X_f) \), given levels of human capital in the household that affect farm production \( (H_f) \) and other household and area characteristics \( (Z_f) \)
\( P_x \) = input price for purchased farm inputs, including hired farm labour
\( X_f \) = quantity of inputs used for farm production, including hired farm labour
Off-farm wages are determined as in equation (4). It should be noted that for both the simple model and the farm household model, commuting costs can be explicitly incorporated into the model. Inclusion of these costs reduces the realised wage for off-farm work (Bollman, 1979; Huffman 1991).

The constrained maximisation problem involves maximising the Lagrangian function $L$:

$$L = U(C_h; T_h; H_h, Z_h) + \lambda_1[P_f F(T_f; X_f; H_f, Z_f) - P_x X_f + w_m(H_m; Z_m; J_m) T_o + V - P_h C_h] + \lambda_2[\overline{T} - T_o - T_f - T_h]$$  

(8)

The (Kuhn-Tucker) conditions characterising an optimum are then derived (Huffman 1991):

$$\lambda_1 (P_f F_x - P_x) = 0$$  

(9)

$$\lambda_1 P_f F_{T_f} - \lambda_2 = 0$$  

(10)

$$\lambda_1 w_m (H_m; Z_m; J_m) - \lambda_2 \leq 0, \ T_o \geq 0, \ T_o [\lambda_1 w_m (H_m; Z_m; J_m) - \lambda_2] = 0$$  

(11)

$$U_{C_h} - \lambda_1 P_h = 0$$  

(12)

$$U_{J_h} - \lambda_2 = 0$$  

(13)

$$\overline{T} - T_o - T_f - T_h = 0$$  

(14)

$$P_f F(T_f; X_f; H_f; Z_f) - P_x X_f + w_m(H_m; Z_m; J_m)T_o + V - P_h C_h = 0$$  

(15)

Using these conditions, the demand functions for farm inputs (including the demand functions for farm household labour in farming and hired farm labour), farm output supply, household net cash income, household demand for leisure (“home time”), household demand for consumption goods and services, and off-farm labour supply can be derived.

Two different types of models can be estimated at this point: a separable (recursive) model and a nonseparable (nonrecursive) model. The separable model assumes that the farm household first makes optimal farm production decisions and then decides on the optimal level of consumption. If the model is nonseparable, production and consumption decisions are made simultaneously.

Functions of importance to labour decisions are as follows for a separable model, where an asterisk (*) indicates an optimal level:

1. **Demand for farm household labour in farming**

$$T_f' = D_{T_f}'(w_m; P_p; P_o; H_f; Z_f), \ \partial T_f' / \partial w_m < 0$$  

(16)

Equation (16) shows that the amount of time allocated to farming by the farm household depends on the wages received in the off-farm labour market, the price received for agricultural commodities produced on the farm and sold, farm input price(s), and human capital and other household and location-related characteristics that affect the efficiency of farming.
2. **Demand for hired labour in farming (as well as for other farm inputs)**

\[
X'_f = D'_{X_f} (w_m, P_f, P_x, H_f, Z_f), \frac{\partial X'_f}{\partial \mathbf{P}_s} < 0
\]  

(17)

Similar to the demand for farm household labour in farming, the demand for inputs, including hired farm labour, is dependent on farm output and input prices, off-farm wages, and other human capital, household, and location-related characteristics.

3. **Leisure time (“home time”) demand by farm households**

\[
T' = D'_{T_h} (w_m, P_h, I'_h, H_h, Z_h, \overline{T})
\]  

(18)

The demand by the farm household for leisure time (“home time”) depends on off-farm wage(s), the price(s) of consumption goods, and on the optimal (maximum) net household cash income ($I'_h$). In addition, leisure demand depends on human capital and other household and location characteristics that affect leisure demand, and on the total time endowment of the household.

4. **Off-farm labour supply of the farm household**

\[
T'_m = \overline{T} - T'_f - T'_h, \text{ or }
\]

\[
T'_m = S'_{T_m} (w_m, P_f, P_h, I'_h, H_h, H_f, Z_h, Z_f, \overline{T}), \text{ or }
\]

\[
T'_m = S'_{T_m} (w_m, P_f, P_h, P_{v_h}, V_h, H_h, H_f, Z_h, Z_f, \overline{T})
\]  

(19)

(20)

(21)

The off-farm labour supply is the difference between the total time endowment (a fixed amount) and the optimal time allocation to farming plus the optimal allocation of time to leisure. The off-farm labour supply is found to be a function of the off-farm wage, farm input and output prices, the price(s) of consumption goods and services, exogenous income and the household’s total time endowment. Additionally, human capital and other household and location characteristics affecting farming or leisure (“home time”) can affect household off-farm labour supply.

In the case where there is no off-farm work ($T'_m = 0$), the model is no longer recursive or separable. If the model is nonseparable, farm production and household consumption decisions are jointly determined. This means that farm household labour decisions depend on additional variables not included in equations (16-21). The equations for the optimum are simultaneously determined. The equations related to labour for the nonseparable farm household model are as follows:

1’. **Demand for farm household labour in farming**:

\[
T'_f = D'_{T_f} (P_f, P_h, V, H_h, H_f, Z_h, Z_f, \overline{T})
\]  

(22)

2’. **Demand for hired labour in farming (as well as for other farm inputs)**:

\[
X'_f = D'_{X_f} (P_f, P_h, V, H_h, H_f, Z_h, Z_f, \overline{T})
\]  

(23)
Leisure time ("home time") demand by farm households:

\[ T_h^* = D_f^* (P_x, P_f, P_h, V, H_h, Z_h, Z_f, \bar{T}) \]  

Equations (22) – (24) are applicable when the farm household does not engage in off-farm work. Under these conditions, the demands for household labour in farming and for hired farm labour depend on a set of prices (farm input, farm output, and consumption goods and services), exogenous income, human capital and other household and location characteristics, as well as on the total time endowment of the household.\(^ {11} \)

Using the farm household model, the effects of changes in specific variables on the decisions discussed above can be assessed. For example, the effects of variations in farm output prices, farm input prices, exogenous income (nonlabour or passive income), or off-farm wage rates can be traced through the model to assess the effects on labour allocation. Therefore, the effects of policy reform on farm household behaviours related to labour allocation can be assessed.

**Labour allocation decisions in imperfect labour markets**

Before analysing the effects of agricultural policy reform on farm household labour decisions, it should be recognised that labour markets are imperfect in some regions where farms are located, leading to the failure of some farmers to participate in the labour market. In some countries the main market failure may not arise in the labour input market, but in the commodity output market. For example, this seems to be the case of Mexican ejidatarios as reflected by de Janvry, Sadoulet and Gordillo (1995b). The nature of the analytical approach in both cases is exactly the same. However, the most likely market failure in most OECD countries seems to be the labour market and not the commodity market.

Under perfect labour markets, supply and demand of farm labour meet at a common wage that is determined for the entire economy. In this situation, a reduction in the monetary returns to agricultural labour will lead to changes in the level of production and the use of variable inputs, such as labour. In addition to these changes on the demand side of the market, lower monetary returns to farm labour will reduce the level of profits and have a negative income effect on the supply of labour by farmers. Exogenous changes in farmers’ income will affect labour supply by farmers but not labour demand. In either case, excess demand or supply of labour in agriculture will be absorbed by other sectors in the labour market at the offered wage rate.

It could be, however, that the marginal returns to farm family labour allocated to the farm operation are below the opportunity wage in off-farm labour markets (see, for example, Sen 1966 or Schmitt 1991). This apparent over-use of labour, sometimes called surplus labour, can be explained by the existence of transaction costs for farmers participating in labour markets. These transaction costs create a gap between the cost the farmer incurs to hire labour and the effective wage the farmer receives when working off-farm. In other words, the farmer finds the buying price of labour (hired labour wage) above the selling price (off-farm wage).

It should be noted that transaction costs can make both wages different from the reference market wage for the entire economy, but that both wages are always related to this wage through the transaction costs. Considering the hired labour wage to be the effective cost of hiring labour and the off-farm wage to be the effective return from off-farm work, the marginal return to labour may be between the farmer’s buying and selling prices. In this case, the household farm will not participate in the labour market at all. A farm household that does not participate in the labour market may have a more rigid response to price and policy changes. This smaller adjustment might not even be transmitted to the labour market. This is the
main shortcoming of the aggregate models trying to measure the employment effects of policy changes; i.e. they do not take into account the differential incidence of market failures across households. De Janvry et al. (1995b) propose to address this problem using the farm household model to classify all farm households according to different criteria. This procedure allows for the accounting of different degrees of responsiveness by different types of farms. Question 1 defined employment effects in terms of market adjustment required in other sectors’ employment, making the distinction between farms participating or not in the labour market more relevant.

There are several plausible explanations for the wage gap between the hired labour wage and the off-farm wage. Among them, the following circumstances are possible:

1. The existence of transaction costs associated both with hiring labour, including monitoring and supervising workers, and off-farm work commuting costs (for example, Bollman, 1979 and Schmitt, 1991). This transaction costs assumption also covers the case of incomplete markets when off-farm employment opportunities for farm household members are rather limited.

2. Hired labour and family labour are not perfect substitutes. Both types of labour may have different productivities. Wages could be measured in efficiency terms assuming higher efficiency for family labour due to specialised skills (Sen, 1966). Efficiency wages of hired labour would be higher than off-farm wages.

3. Farmers may simply prefer working on their own farm rather than working for somebody else (Benjamin, 1992; Swidinsky, 1999; Corsi and Findeis, 2000). These preferences could make them work on their own farms with monetary marginal returns below market wages.

Different types of farms according to linkages with off-farm labour markets

The farm household model with a wage gap allows the definition of several types of farms that may have significantly different responses to changes in policy and market conditions. Following Sadoulet, de Janvry and Benjamin (1998), farm households can be classified into several groups or types:

1. There are likely to be farm households that have such a small endowment of farm assets (for example, land) that the marginal returns to farm production are much lower than the off-farm wage rate. Such farmers work only off-farm and they are part of the economy-wide labour supply. They supply labour to farm production on others’ farms as hired farmworkers or to other industries. They are not farmers per se, but are hired workers, either in farm production on others’ farms or in other industries.

2. There are also farm households that supply labour to off-farm labour markets. That is, at least one family member works at least part-time outside the farm. The household has an excess supply of labour that enters the off-farm labour market. These farm households are net suppliers of labour, and will be considered Type I farms.

3. Other farm households may have all members working only on the farm, with no off-farm work and with no hired labour. These farms do not enter into the external labour market either as demanders or suppliers of labour. They have zero excess demand or supply of labour. These will be called Type II farms, and are self-sufficient in labour.

4. Finally, there are other farm households that employ some hired labour. They are assumed to have no off-farm work, since both kinds of work are assumed to be perfect substitutes.
However, in a more realistic world with imperfect substitutability, farms with both hired labour and off-farm work may well exist. These will be called Type III farms.

Table 3 below summarises the three types of farms in a single table with two criteria: participation in off-farm work or not (denoted by the table rows) and use of hired farm labour or not (denoted by the table columns).

**Table 3. Classification of farms by linkages to external labour markets**

<table>
<thead>
<tr>
<th></th>
<th>No hired labour</th>
<th>Some hired labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some off-farm work</td>
<td>Type I</td>
<td>Type III</td>
</tr>
<tr>
<td>No off-farm work</td>
<td>Type II</td>
<td>Type III</td>
</tr>
</tbody>
</table>

Type II farms are the only farms not linked to the labour market, according to the classification above. They are expected to have a very different response to policy changes than the other two classifications. From a technical viewpoint, Type II farms are those in which production decisions cannot be separated from consumption decisions, *i.e.* the nonseparable or nonrecursive farm household model applies. Benjamin (1992) proves that the model would also be nonrecursive (nonseparable) whenever there is a binding quantity constraint on either hired labour or off-farm work. This covers two cases: (1) a farm with a binding constraint with respect to the quantity of labour that can be hired at the peak seasons of agricultural activity, and (2) a farm with some off-farm work that is also constrained by the number of hours that can be worked off-farm. Therefore, the Type II farm classification can be extended to include several different groups of farm households where consumption and production decisions cannot be separated. These can be summarised as follows:

1. All farms with no hired labour and no off-farm work, *i.e.* according to the classification in Table 3.
2. Those farms with *some* hired labour, but with a *binding* constraint with respect to the quantity of labour they can hire. Some hired labour could also be compatible with a nonseparable model whenever the hired labour is complementary and not a substitute for farm family labour. Benjamin (1996) found empirical evidence of this complementary relationship in French agricultural households, and Findeis and Lass (1992) report similar results for Pennsylvania farms.
3. Those farms with some off-farm work, but with a binding constraint on the quantity of hours they can work off-farm.
4. Those farms with either hired labour or off-farm work that is not market labour per se. For example, mutual arrangements between neighbouring farmers.

The statistical definition of Type II farms may not be easy. However, the measurement of the relative importance of this group in each country or region could be of the highest importance to have a good measure of employment impacts of policy changes.

The distinction between the different types of farm households is relevant from an analytical viewpoint, since the manner in which decision making will be made is substantively different. However, for the purpose of measuring a policy impact, the main problem is an empirical one. Could the observed
behaviours of these different types of farm households be so different from one type to another? The answer is yes. De Janvry et al. (1991) simulate a farm household model with reasonable parameter values and estimate the impacts of a 10% increase in the price of an agricultural commodity on two alternative farm households. The households both have the same initial production and input situation, but one makes separable decisions linked to labour markets and the other not, i.e. it is self-sufficient or autarkic. The estimated change in the use of labour in the former was found to be +1.7% compared to a -1.0% change in the latter. That is, the differences in response may affect not only the magnitude of the impact, but the direction as well. Benjamin, Corsi, and Guyomard (1996) found empirical evidence of nonseparability in the decision making of French farm households.

**Expected impacts of policy reform**

The three policy-relevant questions posed earlier in this report can be examined for the farm typology discussed above.

**Question 1: Is agricultural policy reform likely to affect unemployment levels in some countries or regions?**

*Question 1* asks if agricultural policy reform will likely affect unemployment rates. To answer this question, the effect of policy changes on the excess supply of market labour should be measured. Since Type II farm households have zero excess supply of labour, this question is especially relevant for farm households of Types I and III. Policy reform affects Type II farms only to the extent that they could start working off-farm and become Type I. The answer to this question will not include the reduction in the working time by Type II farm households deciding to have more leisure or “home time” in response to the extra income from direct payments. On the contrary, the specific interest is in Type III farms deciding to hire less labour due to a reduction in monetary returns to farming and Type I farms deciding to work more hours off-farm and fewer hours in farming.

The increase in direct payments considered in this section is also assumed to have no effect on the marginal returns to labour. It is known that in the longer-term, direct payments based on the use of land could induce increases of fixed factors such as land. This would induce higher production and use of labour, but the signs of the net effects on the excess supply of market labour would not change.

Tables of expected employment impacts are presented for each type of farm defined in Table 3. In Tables 4 through 6, four different scenarios are defined based on three possible policy changes: (1) the initial scenario or baseline, (2) a reduced market price scenario, where lower commodity prices are due to lower levels of market price support, (3) an increased direct payments scenario, and (4) a combination of both lower price supports and higher direct payments with no overcompensation, i.e. the increase in direct payments does not overcompensate the income loss of lower commodity prices. The initial level (baseline) column refers to the farm type and to the initial allocation of labour; in the other columns, the information refers to changes with respect to the initial level or baseline.

After a policy shock, a farm may change type or exit the farm production sector. The non-market labour quantity includes all labour with no link to external labour markets, that is, farm work on Type II farms. Market labour demand is the total amount of labour demanded by farms that are linked to external labour markets (Types I and III) and includes both family labour allocated to farming and hired labour. Market labour supply is the total amount of work supplied by members of farm households that are linked to the off-farm labour market. It includes both on-farm and off-farm work.

Excess market labour supply is the difference between supply and demand, and measures the unemployment effect as defined in *Question 1*. Therefore, for the purpose of answering *Question 1*,
changes in excess market labour supply is particularly relevant. In each table, a plus sign represents an increase, a minus represents a decrease, and a zero indicates that there is no expected change. The number of pluses and minuses indicate the strength of the change. A superscript sign or value is referred to in the case where a change of type occurs.

**Type I farms**

Results for Type I farms, *i.e.* farms with off-farm work, are presented in Table 4. The signs of all impacts are known. The reduction in price support will reduce the monetary returns to farm work, leading to a lower level of labour demand by the farm. Farm profit will decline and reductions in farm income will induce farm household members to work more hours off-farm. Therefore, there will be an increase in excess market labour supply to be absorbed by other sectors. An extreme case of reduction in labour demand by the farm household would be quitting the farm production sector.

Table 4. Expected employment impacts of policy reform on type I farms (farms with off-farm work but no hired labour)

<table>
<thead>
<tr>
<th></th>
<th>Initial level (baseline)</th>
<th>Reduced price support</th>
<th>Higher direct payments</th>
<th>Combined policies¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Potential change of farm type</td>
<td>I</td>
<td>Exit</td>
<td>II/III</td>
<td>Exit</td>
</tr>
<tr>
<td>b. Non-market labour quantity</td>
<td>0</td>
<td>0</td>
<td>0⁺</td>
<td>0</td>
</tr>
<tr>
<td>c. Market labour demand</td>
<td>Family on-farm labour</td>
<td>-</td>
<td>0⁻</td>
<td>-</td>
</tr>
<tr>
<td>d. Market labour supply</td>
<td>Family on-and off-</td>
<td>++</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>farm labour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Excess market labour supply =</td>
<td>Off-farm labour</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>d - c</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The combined policies scenario combines lower levels of market price support with higher direct payments, with no overcompensation.

An increase in direct payments to a Type I farm will reduce labour supply by the farm household, with no change in demand. The net effect will be a reduction in excess market labour supply. In the extreme case, off-farm work would become zero and the farm would change to Type II or even to Type III.

A policy package of price reductions coupled with direct payments will be dominated by the negative employment effects of lower prices, whenever direct payments do not overcompensate the income loss. Quitting agricultural production may occur as an extreme case. If overcompensation occurs, the net effect on unemployment is unknown. That is, the policy package could reduce unemployment through a lower supply of labour.

**Type II farms**

Table 5 presents the expected impacts for Type II farms. The signs of the impacts for Type II farms cannot be predicted from theory, since consumption and production decisions are made simultaneously. In this context, a reduction of market price will have an unknown effect on farm employment; the sign of the effect depends on the preferences of the farmer. However,
Table 5. Expected employment impacts of policy reform on type II farms (autarkic)

<table>
<thead>
<tr>
<th>Potential change of farm type</th>
<th>Initial level (baseline)</th>
<th>Reduced price support</th>
<th>Higher direct payments</th>
<th>Combined policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>II</td>
<td>I/Exit</td>
<td>III</td>
<td>I/Exit</td>
</tr>
<tr>
<td>b. Non-market labor quantity</td>
<td>Family on-farm labour</td>
<td>?</td>
<td>-</td>
<td>?</td>
</tr>
<tr>
<td>c. Market labor demand</td>
<td>0</td>
<td>0</td>
<td>0^</td>
<td>0</td>
</tr>
<tr>
<td>d. Market labor supply</td>
<td>0</td>
<td>0^</td>
<td>0</td>
<td>0^</td>
</tr>
<tr>
<td>e. Excess market labor supply = d - c</td>
<td>0</td>
<td>0^</td>
<td>0</td>
<td>0^</td>
</tr>
</tbody>
</table>

1. The combined policies scenario combines lower levels of market price support with higher direct payments, with no overcompensation.

An increase in direct payments to a Type II farm will have a negative effect on farm labour. If no change of farm type occurs, the labour market would not be affected. However, the farm could start to hire labour, therefore becoming a Type III farm. In this case, the farm could absorb unemployment from other sectors.

A policy package of lower price supports coupled with higher direct payments has an unpredictable impact on farm employment for Type II farms. If no change of type occurs, the employment effect is not transmitted to the labour markets because the demand and supply of labour change by the same amount. However, both working off-farm and exiting the farm sector could occur as a consequence of the policy package.

*Type III farms*

Expected effects of policy reform for Type III farms are presented in Table 6. In this case the signs of the impacts can be predicted from theory. The signs of the net effects are exactly the same as for Type I farms, since both Type I and Type II farms are linked to the external labour market. However, Type III farms hire labour, are likely to be larger than Type I farms and generally conform to the idea of a commercial farm. Labour adjustments on these farms will likely affect hired labour before farm family labour. Even if little more can be derived from the model, there is the intuition of different degrees of response to policy changes on Type I and Type III farms. It is very likely that Type III farms will have a higher degree of responsiveness to policy and market shocks than Type I farms, but may have a lower probability of quitting the sector altogether. However, Type I farms may not quit even given lower farm returns, if farm income is used to offset (nonfarm) income taxes or if the property tax burden of holding land is lower if the land is kept in agricultural use. For households living on small farms, this may be a preferred residential lifestyle (Johnson, 1991) and may reduce the likelihood of quitting farm production.
### Table 6. Expected employment impacts of policy reform on Type III farms
(farms with hired labour)

<table>
<thead>
<tr>
<th></th>
<th>Initial level (baseline)</th>
<th>Reduced price support</th>
<th>Higher direct payments</th>
<th>Combined policies ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Potential change of farm type</td>
<td>III</td>
<td>II/I/Exit</td>
<td>0</td>
<td>II/I/Exit</td>
</tr>
<tr>
<td>b. Non-market labor quantity</td>
<td>0</td>
<td>0⁺</td>
<td>0</td>
<td>0⁺</td>
</tr>
<tr>
<td>c. Market labor demand</td>
<td>Hired and on-farm labour</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>d. Market labor supply</td>
<td>Family on-farm labour</td>
<td>++</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>e. Excess market labor supply = d - c</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

1. The combined policies scenario combines lower levels of market price support with higher direct payments, with no overcompensation.

Aggregating the impacts on unemployment for the three types of farms, the predicted effect of the policy package is an increase in excess market labour supply, *i.e.* an increase in unemployment. This is true if direct payments do not overcompensate farmers for the decline in commodity prices. If overcompensation takes place, the policy package could reduce unemployment in other sectors.

**Question 2**: Is agricultural policy reform likely to affect the number of households that enter or leave the farm production sector?

*Question 2* focuses on understanding the effects of farm policy on farm mobility, *i.e.* on decisions to enter or leave farming. Both market price reductions alone and a non-overcompensating policy package of price reductions and direct payments result in a reduction of farm labour demand on Type I and Type III farms. Such changes could ultimately push farmers to leave the farm production sector. The farm household model cannot predict the response of Type II farms; Type II farm households could work more or less time depending on their preferences. Farms of all types could theoretically leave the sector as a result of the policy change. *Question 2* is therefore relevant for all three types of farms.

A farm will exit the sector whenever the expected marginal return of the first unit of labour devoted to farm production is less than the individual’s expected off-farm real wage. In this case, farm operator(s) do not expect to cover the variable costs measured in terms of the opportunity cost of labour. These are the two main elements affecting the decision to quit farming.

**Expected marginal returns of the first units of farm labour**

Expectations may be important in this context. Policy measures not only affect effective payments or prices — they also affect expectations concerning these payments in the future. Farm households will maximise their utility in an inter-temporal framework and the expected discounted value of the income series may be substantially affected by current production decisions. It is likely that farm households assign a very small subjective probability to receiving direct payments in the future if they stop producing in the current time period. Therefore, they may be assigning a very high marginal value to the first units produced and a very high marginal return to the first labour units used in farm production. In an extreme case, farm households may assign a zero probability to receiving the payments in the future if the farm quits production. If this is the case, farm production will not cease in the short run because the
marginal returns of the first units of labour are infinite. In fact, many direct payment programs require farms to produce to receive payment. Even if no planting is required, farm households could expect that they would be entitled to benefit from these programs in the future only if they continue to farm.

**Expected real wages from off-farm work**

The off-farm expected real wage depends to a significant extent on the farmer’s human capital (schooling and experience), age, and the opportunities available in external labour markets. Transaction costs could be very high in remote rural areas where alternative work opportunities are scarce. With high transaction costs, the expected real wage for off-farm work may be very low.

However, the decision to leave the sector is a long-term decision that cannot be analysed properly within the farm household model, which is a short run model with fixed inputs. The argument used nevertheless for the expected marginal returns from farm work can also be applied to the fixed inputs, especially to land. In fact, direct payments in many countries are linked to the use of land. The perception of farm households on how policymakers decide policies is crucial for determining the expected value of the marginal returns from the first units of resources dedicated to farming. This effect of the perception of the policy package is not included in the single period household model. An inter-temporal version of this model can include this impact of policy on exit/entry decisions. However, a quantitative evaluation of these “subjective” effects would be difficult from an empirical standpoint.

This demonstrates that the impact of policy reform on exit decisions is far from obvious. For example, a study by Barkley (1990) found no statistically significant effect of government payments on labour migration out of agriculture in the United States.

**Question 3. Is agricultural policy reform likely to affect the number of households that enter or leave the farm production sector?**

*Question 3* asks if policy reform is likely to affect underemployment in the farm sector. Defining underemployment in agriculture is not easy. The first problem is that it is necessary to determine the relevant reference wage under which returns to agriculture represent a situation of underemployment. This reference wage for the economy should be independent of any transaction costs affecting farm household decisions. In principle, there could be some or no underemployment on any type of farm. To avoid the difficult question of deciding whether there is underemployment on a type of farm with no additional information, attention will focus on the marginal physical returns to farm labour. A policy change that increases these returns would reduce underemployment, if it exists. Conversely, a policy change reducing these returns would increase or create underemployment. Any policy package including a reduction in price support will increase the physical marginal returns from farm labour on all farms of Types I or III. Therefore, if underemployment existed on these farms prior to the policy change, the policy change would reduce it. However, the model cannot predict changes on Type II farms, which again would depend on the preferences of farmers.

Underemployment has two main potential sources in the farm household model: the existence of both transaction costs and of market price support. Agricultural policies can deal with the second source. The first source, which is not specific to agriculture, should be dealt with through structural policies that can reduce the transaction costs of farm household members participating in the external labour market.

Any policy package implying a reduction of market price support will reduce the monetary marginal returns of any given amount of labour allocated to farming. Even if underemployment could be reduced on Type I and Type III farms, it would become much more visible on Type II farms. However,
increasing transparency of underemployment should not be interpreted in general as a larger picture of the general phenomenon.

**Summary of impacts by farm type**

The answers to the three policy-relevant questions have demonstrated that the size of the Type II group is crucial to understanding the aggregate (overall) impacts of agricultural policy reform. For example, in countries with large numbers of Type II farms, the effects on unemployment as defined in Question 1 are likely to be smaller unless these farms quit production altogether. Table 7 summarises the signs of the impacts that can be derived from the farm household model in relation to each of the three questions posed above. A single policy package with no overcompensation is considered.\(^\text{14}\)

**Table 7. Summary of employment impacts of a policy reform package without overcompensation**

<table>
<thead>
<tr>
<th></th>
<th>Type I farms</th>
<th>Type II farms</th>
<th>Type III farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1: Unemployment</td>
<td>+</td>
<td>0(^*)</td>
<td>+</td>
</tr>
<tr>
<td>Question 2: Farm exit</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Question 3: Underemployment</td>
<td>-</td>
<td>?</td>
<td>-</td>
</tr>
</tbody>
</table>

**Factors influencing linkages to the external labour market**

The essential question now becomes: what factors influence the likelihood and character of linkages to the external labour market? That is, under what conditions are linkages more likely to exist, and when are linkages — either through labour supply or labour demand — less likely to be present? Both the location of the farm operation and the demographic characteristics of the farm household are likely to influence the existence of linkages. Therefore, both the farm’s location and individual and household demographic characteristics will likely affect the responsiveness to policy and market shocks

**Location-related and demographic characteristics**

Location of the farm will likely affect both the use of farm family labour and hired labour. In remote rural regions, off-farm employment is less likely to be observed, due to lack of accessibility of off-farm employment opportunities. In such regions, it is likely that the proportion of farms classified as Type I (i.e. those with off-farm work) is lower, with Type II farms being relatively more prevalent. It is difficult to predict the relative prevalence of Type III farms, i.e. those farms that hire labour, in remote locations. For example, in more remote rural regions with high rates of unemployment, hired jobs on farms may be attractive to the local labour force. Alternatively, in remote rural regions it may be more difficult to assure a consistent and reliable qualified workforce is the workforce if migrant or seasonal.

In areas that are more densely populated, there is often a close proximity of off-farm job opportunities to farms. The adjacency of off-farm jobs tends to attract farm household labour off the farm, enhancing the relative prevalence of Type I farms. Type II farms therefore are likely to be less prevalent. Type III farms may also be less prevalent in the more densely populated regions, because of the competition for (unskilled) wage labour by nonfarm employers. Hired labour may be lured away from
farming by higher wages, better job benefits, and better work conditions in the nonfarm service sector, in particular (Findeis and Chitose, 1994).

Demographic characteristics are also likely to play a role. Labour supply may be influenced by education, age and work experience, and the number and ages of children, among other factors that are demographic in nature. Higher levels of education, for example, enhance the individual’s human capital, and generally result in a higher off-farm wage, but this will depend on whether the education is focused on nonfarm skills or on farming. If the education is not farming-specific and, instead, is more likely to enhance productivity and the wage paid for off-farm work, farm household members with higher levels of education are likely to be “pulled” into the off-farm labour market. On the other hand, if education is more applicable to agriculture, off-farm work will be less likely. Thus, it is the more general form of education that improves the likelihood of farm household labour being linked to external labour markets. Farm households with more education of the general form are more likely to be Type I or Type III farms, with off-farm work being observed.

Age is a critical variable. It is anticipated that younger farmers as well as older members of farm households are less likely to be linked to external labour markets; middle-age farmers, as is true for the labour force more generally, are more likely to allocate more time to work and may spend more time working of-farm. The reasons hypothesised for a greater probability of off-farm work among middle-aged farmers vary, reflecting a combination of both “push” and “pull” factors, as discussed by Kada (1980).

Table 8 shows the potential effects of education on both off-farm work and farm exit behaviours. Other basic demographic characteristics are included in Table 8. A policy package that reduces the profitability of farming is most likely to negatively influence those farmers and farm households with lower levels of education that reduce their employability off-farm.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Off-farm work</th>
<th>Farm exit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Farm-specific</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Younger</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Middle-age</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Older</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Household size</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Number of children present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Older</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Younger</td>
<td>?</td>
<td>-</td>
</tr>
</tbody>
</table>

This would suggest that younger farm households that are entering farming or have limited farming experience and those that are older are more likely to be found on Type II farms, and these farms may be more likely to quit farming altogether but this will depend on the particular policy reform package. In response to policy reform, younger farmers may be able to find off-farm jobs while continuing to farm, depending on the farm’s location and on their own human capital. Older farmers, however, may find it particularly difficult to adjust, unless they already possess job experience from prior off-farm work that enhances their employability.
The number of children in the farm household and their ages may affect the farm’s linkages by influencing the supply of labour available to operate the farm, but this will depend on the ages of children, the size of the farm operation, and the extent to which adult and child labour is substitutable. Adult children no longer living on the farm may be an important source of labour, and partnerships as a form of farm organisation may play a role in providing labour resources. Finally, intergenerational ties to a particular farm may not directly influence linkages of the farm to off-farm labour markets, but may strongly affect farm exit behaviour, by influencing farm household preferences to continue farming, despite the potential for underemployment.

III. Empirical studies

The relationships discussed above can be empirically tested in a farm household model framework. A number of empirical studies have analysed labour adjustments among households engaged in farming. These studies can be grouped into three broad categories assessing (1) farm household labour supply (off-farm and on-farm), (2) exit and entry behaviours of farms, and (3) aggregate labour adjustment analysed in a general equilibrium framework. Each of these categories of empirical studies is discussed below.

I. Off-Farm household labour supply

The determinants of off-farm labour supply, including both the participation decision (whether to work off-farm or not) and the amount of time supplied by farm household members to off-farm work, have been the focus of many empirical studies in both developed and developing countries. Some studies have estimated a system of equations describing household behaviour based on the theoretical farm household model (FHM) previously outlined. For example, Kuroda and Yotopolous (1978, 1980), Kuroda (1979, 1980), Sonoda and Maruyama (1999) and Lopez (1984, 1986) are of this type.

A second approach is to estimate off-farm labour supply functions using reduced form equations, again based on the farm household model (Huffman, 1991). There have been a significant number of these studies using survey data collected from farm households in the OECD countries. This literature shows that off-farm labour supply decisions are influenced in general by the characteristics of individuals, farm households, external labour markets, and the farm itself. Off-farm labour supply decisions are also shown to be affected by policy, although most studies of this type to date have not explicitly considered the differential effects of alternative farm policies. The determinants of off-farm labour supply are discussed below.

Individual characteristics

The individual’s age and education (human capital) are found to be among the most important determinants of the off-farm work. Studies have consistently documented a life-cycle effect related to off-farm labour supply among adults in farm households, both in terms of the off-farm work participation decision and time worked [including Sumner (1982), Shigeno (1989), Huffman and Lange (1989), Tokle and Huffman (1991), Lass and Gempesaw (1992), Findeis and Lass (1992), Schulz-Greve (1994), Corsi and Findeis (2000), Oluwole (2000)]. The life-cycle hypothesis posits that work effort increases with age during the early and middle years, to accumulate additional assets that can be used later in life as work effort declines (Lass, Findeis, and Hallberg, 1991). Therefore, off-farm work is most likely to be observed among the middle-aged: the greatest likelihood or probability of working off-farm tends to occur between 42 and 55 years of age, although younger ages for the maximum effect have been observed (Tokle and Huffman, 1991; Schulz-Greve, 1994). Early studies of off-farm work among farm women tended to show a
lower age for the maximum effect, but it is likely that samples used in these studies included a significant number of older women who had not worked outside the farm and home over most of their lives. More recent studies generally show maximum effects in the same age range for farm women as for men.

Years of schooling also has the effect of increasing the likelihood of off-farm work by both farm men and women, by raising the offered wage. However, as discussed previously, schooling may be farm-specific (e.g. vocational education, or education in a school of agriculture) and contribute to higher returns from farming, or may be more general in focus and enhance the off-farm offered wage (Huffman, 1980; Lass et al., 1991). Positive effects of schooling on off-farm labour decisions are reported in many empirical studies (Huffman and Lange, 1989; Tokle and Huffman, 1991; Lass et al., 1991; Findeis and Lass, 1992; Lass and Gempesaw, 1992; Zweimüller, Pfaffermayr, and Weiss, 1992; Corsi, 1994; Benjamin and Guyomard, 1994; Schulz-Greve, 1994; Weiss, 1997; Corsi and Findeis, 2000; Oluwole, 2000, among others). Further, the effect of schooling appears to be greater for women than men on farms. Other individual characteristics that may be important include human capital in the form of work experience, both on and off the farm (Sumner, 1982).

**Household characteristics**

Household characteristics, and particularly the presence or number of children, have been shown to affect the labour supply of adult farm household members by raising the reservation wage. Many studies have shown that young children reduce the likelihood that a farm woman works off-farm (Kada, 1980; Findeis and Reddy, 1989; Huffman and Lange, 1989; Tokle and Huffman, 1991). Huffman and Lange (1989) and Oluwole (2000) found that the presence of young children reduced the likelihood of off-farm work among both husbands and wives. Tokle and Huffman (1991) show that children under 18 years of age and especially young children affect the off-farm work participation of farm women, in particular. Benjamin and Guyomard (1994), Schulz-Greve (1994), and Corsi and Findeis (2000) report that family or household characteristics are generally insignificant for farm men. In the case of Dutch cash crop farms, Woldehanna, Lansink and Peerlings (2000) report that larger family sizes increase the desire of households to work off-farm.

There may also be jointness between the work behaviours of adult farm household members, and particularly between spouses (Lass, Findeis and Hallberg, 1989; Huffman and Lange, 1989; Oluwole, 2000). Ishida (1981, 1983) presents evidence to confirm “Douglas’s law” that posits that the employment behaviour of a secondary worker likely depends on the principal earner’s work decisions (and, importantly, not vice versa). For farm households in Japan, Ishida (1981) showed that farm women generally work off-farm when their husbands decide to do so, and are more likely to work full-time in farming if their husbands do. Bollman (1979) explains this phenomenon in Canada by noting that very often farm couples will both work off-farm to reduce the per job costs of commuting to work. An increase in commuting costs generally reduces the probability of off-farm work.

**Farm characteristics**

As discussed in Lass et al. (1991), the quantity of farm output is expected to influence off-farm labour supply due to the existence of quasi-rents or variable profits accruing to farm household members. The estimation of a quasi-rent function with predicted values then incorporated as exogenous variables in the labour supply function would be the best approach. However, the approach is not tractable (Lass et al., 1991). A second-best choice is to use the total value of farm sales (or a similar output measure) in the estimated labour supply function. Studies have consistently shown a negative effect of farm output on off-farm labour supply, a result that is certainly not surprising. Higher levels of asset income also are observed.
to reduce the probability of off-farm work participation, for both farm men and women (Huffman and Lange, 1989). Expected short-run farm profit has a strong influence (negative) on the probability of off-farm work (Woldehanna et al., 2000).

Empirical research has also shown that certain farm enterprises tend to be associated with less off-farm work. For example, regions where dairy farms are more prevalent tend to have lower rates of off-farm employment; dairy farms have greater labour requirements throughout the year, and therefore are less compatible with off-farm work generally and even seasonal off-farm employment (Corsi and Findeis 2000). Corsi and Findeis (2000) report that Pennsylvania farms with seasonally labour-intensive principal enterprises are 20% less likely to have a farm operator working off-farm. This may be due, again, to the greater labour requirements of seasonally labour-intensive enterprises or may reflect a greater profitability associated with these enterprises (Corsi and Findeis, 2000).

Location-related characteristics

The effects of location on off-farm work have been analysed empirically using a wide variety of measures: distance to the nearest town/city (Lass and Gempesaw, 1992), industrial structure in the local labour market (Gunter and McNamara, 1990; Hearn, McNamara and Gunter, 1996; Corsi and Findeis, 2000), population density (Benjamin and Guyomard, 1994), the local unemployment rate (Zweimuller et al., 1992; Benjamin and Guyomard, 1994; Weiss, 1997), and local employment growth rates (Tokle and Huffman, 1989), among other measures. The reported results of these studies show a considerable degree of variability. However, studies focusing specifically on the off-farm work participation decision generally have concluded that distance to off-farm opportunities reduces the likelihood of off-farm work, while population density contributes to a greater likelihood of off-farm employment being observed. Corsi and Findeis (2000) report that local employment structure is also important, with high-wage service and trade jobs encouraging off-farm work and a concentration of low-wage jobs in these sectors reducing the probability of off-farm employment. When sets of variables were tested for exclusion from the participation models estimated in Corsi and Findeis (2000), the set of local labour market variables could not be excluded from the models for either farm men or women.

Policy effects

Agricultural policies can be expected to affect labour supply decisions of farms, as demonstrated in Section II. However, relatively few empirical studies of the determinants of off-farm labour supply have explicitly incorporated policy variables. Tokle and Huffman (1991), Weeksink, Nicholson, and Weerahewa (1996), Mishra and Goodwin (1997), and Oluwole (2000) have incorporated farm policy. Recently, Woldehanna et al. (2000) analysed the implications of the 1992 and Agenda 2000 CAP reforms on Dutch cash crop farms. Tokle and Huffman (1991) analysed US data for 1978-82, focusing on off-farm labour demand and off-farm work participation decisions among US farm households and Oluwole (2000) has recently conducted a similar analysis for the period 1977-98. Tokle and Huffman (1991) considered the effects of farm crop and livestock prices and hired labour wages on off-farm work decisions, showing that declines in crop and livestock output prices increase the likelihood of off-farm wage work among farm men and women. These effects are stronger for men than women, indicating that lower commodities prices (no price supports) provide a greater impetus for men to work off-farm than women. Oluwole (2000) found that the effects of demographic variables tended to be stronger than the policy variables that were incorporated in the models.

Mishra and Goodwin (1997) analysed the effects of US farm programs directly, focusing on farm income risk. Greater farm income variability was found to increase the likelihood of off-farm employment.
Higher direct payments reduced off-farm work, even when controlling in the estimated models for farm size, a result consistent with Oluwole (2000). From a policy perceptive, the transition from price supports to direct payments under the 1996 FAIR Act means that farm income risk is increased (Mishra and Goodwin, 1997). In the absence of price supports, the impacts of increased risk of farm production coupled with the theoretical labour impacts of lower farm prices point to more off-farm work. On the other hand, the study results show that direct payments tend to reduce off-farm employment.

Weersink et al. (1996) provide intercountry comparisons, between dairy farms in Canada (Ontario) and the US (New York). Off-farm employment is found, as in many studies, to act as a means of enhancing and stabilising farm household income in both countries. However, differences in policy between the US and Canada lead to different results. Specifically, the likelihood of participation in off-farm employment and the time allocated to off-farm work are lower in Canada than the US Weersink, et al. (1996) attribute these differences to (1) supply managed milk marketing systems in Ontario that result in higher and more stable farm returns to dairy farms, and (2) free medical care in Ontario that serves to reduce the likelihood of off-farm work. Finally, freer trade in dairy in the future will likely reduce returns in Canada with more labour adjusting into off-farm employment (Weersink et al., 1996).

Finally, Woldehanna et al. (2000) report that price supports tend to provide a disincentive to work off-farm, while direct payments do not. However, they note that CAP reforms will likely increase off-farm work participation, many farm households at least in The Netherlands appear “inhibited” in their willingness to pursue off-farm work. The results support the view that Type II farms in some contexts at least may not forge linkages with external labour markets, despite the incentive to do so. Woldehanna et al. (2000) argue that in the long run, policies should promote education to enhance the abilities of farm household members to become employed off-farm, whereas in the short run, providing information to farmers on off-farm work possibilities should be provided.

2. Farm exit decisions

Farm exit behaviours are also likely to be affected by individual and household characteristics, characteristics of the farm, and location. Empirical studies have analysed farm exit behaviours, but fewer studies of this type exist in comparison to research on off-farm labour supply. However, the collection of panel data on farm households that has become more prevalent in recent years will be particularly useful for analysing farm exit behaviours. The determinants of farm exit are discussed below.

Individual and household characteristics

Weiss (1996, 1999), Lee (1998), Kimhi and Bollman (1999), Oluwole (2000), and Goetz and Debertin (2000) report a significant life-cycle pattern in farmer’s exit behaviour in selected OECD countries (and Israel). Non-linearities observed between age and farm dissolutions are also reported by Gale (1994) and Roe (1995). Lee (1998) found that the effect of age is negative for young farmers and becomes positive when the farm operator’s age exceeds 25 years; the corresponding ages reported in Weiss (1996) and Oluwole (2000) were 43 years and 47 years, respectively. The minimum occurs at an even older age in Goetz and Debertin (2000).

The negative relationship reported for farm operators at younger ages is consistent with Jovanovic’s evolutionary model that focuses on the effect of learning and the acquisition of experience (Jovanovic, 1982). Furthermore, switching from farming to an off-farm job becomes a less viable option as the individual ages, since specific human capital investments are involved and the time to retirement over which those investments can be recouped is shorter for older farmers. On the other hand, and almost by
definition, the probability of farm exits can be expected to increase as the farm operator(s) age, particularly on farms where succession is unlikely.

Empirical studies for the nonfarm economy (Evans and Leighton, 1989; Bates, 1990) also identify owner’s education level as a key determinant of firm survival. In the present case, however, it is important to bear in mind that formal education may have two opposing effects on farm exits. First, an increase in human capital allows the farm operator(s) to process information, allocate resources and evaluate new technologies more effectively. By raising the farm's earnings capacity, this would suggest a negative impact of schooling on farm exits. Alternatively, increases in human capital by farm household members increases the opportunity for employment outside the sector and thus reduces the attractiveness of remaining in the farm sector. To capture both effects explicitly in the empirical model, Weiss (1996) distinguishes between farm-specific and general education. A higher level of farm-specific schooling is found to reduce the probability of leaving the agricultural sector for a hypothetical farm by 1.18 percentage points. A higher level of general schooling was not found to be significantly different from zero at the 10% level of statistical significance (Weiss, 1996).

The size of the farm household is also an important determinant of farm exits. A strong negative impact on farm exits is reported in Weiss (1996) for farms where the farm operator is married. The number of other family members living on the farm also significantly reduces the probability of a farm exit (Weiss, 1996). These results are not surprising, since family members provide both an incentive as well as the necessary labour resources for continuation of the farm business (Kimhi, 1994).

Farm characteristics

With respect to the impact of farm size on the probability of exits, two opposing effects are potentially relevant. First, the existence of increasing returns to scale makes larger firms more efficient compared to smaller ones. Such differences in efficiency would cause smaller producers to quit production or exit if prices fall during the declining phase. In the agricultural sector, strong empirical evidence exists for an “L” shaped cost curve (Mukhtar and Dawson, 1990; Kumbhakar, 1993) which implies increasing returns to scale at low or moderate farm sizes and suggests a negative relationship between farm size and exits. However, Lieberman (1990) argues that small firms can remain profitable over a longer period as demand declines and Gasson, Crow, Errington, Hutson, Marsden and Winter (1995) argue that small farms are tenacious in their abilities to survive. Empirical studies for the European farm sector (Lee, 1998; Weiss, 1996) observe a highly significant negative effect of farm size on farm exits. According to Weiss (1996), an increase in farm size by one standard deviation at the sample mean reduces the probability of failure by 1.45%. This reinforces the argument that larger farms tend to experience economies of scale and produce greater returns than smaller farms, thus bolstering the relative profitability of remaining in farming versus seeking other employment. Kimhi and Bollman (1999) similarly report that large farms in Canada are less likely to exit the sector, whereas the opposite tendency was observed in the case of Israel.

The majority of empirical studies that consider the effects of the land resource on farm exit decisions use a land size variable, in most cases either cultivated acres or land owned. Land prices may also influence exit decisions. At the urban/rural fringe, land prices can increase rapidly under pressure of development. Farmers often hold onto the land, at least in the short run, with the expectation of even higher land prices in the future when the farm is sold. Farm households in urbanizing environments may also participate in farmland preservation programs and continue to farm while adjusting in a variety of ways to urbanisation. Participating in off-farm employment is one of several adjustments that may occur. However, research on farm household adjustments both on and off the farm in south-eastern Pennsylvania, an urbanizing region, showed fewer adjustments than expected (Larson, Findeis and Smith, 2001). Higher
land prices meant greater obstacles to holding onto the farm, in a region where land is highly valued for development (commercial and residential) purposes.

**Off-farm labour supply and farm exits**

Finally, it is important to combine the two dimensions of labour market adjustment in the farm sector, off-farm employment and off-farm migration (farm exits). It is frequently asked whether part-time farming is a steady state phenomenon or the first step out of farming (Gasson, 1986; Pfeffer, 1989; Kimhi, 2000). The answer could have broad consequences for farm policy design. Lee (1998) reports that off-farm employment raises the attractiveness of staying in the farm sector, *ceteris paribus*. A 1999 comparative study by Kimhi and Bollman (1999) using panel data found this to be the case empirically in both Canada and Israel, with off-farm work reducing the likelihood of farm exit. However, the opposite result is reported in Weiss (1996). As reported in Weiss (1996), if a married couple spends more than 50% but less than 90% of total working time on the farm, the probability of exit increases by 2.59% compared to a hypothetical full-time farm. If the number of hours spent off the farm is even higher and amounts to more than 50% of total working time, the probability of leaving the agricultural sector in the following period increases by 4.82%, again compared to a hypothetical full-time farm (Weiss, 1996). Finally, Goetz and Debertin (2000) find that higher rates of off-farm employment in counties in the US tend to be associated with reducing the odds of losing farms but that once farms start to leave the local area, that higher rates of off-farm work accelerate the loss. Thus, whether additional off-farm activities are a substitute to farm work and constitute the first step on the way out of the agricultural sector is still an open question.

3. **General equilibrium model results**

The studies discussed above focus on labour adjustment in a partial equilibrium framework. A general equilibrium framework that allows interactions (linkages) between sectors of the economy can also be used to analyse farm labour decisions. General equilibrium models have been used in North America to examine impacts of farm policy on factor mobility (Kilkenny and Robinson, 1990) and on US-Mexico migration (including Robinson, Burfisher, Hinojosa-Ojeda, and Thierfelder, 1993). Similar models have been used in the European Union to analyse CAP (Weyerbrock, 1998) and in Japan to examine the agricultural sector (Ichioka and Tachibanaki, 1989; Takahashi, 1991; Saito, 1996). General equilibrium models have been applied more frequently in the 1980s and 1990s, because of the development of computable general equilibrium (CGE) or applied general equilibrium (AGE) models.

Applying the US CGE model, Kilkenny and Robinson (1990) found that termination of agricultural subsidies in the US reduces agricultural employment in a wide range of scenarios, including alternative trade liberalisation scenarios. Results show that trade liberalisation enhances farm prices by *reducing* farm employment (Kilkenny and Robinson, 1990). Further, Robinson *et al.* (1993) report that complete trade liberalisation coupled with removal of subsidies to Mexican agriculture has a significant impact on labour out-migration. Under these conditions, Robinson, *et al.* (1993) predict an 11% migration of Mexico’s rural labour force to Mexico’s urban areas or to the US Only by increasing farm payments to Mexican producers can this outflow of employment from agriculture be prevented. Ichioka and Tachibanaki (1989) in Japan assess the effects of removal of agricultural protection policies, also showing significant migration out of agriculture as a result.

General equilibrium models are particularly useful for policy analysis related to labour as long as the interrelationships in the model can be accurately modelled and if there is sufficient detail with regard to labour. More work stands to be done.
IV. Policy reform versus other changes affecting farm employment

Technological innovation has been the single most significant force contributing to long run reductions in employment in production agriculture in the OECD countries during the post World War II era. Labour productivity in the farm sector has increased markedly, with labour previously in agricultural production being absorbed into other sectors. This has been the story in many developed economies that have witnessed long run declines in the relative sizes of their agricultural populations — both those owning and working on their own farms and those hired to work in farming. Since the labour resources released from agriculture largely have been absorbed by other sectors, the positive side of this pervasive trend is that agricultural production is now more efficient and underemployment of labour resources in the farm sector has declined in many countries. However, there is a negative side as well: some countries and regions have found it difficult to absorb the labour resources “released” from agriculture. The transition into other gainful employment also has been difficult for households that preferred to continue farming.

Other factors have also played a role in affecting farm employment trends. These include changes in (1) external labour markets in the short and long runs, and (2) the demographic structure of households, the characteristics of household members, and socio-cultural factors. These determinants and their potential influences under policy reform are discussed below.

1. Changes in external labour markets

The ability of local labour markets to absorb labour released from agriculture by technological innovation is a critical variable from the perspective of understanding farm household labour adjustments and farm exit behaviours. While local labour markets, even in rural areas, are highly diverse, it is useful to consider labour adjustments at the two ends of the spectrum, i.e. in spatially integrated farm/nonfarm labour markets versus in labour markets found in more remote rural regions. The trend today is toward more spatially integrated farm/nonfarm labour markets but many areas remain more rural and more remote.

Spatially integrated farm/nonfarm labour markets

Some regions that were previously principally agricultural have seen significant economic growth in the nonfarm sectors that has increased the demand for labour in these sectors. Growth of nonfarm employment opportunities in the countryside have attracted population into regions that were previously agricultural. There has also been rapid growth of nonfarm jobs in those local labour markets directly adjacent to urban areas, i.e. at the rural-urban fringe. The result has been that farm households in these labour markets now have more opportunities to work both on and off the farm simultaneously as a household unit. This may involve multiple job-holding, with the farm operator(s) working in both sectors, or the allocation of time by different household members to farm and nonfarm work (separately).

The linkages that exist between farms and the external labour market are in part a reflection of the demand side, i.e. the existence of off-farm opportunities. When these opportunities exist, farm households have the flexibility to take advantage of off-farm income. Type I farms are more prevalent in those countries and regions with more spatially integrated farm/nonfarm labour markets. While Type I farms found at the rural/urban interface or in those rural areas with growth in population may choose to exit farming under policy reform, they may also simply adjust more labour into off-farm markets while holding onto the land.

In those labour markets where off-farm employment opportunities exist, Type II farms are more likely to seek off-farm work under policy reform. That is, farms that have been self-sufficient from a labour perspective now may find household members working off-farm, i.e. they become Type I farms.
Underemployment in agriculture is reduced, but unemployment in the external labour market may result. The extent to which the policy reform package results in more unemployment in such regions will depend on conditions within the external labour markets. Fortunately, in such regions, agricultural employment as a percentage of total civilian employment tends to be lower than in more remote rural regions. When labour is released from agriculture, the economy-wide impacts are lower.

Type III farms in regions or countries where nonfarm opportunities exist are likely to reduce the size of their hired labour force under policy reform — with hired workers being released to compete for jobs in the external economy. Such farms may become Type II or even Type I. Whether hired labour can be absorbed into the external economy will depend on hired labour’s human capital and on the set of institutional arrangements or policies that either create barriers to hired farm labour moving into other sectors or facilitate this transition. An example of an institutional arrangement/policy that can have significant effects in this regard is immigration policy.

Labour markets in more remote rural regions

The spatially integrated farm/nonfarm labour markets that have become more prevalent are in contrast to the labour markets that are typical of more remote rural regions. Although farms in more remote regions benefit from lower land prices, they are less likely to be able to take advantage of the flexibility afforded by proximity to off-farm job opportunities. Type I farms found in more remote rural areas are often what might best be described as “limited resource farms.” Policy reform will likely cause a significant decline in the number of Type I farms found in remote rural labour markets. This loss of agriculture as a source of income for Type I farms will likely exacerbate the unemployment problem that is often characteristic of such regions. Households that rely on agriculture as one of several income sources to help “make ends meet” will find it increasingly difficult to generate a sufficient level of household income. Unfortunately, these households often have low levels of human capital and low mobility, creating potentially significant labour market distortions at the local level.

With policy reform, Type II farms in remote regions will either remain Type II or exit the sector altogether. Type II farm households will likely continue to allocate labour to farm work, but depending on the policy package, may find that they are unable to continue farming. Older farmers may exit; other farmers will need to adjust their labour resources. If they are mobile and possess adequate human capital, there is less of a problem. If, however, they are immobile or lack skills consistent with off-farm work opportunities, then local unemployment rates will rise. Again, the relative size of the Type II farm population is critical – a large number of farms and a relatively large proportion of the local population engaged in farming can have significant negative local impacts, depending on the specific policy reform package.

Finally, Type III farms in these regions will also likely release labour, that may or may not be absorbed locally. To the extent that current Type III farms are more economically viable than Type I or Type II farms, Type III farms will likely become increasingly prevalent in remote rural regions over time as policy reform takes place, although this will depend on the exit behaviours of Type I and Type II farms.

2. Changes in demographic structure and socio-cultural factors

Work decisions and farm exits are also clearly influenced by the demographic structure of the farm household and by the socio-cultural factors that encourage or discourage linkages to external labour markets. The empirical studies reviewed in this report have shown that the human capital endowments and ages of farm household members influence both off-farm work decisions and farm exits. The studies have also shown that the size of the farm household is an important determinant. Finally, changes in the work
patterns of women that have meant a greater degree of participation in market work have influenced rates of off-farm work participation and may have influenced farm exit behaviours.

The prevalence of off-farm employment observed in many developed economies is, in part, the result of long run demographic and socio-cultural changes. Increases in human capital among the farm population have contributed to higher levels of off-farm labour supply, that has been significantly affected by labour-saving technological change and the changes in external labour markets discussed above. Smaller family sizes coupled with socio-cultural change have also encouraged the movement of farm women in particular into the external labour force, contributing to more off-farm work participation and higher off-farm incomes. These long run trends have had significant impacts on the labour decisions that farm households make and may affect, in important ways, the adjustments that farm household will make to policy reform. Policy reform will likely contribute to even more off-farm work, unless a large proportion of Type I farms quit farming altogether. Even then, however, some Type II and Type III farms may become Type I given the policy change.

The exit behaviours of farm households are also sensitive to demographic and socio-cultural changes. Many argue that older farmers increasingly constitute a greater proportion of the farm population (Gale and Pursey, 1995), due to fewer young farmers entering farming and to the general ageing of the overall population. The result has been that the age distribution of the farm population in many developed economies has become skewed toward the middle-aged and older farmer and farm household. These two populations are affected in different directions in terms of off-farm work and farm exit decisions -- older farmers are less likely to work off-farm but are more likely to quit farming, whereas middle-aged farmers are more likely to have off-farm employment but are less likely to quit farming. If this trend continues, the decline in numbers of farms and farm households will continue, unless more younger farmers can be encouraged into farming. This will depend, in part, on expectations regarding the marginal monetary returns to farming and potential changes in policy that influence these returns. Again, expectations are critical.

Conclusions

Technological change continues to exert a significant long run influence on farm sector employment and it is likely that, overall within the OECD countries, this long term trend will continue. The result is a decline in the demand for labour in farming. Policy reform will also negatively affect employment levels within agriculture and may result in higher unemployment rates, but the magnitudes of impacts will depend crucially on external labour markets. It is likely that the effects in areas with access to off-farm job opportunities will be very different than in more remote rural regions. The existence of off-farm jobs allows more flexibility for farms that are financially stressed. Remote rural regions face more difficulties particularly if capital is immobile and labour is both immobile and lacks sufficient human capital (and information) to facilitate mobility. In such regions, unemployment will be an increasing problem, particularly in the short run.

In addition to technological change, demographic and socio-cultural change also have influenced farm household employment and the farm workforce in the long term. The demographic and socio-cultural changes that have occurred in the post World War II era include an increasingly better educated farm workforce (due to higher levels of education among younger and middle-aged farmers), more farm women working off-farm, fewer children raised on the farm, and an older farm labour force. Higher levels of education among the farm population and the greater acceptability of working off-farm serve to facilitate adjustments to policy reform. The negative impacts of policy reform are most likely to fall on older farmers who have few alternatives. Younger households that have decided to enter farming will be better
able to adapt and adjust their labour resources, although they will suffer financially if they are unable to continue farming after having made the significant financial investment of entering the farm sector.
NOTES

1. See other OECD publications related to this work listed in the reference section of this report.

2. Appendix Table A.1 includes the average number of workers employed in agriculture (including hunting, forestry, and fishing), as well as changes in the numbers of workers over selected time periods. Appendix Table A.2 includes average FFE and changes in FFE for selected time periods in the EU-15 and OECD-26 countries. As stated in OECD (1999a), the FFE are calculated based on the European Union Annual Work Unit (2 200 hours of work time in agriculture per year).

3. Measured in FFE, employment on farms in New Zealand and the US increased over the period 1986/90 – 96/98. Only these countries (of those analyzed) witnessed an absolute increase in farm employment.

4. The terms “nonfarm” and “off-farm” are used interchangeably in this report, but it is recognized that differences exist in the use of these terms. As shown by Bollman (1994), nonfarm self-employment can be “on the farm” but not farm-related.

5. The decision-making unit in the FHM is assumed to be the farm household, which in many cases, is a single farm family unit.

6. For a review of the agricultural household model (farm household model) and modifications to this model as applied in developing countries, see Singh, Squire and Strauss (1986). For a historical perspective, see Chayanov (1923); Nakajima (1957, 1986) and Huffman (1991) also provide useful perspectives.

7. Much of the literature uses the term “leisure” to indicate the time allocated to nonwork activities. Huffman (1991) uses the term “home time” to include leisure and activities related to the home (child care, etc.).

8. Similarly, a home economic production function has been incorporated in the model in some applications, to explicitly examine household decisions related to home (economic) production. The inclusion of an agricultural production function and/or a home economic production function in the basic model allows analysis of self-employment decisions. For a discussion of incorporation of home production into economic household decisions models, see Pollak and Wachter (1975), Gronau (1977, 1980), and Kooreman and Kapteyn (1987).

9. It is assumed that the farm production function is concave and that farm output \( Y_f \) increases with additional labor allocated to farming and with higher levels of farm inputs. That is, that \( \partial Y_f / \partial T_f > 0, \partial Y_f / \partial X_f > 0 \).

10. Arayama (1985, 1986) and Nandkeolyar (1991) also develop models in which the off-farm time allocation is decided first, followed by the time allocated to farm work.

11. It should be noted that hired farm labour can be analyzed separately from other farm inputs quite readily in the FHM. This allows analysis of the full set of labour resources used on the farm.


13. Some specific criteria should be designed whenever the data do not furnish the level of detail required.
14. The non-overcompensation assumption affects only the signs of the impacts in Question 1 which could become negative. The remainder of the results in Table 7 are not affected by this assumption.

15. This is in part because the majority of studies estimating off-farm labour supply use cross-sectional farm household survey data collected within a single region or country. Only a few studies have used panel data, that facilitate policy comparisons.

16. See also discussions in Frohberg (1994), Goetz and Debertin (1996) and Hertel (1989) for related issues.

17. A hypothetical farm is characterized by taking mean and mode values of exogenous continuous and dummy variables, respectively.
ANNEX

Annex Table A.1. Agricultural employment in OECD countries: numbers of workers

<table>
<thead>
<tr>
<th>Country</th>
<th>Average 1986-90</th>
<th>Average 1991-95</th>
<th>Average 1996-97</th>
<th>Change 86-90 to 91-95</th>
<th>Change 91-95 to 95-97</th>
<th>Change 86-90 to 96-97</th>
</tr>
</thead>
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</table>

1. Unified Germany since 1991. n.a: not available.
2. In the Czech Republic farm employment statistics before 1990 included all workers employed by large-scale agricultural enterprises, including those who actually did not work in agriculture. After 1990, labour statistics more accurately reflect farm employment. Therefore the reduction in farm employment from 1986-90 base period is partly a "statistical effect" and, thus, overestimated.

Source: OECD Labour Force Statistics. Includes not only agriculture, but also hunting, forestry and fishing. It may be better to measure employment in Full-Time Farmer Equivalents (FFE) (Table A.2). The number of workers in OECD Labour Force Statistics is usually larger than the number of FFEs, with some exceptions.
### Annex Table A.2. Agricultural employment in OECD countries: Full-Time Farm Equivalents (FFE)

<table>
<thead>
<tr>
<th>Country</th>
<th>Average 1986-90</th>
<th>Average 1991-95</th>
<th>Average 1996-98</th>
<th>Change 86-90 to 91-95</th>
<th>Change 91-95 to 95-98</th>
<th>Change 86-90 to 96-98</th>
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<td><strong>16218.2</strong></td>
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<td><strong>-16</strong></td>
<td><strong>-11</strong></td>
<td><strong>-26</strong></td>
</tr>
<tr>
<td>Mexico</td>
<td>n.a.</td>
<td>n.a.</td>
<td>7704.6</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

1. Unified Germany since 1991. n.a: not available.
2. In the Czech Republic farm employment statistics before 1990 included all workers employed by large-scale agricultural enterprises, including those who actually did not work in agriculture. After 1990, labour statistics more accurately reflect farm employment. Therefore the reduction in farm employment from 1986-90 base period is partly a "statistical effect" and, thus, overestimated.

Source: OECD, Agricultural Policies in OECD Countries: Monitoring and Evaluation. No data available for Poland and Turkey. Caution is needed in interpreting these data as definitions and coverage over time and across countries are not fully consistent.
REFERENCES


