Farm Household Production in the Presence of Restrictions on Debt: Theory and Policy Implications.

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ABSTRACT

In this paper a two period life cycle model of the farm household is constructed allowing for production and restrictions on debt in which the consumption and production decisions of the farm household are simultaneous. It is shown that the farm household's production responses to exogenous changes may be qualitatively different to that predicted by the profit-maximizing model when all markets are perfect. In particular, when the household is debt constrained, 'perverse' output effects are possible with output increasing in response to output price decreases. Further, for such households, compensation payments will have production effects. Finally, the financial situation of the farm has an impact on production for debt constrained farms.

1. Introduction

Despite the tremendous technical changes which have occured in the last few decades, the majority of farms in EU agriculture are still (residually) owned and operated by farm households. This combination of ownership and control may, from a behavioural perspective, be potentially important as farm capital represents both a source of finance for the farm business and also a store of wealth for the household. Hence, there exists a potential tradeoff between current farm household consumption and farm investment (and hence production). In terms of agricultural policy, the existence of such interactions has implications for the household's responses to exogenous changes, e.g. output price changes. Further, in terms of compensation payments for output price cuts, if there are interactions between consumption and production then this raises the question as to whether such payments are ‘decoupled’. Finally, if such interactions exist, they permit farm production to be influenced by a far wider range of factors, e.g. household preferences, farm financial structure, than is permitted under the profit-maximizing view of farm behaviour.

The existence of this potential tradeoff between farm consumption and investment has long been recognized (Chayanov, 1925), and although a number of recent studies have applied models which allow for interactions between farm consumption and investment (Lifran, 1994; Phimister, 1993; Roe and Graham-Tomasi 1986; Shalit and Schmitz, 1982), the main body of analytical work on farm household behaviour has concentrated on the interactions between labour demand and supply on the farm (Dawson, 1984; Nakajima, 1986; Singh et al., 1986). The main purpose of this paper is therefore to show analytically how potential interactions may arise between consumption and investment (and future production) on the farm household. A simple two period life cycle model of the farm household is constructed which allows for production but where borrowing by the household may be quantitatively restricted. This latter aspect is justified by the presence in practice of a large number of quantitative restrictions on farmers access to credit, e.g. collateral requirements (Miller et al., 1993; LEI/Rabobank, 1987).

The plan of the paper is as follows. In the next section the basic life cycle model of the farm household is presented and its solution characterized and interpreted. Finally, in section 3, the response of the model to a number of exogenous parameter changes is considered, namely, its response to changes in the output price, the level of exogenous payments and initial debt.

2. Farm Household Life Cycle Model

The model is a two period version of the modern life cycle model formulated by Modigliani and Blumberg (1955) with extensions to allow for agricultural production and restrictions on borrowing. Perfect foresight is assumed for all prices, yields etc. in the second period.[2] As in the general model, it is assumed that at the beginning of the first period the household must plan its consumption and production levels for all periods, i.e. for both the current and future periods, so as to maximize lifetime utility. The household's intertemporal utility function is assumed to be additive with a strictly concave subutility function, $U(\cdot)$, defined over consumption in each period. The farm household's own production is determined by a strictly concave function, $f(\cdot)$, defined over capital in each period.[3] The household's possible choices are further restricted by a series of equality and inequality constraints defining consumption, capital stock and maximum permissible debt in each period. The formulation of the model is as follows:

[2]Uncertainty can, in principle, be introduced fairly easily in this version of the life cycle model. However, in this context the extra insights gained do not compensate for the loss of analytical tractability which occurs.

[3]While the model can be extended to allow for labour supply and demand decisions, these aspects have been excluded in order to focus on the potential tradeoffs between consumption and future production.

(1) $$\max_{\substack{C_1, C_2 \\ K_2, K_3 \geq 0 \\ d_2, d_3 \\ I_1, I_2}} \quad U(C_1) + \frac{1}{(1+\rho)} U(C_2)$$

subject to

(2) $$C_1 = P_1 f(\overline{K}_1) - r\overline{d}_1 + (d_2 - \overline{d}_1) - p_1^k I_1 + E_1$$

(3) $$C_2 = P_2 f(K_2) - rd_2 + (d_3 - d_2) - p_2^k I_2 + E_2$$

(4) $$K_2 = (1-\delta)\overline{K}_1 + I_1$$

(5) $$K_3 = (1-\delta)K_2 + I_2$$

(6) $$d_2 \leq d^*$$

(7) $$d_3 \leq 0$$

The following variables are defined for $t = 1, 2$.

Exogenous variables

P_t, - output price period t, r - interest rate, p_t^k - capital good price period t, δ - depreciation rate, ρ - rate of time preference, d^* - maximum permitted debt level period 2, $\overline{d}_1$ - initial debt, $\overline{K}_1$ - initial capital stock, E_t - exogenous income period t.

Endogenous variables

C_t - consumption period t, K_{t+1}, capital stock at beginning of periods $t+1$, I_t - investment period t, d_{t+1} - debt owed at beginning of period $t+1$.

Constraints (2) and (3) define consumption in the two periods as the value of production, minus interest payments on existing debt, plus new borrowings, minus investment, plus exogenous payments. Constraints (4) and (5) define the evolution of capital stock for the beginning of periods 2 and 3 which is the depreciated value of existing stock plus investment from the previous period. The inequality constraints (6) and (7) define the permissible debt levels for the start of periods 2 and 3; (7) is a standard end of period constraint preventing the household from holding positive debt at the end of its planning horizon (without such a constraint the household would be able to consume without limit); (6) prevents the household from borrowing freely, which captures capital market imperfections in the model. This constraint reflects the quantity restrictions which farm households face in the capital market (Miller et al., 1993; LEI/Rabobank, 1987). Theoretically, such quantity constraints can be justified in a perfect foresight model by the presence of imperfect information in the capital market (Jaffee and Russell, 1976), where, given the possibility of default and the presence of ‘dishonest’ borrowers, lending institutions cannot only rely upon the interest rate to allocate credit. As will be shown below, (6), plays an important role in determining the extent of the interactions between consumption and future production in the model.

If a solution exists then the optimal solution to the problem of maximizing (1) subject to the constraints (2)–(7) can be completely characterized using the Kuhn-Tucker Theorem. The following equations, derived from the Kuhn-Tucker conditions, determine the optimal values of the endogenous variables.[4]

$$(8) \qquad (1+\rho)\,\frac{\partial U(C_1)/\partial C_1}{\partial U(C_2)/\partial C_2} = 1+\overline{r}$$

$$(9) \qquad P_2\frac{\partial f(K_2)}{\partial K_2} = \overline{r}p_1^k + \delta p_2^k + (p_1^k - p_2^k)$$

$$(10) \qquad \overline{r} \geq r, \qquad d_2 \leq d^*, \qquad [\overline{r} - r]\,[d^* - d_2] = 0$$

$$(11) \qquad C_1 = P_1 f(\overline{K}_1) - (1+r)\overline{d}_1 + d_2 - p_1^k\left(K_2 - (1-\delta)\overline{K}_1\right) + E_1$$

$$(12) \qquad C_2 = P_2 f(K_2) - (1+r)d_2 + p_2^k(1-\delta)K_2 + E_2$$

where $\overline{r} = (\mu_1/\mu_2) - 1$ is the household's endogenously determined rate of discount, while μ_1 and μ_2 are the dual variables associated respectively with the two consumption constraints (2) and (3). The role of $\overline{r}$ in coordinating the production and consumption sides of the model can be seen from (8) and (9), as it determines the marginal rate of substitution in consumption in the former, while also affecting the effective marginal cost of capital in the latter.

The importance of the restriction on debt in determining the interactions between production and consumption decisions can be seen from the complementary slackness condition (10). From this equation it follows that the solution of the model can be characterized by two distinct cases or 'regimes'. For exposition purposes these regimes are also illustrated in Figure 1 using the overall budget constraint for consumption in periods 1 and 2, XYZ. In the first regime the debt constraint (6) is not binding, i.e. $d_2 < d^*$, and the household's internal rate of discount is equal to the market rate, i.e. $\overline{r} = r$. This is represented by the linear portion XY of the budget

[4]Under the additional assumptions that $\lim_{C\to 0} \frac{\partial U(C)}{\partial C} \to \infty$ and $\lim_{K\to 0} \frac{\partial f(K)}{\partial K} \to \infty$

constraint. Preferences of the form UU' place the household in this regime with the (absolute) slope of the indifference curve, i.e. the marginal rate of substitution, equal to the (absolute) slope of the linear segment, i.e. $(1+r)$. For this case the model can be solved recursively with the solution collapsing to that obtainable by first maximizing (discounted) profits[5] and then maximizing utility subject to a single lifetime budget constraint. The recursivity follows from (9), as with $\bar{r} = r$, the value marginal product is simply equated to the marginal cost where this is composed of the interest cost, depreciation cost and capital 'loss', as in the model of the profit-maximizing producer (Keyzer, 1988).

FIGURE 1

Preferences of the form VV' place the household in the second regime, i.e. $d_2 = d^*$, with $\bar{r}$ simultaneously determined by equations (8)–(12). Here the household's preference for first period consumption means that the optimal consumption allocation occurs on the non-linear portion YZ of the overall budget constraint, with the shape and position of this section determined by the farm's production possibility curve and the maximum level of debt d^*. At the optimal solution for this regime the slope of the tangent to the indifference curve (and the budget constraint) is equal to $(1+\bar{r})$. As will be shown below it is in this case that the household's production responses to exogenous changes may be qualitatively different to those predicted by the profit-maximizing model.

[5] $\max_{I_1,I_2,K_2,K_3} \pi = \left(P_1 f(\overline{K}_1) - p_1^k I_1\right) + \frac{1}{1+r}\left(P_2 f(K_2) - p_2^k I_2\right)$ subject to (4), (5) and nonnegativity restrictions on K_2 and K_3.

3. Comparative Statics

In this section, the response of the endogenous variables to changes in a number of key parameters will be analyzed. The discussion focuses on the production responses of debt constrained farm households (that is those within the second regime) to changes in the output price, exogenous income payments, and initial debt level. These are compared to those of the unconstrained farm household, where, because of the equivalence with the simple profit maximization problem, the behavioural responses are well known.

To simplify the exposition, the function $h(C_1, C_2)$ is defined to represent the marginal rate of substitution function. From the strict concavity of the subutility functions this function is decreasing with respect to C_1 and increasing with respect to C_2, i.e.

$$h(C_1, C_2) = (1+\rho)\,\frac{\partial U(C_1)/\partial C_1}{\partial U(C_2)/\partial C_2}, \tag{13}$$

where

$$\frac{\partial h(C_1, C_2)}{\partial C_1} < 0, \qquad \frac{\partial h(C_1, C_2)}{\partial C_2} > 0$$

Substituting for $\overline{r}$ in (9) using (8), and d^* for d_2 in (11) and (12) generates, after rearrangement, the following three equations which determine the optimal levels of capital stock K_2 and consumption C_1 and C_2 when the household is debt constrained.

$$P_1 f(\overline{K}_1) - (1+r)\overline{d}_1 + d^* - p_1^k\left(K_2 - (1-\delta)\overline{K}_1\right) + E_1 - C_1 = 0 \tag{14}$$

$$P_2 f(K_2) - (1+r)d^* + p_2^k(1-\delta)K_2 + E_2 - C_2 = 0 \tag{15}$$

$$P_2\frac{\partial f(K_2)}{\partial K_2} - h(C_1, C_2)p_1^k + (1-\delta)p_2^k = 0 \tag{16}$$

Change in the Future Output Price

Here the effect of a foreseen change in the output price of the second period, P_2, is considered. Given the implementation of the MacSharry reforms with pre-announced phased reductions in support prices, the assumption of a known change in the output price is not unrealistic.

First, consider the unconstrained farm household (or equivalently the profit- maximizing farm). For this regime the effect on capital stock can be derived directly from (9) by applying the implicit function theorem (Varian, 1992) and then differentiating with respect to P_2. Hence, the effect of the output price change is

$$\frac{\partial K_2}{\partial P_2} = -\left[P_2 \frac{\partial^2 f(K_2)}{\partial K_2^2}\right]^{-1} \frac{\partial f(K_2)}{\partial K_2} > 0. \tag{17}$$

Hence, in the context of foreseen output price decreases, as in the MacSharry reforms, the unconstrained household (and the profit-maximizing farm) will react in a 'standard' way, namely, by reducing current investment and hence future capital stock and output.

The analysis of the effect of a foreseen output price increase on debt constrained farms is complicated by the fact that the solution is simultaneously determined by equations (14)–(16). Applying the implicit function theorem and differentiating with respect to P_2 gives:

$$\begin{bmatrix} -p_1^k & -1 & 0 \\ P_2 \frac{\partial f(K_2)}{\partial K_2} + p_2^k(1-\delta) & 0 & -1 \\ P_2 \frac{\partial^2 f(K_2)}{\partial K_2^2} & -\frac{\partial h(C_1, C_2)}{\partial C_1} p_1^k & -\frac{\partial h(C_1, C_2)}{\partial C_2} p_1^k \end{bmatrix} \begin{bmatrix} \frac{\partial K_2}{\partial P_2} \\ \frac{\partial C_1}{\partial P_2} \\ \frac{\partial C_2}{\partial P_2} \end{bmatrix} = \begin{bmatrix} 0 \\ -f(K_2) \\ -\frac{\partial f(K_2)}{\partial K_2} \end{bmatrix} \tag{18}$$

Using Cramer's rule one obtains:

(19)
$$\frac{\partial K_2}{\partial P_2} = \frac{1}{|\boldsymbol{Z}|} f(K_2) \frac{\partial h(C_1, C_2)}{\partial C_2} p_1^k - \frac{1}{|\boldsymbol{Z}|} \frac{\partial f(K_2)}{\partial K_2}$$

where $\boldsymbol{Z}$ is defined as the coefficient matrix on the left hand side of (18). The determinant of this matrix is

(20)
$$|\boldsymbol{Z}| = (p_1^k)^2 \frac{\partial h(C_1, C_2)}{\partial C_1} - \left[P_2 \frac{\partial f(K_2)}{\partial K_2} + p_2^k (1 - \delta) \right] \left[\frac{\partial h(C_1, C_2)}{\partial C_2} p_1^k \right] + P_2 \frac{\partial^2 f(K_2)}{\partial K_2^2} < 0$$

However, given that $\partial f(K_2)/\partial K_2 > 0$ and $\partial h(C_1, C_2)/\partial C_2 > 0$, the overall effect on second period capital stock is ambiguous. Hence, there is the possibility of a so-called 'perverse' output response when the household is debt constrained, with capital stock (and therefore output) actually decreasing (increasing) in response to a signalled increase (decrease) in the future price. Further, even if the overall sign of (19) is positive, given that $|\boldsymbol{Z}| < \partial^2 f(K_2)/\partial K_2^2$ the effect on capital stock in the debt constrained regime is always strictly less than the effect in the unconstrained regime (and hence the profit-maximizing firm).

This result can be explained intuitively as follows. While the overall effect on household utility of an increase in the output price is positive,[6] as the debt level is fixed, capital stock in the second period can only be increased at the expense of first period consumption. This can be seen directly from the first equation in (18), i.e.

$$\frac{\partial C_1}{\partial P_2} = -p_1^k \frac{\partial K_2}{\partial P_2}$$

As a result of this tradeoff any increase in the second period capital stock must, given its effect on first period consumption, decrease the utility obtained from the first period, i.e. from

[6] This is a straightforward application of the envelope theorem, i.e. it can be shown by differentiating the lagrangian function for the original optimization problem with respect to the second period output price.

$U(C_1)$. This negative effect is captured by the first term on the right hand side of (19). Of course any increase in the capital stock in the second period will also increase second period consumption and this will have a positive effect on household utility. Whether the household reacts to a foreseen price increase by increasing or decreasing the second period capital stock will therefore depend on the balance of these two utility effects.

Change in Exogenous Income

When compensation for farmers for support price reduction is discussed by policy makers it appears that it is implicitly assumed that they will generally be 'decoupled' from production, i.e. the production effects are neglected. In the household model compensation payments appear most naturally as exogenous income, i.e. through E_1 and E_2. Hence, to consider whether these types of payments are decoupled in the household model it is useful to examine the effect of changes in these values.

For simplicity, initially only a change in E_1 is considered. This can be interpreted as capturing the effects associated with a single lump sum compensation payment (or bond), a scheme which has been analyzed by a number of authors (Folmer et al., 1987, Tangermann, 1991, 1992).

First, consider the effect of a change in E_1 on the unconstrained household (profit-maximizing farm). From (9) it follows that in this regime

$$\frac{\partial K_2}{\partial E_1} = 0$$

i.e. that any compensation through E_1 is truly decoupled and has no production effect. Applying the techniques used in the previous section it can be shown that the effect on the debt constrained household is

$$\frac{\partial K_2}{\partial E_1} = \frac{1}{|\mathbf{Z}|}\frac{\partial h(C_1, C_2)}{\partial C_1} p_1^k > 0 \qquad (21)$$

which, as indicated, has an unambiguously positive effect on capital stock and therefore on future production. Hence, it follows that for debt constrained households any compensation payment of this type is not decoupled. In the context of the MacSharry reforms, while the overall package may (depending upon the sign of (19)) have a negative effect on capital stock and hence future output, the ‘compensation’ production effect does provide a source of ‘slippage’.

Given that exogenous payments can have production effects, it raises the further question of how much the manner in which the payments are made matters. In the case considered, the compensation was given in the first period only. An alternative scheme is to make payments every period as, for example, in the new CAP arable regime. To consider the potential production effects of this type of scheme simultaneous changes in E_1 and E_2 can be examined. To simplify the exposition let the household receive an identical payment in each period, i.e.

$$E_1 = E_2 = E$$

As before it follows from (9) that such changes are decoupled from production if the household is unconstrained. However, in the debt constrained regime the effect on capital stock is

$$\frac{\partial K_2}{\partial E} = \frac{1}{|\mathbf{Z}|}\frac{\partial h(C_1, C_2)}{\partial C_1} p_1^k + \frac{1}{|\mathbf{Z}|}\frac{\partial h(C_1, C_2)}{\partial C_2} p_1^k \qquad (22)$$

In contrast to the effect of simple changes in E_1 the overall effect is now ambiguous as although the first term (identical to (21)) is positive the second is negative. It follows from (21) and

(22) that, for the borrowing constrained farm household, the output effect of a compensation scheme will be less if the payments are made over a number of periods. Thus, at least for borrowing constrained farms, the timing of payments matters.

Change in the Initial Debt

The final effect to be considered is the impact of changes in initial debt, d_1. This can be interpreted as illustrating the impact of the farm's financial position on production in debt constrained households. It is of particular interest as in the standard profit-maximizing model of the farm, financial variables play no role in explaining farm investment and growth. This is problematic as the empirical evidence indicates that a farm's financial situation is a significant determinant of farm investment (Brase and LaDue, 1989; Elhorst, 1993).

First, consider the effect of changes in d_1 for the unconstrained household (or equivalently the profit-maximizing farm). As for exogenous payments it follows directly from (9) that $\partial K_2/\partial E_1 = 0$ in this case. This is equivalent to the standard result from the profit-maximizing model, namely, that financial variables play no role. For the debt constrained case it can be seen from (11) that an increase in $(1+r)\overline{d}_1$ is equivalent to a decrease in E_1. Hence, from (21)

(23) $$\frac{\partial K_2}{\partial \overline{d}_1} = -(1+r)\frac{1}{|\boldsymbol{Z}|}\frac{\partial h(C_1, C_2)}{\partial C_1}p_1^k$$

i.e. the overall effect of an increase in initial debt on capital stock and production is unambiguously negative. Thus, for debt constrained farms, higher initial debts levels will *ceteris paribus* induce lower investment and (therefore ultimately) lower production. Hence, the possibility that some farm households are debt constrained provides one theoretically consistent explanation as to why farms with identical technical conditions may, nevertheless, invest different amounts.

4. Summary and Conclusions

In this paper a two period life cycle model of the farm household has been constructed and analyzed. Under the assumption of the existence of constraints on debt, it was shown that the household's production and consumption decisions are simultaneously determined. The solution of the household model is characterized by two distinct regimes. In the first the household is not debt constrained and therefore appears *ex-post* to be profit-maximizing with production and consumption decisions being recursive. In contrast in the second debt constrained regime, household production and consumption decisions must be simultaneously determined. In terms of behaviour, if the household is in the unconstrained regime it responds to exogenous parameter changes in a standard way, i.e. consistent with the profit-maximizing model of the farm and the life cycle model of the consumer without production. However if it is debt constrained, its responses can be qualitatively different.

The nature of these latter responses was examined by considering the effect of exogenous parameter changes including those relevant to current agricultural policy in the EU. It was shown, for debt constrained households, that there is the potential for a 'perverse' output response to announced price drops (such as in the MacSharry reforms), where the debt constrained farm increases future output despite the anticipated drop in price. Further, for these farms, compensation in the form of exogenous payments are not decoupled, i.e. there will be output effects. The exact nature of the output effects was also shown to be dependent upon the form of the compensation scheme, with a single lump sum payment having a larger positive output effect than a scheme where payments were spread over both periods. Finally, it was shown how the level of initial debt on the farm influences production for the debt constrained regime. This result provides one possible theoretically consistent explanation for the empirical evidence which shows that financial variables are important in farm production.

References

Brase, B.T. and E.L. LaDue (1989), 'Farmer Investment: A Review of the Literature', Working Paper A.E.Res.89.5, Department of Agricultural Economics, Cornell University.

Chayanov, A.V. (1925), 'Peasant Farm Organization' reprinted in eds. D.Thorner, B. Kerblay, R.F.F.Smith, *Theory of Peasant Economy* (1986). Manchester: Manchester University Press.

Dawson, P.J. (1984), Labour on the Family Farm: A Theory and some Policy Implications, *Journal of Agricultural Economics*, 35, 1-19.

Elhorst, J.P. (1993), 'The Estimation of Investment Equations at the Farm Level', *European Review of Agricultural Economics*, 20, 167-182.

Folmer, K., M.A.Keyzer, M.D.Merbis, E.Phimister H.Schweren, H J J Stolwijk, P Veenendaal (1987), 'Budgetary Consequences of Changing Rules for Financing EC Farm Support: Some Outcomes from the European Community Agricultural Model', paper presented at the Congress of the European Association of Agricultural Economists, Hungary, September 1987.

Jaffee, D.W. and T. Russell (1976), Imperfect Information and Credit Rationing, *Quarterly Journal of Economics*, 90,.651-660.

Keyzer, M.A. (1988), On the Incorporation of the Life Cycle Hypothesis in an Applied General Equilibrium Model, SOW Working Paper 88-02R, Centre for World Food Studies, Amsterdam.

LEI/Rabobank (1987), De Financiering van de Nederlandse Landbouw. The Hague: Landbouw Economisch Instituut.

Lifran R. (1994), ‘Credit Constraints in a Life Cycle Model with Self Employment: Empirical Evidence from French RICA’, in eds. F.Caillavet, H.Guyomard and R.Lifran *Agricultural Household Modelling and Family Economics*. Amsterdam: Elsevier.

Miller, L.H., P.N. Ellinger, P.J. Barry and K. Lajili (1993) ‘Price and nonprice management of agricultural credit risk, *Agricultural Finance Review*, 53, 28-41.

Modigliani, F. and R. Blumberg (1955), Utility Analysis and the Consumption Function: An Interpretation of Cross-section data, in eds. K K Kurihara, *Post Keynesian Economics*. London: George Allen and Unwin.

Nakajima, C. (1986), *Subjective Equilibrium Theory of the Farm Household*. Amsterdam: Elsevier.

Phimister, E. (1993) ‘The Impact of Borrowing Constraints on Farm Households: A Life Cycle Approach’, *European Review of Agricultural Economics*, (forthcoming).

Roe, T. and T. Graham-Tomasi (1986), Yield Risk in a Dynamic Model of the Agricultural Household, in eds. Singh et al. (1986). *Agricultural Household Models: Extensions, Applications, and Policy*. Baltimore: World Bank.

Shalit, H. and A. Schmitz (1982), ‘Farmland Accumulation and prices’, *American Journal of Agricultural Economics*, 64, 710-719.

Singh, I., L. Squire, and J. Strauss (1986), *Agricultural Household Models: Extensions, Applications, and Policy*. Baltimore: World Bank.

Tangermann, S. (1991) 'A Bond Scheme for Supporting Farm Incomes', in eds. J.Marsh and B.Green *The Changing Role of the Common Agricultural Policy*. London: Belhaven Press.

Tangermann, S. (1992) 'Reforming the CAP? In for a Penny, In for a Pound', *Institute of Economic Affairs Inquiry*, No.29, 6 February 1992.

Varian, H.R. (1992), *Microeconomic Theory*, third edition. London: Norton.