ARE FARMERS COMPLETELY RATIONAL CONSUMERS AND DO THEY SUFFER FROM A BORROWING CONSTRAINT?: THE DUTCH CASE[+]

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ABSTRACT

There is some confusion in the literature on the consumption behaviour of farmers. We try to clear up some of the issues surrounding this confusion by elaborating and testing a model. Euler equations have been derived from a constant relative risk aversion utility function for total consumption expenditure, household expenditure and other expenditure, which includes durable goods. According to a test of Euler equations, farm households are not simply optimising lifetime utility. Rather, these households follow simple consumption rules, strongly influenced by habit formation. In line with most of the literature, we find that farm households are not borrowing constrained in their consumption expenditures.

Keywords: *consumption, Euler equation, borrowing constraint, Dutch farm households.*

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1. Introduction

Consumption behaviour of farm households – as the complement of saving – plays a role in investment and growth in the agricultural sector. Investigating consumption behaviour of farm families whose income fluctuate substantially over time can be important for policy makers. Farm families may absorb fluctuating incomes in their consumption or in their savings. This is also interesting information for farm income insurance. Hence, this paper is focused on a number of issues with respect to farm household consumption behaviour and more in particular on the question, whether they are constrained in their consumption behaviour by insufficient liquidity.

Several empirical studies indicate that the consumption of households is sensitive to innovation in income (Hall, 1978; Flavin, 1981; Deaton, 1992; Carroll, 1994; Zeldes, 1989; see an overview in Browning and Lusardi, 1996, p. 1830, 1831), which is often attributed to a liquidity constraint (Deaton, 1992). Zeldes (1989) investigated whether the liquidity constraint affects the consumption of a significant proportion of the population. Carroll's (1994) result showed that future income uncertainty has an important effect such that consumers facing greater income uncertainty consume less.

Studies of the behaviour of farm families show a mixed reaction to the borrowing constraint. Most studies reject the hypothesis that farmers are constrained in borrowing (Langemeier and Patrick, 1993). This is because farmers with a solid equity position can borrow against their assets at times whe their income is low and the debt can then be paid off in high-income years. It may also be possible to maintain consumption by postponing investments or principal payments (Langemeier and Patrick, 1993). Phimister (1995) argued, based on a small number of observations of Dutch dairy farmers, that the borrowing position of farmers played an important role. The results, however, were inconclusive. On the one hand, he concluded by implicit reasoning and testing that households are constrained currently in their borrowing. On the other hand, he did not find that lagged income affected the growth rate of consumption: the basic signal of a possible liquidity constraint in the model of Zeldes (1989, p. 323), which he applied.[1] Besides, his data did not allow him to distinguish between household expenditure and other expenditure (including durables). Using the same data but for a larger number of households and a longer period, Oskam and Woldehanna (2001) found a result consistent with excess sensitivity of consumption that is due to habit formation, but not due to income uncertainty and a borrowing constraint. However, their approach is different from the Euler approach of Phimister (1995) and Zeldes (1989). Hence it seems interesting to investigate the consumption behaviour of Dutch farm households using an Euler equation approach - similar to Phimister (1995) - but then with a large data set. Moreover a distinction will be made between two categories of consumption expenditure.

The objectives of this paper are, therefore:

1. To test if Dutch farm households' behaviour is consistent with the basic life cycle utility maximisation model. This is done by means of Euler equations;
2. To develop this test for total consumption expenditure and two categories of consumption expenditure, namely, household expenditure and other expenditure;
3. To test whether households' consumption behaviour reflect borrowing constraints;

The rest of the paper is organised as follows. In the next section, the theoretical and the empirical models are presented. In section three, the data and the estimation methods are explained. The results are presented in section four. The paper finishes with discussion and conclusions.

[1] The insignificant coefficient had even the wrong sign.

2. The Model

According to the standard neo-classical intertemporal choice, household *i's* problem is to choose its consumption (C_{it}) over a period of time in order to maximise the expected value of its lifetime utility function (Zeldes, 1989, p. 309):

$$\max_{\{C_{it}\}} U_i = E_t \sum_{k=0}^{T-t} \frac{V_{it}(C_{it+k}, Z_{it+k})}{(1+\delta_i)^k} \tag{1}$$

subject to:

$$A_{it+k} = A_{it+k-1}(1+r_{it+k-1}) + Y_{it+k} - C_{it+k}\ , \quad k = 0, \ldots. T-t \tag{2}$$

$$C_{it+k} \geq 0;\ k = 0, \ldots\ldots\ldots\ldots T-t$$

$$A_{iT} \geq 0;$$

where U_i is lifetime utility; subscript i denotes individual households, V_{it} is within-period utility which is increasing and concave; C_{it+k} is real consumption expenditure at time $t+k$; Z_{it+k} is a vector of taste shifters and life cycle elements; E_t is the expectation operator conditional on information available at time t; A_{it+k} is end of period assets; Y_{it+k} is real disposable income; δ_i is the rate of time preference; r_{it+k} is ex post real after-tax asset return; and T is the end of the household's horizon.

Maximisation of utility (1) subject to the lifetime budget constraint (2) gives the following first order condition and Euler equation, respectively:

$$V_t^{/}(C_{it}, Z_{it}) = \lambda_{it}\left(\frac{(1+\delta_i)}{(1+r_{it})}\right)^t \tag{3}$$

$$V_t^{/}(C_{it}, Z_{it}) = \tfrac{1}{1+\delta_i} E_t[1+r_{it}]\, E_t[V^{/}{}_{it+1}(C_{it+1}, Z_{it+1})] \tag{4}$$

where λ_{it} is the Lagrange multiplier which belongs to the lifetime budget constraint and reflects the marginal utility of income at period t for household i; δ_i is rate of time preference; and $V'_t(.) = \partial V_t(.)/\partial C_{it}$. Equation (3) characterises the evolution of consumption over time during the life cycle, in terms of real interest rate, a discount factor and marginal utility.

Equation (4) is an Euler equation which links consumption between period *t* and *t+1*, defining a stochastic difference equation that governs the behaviour of consumption over time. According to the rational expectation life cycle permanent income hypothesis (RLPH), the realisation equals expectation, and only asset return and preferences determine the evolution of consumption (Hall, 1978; Flavin, 1981). Under rational expectations, therefore, the Euler equation can be written as:

$$\frac{V'_{it+1}(C_{it+1}, Z_{it+1})(1+r_{it})}{V'_{it}(C_{it}, Z_{it})(1+\delta_i)} = 1 + \varepsilon_{t+1} \qquad (5a)$$

where ε_{t+1} is an expectation error uncorrelated with information known at time t.

In the absence of uncertainty, consumption levels are shaped by tastes and by life cycle needs, and not by a temporal pattern of income. A liquidity constraint can cause an excess sensitivity of consumption to predictable changes in income (Hall, 1978; Flavin, 1981; Deaton, 1992; Zeldes, 1989). If individuals face higher interest rates for borrowing, they might choose not to borrow at all. If they cannot borrow at all, they have no choice but to lower consumption when their current income is low.

When there is a borrowing constraint, the Euler equation (5a) is specified as (Zeldes, 1989, p. 312-313)

$$\frac{V'_{it+1}(C_{it+1}, Z_{it+1})(1+r_{it})}{V'_{it}(C_{it}, Z_{it})(1+\delta_i)}(1+\lambda'_{it}) = 1 + \varepsilon_{it+1} \qquad (5b)$$

where $\lambda^{/}_{it}$ is the Lagrange multiplier associated with a borrowing constraint[2] normalised by the marginal utility.

The instantaneous utility function is assumed to take a constant relative risk-aversion form of

$$U_i = \sum_{t=1}^{T} \frac{1}{(1+\delta_i)^t} \frac{C_{it}^{1-\theta}}{1-\theta} \exp(Z_{it}), \tag{6}$$

where θ is the relative risk-aversion parameter. Equation (6) is an isoelastic utility function that handles precautionary saving motives (Kimball, 1990; Deaton, 1997). The Euler equation related to consecutive periods is given by:

$$\frac{C^{-\theta}{}_{it+1} \times \exp(Z_{it+1} - Z_{it})(1+r_{it})(1+\lambda^{/}_{it})}{C_t^{-\theta}(1+\delta_i)} = 1+\varepsilon_{it+1} \tag{7}$$

$$\Rightarrow \frac{C_{it+1}}{C_{it}} = \left(\frac{1+r_{it}}{1+\delta_i} \exp(Z_{it+1} - Z_{it})(1+\lambda^{/}_{it})(1+\varepsilon_{it+1}) \right)^{\frac{1}{\theta}}. \tag{8}$$

The innovation ε_{t+1} reflects unanticipated changes in income. If income is changed in a way that was not previously anticipated, a new lifetime level of consumption is warranted so that current and expected future level of consumption will be changed. Hence the model requires consumption to be orthogonal to lagged income at least if the consumer prior to the current period knows his lagged income. Taste shifts for household *i* are included in Z_{it}. Any individual effect that is constant between two periods will not affect the relationship.

[2] See Zeldes (1989, p. 310-313) for the derivation of the Euler equation consistent with constrained borrowing.

Assuming the family's taste shifter in time t is a linear function of time invariant individual household component (w_i), age of the household head (AG_{it}) and total family size (FS_{it}), we specify (Zeldes, 1989, p.316)

$$Z_{it} = w_i + \beta_1 AG_{it} + \beta_2 AG_{it}^2 + \beta_3 \ln FS_{it} \qquad (9)$$

substituting Z_{it} and Z_{it+1} in (8), taking logs and rearranging, gives

$$\ln\left(\frac{C_{t+1}}{C_t}\right) = \frac{1}{\theta}[\beta_1 + \beta_2 - \ln(1+\delta_i)] + \frac{1}{\theta}\ln(1+r_{it}) + 2\frac{1}{\theta}\beta_2 AG_{it} + \frac{1}{\theta}\beta_3 \ln\left(\frac{FS_{it+1}}{FS_{it}}\right) + \frac{1}{\theta}\ln(1+\varepsilon_{t+1}) + \frac{1}{\theta}\ln(1+\lambda_{it}^{/}) \qquad (10)$$

To make these equations estimatable the following supplementary assumptions are in order (Zeldes, 1989, pp. 317-318). First, the error term is decomposed into an aggregate shock ($1 + e^{*}_{t+1}$) and an individual specific element u_{it+1}:

$$1 + \varepsilon_{it+1} = (1 + e^{*}_{t+1})(1 + u_{it+1}) .$$

Each of these shocks is independently distributed with mean zero and with a forecast error variance σ_u^2. Second, the interest rate is decomposed into a common and an individual component (μ_i) as $1 + r_{it} = (1 + r_t)\mu_i$ with $E(\mu_i) = 1$ and $var(\mu_i) = \sigma^2_{\mu}$. The common portion of the interest rate is independent of u_{it+1} and μ_i.

Given these supplementary assumptions, equation (10) is rearranged as

$$\ln\left(\frac{C_{t+1}}{C_t}\right) = \alpha_1 + \alpha_2 AG_{it} + \alpha_3 \ln\left(\frac{FS_{it+1}}{FS_{it}}\right) + \frac{1}{\theta}\ln(1+r_t) + \frac{1}{\theta}\ln(1+\lambda^{/}_{it}) + v_{Cit+1} \qquad (11)$$

where $\theta^{-1} \ln(1+\lambda^{/}_{it})$ is the growth in consumption over and above the amount that would be predicted at time t without a borrowing constraint;

$$\alpha_1 = \frac{1}{\theta}[\beta_1 + \beta_2 - \ln(1+\delta_i) + \frac{1}{2}(\sigma_u^2 + \sigma_\mu^2) + \ln(1+\varepsilon^{*}_{t+1})]$$

$$\alpha_2 = 2\beta_2\frac{1}{\theta}; \quad \alpha_3 = \beta_3\frac{1}{\theta}$$

$v_{Cit+1} = \frac{1}{\theta}[\ln(1+u_{it+1}) + \ln \mu_i + \frac{1}{2}(\sigma_u^2 + \sigma_\mu^2)]$ with a mean zero.

Equation (11) is an Euler equation consistent with the basic life cycle model. According to rational expectations, if equation (11) is true, any information available at time *t* should not have any significant effect on the growth of consumption. If it has an effect on the growth of consumption at time *t+1,* it may be because households have a borrowing constraint[3]. If they are not constrained in borrowing or liquidity, they are not optimal in their consumption behaviour according to the life cycle model.

When consumption expenditure is divided into household expenditure (CF_{it}) and other expenditure (D_{it}) such as durable goods expenditure and insurance, the utility function can be specified as (Zeldes, 1989, p. 319):

$$U = \sum_{t=1}^{T} \frac{1}{(1+\delta_i)^t} \frac{CF_{it}^{1-\eta}}{1-\eta} \frac{D_{it}^{1-\kappa}}{1-\kappa} \exp(Z_{it}). \tag{12}$$

The corresponding Euler equations for household expenditure and other expenditure are given, respectively, as:

$$\begin{aligned} \ln\left(\frac{CF_{it+1}}{CF_{it}}\right) = {} & \alpha_{1F} + \alpha_{2F} AG_{it} + \alpha_{3F} \ln\left(\frac{FS_{it+1}}{FS_{it}}\right) + \alpha_{4F} \ln\left(\frac{D_{it+1}}{D_{it}}\right) \\ & \frac{1}{\eta}\ln(1+r_t) + \frac{1}{\eta}\ln(1+\lambda'_{it}) + v_{Fit+1} \end{aligned} \tag{13}$$

$$\begin{aligned} \ln\left(\frac{D_{it+1}}{D_{it}}\right) = {} & \alpha_{1D} + \alpha_{2D} AG_{it} + \alpha_{3D} \ln\left(\frac{FS_{it+1}}{FS_{it}}\right) + \alpha_{4D} \ln\left(\frac{CF_{it+1}}{CF_{it}}\right) \\ & \frac{1}{\kappa}\ln(1+r_t) + \frac{1}{\kappa}\ln(1+\lambda'_{it}) + v_{Dit+1} \end{aligned} \tag{14}$$

where

[3] It could also be due to the fact that households have uncertainty about their future income, but the model used includes precautionary saving motives.

$$\alpha_{1F}=\frac{1}{\eta}[\beta_1+\beta_2-\ln(1+\delta_i)+\frac{1}{2}(\sigma_u^2+\sigma_\mu^2)+\ln(1+\varepsilon^*{}_{t+1})];$$

$$\alpha_{2F}=2\beta_2\frac{1}{\eta};\quad \alpha_{3F}=\beta_3\frac{1}{\eta};\quad \alpha_{4F}=\frac{1}{\eta}(1-\kappa);$$

$$\nu_{Fit+1}=\frac{1}{\eta}[\ln(1+u_{it+1})+\ln\mu_i+\frac{1}{2}(\sigma_u^2+\sigma_\mu^2)]$$

$$\alpha_{1D}=\frac{1}{\kappa}[\beta_1+\beta_2-\ln(1+\delta_i)+\frac{1}{2}(\sigma_u^2+\sigma_\mu^2)+\ln(1+\varepsilon^*{}_{t+1})];$$

$$\alpha_{2D}=2\beta_2\frac{1}{\kappa};\quad \alpha_{3D}=\beta_3\frac{1}{\kappa};\quad \alpha_{4D}=\frac{1}{\kappa}(1-\eta);$$

$$\nu_{Dit+1}=\frac{1}{\kappa}[\ln(1+u_{it+1})+\ln\mu_i+\frac{1}{2}(\sigma_u^2+\sigma_\mu^2)].$$

These additional two equations show that the growth of household expenditure is influenced by the growth of other expenditure and vice versa (Zeldes, 1989, p. 319). While parameters θ, η, κ, β_2, β_3 can be identified, β_1, and δ can not be identified. However, the model is able to test our hypothesis.

3. Data and Estimation

The data used cover the period 1971 to 1992 and consist of 7629 observations gathered by the Agricultural Economic Institute (LEI-DLO)[4]. It is an incomplete panel where each farmer is included for normally 5 to 7 years in the sample, creating a pooled time-series cross-section data set. A total of 19 observations were dropped because of negative consumption or wealth, which made it impossible to take logarithms. Some characteristics of the data set used in this paper are presented in Table 1. All monetary data have been converted to the 1980/81 price level by using the general price index of consumption

[4] The willingness of the Agricultural Economic Research Institute to provide the data is gratefully acknowledged.

expenditure in the Netherlands. Income is defined as the income available after depreciation of capital goods and after taxes. The total real consumption (C) is composed of household expenditure (CF) and other costs-of-living expenditure (D), which includes, for example, consumption expenditure on durables (cars, housing) and expenditure on insurance, etc. There is a small difference between total consumption expenditure and the sum of household expenditure and other expenditure, mainly because of some direct consumption at the farm.

Wealth (A) is defined as the on and off farm assets minus debt. It is computed from the data as the beginning value of fixed assets plus capital assets outside the farm minus long-term loans minus beginning short term debts and beginning debts outside farming. The liquidity constraint (LQC) is equal to zero if short and long term debts are lower than the borrowing capacity[5]. Above this threshold, the liquidity constraint equals the debts divided by the borrowing capacity minus 1. Here, no zero-one situation is defined, but farm families, which are assumed to be constrained in borrowing capacity, operate on a continuous scale. The family size (FS) is the number of household members. The age of the farm head (AG) is assumed to be a life cycle characteristic.

To test whether there is violation of the basic life cycle Euler equations, additional variables with past information, e.g. income at time t and $t-1$ and wealth at time t, are added to the Euler equations. The expectation is that variables with only past information do not significantly influence the growth rate of consumption between t and $t+1$. We use two methods to see if the violation of Euler equation is due to the borrowing constraint.

[5] The borrowing capacity is equal to the sum of 0.7 times the asset value of land and stocks of variable inputs and outputs; 0.5 times the asset value of livestock capital and machinery and 0.3 times the asset value of buildings, drainage and orchards.

The first method is to include a measure of the borrowing constraint (LQC) in equations (11), (13) and (14), and test for significant effects on the Euler equations between period *t* and *t+1*. The second one is to split the sample households into two groups: the borrowing constrained group and the borrowing unconstrained group. If the short and long-term debts of a household are less than its borrowing capacity, the household is categorised into the unconstrained group, where-as if the sum of the short and long-term debts of the household is greater than or equal to its borrowing capacity, it is categorised in the constrained group. Then the Euler equations are estimated separately for each group. Our expectation is that lagged income and wealth will show both a significant and negative effect on the growth rate of consumption (Euler equation) for the borrowing constrained group, but not for the unconstrained group. If households are borrowing constrained, a higher past income and wealth reduces that. As a result, the left-hand side of equations (11) (13) and (14) will be affected negatively by higher income and wealth, and positively by variables that are positively associated with borrowing constraints if farm households are constrained in their consumption expenditure (Zeldes, 1989).

Equations (11), (13) and (14) together with lagged income and wealth are estimated using a fixed-effect estimator with an instrumental variable estimation method. The generalised method of moments is used in order to obtain an optimal weight for the instruments (Hansen, 1982; Hansen and Singleton, 1982). Growth of total consumption, household expenditure, other expenditure, lagged income and wealth are treated as endogenous variables, while the rest are assumed to be exogenous. The instruments used are lagged income, wealth and interest rate, as well as education dummies.

4. Results

The results are presented in the form of the Euler equation for the total expenditure (*C*) and the two categories of expenditure, namely, household expenditure (*CF*) and other expenditure (*D*). The dependent variables are in log first-difference. The two categories of consumption expenditure equations have slightly different explanatory variables. Moreover, the sum of 'household expenditure' and 'other expenditure' does not equal (as the name might suggest) total expenditure (Table 1). Here the growth of total consumption expenditure, household expenditure and other expenditure have been estimated using an instrumental variable estimation method employing a Generalised Method of Moments (GMM). Hansen's J-test is used to test for the over-identifying restrictions (Hansen, 1982, pp. 1049). In all of the estimated equations (except for those presented in Table 6), the null hypothesis is that the over-identifying restrictions of the model are not rejected at a 10% significance level, indicating that the restrictions imposed by GMM estimations are valid. P-values for the Hansen's J-test are given in Tables 2 to 5. Table 2 shows the results of the parameter estimates of the basic Euler equations (11), (13) and (14) for total consumption expenditure (*C*), household expenditure (*CF*) and other expenditure (*D*), respectively.

The model gives levels of explanation which are rather low compared to other studies (see Browning and Lusardi, 1996, p. 1831 for a large number of references). The signs of most coefficients are consistent with our expectations, but statistically not different from zero. Age seems to affect the growth of consumption, but insignificantly. The growth of household expenditure decreases when family size increases, while the growth of other expenditure increases with the growth in family size, although it is not statistically significant. The coefficient on interest rate is positive for the growth of total consumption and household expenditure, but negative for that of other expenditure.

Here it seems that household expenditure is a better indicator for other expenditure than the family size, which simply consists of the number of household members. The results also indicate that the change of household and other expenditure are complementary: they influence each other significantly. Hence, the separability assumption between food consumption and durable goods consumption might be misleading.

Various versions of equations (11), (13) and (14) were estimated to test the sensitivity of consumption to past information. The first variant is an Euler equation with lagged income and wealth. The second variant includes a measure of liquidity constraint (LQC). The third variant is an Euler equation for the borrowing constrained group. The fourth variant is an Euler equation for the borrowing unconstrained group. The results are presented in Tables 3, 4, and 5.

Clearly, the basic Euler equation for total consumption is violated (version one, Table 3). The effects of two period lagged income and one period lagged wealth on the growth rate of consumption are negative. This is consistent with a borrowing constraint, but the influence of one period lagged income is positive which is not consistent with the borrowing constraint. An F test was made to discriminate between the basic Euler equation and the Euler equation with past income and wealth level included. The result rejects the basic unconstrained Euler equation at the 1% significance level. This means that farm households are not optimising according to the rational expectations life cycle permanent income hypothesis.

The influence of lagged income and wealth shows a different pattern when total consumption is divided into household keeping expenditure and other expenditure (version one in Table 4 and 5). Here only one-period lagged wealth shows a negative and significant effect on the Euler equation for household expenditure only. The influence of one period and two period lagged incomes are not statistically different from zero for both household expenditure and other expenditure. The parameter estimates of intertemporal elasticity of substitution (the inverse of the constant relative risk aversion) are also plausible when lagged income is added to the model. In this case the intertemporal elasticity of substitution for total consumption is estimated to be 0.53. The response of total consumption to family size is statistically significant when total consumption is decomposed into household expenditure and other expenditure, particularly other expenditure which includes expenditure on durables and insurance. However, the results of the Euler equation estimation for different categories of consumption are not consistent or conclusive. The results show that households are constrained for household expenditure, but not for other expenditure such as durables and insurance. If a borrowing constraint matters, it should influence consumption of durables rather than household expenditure. Hence it is difficult to conclude that households are borrowing constrained in their consumption expenditure.

One could question why past information has a significant effect on consumption growth rate, which is contrary to rational expectations life-cycle model. There are two possible explanations. The first reason is that households are borrowing constrained in their consumption (Phimister, 1995). When household income is very low, they have no choice but to lower consumption and to follow their current income. The second reason may be that households do not behave according to the lifecycle model. They are basically myopic and follow simple consumption rules of habit formation.

To distinguish between these two possible explanations, measures of borrowing constraint are included as an explanatory variable in the basic life cycle Euler equation.

The results are given in version two of Table 3, 4 and 5. The measure of borrowing constraint (LQC) does not have any significant influence on the Euler equation for all categories of consumption.

Euler equations are also estimated for both the constrained group (version 3 of Table 3, 4 and 5) and the unconstrained group (version 4 of Table 3, 4 and 5). The Euler equation is violated for the unconstrained group, but not for the constrained groups, which is quite contrary to our expectation. The growth rate of consumption is more sensitive to lagged income and wealth for the unconstrained group than for the constrained group for all categories of consumption. Hence the sensitivity of Euler equation for past information such as lagged income and lagged wealth is not due to the borrowing constraint, but due to habit formation and perhaps due to model mis-specification. This result is similar to Phimister's (1993, 1995) results, but differs in its conclusions. Using 285 observations, he found that past income had no clear influence on the growth of consumption, but using a joint test for all types of financial variables included in the Euler equations, he concluded that households are borrowing constrained.

In conditions where the Euler equations do not hold, one would predict that the growth of consumption should be influenced by current changes in income and wealth (Phimister, 1993). Furthermore, if households react ad hoc and use non-optimal distributed lags, not only changes in current income and wealth, but also lagged changes in income must have a significant effect on the growth of consumption indicating habit formation. To see if the argument works (hereafter we call this the second model), the rate of growth of consumption is regressed on the current changes in family size, interest rate, income and wealth as well as lagged changes and the age of the household head. The changes in income and wealth are specified in logarithms. Here we use a fixed effect estimator, but not GMM, because Hansen's J-test indicates that the moments restriction imposed by GMM estimators are not valid. We find that this second model has a better fit to the data than the Euler equations (Table 6). On top of the current changes in income and wealth, lagged changes in income significantly explain the change in total expenditure as well as the change in household and other expenditure, which signifies that habit formation is an important factor for household consumption expenditure. The effect of a change in wealth is quite important in magnitude, which is consistent with the results of Oskam and Woldehanna (2001). Furthermore, a change in family size shows a significance effect on the other expenditure category of consumption, but the effect of a change in family size on the household expenditure is not statistically significant.

To distinguish between the second model and the model of the rational expectations life cycle permanent income hypothesis (Euler equation), a J-test (non-nested hypothesis) is conducted (Greene, 1993, pp. 222-225). The test suggests that the second model outperforms the Euler equations for total consumption expenditure and household expenditure. For the other expenditure category, the Euler equation is rejected at 1% significant level, while the second model is rejected at a 10% significant level. Hence, we conclude that households are not borrowing constrained, but that they follow a simple consumption rule in which habit formation dominates the consumption expenditure of farm households.

5. Discussion and conclusions

In a country like the Netherlands, the average wealth level of farmers (even if they perform in the lower wealth range), the large cash flow and the fact that they are often not well-informed about their present income suggests that farmers form a special category of consumers, which cannot be compared easily with ‘average consumers’. One of the very characteristic elements is that they even save substantial amounts when they have a very high wealth level and are old. It is, therefore, not very surprising that they do not operate according to the rational expectations life cycle permanent income hypothesis (RLPH), but that habit formation plays a much more important role. The same holds for ‘specialities of the RLPH’ as borrowing constraint. These results have been indicated earlier (Langemeier & Patrick, 1993), but Phimister (1993, 1995) came up with different results for a group of Dutch dairy farmers.

The Euler equations were derived from a constant relative risk aversion utility function for total consumption expenditure and for two categories of consumption expenditure, namely household expenditure and other expenditure. The assumption of separability between food and durable goods consumption is relaxed. The Euler equations were estimated using a generalised method of moments estimator. The main conclusion is that farm households are not optimising according to the Euler equations of a RLPH-model. Households are not borrowing constrained in their consumption expenditure. Rather, farm households follow simple consumption rules in which habit formation dominates. The growth of family size has a significant influence on other expenditure but not on household expenditure. Influences of a larger household run via other expenditure, which influences household expenditure significantly. This indicates that there are economies of scale in household expenditure.

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Table 1. Characteristics of the total data set (7629)

Variable	Unit	n=Mean	Std. Dev.	Min	Max
Total consumption (C)	Dfl	43788	19175	3562	269988
Household expenditure (CF)	Dfl	26421	12785	48	153192
Other expenditure (D)	Dfl	13818	7536	119	88551
Available income (Y)	Dfl	67057	51519	99	744560
Wealth (A)	Dfl	690997	492132	2679	4700283
Family size (FS)	Number	4.67	1.85	1	20
Age of the farm head (AG)	Years	47.16	9.86	22	83
Liquidity constraint	No	0.02	0.065	0	0.63

The share of observations under liquidity constraint is 0.127.

Table 2. Estimates of the basic Euler equations

	Dependent Variable					
	Δ lnC_{it+1}		Δ lnCF_{it+1}		Δ lnD_{it+1}	
	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio
Constant	-0.053	-0.48	-0.169	-0.76	0.182	0.79
$\Delta\, ln\, FS_{it+1}$	0.016	1.24	-0.012	-0.44	0.027	1.05
Age at time *t*	0.001	0.66	-0.001	-0.31	0.002	0.42
Ln (1 + r_t)	0.022	0.17	0.366	1.69	-0.412	-1.79
Δ lnD_{it+1} or Δ lnCF_{it+1}			0.728	4.18	0.918	4.28
Adjusted R^2	0.0004		0.001		0.003	
Hansen J-test $\chi^2(2)$ P-value			8.07 0.090		8.01 0.09	

Δ before variable stands for a change in relative first difference; ln is natural logarithm; C_{it} is total consumption expenditure; CF_{it} is household expenditure; D_{it} is other expenditure.

Table 3. Parameter estimates of life cycle Euler equation (dependent variable Δ lnC_{it+1})

	Version 1		Version 2		Version 3 (n=721)		Version 4 (n=5677)	
	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio
Ln of income at *t*	0.502	1.71	0.365	2.44	0.062	0.09	0.274	2.69
Ln of income at *t-1*	-0.509	-1.78	-0.343	-2.71	0.052	0.12	-0.276	-3.22
Ln of wealth at *t*	-0.311	-2.50	-0.030	-0.17	-0.115	-0.85	-0.249	-2.79
$\Delta\, ln\, FS_{it+1}$	0.031	1.45	0.039	1.58	0.026	0.31	0.018	1.11
Age at time *t*	0.006	1.36	0.007	1.59	0.014	1.25	0.004	1.32
Ln (1 + r_t)	0.539	1.09	-0.479	-0.98	-0.345	-0.64	0.156	0.79
Liquidity constraint			13.704	1.45				
Constant	3.615	1.91	-0.077	-0.03	-0.158	-0.04	3.054	2.06
Adjusted R^2	0.01		0.01		0.014		0.01	
Hansen J-test $\chi^2(2)$ P-value	0.719 0.698		0.527 0.768		0.000 1.000		2.624 0.453	

see table 2 for further explanation

Table 4. Parameter estimates of life cycle Euler equation (dependent variable Δ lnCF_{it+1})

	Version 1		Version 2		Version 3 (n=721)		Version 4 (n=5677)	
	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio
Ln of income at time *t*	0.823	1.39	0.666	1.54	0.403	0.37	0.479	1.66
Ln of income at *t-1*	-0.897	-1.53	-0.698	-1.77	-0.108	-0.18	-0.552	-2.06
Ln of wealth at time *t*	-0.791	-1.93	-0.427	-0.82	-0.328	-0.48	-0.686	-2.06
Δ lnD_{it+1}	-1.666	-0.84	-2.065	-1.04	-0.815	-0.27	-1.658	-1.12
$\Delta\ ln\ FS_{it+1}$	0.150	1.18	0.189	1.37	0.118	0.29	0.119	1.40
Age at time *t*	0.012	1.28	0.016	1.31	0.028	0.36	0.008	1.22
Ln (1 + r_t)	-0.018	-0.01	-1.847	-1.08	-0.389	-0.09	-0.614	-0.60
Liquidity constraint			21.894	0.93				
Constant	10.719	1.70	6.061	0.76	---	----	9.907	1.85
Adjusted R^2	0.004		0.004		0.004		0.005	
Hansen J-test $\chi^2(2)$	0.351		0.097		0.000		1.141	
P-value	0.554		0.756		1.000		0.565	

see table 2 for further explanation.

Table 5. Parameter estimates of life cycle Euler equation (dependent variable Δ lnD_{it+1})

	Version 1		Version 2		Version 3 (n=721)		Version 4 (n=5677)	
	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio
Ln of income at *t*	0.327	0.75	0.305	1.20	0.495	0.43	0.200	1.29
Ln of income at *(t-1)*	-0.358	-0.79	-0.320	-1.32	-0.132	-0.17	-0.229	-1.49
Ln of wealth at *t*	-0.360	-1.31	-0.203	-1.04	-0.403	-0.58	-0.296	-1.70
Δ lnCF_{it+1}	-0.389	-0.86	-0.443	-1.03	-1.227	-0.27	-0.322	-1.05
$\Delta\ ln\ FS_{it+1}$	0.079	2.49	0.089	2.38	0.145	0.98	0.062	2.70
Age at time *t*	0.005	0.91	0.007	1.08	0.035	1.03	0.003	0.73
Ln (1 + r_t)	-0.262	-0.38	-0.872	-1.47	-0.477	-0.13	-0.491	-1.86
Liquidity constraint			9.782	0.70				
Constant	5.013	1.41	2.898	0.99			4.420	1.75
Adjusted R^2	0.017		0.018		0.032		0.017	
Hansen J-test $\chi^2(2)$	0.389		0.097		0.000		0.838	
P-value	0.533		0.755		1.000		0.658	

see table 2 for further explanation.

Table 6. Parameter estimates of the basic consumption functions in log first difference

	Dependent Variable					
	Δ lnC_{it+1}		Δ lnCF_{it+1}		Δ lnD_{it+1}	
	Coef.	T-ratio	Coef.	T-ratio	Coef.	T-ratio
Constant	0.178	1.12	0.319	1.29	0.160	0.82
$\Delta\ ln\ FS_{it+1}$	0.016	1.08	0.038	1.67	0.059	3.32
Age at time *t*	0.001	0.52	0.000	-0.16	0.000	0.14
Δ Ln (1 + r_{t+1})	-0.193	-1.68	-0.265	-1.49	-0.153	-1.09
Δ Ln of income at time *t+1*	0.031	4.86	0.031	3.14	0.025	3.23
Δ Ln of income at time *t*	0.020	3.06	0.011	1.12	0.018	2.22
Δ Ln of wealth at *t+1*	0.161	6.08	0.145	3.50	0.221	6.78
dlcexo/dlcexh			-0.050	-2.48	-0.031	-2.48
Adjusted R^2	0.016		0.008		0.018	

see table 2 for further explanation