The Propensity to Consume Income from Different Sources and Implications for Saving: an Application to Norwegian Farm Households

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Abstract
Traditionally, farm households have relatively high saving and low marginal propensity to consume (MPC). In the last decades, this seems to have changed. To investigate these matters, a dynamic consumption model is estimated using a GMM-system estimator and a panel of 258 Norwegian farm households followed from 1976-1997. The main findings are that the MPC of farm income is lower than for off-farm income and that average MPC is low but increasing over time in these households. This may imply that some of the observed reduction in farm saving is explained by reduced need for precautionary saving.

Keywords: saving, consumption, dynamic panel model

Introduction

In the last decades, the saving behaviour in farm households seems to have changed. In Norway, see figure A1 in appendix, the saving rate (net savings as share of disposable income) in farm households has fallen from above 30 % in 1976-1984 to 10-12 % in 1995-1997. In the same period, the saving rate in Norwegian households in general has been stable at about 5-6 % (the main exception is the consumption boom in 1985-1987).

Saving is especially important in farm households because of the impact on future production and consumption possibilities. The fall in farm saving does obviously have effects on the survival of farms. Information about saving behaviour in farm households is important for policy makers, who want to know what happens when the farm income policy changes.

Traditionally, farm households have much higher saving than households in general (Mullen et al. 1988). Some explanations of this behaviour is the need for precautionary saving because of a volatile/risky farm income, the need for own saving to self-finance investment because of an imperfect capital market and the need for private retirement saving because farmers (as self-employed) may not have other pension sources. In addition, we have the issue of inheritance farm transfer. For many farms, it is important that the farm stays in the family. Therefore, many farmers save to create a competitive farm, with high future production and income potentials, for the next generation.

The intention with this study is to explain and rationalise the consumption and saving behaviour in farm households with use of traditional economic theory and estimation of a dynamic consumption model. In the study, the focus is on the need for own saving and precautionary saving. These two saving motives are incorporated in the life cycle and permanent income model (the LCP model) that seems to describe the saving and consumption behaviour in farm households well (Carriker et al. 1993, Chen et al. 1999). In empirical works, it is common to study consumption rather than saving, because households preferences for a steady path of consumption growth causes saving to vary with income. In LCP models, the (short run) marginal propensity to consume income (MPC) is an important measure. MPC has a direct impact on saving for a given income. Therefore, we see that farm households have high saving rates and a very low MPC compared to other households (Mullen et al. 1988). Carriker et al. (1993), Oskam and Woldehanna (1999) find that the MPC for US and Dutch farmers seem to be below 0.06. To compare, the MPC in Norwegian households in general is estimated to be in the range 0.40-0.65 (Brodin and Nymoen 1992, Magnussen 1994).

According to Friedman (1957), MPC decreases with the volatility of income because of increased uncertainty of permanent income. Income uncertainty increases the need for precautionary saving, since it is optimal to build reserves to offset future income risks and assure the expected standard of living in later years. Therefore, one reason for the relatively high saving and low MPC in farm households is that farm income is more volatile/risky than ordinary wage income.

In the last decades, Norwegian farm households have increased their off-farm income as share of disposable income and the farm income system has changed from a price support system in the 1970s to a system with more weight on direct (decoupled) payments from the government. Production dependent income is likely to be more volatile and to have lower MPC than direct payments and off-farm income (Carriker et al. 1993). The change in the income system, the increase in off-farm income but also the effect from having income from different sources (risk sharing) may all contribute to reduced need for precautionary saving in farm households.

In addition to precautionary saving, the fall in saving might be related to reduced need for own saving to self-finance investments. Theoretically, it can be shown that a better functioning credit market can cause a reduction in own saving. After the World War 2 the Norwegian credit market policy was to set the interest rate at a low level and restrict the available quantities of credit. This regulation policy was deregulated in the beginning of the 1980s.

To explain the observed behaviour and to show how MPC varies with the volatility of income, a dynamic consumption model is estimated with use of a balanced panel data set of 258 Norwegian farm households, followed from 1976-1997. The model is formulated in levels as in e.g. Carriker et al. (1993), Chen et al. (1999) and Oskam and Woldehanna (1999). The difference between this study and the earlier comparable studies of farm households is the use of Norwegian panel data with very long time series dimension, more sources of income specified and large changes in both saving and composition of disposable income. In addition, it is used a relatively new GMM (Generalised Method of Moments) system estimator to get consistent estimates of parameters and variances in the dynamic model. Since there are few published (consumption) studies that use this estimator, the study presents results from common estimators as OLS and within groups.

The plan for the rest of the paper is as follows. In the next section, the theoretical and statistical model, the data and the main empirical method are presented. Section 3 presents the results. Section 4 discusses the main results, while section 5 concludes the paper.

Methods

Theoretical and statistical model:

The LCP model (the life cycle and permanent income model) developed mainly by Ando, Brumberg and Modigliani (life cycle) and Friedman (permanent income) is used as the theoretical background in most empirical studies of saving and consumption behaviour. One problem with the LCP model is that it is difficult to develop a theoretically consistent empirical equation. After Hall (1978), many studies have used the Euler equation approach and specific utility functions to get such consistent equations (Browning and Lusardi 1996). For the farm sector, Langemeier and Patrick (1993) and Phimister (1995) estimate Euler equations for farm households. The main problem of the Euler approach, where the focus is on consumption growth, is that one loses the ability to analyse the levels of consumption and saving. At the cost of not being consistent with formal theory, the focus is on levels in this study.

A modern LCP model tell us that the MPC out of total expected lifetime resources for a household is a highly non-linear function of earnings risks, interest rate risks, the covariance of this risks, the current and future relative sizes of income and non-human-wealth, the discount rate, interest rate and the time horizon (Miles 1997). In addition, household characteristics may have a strong impact on consumption due to life cycle theory (Keynes 1936, Ando and Modigliani 1963). It is common to model consumption for household i in year t (C_{it}) as linearly dependent of disposable income (I_{it}), net wealth (NW_{it}) in the beginning of the period and some characteristics of the household (Z_{it}).

(1) $$C_{it}^* = \alpha_0 + \alpha_1 I_{it} + \alpha_2 NW_{it} + \alpha_3 Z_{it}$$

This linear model may be a good approximation when the different risks, discount rates, interest rates and time horizons are constant over time in each household (Miles 1997). C_{it}^* may be interpreted as the household's consumption in long run equilibrium. The short run adjustment rule is likely to be different from the long run adjustment because of inertia/habit persistence in consumption. This implies that the (short run) MPC will be relatively low while previous consumption would have a significant influence on current consumption. Therefore, consumption lagged one period is often used to model habit persistence. Carriker et al. (1993) shows how an empirical life-cycle consumption system is consistent with the hypotheses of habit persistence and that income is not fungible:

(2) $C_{it} = a_0 + a_{11}I_{1,it} + a_{12}I_{2,it} +..+ a_{1m}I_{m,it} + a_2NW_{it} + a_3Z_{it} + a_4C_{i,t-1} + e_{it}$

C_{it} is consumption and $e_{it} = e_i + e_t + v_{it}$ where v_{it} is the usual error term. Several theories have been postulated to explain habit persistence in consumption. (2) is consistent with both partial adjustment and adaptive expectations hypotheses of consumption behaviour. In (2), the short run MPC of Income I_1 is a_{11}. If $a_{1s}= a_{1n}$ for all s and n, then income is fungible, as assumed in the literature with exception of Carriker et al. (1993). A simple formula for the long run MPC of I_1 is $a_{11}/(1- a_4)$. We do not focus on the long run MPC here.

Data

Data for this study were obtained from the survey of account statistics for Norwegian agriculture, documented in NILF (1998). Since 1950, about 1000 farms have been included annually in this survey. In selecting the farm holdings for the survey, care has been taken to ensure a representative selection of holdings where the farmer is below 67 years of age and a large part of the family's income is derived from the holding. Five to ten percent of the holdings are replaced each year mainly because the holding does not want to participate any longer, the holding is excluded because the age of the farmer is too high and/or the farm activity seems to be a very small part of the total income in the household on permanent basis.

Table 1: Means of consumption, disposable income, depreciation, net value regulation and wealth (standard deviations in parenthesis).[1]

	consumption		disposable income		depreciation		net value regulation		net wealth	
1976	158	(71)	328	(280)	53	(31)	66	(247)	685	(373)
1977	160	(73)	318	(136)	57	(34)	48	(74)	795	(449)
1978	171	(78)	318	(161)	59	(35)	45	(125)	889	(490)
1979	174	(81)	285	(125)	65	(38)	47	(76)	987	(517)
1980	172	(75)	302	(157)	65	(34)	48	(105)	989	(521)
1981	173	(74)	278	(125)	65	(34)	31	(80)	979	(523)
1982	168	(75)	266	(121)	64	(33)	39	(71)	968	(512)
1983	168	(70)	249	(117)	64	(31)	40	(66)	977	(527)
1984	167	(72)	280	(124)	66	(33)	37	(65)	1004	(545)
1985	182	(75)	280	(119)	69	(32)	30	(63)	1066	(571)
1986	185	(74)	258	(124)	70	(31)	33	(62)	1092	(589)
1987	193	(82)	276	(118)	70	(31)	39	(68)	1075	(603)
1988	194	(75)	270	(118)	70	(33)	45	(71)	1081	(623)
1989	202	(81)	285	(159)	71	(33)	40	(122)	1098	(633)
1990	206	(76)	289	(151)	72	(38)	43	(116)	1127	(658)
1991	212	(80)	284	(151)	74	(42)	49	(104)	1189	(713)
1992	226	(88)	289	(144)	75	(43)	45	(83)	1222	(745)
1993	229	(87)	284	(139)	75	(46)	35	(86)	1257	(773)
1994	232	(86)	276	(108)	76	(47)	41	(62)	1296	(805)
1995	236	(88)	274	(125)	76	(47)	44	(89)	1289	(811)
1996	238	(87)	288	(235)	76	(48)	60	(218)	1300	(829)
1997	245	(95)	273	(142)	75	(50)	40	(89)	1334	(913)

1) All values are measured in thousand NOK and they are converted from nominal to real values using the Consumer Price Index (1997=100).

One characteristic of the data is the treatment of real capital and depreciation. Historic cost, and not replacement cost, is used as a basis for calculating depreciation. Depreciation is treated as linear (the same amount each year) and is defined as the planned distribution of the reduction in the value of assets throughout their expected lifetime. In the tax accounts, the principle of reducing balance depreciation is followed for most depreciable assets (a certain percentage of their book value is depreciated each year).

There are 258 holdings in the balanced panel data series for 1976-1997 used in this study.[1] Such panel data may include problems with self-selectivity, non-response and attrition (Hsiao 1986). Although in this study, such errors are not tested, Løyland and Ringstad (1999) test the data from NILF (1998) for self-selectivity and find that the data seem to represent the actual population of farm households.

Table 1 presents information on consumption, disposable income, depreciation, net value regulation (transfers like inheritance, gifts, child benefits) and net wealth (net real capital plus net financial capital). Disposable income is defined as farm subsidies (direct governmental payments) plus other farm income (price- and production dependent income minus depreciation) plus off-farm income (other self-employed activity, pensions and wage labour work) plus net value regulation minus taxes and net interest costs. More details of the development in the different parts of farm household disposable income are presented in table 2.

Table 2: Means of net farm income, farm subsidies, off-farm income, net interest costs and taxes (standard deviations in parenthesis),[1] age of farmers, share of farmers born before 1940 and share of farmers with family.

	net farm income		farm (agricultural) subsidies		off farm income		net interest costs and paid taxes		age of farmer	share borne before 1940	share with family
1976	273	(125)	86	(37)	30	(48)	94	(57)	45.6	0.78	0.86
1977	284	(128)	101	(43)	32	(50)	102	(58)	46.0	0.76	0.86
1978	302	(134)	115	(48)	35	(53)	123	(68)	46.0	0.74	0.88
1979	266	(127)	124	(53)	39	(55)	132	(79)	46.6	0.74	0.87
1980	280	(122)	118	(50)	40	(53)	130	(76)	47.2	0.72	0.89
1981	269	(123)	127	(54)	43	(54)	130	(73)	47.5	0.71	0.88
1982	244	(117)	132	(52)	39	(53)	120	(71)	47.7	0.68	0.88
1983	219	(111)	132	(49)	45	(59)	120	(75)	47.9	0.66	0.90
1984	241	(124)	127	(47)	53	(65)	118	(73)	47.9	0.62	0.91
1985	239	(113)	124	(44)	52	(64)	110	(70)	48.0	0.60	0.90
1986	218	(108)	101	(35)	61	(78)	123	(75)	47.9	0.57	0.88
1987	220	(109)	103	(36)	75	(84)	128	(79)	48.1	0.54	0.88
1988	210	(112)	113	(42)	78	(82)	133	(79)	48.2	0.51	0.87
1989	227	(127)	116	(45)	85	(90)	138	(76)	48.1	0.48	0.85
1990	223	(123)	117	(43)	91	(88)	140	(80)	47.9	0.45	0.85
1991	209	(136)	135	(48)	100	(100)	148	(84)	47.4	0.40	0.83
1992	211	(150)	156	(56)	109	(106)	151	(85)	46.4	0.34	0.83
1993	192	(138)	159	(56)	119	(108)	137	(75)	46.9	0.32	0.84
1994	164	(119)	158	(57)	125	(114)	130	(59)	47.3	0.31	0.85
1995	156	(112)	148	(52)	130	(113)	132	(62)	47.5	0.28	0.84
1996	145	(125)	152	(55)	138	(118)	131	(66)	48.3	0.27	0.84
1997	133	(122)	154	(57)	147	(131)	123	(64)	49.0	0.26	0.83

1) All economic values are measured in thousand NOK and they are converted from nominal to real values using the Consumer Price Index (1997=100).

In table 1, note the large standard deviations of disposable income in especially 1976 and 1996. This is mainly a result of very high values on net value regulation for some of the households in these years. Net value regulation seems to be rather unstable at the farm level because of positive and negative transfers in connection with inheritance and farm transfer.

[1] 1976 is used as the first year because there is a lack of information about taxes in the years before that year.

Another finding in table 1 that disposable income has fallen while consumption has been growing steadily. After Norway's refusal to join the European Community and the international oil and food supply crisis in the early 1970s, the Norwegian government decided to raise the level of farm income (Hegrenes et al. 1991). Farm and disposable income increased sharply from 1975 to 1978 but, since then, there has been a decline in these measures. In table 2, we see that farm subsidies almost doubled while there has been a decrease in total farm income in the period 1976-1997. The decline in farm income reflects declining profitability in farming. Off-farm income has more than doubled on average. Not surprisingly, farm households compensate with more work outside the farm in times with declining profitability in the farm activity.

The data contains information about paid, not real, taxes during the account year. In table 2, we see that (paid) taxes and net interest costs has increased as share of disposable income. Some of this increase may be explained by reduced investments and basis for depreciation in the tax accounts.

In table 2, also age of farmer, share of farmers born before 1940 and share of farmers with family is presented.[2] Other socio-economic characteristics are not directly available in the survey. As an indicator of that consumption may increases with the size of the household (Browning and Lusardi 1996), the study uses information about positive or zero hours of work registered on the farmers' family. In addition, a cohort variable: the share of households where the farmer is born before 1940 is included. This is due to the established relationship that generations born before 1940 save more than younger generations because of different attitudes to risk, thrift and borrowing (Magnussen 1994, Browning and Lusardi 1996).

In table 2, we also see that there is a small increase in age and a large decrease in the number of household where the farmer is born before 1940. It is important to remark this fact, because 135 out of 258 farms in the data are experiencing an intergenerational farm asset transfer during the period 1976-1997 while the other 123 farms do not have these changes. The effect of these changes within many of the households will be investigated.

Panel data

Panel data contains observations over time and over cross-sections. A number of different econometric methods can be used with panel data models (see Hsiao 1986 or Baltagi 1995). The most common methods differ in handling of the individual/household specific term that captures the effects of omitted variables that vary across households but not over time. The most restrictive estimation method, ordinary least squares (OLS), assumes no omitted cross-section variation. However, the advantage of panel data is to control for unobserved household specific effects, which can be handled by the fixed or the random effects model.

The consumption model (2) is dynamic in the sense that it contains a lagged dependent variable on the right hand side. In such models, the OLS, random effects and within group estimators are not valid because the lagged dependent variable, and variables correlated with lagged dependent variable, is correlated with the error term due to the existence of individual specific effects (Nickell 1981, Baltagi 1995). Usually, panel data models are estimated with the within group estimator. In dynamic models, Nickell 1981) shows that for small *T* and positive effect from lagged dependent variable, the bias in the within estimator is always negative and the smaller *T,* the larger is the bias.

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[2] Standard deviations are not presented for these variables since these measures do not vary much over time. It can be shown that the standard deviation is about 10.5 for age, 0.47 for CH and about 0.35 for F.

A normal technique for dealing with variables that are correlated with the error term is to instrument them. Taking first differences eliminates the individual specific effects that were the source of the bias in the OLS estimator. In the first differenced equation the error term and the lagged dependent variable are clearly correlated. Arellano and Bond (1991) argue that this first differenced model should be estimated by GMM using appropriately lagged level variables as instruments. Later, it is shown that lagged levels provide weak instruments for first differences in some situations. Blundell and Bond (1998) shows that a GMM-system estimator, that uses lagged differences of the dependent variable as instruments for equations in levels in addition to lagged levels as instruments for equations in first differences, is superior to the standard GMM estimator.

In this study, the DPD software developed by Arrelano and Bond (1998) is used where both these GMM estimators, as well as more common estimators, are implemented. DPD produces one-step and two-step estimators with robust covariance matrixes. In this study, the focus is on the one step estimator because the two-step estimator may give seriously misleading standard errors (Arellano and Bond 1991, 1998, Blundell and Bond 1998).

Results

Table 4 presents results from estimation of a model where disposable income is separated in farm subsidies (FS_{it}), production dependent farm income (PF_{it}), off-farm income (OF_{it}), taxes plus net rental costs (TR_{it}) and net value regulation (NVR_{it}). Taxes and net interest costs is specified as a separate variable and not subtracted from the different income sources because of problems with negative and positive values of all income variables. NW_{it} is net wealth, AGE_{it} is the age of the farmer and $AGE2_{it}$ is AGE_{it} squared. CH_{it} is equal to one if the farmer in the household is born before 1940, zero otherwise. F_{it} is equal to one if there are hours of work registered on the farmers family, zero otherwise.

The estimated models allow for time-invariant effects for each household (except the OLS model) and household-invariant effects for each time period. The latter accounts for time specific effects (e.g. macroeconomic and political shocks) that affect all households in the same manner but are not included in the regression. These effects are significant but not reported here. In the models, depreciation is not a part of either consumption or farm income. This is mainly because the explanatory power in such models was lower than in the models which results are reported here. It can be shown that including depreciation caused the MPC to be the same or higher than in the reported results.

Column (a) reports OLS estimates and column (b) reports within group estimates. This estimates may give us important information about bounds for the effect of the lagged dependent variable since the OLS estimate is biased upwards while the within estimate is biased downwards (Blundell and Bond 1998). In the consumption model it seems like the true value of this parameter is between 0.4 and 0.2. It can be shown that the standard GMM-estimates of the lagged dependent variable, overall, was below the within estimate.[3] An invalid instrument matrix is one probable cause of this. Here, the second lag was accepted as instrument for the first lag of the dependent variable when the standard GMM was used. In addition, an unreported test revealed that instrumenting potential endogenous explanatory variables (as in Arrelano and Bond 1991) in the model did not improve the results.

[3] This is the same as Arrelano and Bond (1991) found in their tables 4 and 5.

Table 4: A dynamic consumption model

	(a)	(b)	(c)	(d)
	OLS	Within	GMM-SYS (1)	GMM-SYS (1)
$C_{i,t-1}$	0.397	0.201	0.304	0.289
	(18.28)	(10.79)	(3.63)	(3.41)
FS_{it}	0.208	0.194	0.199	0.198
	(7.76)	(5.25)	(6.06)	(6.00)
PF_{it}	0.160	0.121	0.136	0.136
	(14.02)	(9.23)	(9.88)	(9.84)
OF_{it}	0.233	0.243	0.237	0.241
	(13.70)	(11.05)	(10.37)	(9.62)
TR_{it}	0.006	-0.053	0.014	
	(0.30)	(-2.29)	(0.50)	
NVR_{it}	0.034	0.029	0.018	0.018
	(1.98)	(1.82)	(1.10)	(1.12)
NW_{it}	-0.004	0.014	0.004	
	-1.78)	(4.15)	(1.88)	
NRC_{it}				0.007
				(2.88)
NFC_{it}				0.011
				(2.41)
AGE_{it}	3635.9	8012.2	4780.8	5150.8
	(4.61)	(6.36)	(4.27)	(4.36)
$AGE2_{it}$	-42.1	-73.9	-53.9	-59.7
	(-5.17)	(-6.54)	(-4.62)	(-4.73)
CH_{it}	-4984.6	-50330.5	-7702.3	
	(-1.16)	(-2.56)	(-1.39)	
F_{it}	21933.6	16313.2	22951.9	24277.5
	(6.22)	(3.63)	(4.65)	(4.84)
$D_1{*}NRC_{it}$				-0.010
				(-3.72)
m_2	0.000	0.000	0.005	0.007
S			193.0 (191)	192.4 (191)
			(0.446)	(0.457)

1) The first lags of age and age squared and the 3-21. lag of the dependent variable is used as instruments.
2) Time dummies are included in all equations. For each variable, the estimates of the parameters are in the first row while t-values robust to heteroscedasticity are in parenthesis below.
3) m_2 is p-value for the Arrelano and Bond test for second order serial correlation. S is the Sargan test statistic that may be used to test instrumental validity (see Arrelano and Bond 1991)

Another explanation for the downward bias in the estimated effect of the lagged dependent variable is that the instruments used are weak because lagged levels are only weakly correlated with first differences of the actual variable (Blundell and Bond 1998). The GMM system estimator may better handle this. When using this estimator there were clear indications of second order serial correlation in the model so that the second lag of the dependent variable was not valid as instrument. Therefore, the 3-21. lag of the dependent variable was used as instruments. Use of this instrument matrix should lead to consistent but maybe not efficient estimates. It has been tried to transform the model to make the serial correlation disappear, but it has been failed in finding a better specification than the reported one's. Finally, the effect of the lagged dependent variable fitted in nicely between the OLS and within estimates, as reported in column (c) and (d).

The time specific effects capture the general impact on consumption from changes that affected the Norwegian farm sector in the period 1976-1997. It might be that some of the changes affect different households in different ways. This may be of especially relevance with regard to access to credit. To test for stability over time and the impact of the credit market regulation before 1984, a dummy variable (D_1) was created with values equal to one for the years 1977-1984, 0 otherwise. D_1 was multiplied with the ordinary explanatory variables to create interaction variables.

The most general model estimated had 25 variables (12 explanatory plus 12 interaction variables and lagged dependent variable) on the right hand side. In this model, taxes and net rental costs was separated while net wealth was separated in net real capital (NRC) and net financial capital (NFC).[4] The reported results in column (d) are for a valid simplification of the general model, due to a Wald test.[5] In this final model (d), we see that there is instability in the effect from net real capital, and it can be shown that the effect on consumption from off-farm income is higher than from price-dependent farm income.[6] It is difficult to reject hypotheses about different effects of farm subsidies and other income components because of a very high standard deviation of farm subsidies.

The results might be biased because decisions about investment and consumption are taken simultaneously in farm households (Phimister 1995). In an early stage, a specification allowing for this was estimated but no evidence of such simultaneity was found. The results may also be biased because the effects from the right hand side variables are dependent on omitted demographic variables, the time period distance to the year of the farm transfer and/or because holdings with a farm transfer are included in the data. No significant differences were found between age groups, between generations born before and after 1940 and between regions in Norway. It was estimated models with use of data for households with no change in the head of the households, as in Phimister (1995), but these models did not change the main results. Of simplicity, these results are not reported here.

Discussion

The GMM system estimator gave reasonable estimates for the dynamic consumption model while the bias from using OLS and within seems to be large especially with regard to the effect of lagged dependent variable. The OLS estimate on the effect from the lagged dependent variable was very close to the results in Oskan and Woldehanna (1999) that also uses OLS. However, OLS and within seem to give good indicators for the different MPCs. Beyond the lagged dependent variable the main difference between the within group (b) and the GMM system (c) estimator is that the taxes and rental costs are significantly negative in (b) but insignificantly positive in model (c). In addition, there is differences in effects of the demographical variables, especially the strong cohort effect (CH) in (b) is much weaker in (c) and finally excluded in (d).

The effect from net wealth was significant positive as expected. The effect from net value regulation was also positive but not significant. This is maybe a result of the fact that net value regulation is a very volatile income source. Transfers of capital between generations dominate this measure, and these transfers might be regarded as farm capital - not as capital for private consumption directly. Net value regulation had much lower MPC than other parts of disposable income. In models where the MPCs are assumed equal it can be shown that the short run "weighted average" MPC (the sum of MPC times their relative mean share of total disposable income) is 0.12-0.14, depending on the treatment of net value regulation.

[4] It can be shown that estimated effects of NFC and NRC in model (a)-(c) are equal.

[5] The Wald test for valid simplification is chi-quadratic distributed with number of restrictions as degrees of freedom. The actual values were Wald=18.7 (DF=13), significant at 0.13 level.

[6] A t-test for the difference between these two parameters has a t-value of 4.91, a t-test of the difference between farm subsidies and production dependent income has a t-value of 1.88 and a t-test of the difference between farm subsidies and off-farm income has also a t-value of 1.88. Only the first result is significant at a 5 % level.

If all income is fungible and the MPC is stable over time and strictly positive, the model would have predicted a decrease in consumption from the observed decrease in disposable income the last decades. The models in table 4 are superior to the models where MPCs is assumed equal mainly because off-farm income has higher MPC than production dependent farm income. These results support the notion from Friedman (1957) that the MPCs of volatile/risky incomes are lower than MPCs of more stable incomes, and they support the findings in Carriker et al. (1993). Therefore, models that do not allow MPC to vary with income source are likely to be misspecified.

In table 4, the weighted average MPC with respect to disposable income is 0.17-0.19, considerably higher than in models with income assumed fungible. In Norway, no comparable studies of MPC in farm households have been conducted, but studies from other countries indicate much lower MPC among farmers. Among American grain producers, Langemeier and Patrick (1990), Carriker et al. (1993) find the MPC to be about 0.02-0.03. Oskam and Woldehanna (1999) find the MPC to be 0.05 among Dutch farm families. It might be that American and Dutch farmers are experiencing greater income variability than Norwegian farm households do in general.

The change in the composition of disposable income towards less riskier incomes causes the average MPC to increase to become more like the MPC for households in general. If the means of 1977 and 1997 are used in the calculation of relative shares, it can be shown that the average MPC increases from 0.17 to 0.23. This implies an increase in consumption that we might interpret as results of reduced need for precautionary saving.

Effects of household size are documented in e.g. Browning and Lusardi (1996), Phimister (1995), Oskan and Woldehanna (1999). There was no available information about age and number of children and spouses here. Based on a proxy variable, it was found a strong family effect. In household with more than one working family member, the consumption seems to be higher than in one-person households. In addition, the age effect was strong. The family and age effects can be interpreted as that the need for consumption for an individual or his family varies over the life cycle (Keynes 1936).

The consumption model was tested whether the credit market change in 1984 had effects on the parameters. Only one variable had an unstable effect: net real capital. This variable seems to have a positive effect on consumption after 1985. Before 1984, the effect seems to be weakly negative. One possible explanation is low income growth that has resulted in farmers starting to use real capital as basis for consumption. However, the fact that none of the income variables seem to have stronger effect after the credit market deregulation indicates that consumption, at the household level, was not greatly affected by the restrictions on credit. One explanation for the stable marginal effects over time is that farmers may have been careful in demanding new borrowings after 1984 because of the declining profitability in farming. Another explanation for such stability is that the actual macroeconomic and political shocks affect all households in the same manner. The time specific effects in the model capture this.

Our model does not explain all the changes in consumption and saving in Norwegian farm households. A calculation of adjusted R^2 in model (d) shows that the model seems to explain about 47 % of the actual behaviour. One alternative explanation for the reduced saving is that farm households have an improvement motive of saving, according to Keynes (1936). Farm households, at least in the data, are characterised by not having real income growth in the last decades. In the same period, the income and consumption growth has been high in other

Norwegian households. Farm households may want the same increase in consumption as other households and, in times with low-income growth, this has affected savings negatively. In the results section it was mentioned that the model specification was widely tested. Based on these tests, the main problem with the reported results is the second order serial correlation in the model and the use of a proxy variable for household size (farmers with or without working family).

Conclusion

A dynamic consumption model was estimated with use of relatively new GMM-System estimator and a balanced panel of 258 Norwegian farm households followed from 1976-1997. The main results are that the LCP model seems to explain the consumption (and saving) behaviour in Norwegian farm households quite well. The MPC in Norwegian farm households seems to be relatively low but higher than what comparable studies find for farm households in other countries. Further, the MPC of off-farm income is higher than for production dependent farm income. These findings support the notion that MPCs of volatile incomes are lower than MPCs of stable incomes. Together with a strong increase in off-farm income as share of disposable income, the different MPCs causes the average MPC to increase in the last decades. This increase may imply that the observed fall in saving in Norwegian farm households is related to reduced need for precautionary saving. The credit market deregulation (1976-1984) does not seem to affect the MPCs in the actual period.

Given these results, there would be some fruitful lines for further research. The issues of whether the household's size affects MPC and whether the decisions of consumption and investment are simultaneous in farm households could be further pursued. This latter issue is clearly important in the explanations of both consumption and investments.

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Appendix

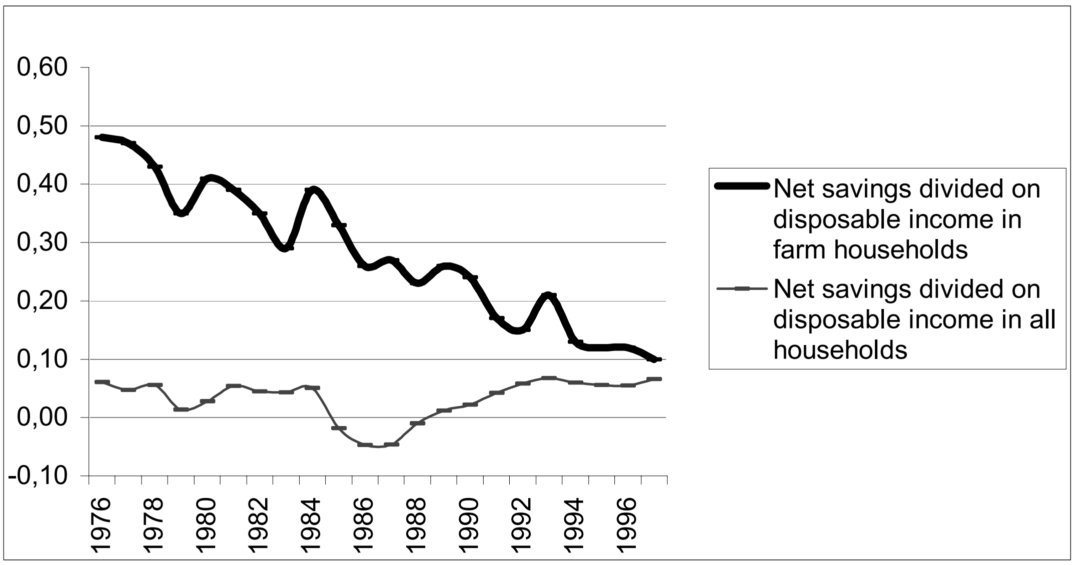

Figure A1: Saving in Norwegian households. Sources are NILF (1998) and SSB (1986, 1997 and 1998).