

1 **Factors affecting exit intentions in Norwegian sheep farms**

2

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7 **Abstract**

8 Western livestock sectors have shifted towards fewer, larger farms, causing concerns about
9 the appearance of the countryside, ecosystem services, and rural depopulation. This study
10 empirically estimates factors likely to affect exit intentions in sheep farms. Data were
11 collected from specialised sheep farms included in the Norwegian Farm Business Survey. Of
12 the 59 responses, 44 operators believed the farm would be producing sheep in 10 years. A
13 logistic regression model was used to determine the most decisive variables associated with
14 an exit intention, where the interdependence of factors affecting profitability and,
15 subsequently, exit intention were taken into account. This study found that farmers reporting
16 the most positive views of the local farming community were less likely to plan an exit. Exit
17 intentions were not significantly influenced by farming goals, location, off-farm income, or
18 profitability. The primacy of non-economic, community-based factors as an engine to sustain
19 farms, suggests that more attention need to be paid to social processes and relations in local
20 communities. Farmer groups and policy-makers should consider how to encourage supportive
21 local communities when designing policies to retain sheep farms.

22

23 **Keywords:** Sheep farming; exit; local community; profitability; logit; Norway

24 **1. Introduction**

25 Over the last decades, Western livestock sectors have witnessed substantial shifts to fewer,
26 bigger farms. The number of sheep farms in Norway has also declined, from 28,887 in 1989
27 to 14,391 in 2015 (Statistics Norway, 2016). The decline has been concentrated among
28 smaller farms. For example, the number of farms with less than 100 winter-fed sheep
29 decreased by 58% between 1989 and 2015, whereas the number of farms with more than 200
30 sheep increased from 84 to 527 in the same period. The number of breeding sheep (ewes and
31 rams per July 31) has been quite constant with 0.89 million in 1989 and 0.91 in 2015, while
32 the number of lambs increased from 1.28 million in 1989 to 1.46 million in 2015.

33 Farm structural changes have been a controversial policy matter in Western societies.
34 Historically, farm exits – and entries – have played an important role in introducing
35 technologies and productivity growth in the agricultural sector of many countries. The shift in
36 production has led to declining farm numbers through farm exit and consolidation. These
37 adjustments are difficult for farm families with implications for the economic and social
38 viability of the local communities (Lobao and Stofferahn, 2008). Fewer sheep farms, and less
39 grazing livestock in particular, will also have consequences for maintenance of rural
40 landscapes, biodiversity and the protection of the environment. Where sheep grazing is
41 removed, there can be shrub encroachment, which can lead to loss of elements of landscape
42 and biodiversity (Dýrmundsson, 2006; El Aich and Waterhouse, 1999; Ross et al., 2016).

43 Despite the importance of sheep farming as regards provision of ecosystem services and
44 vibrant farming communities, few if any studies have attempted to examine why some
45 operations exit sheep farming whereas others continue. Research from farming in general or
46 other farm enterprises has, however, been conducted to identify a large number of factors that
47 influence exit rates. The majority of contributions show that larger farms (Breustedt and
48 Glauben, 2007; Dong et al., 2016; Landi et al. 2016; Susanto et al., 2010), higher profitability

49 (Bragg and Dalton, 2004; Dong et al., 2016), and younger farmers (Bergfjord et al., 2011;
50 Bragg and Dalton, 2004; Howley, 2015; Mishra et al., 2014) are associated with a lower
51 likelihood of exit. Some studies have identified part-time farming as a means of stabilising a
52 farm business (Breustedt and Glauben, 2007; Kimhi and Bollman, 1999), whereas others have
53 reported that working off the farm increases the probability of exit (Bragg and Dalton, 2004;
54 Goetz and Debertin, 2001; Weiss, 1997). The influence of location is also mixed. Goetz and
55 Debertin (2001) and Landi et al. (2016) report that a higher population density positively
56 affects exit behaviour. In contrast, Glauben et al. (2006) argue that population density
57 decreases exit rates.

58 Mental models are cognitive constructs that people use to interact with the world around
59 them (Jones et al., 2014), and farmers' mental models are influenced by values and
60 knowledge and serve as a guide in learning and decision-making (Eckert and Bell, 2005).
61 Bergfjord et al. (2011) and Howley (2015) have provided support that farmers with financial
62 objectives are more likely to leave farming than those finding non-financial concerns such as
63 environment, farming lifestyle, stewardship and farm labour related benefits more important.

64 Community-based social processes can also be engines of change. Lyson et al. (2000)
65 found New York dairy farmers' community engagement to be negatively associated with an
66 exit intention. Gezelius (2014) have suggested that the economic viability of modern, capital-
67 intensive farms increases when these farms are located in multi-farm communities
68 characterised by lasting social networks. Further, Morgan-Davies et al. (2012) found
69 interdependencies in Scottish hill farming areas in such a way that as neighbouring farms
70 disappear, remaining farms become less tenable.

71 The objective of the current study is to identify key factors influencing exit intentions in
72 Norwegian sheep farms. The study combines accountancy and survey data collected from
73 specialised sheep farms.

74

75 **2. Materials and methods**

76 *2.1. Sample and data collection*

77 Data used in this study come from the Norwegian Farm Business Survey (FBS) conducted by
78 the Norwegian Institute of Bioeconomy Research (NIBIO). The FBS contains extensive
79 details about financial condition and farm production from a sample of Norwegian farm
80 holdings. Farms above a minimum economic size (standard gross margin) of 8 ESU
81 (European Size Units, 1 ESU = € 1200), are eligible to become a FBS farm. The annual
82 sample covers about 900 farms, which are selected to represent 70% of the total farm
83 population of about 42 000 farms in Norway, 92% of the total farmland and 96% of the total
84 agricultural gross output. The farms included in the survey are randomly selected along three
85 dimensions: economic size, region, and type of farming (NIBIO, 2016). Around 90% of the
86 farms remain in the sample the following year.

87 To obtain attitudinal and behavioural data not covered in the FBS data, a questionnaire
88 was sent per mail in mid-March 2009 to all FBS farmers at that time. The questionnaire
89 achieved after two reminders a response rate of 60%.

90 In Norway, sheep farming are based on the extensive use of free-range forest and
91 mountain pastures in summer. Housing and feeding are required throughout the winter due to
92 snow and frost, often for more than half of the year. Many sheep farms are located either close
93 to mountain areas and other sparsely populated areas or along the coast, but some farms are
94 also more centrally located.

95 The annual FBS data sets include around 200 farms with sheep. For the purpose of this
96 study, farms with sheep kept in mixed farming systems of various types, for example, mixed
97 dairy and sheep farms, were not included, making it possible to examine the effects of
98 profitability in sheep farming on exit tendencies. This study was therefore restricted to the

99 annually around 100 specialised sheep farms, where the majority of farm gross output came
100 from sheep. The FBS sample of specialised sheep farms represents 46% of the total sheep
101 population and 33% of the sheep farms in Norway (own calculation). Due to the size
102 requirement of at least 8 ESU, specialised sheep farms with less than 40–50 breeding ewes are
103 not included in the FBS sample. These smaller holdings account for 8% of the sheep and 18%
104 of the sheep farms.

105 In this paper, data only on sheep farms participating in the FBS in both 2007 and 2008
106 were used. Average figures of the 2 years were used to better characterise farm differences in
107 physical and financial performance arising from managerial abilities rather than returns from
108 a single year, which are more random because of uncontrollable events (such as the weather).
109 After deleting specialised sheep farms that did not respond to the questionnaire or with
110 missing values on important variables to be used in the analysis, 59 usable observations
111 remained.

112

113 *2.2. Measures*

114 Variables used in the analysis are presented in Table 1.

115

116 [Table 1]

117

118 *2.2.1. Exit intentions*

119 Exit intentions were measured by a self-reported response to whether the operator believed
120 the farm would be producing sheep in 10 years. The indicator =1 was applied if the farm
121 intended to exit sheep farming, and zero otherwise. Therefore, exit in this article means
122 switching out of sheep production, irrespective of whether the farm exits the farming industry
123 or takes up production of an alternative enterprise.

124

125 2.2.2. Profitability

126 The study focus on profitability based on both short-run and long-run rules. The exit or shut-
127 down decision rule is based on the comparison of revenues relative to operating costs. Long-
128 run profitability does also include returns on capital invested in the farm business and the
129 opportunity cost of unpaid labour input, providing an indicator of whether the farm can
130 replace capital assets and stay in business over time.

131 Long-run profitability was measured as the profitability coefficient (PC), defined as
132 (Flaten et al., 2011):

$$133 \text{ PC} = \frac{\text{Net farm income}}{\text{Interest claims on total value of farm assets} + \text{opportunity cost of unpaid labour}} \times 100.$$

134 Here net farm income represents the return to all unpaid labour and management and to all the
135 capital invested in the farm business. The farm asset value for the year is found by averaging
136 the beginning and ending total asset values from the farm balance sheets. Following the
137 procedures of the FBS, a flat labour charge per worked family hour equal to the wage rate for
138 a skilled farm worker was used to compute costs of unpaid labour. The interest claims for
139 farm asset values were set equal to the interest rate used in the FBS (5.5 per cent per annum).
140 If PC equals 100 (or higher), net farm income is sufficient to provide a return to capital and
141 unpaid labour equal to (or higher than) their opportunity costs.

142 The short-run measure, return over operating costs (ROOC), was defined as gross farm
143 sales (government payments included) net of operating costs, measured per breeding sheep.
144 Operating costs included costs for feed; veterinary and medical services; bedding and litter;
145 marketing; custom services; fuel, lubrication, and electricity; repairs; other costs; and
146 operating interest. Annualised cost of maintaining the capital investment in the farming
147 operation, costs for insurance, and costs of all labour were not included.

148

149 *2.2.3. Off-farm income*

150 The off-farm income variable measures the importance of off-farm income relative to other
151 income sources. Total farm household income is defined as the sum of net income from all
152 farming activities (agriculture, forestry, and on-farm diversification), non-farm business
153 income, wages and salaries, pensions and sick pay, dividends, and interest earnings minus
154 interest payments (NIBIO, 2016:137). The share of work-related off-farm activities (non-farm
155 business income, wages, and salaries) in total farm household income was used as a proxy for
156 the off-farm income variable.

157

158 *2.2.4. Farming goals*

159 The questionnaire included 20 statements on goals in farming, ranging over a wide variety of
160 issues. The items were based on previous studies (Lien et al., 2006; Maybery et al., 2005) and
161 were measured on a 7-point rating scale ranging from “not at all important” to “most
162 important”.

163 Principal component analysis (PCA) with varimax rotation was applied to transform the
164 20 items to a smaller number of components. The value of the Kaiser-Meyer-Olkin overall
165 measure of sampling adequacy (MSA) was 0.81 for the final solution, which included 11
166 items. A two-component solution was preferred. These components accounted for 64% of the
167 total variance. Each item had a component loading of 0.74 or higher on only one component.
168 All final communality estimates were above 0.55.

169 The first component, labelled “non-financial”, had high loadings on the following seven
170 components: “ensure the best possible animal welfare standard”, “contribute to domestic food
171 production”, “contribute to rural viability”, “maintain the cultural landscape”, “use pesticides
172 and fertilisers sparingly”, “restrict the loss of nutrients”, and “maintain biodiversity”
173 (Cronbach $\alpha = 0.89$). The second component, labelled “financial”, included four components:

174 “high return on investments”, “maximise income”, “increase net worth”, and “reliable and
175 stable income” (Cronbach $\alpha = 0.82$). The Cronbach α values were above a generally agreed
176 lower limit of 0.70 (Hair et al., 2006).

177 Summated scales were formed by combining all of the items loading highly on a
178 component into a single composite measure where individual items were averaged. The
179 components, represented by the composite measures, highlighted contrasting farming goals.
180 Finally, the difference between the two summated scales was estimated, to be used in
181 subsequent analysis as a measure of non-financial relative to financial goals.

182

183 *2.2.5. Local farming community*

184 Self-reported measures of farmers’ views on their local farming community were used. These
185 measures are original and were measured on a 7-point rating scale ranging from “totally
186 disagree” to “totally agree”. The statements were as follows: “In my local community there is
187 a good farming environment”, “meeting other farmers is for me an important source of well-
188 being”, and “people in my local community recognise ingenuity and innovation”.

189 A PCA was performed on the three statements. The model achieved an overall MSA of
190 0.73. One predominant component explained 78.5% of the variance. All component loadings
191 were close to 0.90. The final communality estimates were all above 0.75. Cronbach’s α for the
192 three items was 0.86, suggesting that it was appropriate to combine them into a single
193 measure of what was labelled “local farming community”. A high score indicates a supportive
194 local farming environment.

195

196 *2.2.6. Location*

197 Statistics Norway (2008) has constructed an indicator of centrality, placing each Norwegian
198 municipality in one of four centrality categories. The variable measures the municipality’s

199 geographical location relative to a centre with higher order functions such as banks or post
200 offices, as well as related to population size. Statistics Norway refers to these categories with
201 values from zero to three, in order of increasing centrality: least central, less central, quite
202 central, and central. To account for possible exit heterogeneity among farms of different
203 centrality, the centrality categories were dichotomised into remote (value 0–1) and central
204 (value 2–3) locations.

205

206 *2.2.7. Other variables*

207 *Flock size* was measured in number of breeding sheep (ewe lambs for breeding included) as
208 of March 1. Flock size was adjusted for other ruminants present based on forage requirements
209 (multiplication factors in parentheses): suckler cows (8), beef bulls (4), and goats (1).

210 *Meat output* per breeding sheep was used as a measure of sheep productivity. In addition
211 to sales of lamb and mutton, inventory changes in sheep stocks and sales and purchases of
212 live sheep were taken into account when calculating production of meat per breeding sheep.
213 Meat output was described on a per kilogram carcass weight basis.

214 *Solvency* refers to a farm household's total capital structure and its ability to meet its
215 liabilities. The equity/asset ratio was used to evaluate solvency. *Agricultural education*
216 indicates if the operator or the spouse has one or more years of agricultural education.

217 *Ownership* denotes the farm operators' years of farm ownership.

218

219 *2.3. Statistical analysis*

220 First, farms that stated an intention to exit and those that did not were compared based on all
221 variables presented in the study. A *t-test* for metric variables and a chi-square or Fisher's
222 exact test for discrete variables was used to assess the significance of differences between the
223 groups.

224 Next, the most decisive variables associated with an exit intention were determined.
225 There is an interdependence of factors affecting profitability and, subsequently, the exit
226 intention. A two-stage approach was used to control for endogeneity in the exit decision
227 model (Bragg and Dalton, 2004). In the first stage, factors affecting farm profitability
228 measures were estimated. In the second stage, a binary logistic regression model was used to
229 determine how the explanatory variables, including predicted profitability, influence the two
230 options: exit or continue in sheep farming.

231 In stage 1, ordinary least squares (OLS) regressions were used to calculate the estimated
232 profitability measures as a function of operator and farm characteristics such as ownership,
233 agricultural education, solvency, flock size, and meat output (ownership was chosen instead
234 of the correlated variable operator age).

235 In stage 2, under a logit specification, the predicted probability of exit for farm i (P_i)
236 (Greene, 2012) is identified as:

$$237 \quad P_i = \frac{e^{\beta X_i}}{1 + e^{\beta X_i}}.$$

238 Here X_i contains the values of the explanatory variables of the model (location, off-farm
239 income, predicted profitability, farming goal, and local farming community), including a
240 constant, and β represents the model coefficients to be estimated. The small sample size
241 restricted the number of explanatory variables to be included in the logit models. The
242 penalised likelihood approach proposed by Firth (1993) was used to reduce small-sample bias
243 in maximum likelihood estimation of the logit models.

244 The results are reported as odds ratios and marginal effects. The marginal effects were
245 computed at every observation in the sample and then averaged across all observations, which
246 produces the average partial effects that are preferred in small samples (Greene, 2012).

247 No collinearity problems were encountered among the explanatory variables using
248 variance inflation factors (all <1.32 in OLS, all <1.30 in logit) and condition indices (<1.89

249 in OLS, <1.74 in logit). Statistical analyses were carried out with SAS 9.3 (SAS Institute,
250 Cary, NC, USA), except for the use of STATA 12.1 (StataCorp, College Station, TX, USA) to
251 estimate marginal effects.

252

253 **3. Results and discussion**

254 *3.1. Descriptives*

255 Twenty-five percent of the sample farms reported that they intended to exit sheep farming
256 within a time horizon of 10 years. The intended annual exit rate is close to the actual
257 exit rate in Norwegian sheep farming in the last decades.

258 Table 2 presents a summary of the characteristics of the exiting and remaining farms as
259 well as the whole sample of sheep farms. Average performance indicates that flock size across
260 the full sample was 138 breeding sheep, producing 28.2 kg meat per sheep per year with a
261 ROOC per sheep of NOK 1969 and a PC in farming of 43. The low PC implies a return to
262 capital and unpaid labour well below their opportunity costs. Average years of farm
263 ownership was 17.8 years, with 63% holding an agricultural education, 29% with a central
264 location, an average share of off-farm income of total household income of 62%, and an
265 equity/asset ratio of 68%.

266

267 [Table 2]

268

269 Table 2 also present results of a bivariate analysis conducted to test if the distributions
270 of the characteristics between the two groups – exiting and continuing – were statistically
271 significant. The results indicate that the intention to exit sheep farming was significantly
272 associated with only two of the variables: local farming community and farming goals.

273 Perceptions of the local farming community were in general positive, but exiting
274 farmers scored 1.37 points lower than the continuing farmers ($P = 0.01$). Non-financial
275 farming goals scored on average higher than the business-related goals, supporting the rich
276 literature on the importance of non-monetary benefits from farming (Garforth and Rehman,
277 2005). Exiting farms did, however, find financial goals relatively more important than the
278 continuing farms ($P = 0.02$), as also reported by Howley (2015).

279

280 3.2. Profitability

281 The first-stage regressions showed as expected that larger flocks, on average, generated a
282 higher PC than smaller flocks ($P < 0.05$; Table 3). On average, more experienced farmers did
283 also perform better, measured as PC ($P < 0.05$). Higher yielding flocks did not achieve higher
284 PC than those with lower meat output per breeding sheep. This result is in contrast with
285 studies of other livestock farming systems, which often find yield differentials to be a key
286 performance driver in farm profitability (Wilson, 2011). A plausible explanation is the use of
287 livestock and area payments rather than higher output prices that moderates the economic
288 importance of high yield per head (Flaten and Rønning, 2011). Agricultural education and
289 solvency also had no significant associations with PC.

290

291 [Table 3]

292

293 ROOC was positively related to a higher equity/asset ratio ($P < 0.05$; Table 3). The
294 other explanatory variables showed no significant effects on ROOC. The predicted PC and
295 ROOC values from the OLS regressions were integrated into the second-stage logit regression
296 models.

297

298 *3.3. Model results*

299 Results from the logit model estimates of farmers' intentions to exit sheep farming are
300 presented in Table 4. Specification 1 reports the model that included predicted PC as an
301 explanatory variable, and specification 2 included predicted ROOC. Marginal effects are
302 reported in Table 5.

303

304 [Table 4 and Table 5]

305

306 The overall models were significant ($P < 0.01$) according to the likelihood ratio test
307 (Table 4). To measure predictive power or how well the response variable is predicted based
308 on the explanatory variables of the models, two R^2 measures were calculated: McFadden and
309 Tjur (Allison, 2014). The estimated models showed R^2 measures of 0.26–0.29. Goodness-of-
310 fit (GOF) tests help to decide whether the model is correctly specified. The models were
311 checked for fit using four GOF tests, as recommended by Allison (2014). The low values in
312 all GOF tests, yielding high P -values, suggest that both models fit the data well.

313 The estimated models yielded statistically significant parameters for the local farming
314 community variable (Table 4). The other explanatory variables (location, off-farm income,
315 predicted profitability, and farming goal) lacked statistical significance. The two model
316 specifications generally yielded similar estimates in parameters, suggesting that specifying
317 profitability in terms of PC and ROOC provided consistent results. For practical discussion,
318 results given in specification 1 (PC) are emphasised, unless otherwise stated.

319 The higher a farmer's perception was of the local farming community, the lower the
320 probability of an exit intention ($P < 0.01$; Table 4). The odds ratio was close to 0.50; that is,
321 holding all other variables constant, for each one-unit increase in the score on the local
322 farming community variable, the odds of exiting were halved. The estimated marginal effect

323 was -0.105 ($P < 0.01$; Table 5). This finding means that with a one-unit increase in the score,
324 the probability of exiting decreased by 10.5%. A plausible explanation is that most economic
325 behaviours are embedded in social networks (Granovetter, 1985), and areas where farming
326 and rurality figure prominently are often found to have high levels of civic engagement
327 (Gómez-Limón et al., 2014). Many studies have described how individuals and local
328 communities that are rich in community participation and the social cohesion that it generates
329 are advantaged across economic, social, and health domains (Coleman, 1990; Hogan et al.,
330 2011; Putnam, 1995); it is positive for farmers' well-being to be part of multi-farm
331 communities with lasting social networks (Gezelius, 2014), and these dimensions are
332 consequently important to exit intentions. The findings in this study support the results given
333 by Lyson et al. (2000), where farmers' community engagement decreased exit intentions.
334 Since the local farming community variable was the only statistically significant variable, this
335 factor seems to be of particular importance for the intent to continue with sheep farming.
336 However, a conclusive relationship between the local farming community variable and farm
337 exit rates solely on the basis of findings in this single study cannot be claimed.

338 The only additional marginal effect that tended to be significant was off-farm income in
339 model 2 (ROOC, $P < 0.10$), suggesting that a 1% increase in total household income from off-
340 farm work increased the probability of exit intentions by 0.36% (Table 5). Many sheep farms
341 are part-time operations that are integrated with off-farm work. High off-farm income
342 nevertheless tended to provide a pulling force on the exit intention, consistent with findings in
343 Bragg and Dalton (2004), Mishra et al. (2014), and Weiss (1997).

344 The lack of statistical significance of many results should be assessed in light of the
345 small sample used in the analysis. Logit-type models remain relatively robust for Type I
346 errors and marginal effects estimates with small samples; however, caution is necessary in
347 forming conclusions based on non-findings, that is, Type II errors (Bergtold et al., 2011; Hart

348 and Clark, 1999). The risk of making Type II errors (false-negative findings) increases, and
349 several true relationships may not be discovered. For example: a central location of a farm
350 more than doubled the odds of reporting exiting compared to remote farms, and for each one-
351 unit increase in the score on the composite variable for farming goals, the odds of reporting
352 exiting decreased by a factor of 0.74 (Table 4). The magnitudes of these effects are large
353 enough for their explanatory variables to have meaningful (although not statistically
354 significant) influences on the exit rate.

355 Predicted farm profitability had a low impact on the exit intention. The non-significant
356 coefficients suggested that more profitable farms, as measured by PC and ROOC, were more
357 likely to exit. In contrast, studies of dairy farms have found higher profitability to lower the
358 exit rate (Bragg and Dalton, 2004; Dong et al., 2016). At first glance, the finding here is
359 surprising. It is, however, widely reported that farmers farm for reasons other than
360 maximising profit (Garforth and Rehman, 2005; Howley, 2015). Furthermore, studies have
361 found sheep farmers (in Norway) to be more satisfied with their farm work and lifestyle
362 (despite the lower profitability) than farmers in general (Flaten and Rønning, 2011). The high
363 satisfaction with the varied lifestyle and non-financial benefits in sheep farming may explain
364 the low relevance of profitability to the exit decision.

365

366 *3.4. Policy implications*

367 Fewer sheep and sheep farms can have severe effects on the well-being of rural communities,
368 the appearance of the countryside, biodiversity, and heritage values. The question arises of
369 what policies best accomplish keeping sheep farmers in agriculture.

370 A number of government policies can influence farm structure. Some studies have found
371 farm-support programmes to decrease exit rates (Breustedt and Glauben, 2007; Mishra et al.,
372 2014; Raggi et al., 2013), whereas a study by D'Antoni et al. (2012) concluded that

373 government payments are a factor in pushing labour off the farm. On the one hand,
374 government payments may help marginal farms to remain in business. On the other hand,
375 payments can encourage farmers to expand. As a result, the structural impact of government
376 programmes may be somewhat ambiguous and dependent on their design. This research
377 identified additional factors that influence exit decisions and the need to go beyond the scope
378 of price support and government payments to reduce farm exits.

379 Findings from this study point to the important effects of farmers' perceptions of their
380 local farming community and social processes on exit intentions. In many societies, (local)
381 farmer collaboration has long been institutionalised in many forms of, for example through,
382 local farmer organisations and associations, meetings and field days, informal farmer
383 networks and groups for co-learning and exchange of ideas. Various collaboration initiatives
384 can be important for farmers' social relations. Further farmer and farmer group engagement
385 and entrepreneurialism in the local community may be required to create new forms of social
386 collaborations, both within and outside the local community, including the use of Internet and
387 social media.

388 The issue of local social relations and innovations is not only a task for individuals in
389 farming communities; public policy is also important (Bock, 2016). Public financial
390 contributions can help to reduce exit rates if facilitating, for example, social networking and
391 collective learning. Withdrawal of support for collaboration efforts can contribute to farm
392 exits. This study suggests that a somewhat larger proportion of public agricultural funds to
393 initiatives that encourage formation of social relations for farmers could have significant
394 implications for keeping farms in the business.

395

396 *3.5. Limitations and future research*

397 This study has some limitations. One important point to note is that the reported relationships
398 are associative rather than causal. To control for endogeneity, predicted values of the
399 profitability measures were used. Endogeneity bias could still be affecting the estimates
400 because the presence of other confounding factors cannot be ruled out. Outcomes can also be
401 influenced by factors not specified in the model.

402 The empirical evidence of determinants of exit intentions is local, derived from a
403 particular time, place, farming enterprise, and research design. There may be a question as to
404 whether the findings are specific to the Norwegian sheep farming context examined at that
405 particular time or whether they are generalisable to other farming environments. To further
406 explore the link between social factors, in particular, and exit rates, additional studies within
407 different kinds of farming environments across time and space should be undertaken so that a
408 more general picture begins to emerge. This study supports the proposal of Gezelius (2014)
409 that more research is needed to address a farm's dependence on the broader community of
410 neighbours, friends, and long-term colleagues.

411 The omission in the FBS of the smallest sheep farms, operations that may exist
412 independently of the farm economy, precluded an analysis of their exit behaviour and
413 implications for farm structures and land uses.

414 The sample was necessarily small because of the reliance on archival financial
415 performance measures from specialised sheep farms in the Norwegian FBS. The small sample
416 size restricted analytical options and model specificity. Future research should include more
417 explanatory variables to further examine the extent and limits of local farming community
418 variables on exit behaviour. There is also a need for qualitative approaches such as in-depth
419 interviews with farmers to gain a sharpened understanding of their reflections on exit
420 decisions, and to better understand the deeper reasons and processes behind a decision to
421 leave farming.

422 This study was based on stated intentions. Stated intentions are valuable information,
423 also serving to examine policy effects. Intentions that are correctly expressed cannot,
424 however, be assumed to be translated automatically into actual exit behaviour. Nor is a
425 retrospective assessment necessarily a good measure of the actual choice because people may
426 state beliefs to justify their choices; that is, the decision affects the beliefs instead of beliefs
427 affecting the decision. Predictive power across a variety of both reported past behaviours as
428 well as future planned behaviour would increase the validity of a hypothesis or theory.

429 Exit intentions connected to policy changes were not analysed. One needs to be aware
430 that the conclusions derived from this study may not apply if major policy changes are
431 introduced.

432

433 **4. Conclusions**

434 The results of this study provide evidence of the impact of farmers' perceptions of the local
435 farming community on the probability of exit intentions, where a lower perception increases
436 the probability of exit intentions from sheep farming. The estimated marginal effect suggests
437 that a one-unit increase in the score (on a scale from 1 to 7) on the local farming community
438 variable decreases the probability of exit intentions by 10.5%. Farming goals, location, off-
439 farm income, and profitability did not play a statistically significant role in the current sample.
440 The study suggests that farms and farmers being part of and embedded in community social
441 structures is a key element to enhance the viability of farms. Farm policy may be more cost-
442 effective in retaining sheep farms if the local community factor is considered in its design.

443

444 **Acknowledgements**

445 Funding for this work was provided by the Research Council of Norway [grant number NFR
446 208036] and Småfeprogrammet for fjellregionen (County Governor of Hedmark) through the

447 project “Sheep in motion”. The author is grateful to Stig S. Gezelius, Torbjørn Haukås,
448 Valborg Kvakkestad, Gudbrand Lien, Sjur Spildo Prestegard, two anonymous reviewers, and
449 one of the Editors for helpful comments and suggestions.

450

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