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Management and Risk Characteristics of Part-Time and Full-Time Farmers in Norway

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The objective of this exploratory study was to provide empirical insight into how different categories of farmers perceive and manage risk. The data originate from a questionnaire of dairy and crop farmers in Norway. The associations between part-time and full-time farming and farm and farmer characteristics, farmers' goals and future plans, risk perceptions, and risk management responses were examined with simple *t*- and chi-square tests, as well as with logistic regression. The results indicate that full-time and part-time farmers' goals, risk perceptions, and management strategies differ significantly. Policy makers and advisers should consider these differences when developing policies and recommendations for the different types of farmers.

An increasing number of Norwegian farm families have off-farm employment. In 2002, about 61% worked off-farm. Norwegian farms are small compared with those in many developed countries and farm income represents on

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average, a relatively small and decreasing part of the farm-family household income. In 2001, only 23% of the average total household income (for holder and spouse/cohabitant) came from agriculture, forestry, and fishing. By contrast, in 1992, the income from the primary industries amounted to 27% of total household income (Statistics Norway). Similar developments are found in many developed countries (e.g., Hill; Andersson, Ramamurtie, and Ramaswami). For example, Mishra et al. reported that more than 94% of U.S. total farm household income was derived from off-farm sources in 2000, up from 62% in 1987.

Studies within a wide range of approaches and disciplines have examined characteristics and motivations that explain part-time and full-time farming. A number of studies examining time allocation in farm households have adapted theory from "new household economics" (Becker) to the special case of the agricultural household model (e.g., Huffman). Results of these studies include: (*a*) the characteristics of those participating in off-farm employment and the factors affecting labor supply (hours worked) in off-farm activities (Weersink, Nicholson, and Weerhewa; Woldehanna, Oude Lansink, and Peerlings), (*b*) the association between education and off-farm work (e.g., Huffman), (*c*) the effect of differences in and variability of incomes/wealth between agriculture and other occupations (e.g., Mishra and Goodwin; Andersson, Ramamurtie, and Ramaswami; Fall and Magnac), (*d*) whether part-time farming is a stable adjustment, a way to full-time farming, or a way out of agriculture (e.g., Kimhi), and (*e*) survival strategies and diversification on marginal farms (Meert et al.).

Combining part-time farming activities with wage labor is a diversification strategy that may contribute more than on-farm diversification to household income stability. Studies of Norwegian farming households indicate that consumption is more affected by wage than farming income (Sand). Similar results are shown for other countries and for the relation between wage income and business income in general (e.g., Carriker et al.).

Part-time and full-time farmers are to different degrees financially dependent on farming income. Because the two groups have chosen different livelihood strategies, it seems likely that there will be differences in their perceptions of risk in farming and how they cope with it. Information is lacking about farmers' risky environment and their reactions to it, and especially about differences between part-time and full-time farmers. Some studies (e.g., Wilson, Dahlgran, and Conklin; Martin; Patrick and Musser; Meuwissen, Huirne, and Hardaker; Hall et al.) have examined how farmers in general perceive and manage risk. The empirical relationships between risk attitudes, management, and part- and full-time farming choices have not, as far as we know, been explored in earlier studies.

Policy makers, farm advisers, and researchers need more practical insights into the likely differences between full-time farmers and the large number of part-time farmers in order to provide better advice and to develop more sharply targeted policies. This exploratory and descriptive study aims to fill part of this gap by providing recent empirical information about part-time and full-time farmers' characteristics, including risk perceptions and responses, but also farm and operator characteristics, and farming goals.

Conceptual Framework

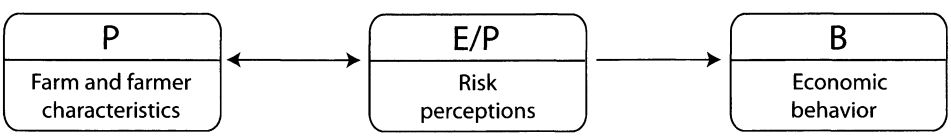
Many studies have been carried out as bases for testable hypotheses about differences between part-time and full-time farmers. For example, results show that part-time farmers are younger, have higher education, and smaller farms (e.g., Mishra and Goodwin; Woldehanna, Oude Lansink, and Peerlings). However, examinations of differences between part-time and full-time farmers' perceptions and management of risk are virtually absent in earlier comparative studies, which makes it hard to develop firm hypotheses. An exploratory approach was considered appropriate as research design in this study, though certainly not as a replacement for testable hypotheses.

Van Raaij's model of the firm's decision-making environment is useful to study the relationship between farm and personal characteristics, risk perceptions, and management responses (e.g., Wilson, Dahlgran, and Conklin). Van Raaij's model is a framework for research on economic behavior, where the perceived economic environment determines the individual's economic behavior with subjective well-being as its consequence.

Figure 1 presents the groups of variables used in our research design. First, $P \rightarrow E/P$ describes how farm, farmers' goals, and other personal variables (P) impact farmers' perceptions of risk factors (E/P). Second, the relationship $P \rightarrow E/P \rightarrow B$ reflects how the farm/personal variables and risk perceptions influence economic behavior (B), i.e., their risk management strategies. Off-farm work is a personal characteristic (i.e., P), but is also a strategy to cope with risk (i.e., B). As pointed out by Wilson, Dahlgran, and Conklin, a personal variable (e.g., part-time vs. full-time farming) influences economic behavior (e.g., risk management). However, the off-farm risk management decision also alters the personal characteristics. In other words, the impact may also be $P \leftrightarrow E/P \leftrightarrow B$, and it is often impossible to prove which way the causation flows.

Within this framework, a range of possible empirical differences between part-time and full-time farmers can be explored, and the results may generate hypotheses for future research. A difference that may be explored is if independence in their work is expected to be a more important goal for full-time than part-time farmers. And since the two groups of farmers have different livelihood strategies, part-time farmers may rank the strategy "off-farm diversification" higher than full-time farmers. Further, since part-time farmers receive part of their income off-farm, farm income stability may be less important to them than to full-time farmers. These examples illustrate the wide range of issues that can be explored in our empirical analysis within this research design.

Figure 1. Elements of Van Raaij's model of a firm's decision-making environment



Materials

The data reported here were collected as a part of a larger questionnaire of risk and risk management in farming. The Norwegian Agricultural Authority (SLF) has a register of farmers who receive support payments, which includes the total population of farmers in Norway. Based on the 2001 applications, there were more than 17,800 dairy farmers (including 325 organic) and more than 15,600 crop farmers (202 organic). From this SLF register, 850 crop and 862 dairy farmers were sampled. Conventional farmers were selected using simple random sampling, while all organic dairy and crop farmers received the questionnaire. The survey was sent out in January 2003. We were informed that 34 of these farmers had quit farming, reducing the number of possible respondents to 1,678. After two reminders, 1,033 farmers returned the questionnaire for an effective response rate of 62%.[1]

Because of small herd sizes in Norway, dairy farms were defined as having more than five dairy cows. Crop farms were defined as having more than 1 hectare (ha) grain, or more than 0.5 ha of potatoes, or more than 0.2 ha of intensive crops (vegetables, fruit, or berries). Dairy farms that also met the cropping criteria were specifically excluded from the crop group.

The survey consisted of questions related to (*a*) farmers' perceptions of sources of risk, (*b*) farmers' perceptions of various risk management strategies, (*c*) farmers' goals and future plans, and (*d*) characteristics of the farm and farmer. Most questions were of the closed type, many in the form of seven point Likert-type scales. The questionnaire was pre-tested in sessions with farmers, and refined over several stages based on the comments and suggestions received.

The distinction between full-time and part-time farmers was based on a question that asked respondents if the holder and the spouse (cohabitant) were employed off-farm. If yes, they were asked to report their percentage of off-farm position(s). In the analysis, we have chosen to define a part-time farm as a holding where a single farmer (i.e., unmarried or noncohabitant) or a farmer and the partner have at least a 15% off-farm work position. By this classification, we have defined "dual career" households as full-time farms for example, when one partner has a less than 15% position off-farm and the other works full-time off-farm. After deleting all respondents that failed to answer the part-time question, we were left with 394 crop farms (169 full-time and 225 part-time farms) and 467 dairy farms (386 full-time and 81 part-time).

Respondents with off-farm work were asked to score six reasons for off-farm work on a Likert-type scale from 1 (not important) to 7 (very important). From a list of 14 farming goals ranging from profit maximization to social contact, the respondents were asked to select up to five as most important. The farmers also indicated their future plans for their holding (within a five-year perspective), by selecting one or several of nine options (such as no changes, downsize, exit, or expand).

The survey presented 33 sources of risk for dairy farmers and 25 risk management strategies. Similarly, crop farmer respondents considered 22 sources of risk and 23 risk management strategies. Farmers were asked to score each source of risk on a Likert-scale from 1 (no impact) to 7 (very high impact) to express its potential impact on their farm's economic performance. Farmers also indicated

their perceived importance of each risk management strategy on a Likert-scale from 1 (not relevant) to 7 (very relevant).

Additional information about the production systems was obtained through merging the questionnaire survey data with two available databases: the SLF-register of farmers' support payments, which includes each farmer's stocking and cropping details, and the dairy cow health and production records registered in the Norwegian Herd Recording System.

The analyses were carried out separately for dairy and crop farmers mainly because part-time dairy farmers inevitably have a heavier daily on-farm workload than part-time crop farmers. While the majority of crop producers combine farming with off-farm work, there are fewer part-time dairy farmers. Because combining off-farm occupation with farm work will probably have widely different implications for dairy and crop operations, the division was made to enable the differences to be highlighted.

Methods

Data examined in this study were collected as part of a larger survey of Norwegian farmers (Koesling et al.; Flaten et al.). Organic farmers were heavily over-represented in the sample versus their actual share of Norway's population. Further, our survey sample was not completely representative of the regional and farm size distribution of Norwegian dairy and crop farming. In all analyses, the survey data were weighted with respect to organic/conventional farming systems, regions and farm size, to give results that are as representative as possible for dairy and crop farming in Norway.

As the first step of the analysis, farmers' and farm characteristics, goals, risk perceptions, and strategies were summarized and compared. Mean values obtained for part-time and full-time farmers were compared using standard *t*-tests for metric (quantitative) variables and chi-square tests for nonmetric (qualitative) variables. Strictly speaking, Likert-type scales are ordinal. In this study, a cardinal interpretation was undertaken. The scale was treated as a continuous variable (Hair et al.; Spicer), making it possible to use standard parametric (multivariate) statistical procedures (e.g., Patrick and Musser; Meuwissen, Huirne, and Hardaker).

Any combined effect of variables that may reflect differences in characteristics between part-time and full-time farmers may be overlooked in bivariate analyses (Spicer). We used regression analysis to gain a more complete picture of differences between part-time and full-time farmers in goals, risk sources, and risk management strategies (figure 1). Data reduction techniques were used to reduce the numbers of factors in the regressions (Hair et al.).

We used common factor analysis to summarize the information about risk perceptions and risk management strategies in a reduced number of factors/variables. Factor analysis also reduced multicollinearity problems in subsequent regressions. Factor solutions with different numbers of factors were examined before structures were defined, in order to have the most representative and parsimonious set of factors (Hair et al.). Orthogonal (varimax) rotation was used to obtain factor solutions that were easier to interpret. Standardized factor scores for each farmer and factor were saved for subsequent multivariate analyses.

Some 20–40% (depending on the group) of the respondents did not answer one or more relevant questions about sources of risk or management responses. In cases with missing data, most of the respondents failed to answer only a few items. If remedies for missing data are not applied, any observations with missing values are omitted. Using only complete observations can produce bias in the results unless observations are missing completely at random. There is also a loss of precision as the sample size is reduced (Hair et al.). To deal with missing data, in the factor analyses we deleted a few cases lacking more than 40% of the risk source variables or 50% of the risk management strategies variables. For the rest, missing data points were replaced with the mean value of that variable based on all valid responses in the group (dairy or crop).

Associations between part-time and full-time farmers (dependent variables) and independent variables were analyzed using binary logistic regressions. Independent variables included farm and farmer characteristics, goals and future plans, in addition to the standardized scores obtained from the factor analyses of risk sources and risk responses. No multicollinearity problems were detected in the regression models. The logistic regression models were complete, but to save space, only the significant variables are reported.

Motivations for Off-Farm Work

The most important motivations for off-farm work, independently of crop or dairy farming system, were to increase the total household income and to get a more reliable and stable income, both with average scores of about 6.3 (figure 2). These results are in accordance with a comparative study of dairy farm families in New York and Ontario (Weersink, Nicholson, and Weerhewa). The Weersink, Nicholson, and Weerhewa study supports our results that social contact was not among the main motivations for working off-farm. Barlett also found that the main reason for off-farm work was in response to the higher variability associated with farm income.

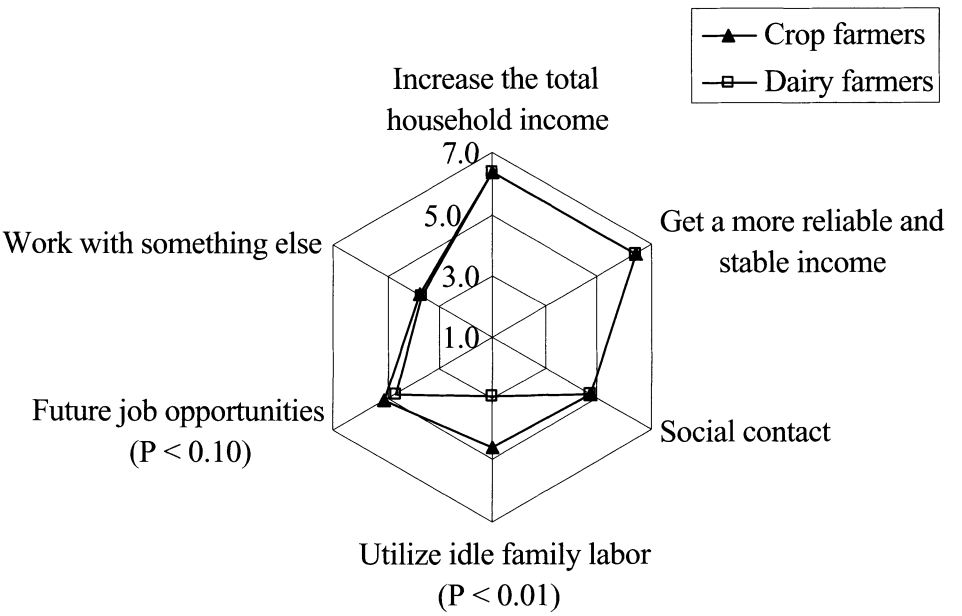
There were, however, differences in motivation between dairy and crop farmers, the latter ranked both future job opportunities ($p < 0.10$) and utilizing idle family labor ($p < 0.01$) significantly higher than dairy farmers. The differences may be related to the large amount of labor required in a dairy operation throughout the year, so that the enterprise does not lend itself so well to part-time farming. Cropping operations, in contrast, are more seasonal. The need to do something other than farming scored low as a motivational factor in both farming systems.

Descriptive Analysis

Key Farmer and Farm Characteristics

Table 1 compares the main farmer and farm characteristics and shows that there are significant differences. Compared with full-time dairy farmers, for example, part-time dairy farmers were younger ($p < 0.001$), worked less on the farm ($p < 0.05$), had more years of schooling ($p < 0.001$), and the main farm operator was more frequently a woman ($p < 0.01$). Part-time crop farmers were younger

Figure 2. Part-time crop ($n = 225$) and dairy ($n = 81$) farmers' main reasons for off-farm work. Weighted average score of responses ranking for each reason. Significance level in parenthesis, based on independent samples t-test between crop and dairy farmers. Values are from a Likert-type scale with 1 being the least important and 7 the most important



($p < 0.001$) than their full-time colleagues, were more frequently unmarried ($p < 0.01$), spent significantly less time working on the farm ($p < 0.001$), had more general education, but less frequently received agricultural education ($p < 0.01$), and had less farmland ($p < 0.01$). Part-time crop farmers had less land in potatoes, vegetables, fruits and berries than full-time crop farmers ($p < 0.01$). These results are consistent with previous studies (e.g., Mishra and Goodwin; Woldehanna, Oude Lansink, and Peerlings).

Farmers' Goals

Full-time farmers ranked producing high-quality food as the most important goal and reliable and stable income second (table 2). Part-time dairy farmers ranked reliable and stable income first and having time for the family second. Unlike dairy farmers, part-time crop farmers differed less from full-time farmers. Instead of income stability, however, part-time crop farmers ranked the goal to improve the farm for the next generation as the second most important. Producing high quality food was more important for full-time than for part-time dairy farmers ($p < 0.001$). As expected, "independence" was ranked higher by full-time than part-time crop farmers ($p < 0.05$). Sustainable and environmentally sound farming (landscape preservation included) was ranked higher among part-time

Table 1. Weighted average farmer and farm characteristics for full-time and part-time dairy and crop farmers

Farmer and Farm Characteristics	Dairy		Crop	
	Full Time	Part Time	Full Time	Part Time
Number of farms	386	81	169	225
Age of the farmer[a]	48.1	43.0***	52.8	47.6***
Marital status (% married)	84	86	90	78**
Farm labor units (man-years)	2.06	1.84*	1.41	0.65***
Education, BS or higher (%)	9	23***	26	44***
Agricultural education (%)	57	55	61	47**
Management responsibility (%)[b]	5/73/22	12/76/12**	7/72/21	7/80/13
Location (%)[c]	26	19	61	65
Farmland (ha)[a]	22.7	21.5	24.3	18.3**
Potatoes, vegetables, and fruit (% of farmland)			9	4**
Number of dairy cows[a]	14.5	13.4		

Note: Weighted average farmer and farm characteristics marked with asterisks show that the characteristics of full-time and part-time dairy and crop farmers, respectively, are significant different at (*)$p < 0.10$, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$, based on independent samples t-test (for metric values) and chi-square-test (for nonmetric values).

[a]Data (2002) from the Norwegian Agricultural Authority.

[b]Principal person(s) in charge for farm management: woman, man, split between two or more persons.

[c]Measured as a dummy variable where 1 denotes central location and 0 denotes otherwise.

farmers than among both full-time dairy ($p < 0.01$) and crop farmers ($p < 0.10$). It seems that part-time farmers are concerned about preserving the landscape, but perhaps full-time farmers do so unconsciously. The data also show an association between education level (which is highest among part-time operators) and the importance assigned to environmental issues.

Profit maximization was ranked rather low by all groups of respondents. However, on average, part-time farmers ranked this goal somewhat higher than full-time farmers, and significantly ($p < 0.05$) so in dairy production. One reason may be that part-time farmers have a higher opportunity cost of farm labor than full-time farmers. Faced with low farm incomes, the part-time farmer may be inclined to work more off-farm.

In our study, having a reliable and stable farm income was less important for part-time than full-time crop farmers ($p < 0.10$). We also found that stable income was more important for dairy than crop farmers. This may be because dairy farmers have more control over the production process since cropping is more dependent on weather and growing conditions. Risk-averse farmers may also choose to go into dairying rather than cropping, since more stable income is obtained from dairying.

Our results support earlier studies (e.g., Bergevoet et al.; Gasson et al.; Willock et al.) reporting that farmers have several goals and see farming as more than a way to make money.

Table 2. Weighted percentage of responses ranking each goal among the top five

	Dairy			Crop			
Farmers' Goals	Full Time	Part Time	Rank P t.[a]	Full Time	Rank F t.[a]	Part Time	Rank P t.[a]
Produce high quality food	68	46***	3	60	1	55	1
Reliable and stable income	66	70	1	56	2	48(*)	4
Independence	49	43	4	45	4	34*	6
Time for family, living quality for children	43	51	2	42	5	49	3
Improve the farm for next generation	33	41	6	46	3	54	2
Have possibility to some leisure	30	27	9	13	11	11	11
Sustainable and environmentally sound farming	27	43**	4	37	6	45(*)	5
Reduce debt, become free of debt	24	29	8	18	10	24	7
Continue to be a farmer	22	31(*)	7	30	7	24	7
Work with animals/crops	20	22	11	20	9	17	10
Maximize profit	17	27*	9	21	8	24	7
Increase equity	3	1	13	8	12	4	13
Social contacts	2	5***	12	2	13	6(*)	12
Higher private consumption	1	1	13	1	14	3	14

Note: Weighted percent of responses for each goals marked with asterisks show that the goals of full-time and part-time dairy and crop farmers, respectively, are significant different at $(*)p < 0.10$, $*p < 0.05$, $**p < 0.01$, and $***p < 0.001$, based on chi-square-test. Ranked by decreasing importance for full-time dairy farmers.

[a] Ranking by part-time (P t.) dairy farmers (column five), full-time (F t.) crop farmers (column seven) and part-time (P t.) crop farmers (column ten), respectively.

Perceptions of Risk Sources

Table 3 shows the rating of risk sources and whether they differ significantly among the groups. The risk sources are presented in order of decreasing importance for full-time dairy farmers. All groups ranked institutional risks (such as uncertainty about the continuation of government support payments, changes in the dairy quota system, or changes in tax policy) as important sources of risk. The importance of institutional risks may reflect the somewhat unpredictable changes in Norwegian farm policies and regulations, together with external pressures for deregulation and associated fears of farm support cuts. The finding should also be linked to Just's proposal that longer-term swings (e.g., lasting changes in agricultural policy) represent a much greater risk to farmers than year-to-year variability in payoffs. Only the downside consequences of long-term changes are likely that to be sufficiently prolonged to cause farm failure. A Finnish study also found that

Table 3. Weighted mean score and *t*-tests for full-time and part-time dairy and crop farmers for sources of risk

	Dairy			Crop			
Risk Sources[a]	**Full Time**	**Part Time**	**Rank P t.[b]**	**Full Time**	**Rank F t.[b]**	**Part Time**	**Rank P t.[b]**
Changes in government support payments	5.92	5.70	2	5.31	4	5.58(*)	3
Changes in tax policy	5.80	5.71	1	5.43	3	5.62	2
Milk price variability	5.79	5.53	3				
Milk quota policy	5.53	5.19(*)	8				
Animal welfare policy	5.49	4.70***	11				
Meat price variability	5.47	5.41	4				
Changes in consumer preferences	5.20	5.20	7	5.28	5	4.75***	7
Injury, illness, death of operator(s)	5.11	5.24	6	4.93	8	4.29***	10
Cost of operating inputs	5.11	5.40	4	4.97	7	4.85	5
Nondomestic epidemic animal diseases	5.01	5.02	9				
Domestic epidemic animal diseases	4.97	4.89	10				
Forage yield uncertainty	4.90	4.34**	16				
Other government laws and regulations	4.74	4.65	12	4.57	9	4.53	8
Fire damages	4.67	4.43	15	4.00	14	3.69	14
Cost of capital equipment	4.64	4.48	14	4.54	10	4.45	9
Technical failure	4.52	4.20	20	4.27	11	4.06	11
Meat production variability	4.35	4.29	19				
Changes in technology	4.34	4.09	23	3.79	15	3.94	12
Marketing/sale	4.32	4.34	16	5.10	6	4.79*	6
Legislation in production hygiene	4.32	3.91(*)	25				
Production diseases	4.32	3.55***	27				
Cost of credit (interest rate)	4.27	4.34	16	3.52	16	3.84(*)	13
Crop prices variability	4.26	4.10	21	5.98	1	5.96	1
Family member's health situation	4.21	4.10	21	4.19	12	3.32***	15
Crop yields variability	4.14	4.49	13	5.71	2	5.48	4
Milk yield variability	4.13	4.00	24				
Hired labor cost and availability	3.73	3.54	28	3.12	18	2.57**	20
Credit availability	3.52	3.56	26	2.95	20	3.14	17
Family relations	3.17	3.15	30	3.05	19	2.85	19
Availability and cost of leased farmland	3.15	3.37	29	3.16	17	3.24	16
Additional organic farming payments	2.73	2.69	31	2.70	21	2.90	18
Organic farming laws/regulations	2.35	2.47	32	2.58	22	2.57	20
Price premiums organic products	2.32	2.38	33	2.42	23	2.51	22

Note: Weighted mean score (1 = no dependency, 7 = very high dependency) for full-time dairy farmers, part-time dairy farmers, full-time crop farmers, and part-time crop farmers. Weighted mean numbers marked with asterisks show that the mean scores of full-time and part-time dairy and crop farmers, respectively, are significant different at (*)$p < 0.10$, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$, based on independent samples *t*-test.

[a]Ranked by decreasing importance for full-time dairy farmers.

[b]Ranking by part-time (P t.) dairy farmers (column four), full-time (F t.) crop farmers (column six) and part-time (P t.) crop farmers (column eight), respectively.

changes in agricultural policy were the most important risk source for farmers (Sonkkila).

Price variability was the highest ranked source of risk among crop farmers. Milk price variability was ranked third by dairy farmers. Crop producers ranked crop yield variability higher than dairy producers ranked milk yield variability. Crop yield variability may be of greater importance because output is highly influenced by weather while milk yields are somewhat stable.

All groups ranked availability and cost of hired labor, credit, and leased farmland, as well as family relations and "organic" risk sources (laws and regulations, price premiums, and farm payments) low as sources of risk (table 3). The low score for organic sources is due to the small numbers of organic farmers in Norwegian agriculture.

Full-time dairy farmers rated milk quota policy ($p < 0.10$), animal welfare policy ($p < 0.001$), forage yield uncertainty ($p < 0.01$), legislation in production hygiene ($p < 0.10$), and production diseases ($p < 0.001$) as more important risk sources than part-time dairy farmers. There was a negative association between risk related to animal welfare policy and increasing education level. The greater importance attached to animal welfare policy by full-time farmers may reflect the higher education level among part-timers.

Full-time crop farmers regarded changes in consumer preferences ($p < 0.001$), injury, illness and death of operator(s) ($p < 0.001$), marketing/sale ($p < 0.05$), family members' health situation ($p < 0.001$), and hired labor cost and availability ($p < 0.01$) as most important. Some of these findings may reflect the fact that full-time crop farmers do more farm work and had more farmland than part timers. Full-time farmers' incomes also are normally more dependent on farm output than part-time farmers. Further, since the full-time crop producers had more potatoes, vegetables and fruit than their part-time colleagues (table 1), marketing/sales often will be more important. The greater vegetable and fruit production also made full-time crop farmers more dependent on availability of seasonal rented labor and their own health situation in labor-intensive harvesting seasons.

Common factor analysis was applied to the risk source variables of the dairy and crop sub-samples separately (table 3) to reduce the number of variables in subsequent binary logistic regression analyses.

The number of variables for the dairy risk source data was reduced from 33 to 6 (the last columns of appendix A). Some 50.2% of the total variance was accounted for, a satisfactory amount in social sciences (Hair et al.). The factors were labeled (*a*) dairy, that loads significantly from a variety of dairy production variables; (*b*) institutional, consist of a wide collection of public payment and government legislation variables; (*c*) organic, which has extremely high loadings of the three variables specific for organic farming; (*d*) human resources, with heavy loadings of health and family variables; (*e*) credit, with high loadings of the interest rate and credit availability; and (*f*) market, which involves high loadings of changes in consumer preferences and marketing.

Of the 22 risk sources presented for crop producers, the factor analysis resulted in six factors (the first columns of appendix A) that explained 56.2% of the total variation. The factors were labeled (*a*) institutional, with high loadings for public payments and government variables, and input prices; (*b*) organic, where the three specific external risks for organic farming had high loading; (*c*) human

resources, includes both health risk of the operator and the family, uncertainty about the family, hired labor and fire; (*d*) credit, with high loadings for credit cost and availability; (*e*) crop, with crop prices and crop yields variability having high loadings; and (*f*) market, involving significant loadings for changes in consumer preferences and marketing. The factor scores from these factor variables were used in subsequent multivariate analysis.

Perceptions of Risk Management Strategies

Having good liquidity, preventing/reducing livestock and crop diseases and pests (for dairy farmers and crop farmers, respectively), buying farm business insurance and personal insurance, and producing at lowest possible cost were strategies generally perceived as highly relevant (table 4). In recent studies of farmers in other countries, the same financial management strategies were also perceived among the most important (Meuwissen, Huirne, and Hardaker; Hall et al.; Harwood et al.), even though the national risk environments are different. Farmers in our study generally did not perceive organizing the farm as a corporation, possessing off-farm investments, and having surplus machinery capacity as important risk management strategies.

While full-time dairy farmers did not consider off-farm work as an important risk strategy, part-time farmers scored it higher ($p < 0.001$). Further, compared to their full-time colleagues, part-time dairy farmers ranked off-farm investments ($p < 0.001$), surplus machinery capacity ($p < 0.001$), solvency ($p < 0.05$), and storage ($p < 0.01$) as relatively more important strategies to deal with risk, but ranked buying farm business insurance ($p < 0.10$) lower. Full-time crop farmers ranked off-farm work low as a risk management strategy, while it was the top-rated strategy for part-time farmers. Full-time crop farmers attached much greater importance than their part-time colleagues to good liquidity ($p < 0.05$), use of risk-reducing technologies (irrigation, etc.) ($p < 0.001$), cooperative marketing ($p < 0.05$), use of economic consultancies ($p < 0.10$), enterprise diversification ($p < 0.001$), and use of production contracts ($p < 0.001$). Full-time crop farmers might rank risk-reducing technologies and production contracts higher because they produce more vegetables and fruit. On-farm diversification was also important for full-time farmers, perhaps since their main source of income is the farm.

Common factor analysis was applied to the risk management variables for dairy and crop farmers separately, in order to reduce the number of variables for use in subsequent regressions (table 4). The factor analysis identified seven interpretable and feasible dairy factors (the last columns of appendix B), accounting for 44.4% of the variance. Labels and interpretations of the factors are (*a*) flexibility, which includes on-farm strategies to enhance flexibility (storage included) and use of price contracts; (*b*) consultancy, with high loadings for veterinarian, agronomy/nutrition, and economic consultancies; (*c*) disease prevention, with high loadings of prevention/reduction of pests and diseases in crops/forage and livestock; (*d*) insurance, which has heavy loadings for insurance contracts; (*e*) diversification, which includes off-farm investments, off-farm work, on-farm diversification, and collecting more information; (*f*) financial, including financial aspects of the farm business (solvency, liquidity, and production costs); and

Table 4. Weighted mean score and *t*-tests for full-time and part-time dairy and crop farmers for risk management strategies

	Dairy			Crop			
Risk Management Strategies[a]	**Full Time**	**Part Time**	**Rank P t.[b]**	**Full Time**	**Rank F t.[b]**	**Part Time**	**Rank P t.[b]**
Liquidity—keep cash in hand	6.44	6.43	1	6.46	1	6.21*	2
Prevent/reduce livestock diseases	6.33	6.29	2				
Buying farm business insurance	6.08	5.82(*)	5	6.01	3	5.96	4
Produce at lowest possible cost	5.88	5.93	3	5.87	6	5.89	5
Buying personal insurance	5.84	5.81	6	5.92	5	5.81	7
Risk reducing technologies	5.75	5.51	10	5.74	7	5.24***	9
Use of agronomic/nutritional consultancies	5.55	5.53	9	5.16	10	4.95	11
Solvency—debt management	5.49	5.84*	4	5.94	4	5.89	5
Prevent/reduce crop diseases and pests	5.43	5.71(*)	8	6.14	2	5.98	3
Small gradual changes	5.36	5.36	11	5.44	8	5.43	8
Cooperative marketing	5.32	5.36	11	4.77	14	4.36*	17
Use of veterinarian consultancies	5.16	5.06	13				
Shared ownerships of equip., joint operations	4.74	4.75	15	4.52	18	4.59	13
Asset flexibility	4.69	4.78	14	5.36	9	5.18	10
Keeping fixed costs low	4.57	4.50	17	4.56	17	4.49	14
Use of economic consultancies	4.52	4.28	19	4.29	19	3.91(*)	20
Storage	4.15	4.66**	16	4.27	20	3.97	19
Enterprise diversification	4.10	4.31	18	4.99	12	4.23***	18
Production contracts	4.05	3.65(*)	23	5.04	11	4.39***	16
Collecting information	3.72	3.97	21	4.82	13	4.60	12
Off-farm work	3.67	5.72***	7	4.73	15	6.33***	1
Surplus machinery capacity	3.31	4.06***	20	3.77	21	3.82	21
Product and market flexibility	3.23	3.25	24	4.61	16	4.41	15
Off-farm investments	2.44	3.77***	22	3.10	22	3.77***	22
Organize the farm as a corporation	2.19	2.60*	25	2.65	23	2.46	23

Note: Weighted mean score (1 = not important, 7 = very important) for full-time dairy farmers, part-time dairy farmers, full-time crop farmers, and part-time crop farmers. Weighted mean numbers marked with asterisks show that the mean scores of full-time and part-time dairy and crop farmers, respectively, are significant different at (*)$p < 0.10$, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$, based on independent samples *t*-test.

[a]Ranked by decreasing importance for full-time dairy farmers.

[b]Ranking by part-time (P t.) dairy farmers (column four), full-time (F t.) crop farmers (column six) and part-time (P t.) crop farmers (column eight), respectively.

(*g*) fixed cost sharing, which has high loadings for shared ownership of equipment and joint operations.

Of the 23 risk management strategies presented for the crop producers, the factor analysis identified six factors (the first columns of appendix B) which accounted for 40.1% of the variance. Labels and interpretations of the crop factors are (*a*) consultancy, which includes heavy loadings for consultancy, storage, and joint operation; (*b*) flexibility, with high loadings for product, market, and asset flexibility; (*c*) insurance, where farm business and personal insurance dominate; (*d*) low cost, which includes producing at lowest possible cost, preventing or reducing crop diseases and pests, and risk-reducing technologies; (*e*) financial, including mainly solvency and liquidity; and (*f*) diversification, which includes mainly off-farm work and joint operations.

The differences in derived factors for crop and dairy farmers were small. In other words, the crop and dairy farmers seem to use much of the same strategies to manage risk. This finding may indicate fairly similar underlying factor structures among management responses of farmers across the two farm types.

Multivariate Analysis

Table 5 presents significant results from the binary logistic regression for dairy and crop farmers. Compared to full-time dairy farmers, part-time dairy farmers (at 5% significance level) were younger; were more frequently married/in partnership; gave higher importance to the goals of sustainable and environmentally sound farming, and to improving the farm for the next generation.

Compared to full-timers, part-time dairy farmers considered downsizing the farm operation as a more important strategic direction; viewed human risk as less important; and considered consultancy, insurance and fixed cost sharing as less important strategies to manage risk. Further, disease prevention, diversification (including off-farm investments, off-farm work, on-farm diversification, etc.), and financial aspects were more important for part-time than full-time dairy farmers.

Compared to full-time farmers (at 5% significance level), part-time crop farmers were younger, more frequently single, worked less on the farm, invested more off the farm, had a higher household income, regarded the goals of independence and sustainable and environmentally sound farming lower, and planned more frequently to downsize the farm operation and less frequently to diversify with more enterprises over the next five years. They were less concerned about risk sources such as human resources and crop price and yield variability, but more concerned about credit risks. They regarded consultancy as a less important strategy to manage risk than did full-time crop farmers.

In general, there was consistency between the partial statistical analyses and the regression analyses. Unlike the bivariate analyses, the regression analyses showed no significant differences between part-time and full-time dairy farmers' off-farm investment strategy. Further, we found no significant differences between part-time and full-time crop producers' education levels and the importance they assigned to maximizing profit. Surprisingly, the regression results indicated that sustainable and environmentally sound farming was more important for full-time than part-time crop farmers, the opposite results of the bivariate analysis.

It is also surprising that both groups of part-time farmers plan more frequently to downsize the farm operation, compared to their full-time colleagues. The

Table 5. Dairy and crop farmers, results of multiple logistic regressions. Binary dependent variable is part-time (=1) or full-time farmer (=0)

	Dairy		Crop	
Independent Variables	**Param.[a]**	**Sign. Lev.[b]**	**Param.[a]**	**Sign. Lev.[b]**
Farmer and farm				
Age of the farmer	−0.59	**	−0.47	**
Marital status[c]	0.90	*	−0.82	*
Education[d]	0.51	(*)		
Agricultural education[e]			−0.38	(*)
Farm labor units (man-years)	−0.31	(*)	−0.81	***
Off-farm investment[f]			0.67	*
Farm income[g]	−0.30	(*)		
Household income[h]			0.91	***
Goals[i]				
Maximize profit	0.38	(*)		
Independence			−0.68	**
Sustain. and environmentally sound farming	0.79	***	−0.54	*
Improve the farm for next generation	0.88	***		
Future plans[i]				
Downsize the farm operation	0.85	*	0.99	*
Diversify, with one/several farm enterprises			−0.52	(*)
Risk sources[j]				
Human resources	−0.28	**	−0.31	**
Credit			0.41	**
Crop			−0.33	**
Risk strategies[j]				
Consultancy	−0.30	*	−0.31	*
Disease prevention	0.35	*		
Insurance	−0.29	*		
Diversification	0.95	***	0.23	(*)
Financial	0.45	**	0.23	(*)
Fixed cost sharing	−0.38	**		
Df	325		276	
Pseudo R^2_{adj}	0.60	***	0.66	***

[a]Coefficients for dummy variables are unstandardized, all others are standardized.
[b]Variables significant at (*)$p < 0.10$, *$p < 0.05$, **$p < 0.01$ and ***$p < 0.001$. Only significant variables are shown. Parameter estimates for the complete models are available from the authors.
[c]Measured as dummy variable where 1 denotes married/partner and 0 otherwise.
[d]Measured as a dummy variable where 1 denotes formal schooling beyond secondary school and 0 denotes secondary school education or less.
[e]Measured as a dummy variable where 1 denotes agricultural education and 0 denotes otherwise.
[f]Measured as a dummy variable where 1 denotes off-farm investments the last five years and 0 denotes otherwise.
[g]Measured as a dummy variable where 1 denotes farm income ≥ NOK 100,000 (≈US$14,700) and 0 denotes otherwise.
[h]Measured as a dummy variable where 1 denotes household income ≥ 350,000 NOK and 0 otherwise.
[i]Measured as a dummy variable where 1 denotes the farmer mentioned the goal or future plan as important and 0 denotes otherwise.
[j]Factor score variables from the factor analysis for each farmer are used.

expected options for most farmers are growth, consolidation, or exit. A Belgian study has, however, found that off-farm employment very rarely led to cessation of agricultural work (Meert et al.). For many part-time farmers, the downsizing option may be necessary to cope with multiple job situations. There are several explanations for the finding that younger farmers participate more frequently in the off-farm labor market. One is that entering farmers often have an off-farm education and experience before taking over the farm. An extra job may also contribute to financing farm investments (Meert et al.), and younger farm families can often get help on the farm from the older generation (Jervell). The age differences between part-time and full-time farmers may also indicate, however, that younger farmers increasingly expect to combine farming and off-farm work (table 1).

Conclusions

There is little published information about differences in how part-time and full-time farmers perceive and manage risk. This study revealed that full-time and part-time farmers' goals, risk perceptions, and risk management strategies differ significantly. Further, compared to full-time farmers, part-time farmers plan more frequently to downsize their farm operations, which may be a necessity to cope with multiple job situations. Policy makers and advisers should consider the differences in goals, management, and risk characteristics between part-time and full-time farmers when developing policies and recommendations. That part-time farmers differ from full-time farmers, for example, in considering off-farm work as a highly relevant strategy to cope with risk and to obtain a more reliable and stable income as an important motivation for off-farm work is important in that connection. We could then expect farm-income stabilization to be of less concern for part-time than for full-time farmers, but the two groups do not differ significantly in their perceptions of government payments and output price risks. Advisers should distinguish between part-time and full-time farmers, since, e.g., the first group may consider on-farm diversification less important.

Since the results showed that several risk factors are important to all farmers, it would be helpful if those advising farmers could provide more and better information to enable their clients to make better-informed judgments about the risks they face. Also, farm management consultants and advisers should make greater use of modern decision analysis tools that incorporate the main sources of risk.

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Endnote

[1]The sampling strategy used, the high response rate and the weighting schemes used (see later in text) imply that the samples should be representative for the farmer populations. Note, however, that the nonrespondents (38%) may introduce selection biases in the analysis of the questions, which are not accounted for in results presented.

Appendix A. Crop and dairy farming, joint varimax rotated factor loading for sources of risk

	Crop Farmers[b]						Dairy Farmers[c]					
	1	2	3	4	5	6	1	2	3	4	5	6
Changes in consumer preferences	0.08	0.03	0.11	0.09	0.10	**0.79**	0.12	0.16	0.02	0.21	0.02	**0.54**
Marketing/sale	0.11	0.04	0.13	0.08	0.10	**0.66**	0.17	0.07	0.20	0.03	0.02	**0.56**
Cost of operating inputs	**0.67**	0.10	0.12	0.11	0.17	0.01	0.27	**0.35**	−0.07	0.13	**0.33**	**0.31**
Cost of capital equipment	**0.62**	0.15	0.18	0.27	0.13	0.05	**0.33**	**0.35**	−0.02	0.14	**0.32**	0.14
Changes in technology	**0.44**	0.19	0.01	0.30	0.09	0.16	a	a	a	a	a	a
Cost of credit (interest rate)	0.23	0.07	0.08	**0.74**	0.09	0.11	0.21	0.16	0.06	0.12	**0.73**	0.00
Credit availability	0.20	0.15	0.24	**0.81**	−0.01	0.04	0.22	0.06	0.19	0.10	**0.62**	0.05
Price premiums organic products	0.10	**0.89**	0.09	0.16	−0.04	0.10	0.03	0.03	**0.87**	0.06	0.13	0.06
Organic farming laws/regulations	0.17	**0.94**	0.09	0.08	−0.01	0.04	0.05	0.07	**0.90**	0.06	0.09	0.13
Other government laws and regulations	**0.49**	0.26	0.15	−0.03	0.06	0.13	0.13	**0.41**	0.27	0.16	0.12	−0.06
Additional organic farming payments	0.26	**0.76**	0.05	0.12	0.01	−0.04	0.13	0.08	**0.81**	0.12	0.02	0.04
Changes in gover. support payments	**0.59**	0.06	0.05	0.05	0.07	0.03	−0.10	**0.54**	−0.02	0.22	0.18	0.14
Changes in tax policy	**0.70**	0.04	0.14	0.04	0.06	0.08	0.03	**0.57**	−0.03	**0.38**	0.14	0.18
Injury, illness, death of operator(s)	0.28	−0.03	**0.67**	0.01	0.08	0.14	0.12	0.16	0.04	**0.67**	−0.02	0.13
Family member's health situation	0.14	0.07	**0.73**	0.05	−0.02	0.16	0.17	0.13	0.13	**0.57**	0.05	0.07
Family relations	0.03	0.22	**0.52**	**0.39**	0.08	0.07	a	a	a	a	a	a
Hired labor cost and availability	−0.03	0.17	**0.40**	**0.37**	0.06	0.12	a	a	a	a	a	a

Continued

Appendix A. Continued

	Crop Farmers[b]						Dairy Farmers[c]					
	1	2	3	4	5	6	1	2	3	4	5	6
Fire damages	0.28	0.04	**0.54**	0.24	0.11	−0.06	0.25	0.23	0.09	**0.63**	0.22	0.03
Technical failure	**0.47**	0.09	0.27	0.24	0.21	−0.01	0.27	**0.35**	0.11	**0.36**	0.26	0.10
Forage yield uncertainty	a	a	a	a	a	a	**0.50**	0.04	0.03	0.27	0.22	0.27
Production diseases	a	a	a	a	a	a	**0.62**	0.15	0.11	0.24	0.12	0.00
Domestic epidemic animal diseases	a	a	a	a	a	a	**0.58**	0.09	0.08	**0.47**	0.16	0.02
Nondomestic epidemic animal diseases	a	a	a	a	a	a	**0.42**	0.14	0.11	**0.44**	0.16	0.08
Animal welfare policy	a	a	a	a	a	a	0.23	**0.49**	0.20	0.17	−0.19	−0.27
Legislation in production hygiene	a	a	a	a	a	a	**0.31**	**0.43**	**0.34**	0.13	−0.14	−0.25
Milk yield variability	a	a	a	a	a	a	**0.66**	0.24	0.12	0.07	0.18	0.09
Milk price variability	a	a	a	a	a	a	**0.36**	**0.58**	−0.02	0.06	0.14	0.27
Milk quota policy	a	a	a	a	a	a	0.29	**0.56**	0.15	0.07	0.03	0.14
Meat production variability	a	a	a	a	a	a	**0.65**	0.18	0.07	0.17	0.14	0.24
Meat price variability	a	a	a	a	a	a	**0.34**	**0.41**	−0.04	0.07	0.13	0.28
Crop yield variability	0.16	−0.08	0.18	0.14	**0.78**	0.12	a	a	a	a	a	a
Price variability	0.29	0.04	−0.01	−0.01	**0.73**	0.14	a	a	a	a	a	a

Factor loadings >|0.30| are in bold.
"a" means that the variable is deleted from the factor analysis because of low factor loadings and low communality or farm-type conditionality.
[b]Factors 1–6 are institutional, organic, human resources, credit, crop, and market.
[c]Factors 1–6 are dairy, institutional, organic, human resources, credit, and market.

Appendix B. Crop and dairy farming, joint varimax rotated factor loading for risk management strategies

	Crop Farmers[b]						Dairy Farmers[c]						
	1	2	3	4	5	6	1	2	3	4	5	6	7
Use of economic consultancies	**0.55**	0.05	0.07	0.00	0.00	−0.11	0.17	**0.67**	−0.04	0.16	0.14	0.01	0.15
Use of veterinarian consultancies	a	a	a	a	a	a	0.09	**0.65**	0.19	0.03	−0.03	0.08	0.03
Use of agron./nutritional consultancies	**0.64**	0.05	0.04	0.06	0.07	−0.02	−0.08	**0.55**	0.20	0.17	0.04	0.01	0.00
Production contracts	**0.56**	0.12	0.00	0.17	0.09	0.06	**0.46**	0.06	0.27	0.06	−0.10	−0.09	−0.11
Storage	**0.53**	0.18	−0.04	0.16	0.06	0.10	**0.46**	0.17	0.23	0.12	−0.11	0.11	−0.27
Liquidity—keeping cash in hand	0.25	0.00	0.07	0.17	**0.58**	0.00	−0.02	0.20	0.15	0.15	−0.16	**0.60**	0.00
Solvency—debt management	−0.09	0.13	0.04	0.10	**0.69**	0.15	0.06	−0.10	0.08	−0.01	0.10	**0.63**	−0.09
Asset flexibility	0.14	**0.39**	0.12	0.28	0.26	0.15	**0.58**	0.02	0.01	0.00	0.10	0.22	0.11
Product and market flexibility	0.12	**0.58**	−0.01	0.26	0.13	0.08	**0.65**	−0.03	−0.04	−0.03	0.18	0.03	0.17
Keeping fixed costs low	a	a	a	a	a	a	0.20	0.01	0.23	0.06	−0.02	−0.01	0.28
Shared ownerships of equip., joint operations	**0.52**	0.12	0.04	0.11	0.01	**0.67**	0.09	0.21	0.11	0.01	0.16	−0.07	**0.81**
Off-farm work	−0.19	0.09	0.00	−0.04	0.17	**0.39**	0.06	0.03	0.13	−0.04	**0.54**	0.10	0.12
Off-farm investments	−0.05	**0.59**	−0.02	−0.23	0.02	0.14	0.15	0.05	−0.14	0.03	**0.68**	−0.11	−0.03
Collecting information	**0.44**	**0.36**	0.14	0.06	0.13	0.04	**0.43**	0.29	0.11	0.09	0.27	−0.07	0.09
Enterprise diversification	**0.44**	**0.30**	0.16	0.13	−0.05	0.07	**0.37**	0.06	0.04	0.04	0.27	−0.09	0.10
Produce at lowest possible cost	0.05	−0.04	−0.01	**0.38**	0.16	0.09	0.13	0.15	**0.39**	0.18	−0.02	0.29	0.11
Risk reducing technologies	0.21	0.17	0.17	**0.65**	−0.04	0.00	0.17	**0.37**	**0.41**	0.11	0.00	0.01	0.14
Prevent/reduce livestock diseases	0.11	−0.02	0.18	**0.49**	0.12	−0.11	0.13	0.20	**0.67**	0.05	0.14	0.08	−0.01
Prevent/reduce crop diseases and pests	a	a	a	a	a	a	−0.04	0.10	**0.67**	0.30	−0.09	0.26	0.16
Buying farm business insurance	0.10	0.04	**0.73**	0.19	0.08	−0.01	0.02	0.19	0.12	**0.70**	−0.08	0.06	−0.07
Buying personal insurance	0.12	0.10	**0.78**	0.07	0.03	0.03	0.09	0.14	0.19	**0.69**	0.10	0.08	0.10
Organize the farm as a corporation	0.16	**0.39**	0.07	0.00	−0.03	−0.04	a	a	a	a	a	a	a
Cooperative marketing	**0.46**	−0.05	0.15	0.09	−0.03	−0.05	a	a	a	a	a	a	a

Factor loadings >|0.30| are in bold.
"a" means that the variable is deleted from the factor analysis because of low factor loadings and low communality or farm-type conditionality.
[b]Factors 1–6 are consultancy, flexibility, insurance, low cost, financial, and diversification.
[c]Factors 1–7 are flexibility, consultancy, disease prevention, insurance, diversification, financial, and fixed cost sharing.

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