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The disposition effect in farmers' selling behavior – an experimental investigation

Elisabeth Vollmer
Daniel Hermann
Oliver Mußhoff

Department für Agrarökonomie und
Rurale Entwicklung
Universität Göttingen
D 37073 Göttingen
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Abstract

The identification of the optimal selling time of stored goods is among the most essential economic decisions on a farm. Beyond monetary aspects, behavioral factors may influence farmers' selling behavior. In financial economics, the disposition effect is a commonly observed phenomenon. It indicates that investors hold losing stocks too long, while they sell stocks that have increased in value too early. In the context of agriculture, this behavioral bias has not been analyzed thoroughly yet. To close this research gap, we conducted an incentivized online experiment with 112 farmers in Germany. The experimental design was based on well-proven experiments from financial economics and adapted to an agricultural decision context where stored goods must be sold. Farmers were provided information on the uncertain price developments. In addition, lotteries were conducted to elicit farmers' risk attitude, probability weighting, and loss aversion. Results indicate that there is a robust disposition effect in farmers' selling behavior. Furthermore, more loss-averse farmers exhibited a higher disposition effect.

Keywords: Disposition effect, experiments, farmers

1 Introduction

On arable farms, great amounts of storable goods are produced. In the last years, about 50% of these goods were not sold immediately during harvest time but rather stored and sold during the year (LfL, 2016). To identify the optimal time to sell stored goods is one of the most essential decisions, significantly affecting the economic success of farmers. Due to the increasing price volatility of agricultural markets in the last decade (FAO *et al.*, 2011; Haile *et al.*, 2016), developing an optimal sales strategy becomes crucial for the competitiveness of farms.

The optimal timing for selling stored agricultural products has been investigated in various studies. For example, Tronstad and Taylor (1991) analyze the influence of taxes on storing and selling decisions of grain. Benirschka and Binkley (1995) determine efficient storing strategies depending on the distance to the market. Furthermore, Fackler and Livingston (2002) derive optimal decisions for selling goods based on the real options approach, and Loy *et al.* (2015) develop marketing strategies for wheat depending on its quality. While the influence of economic factors on selling decisions is broadly examined, only little is known about psychological and behavioral aspects that may influence farmers' selling decisions. Studies from the field of behavioral economics show that decisions can substantially diverge from theoretical expectations (Kahneman, 2003).

Emerging evidence that psychological and behavioral issues may be relevant to explain selling decisions of stored goods comes from the field of financial economics. In the finance sector, a common phenomenon is observed: assets are sold if they have increased in value (winners) and are kept if they have decreased in value (losers) in relation to the purchase price. This effect was labelled "disposition effect" by Shefrin and Statman (1985) and it can be partly explained by aspects of Prospect Theory according to Kahneman and Tversky (1979). Prospect theory states that outcomes are classified as gains or losses relative to a reference point, and that decision-makers are risk-averse in the gain context and risk-seeking in the loss context.

The disposition effect in the finance sector has been vastly examined. Ferris *et al.* (1988) investigate the relationship between trading volume at a given time and trading volume in the past at different stock prices. They find strong evidence of a disposition effect. Odean (1998) analyze 10,000 accounts at a discount brokerage house. They notice that private investors show a strong preference for selling stocks that have gained value rather than those that have lost value. The author also indicates that the disposition effect has a significantly harming effect on investors' profits. Garvey and Murphy (2004) confirm the results of Odean (1998) for the behavior of professional traders. Dhar and Zhu (2006) focus on individual private investors and reveal that they suffer from a disposition effect.

The discussion on the disposition effect is adapted to marketing decisions of agricultural stored goods by Mattos and Fryza (2014). In an agricultural context, the disposition effect is present if farmers sell their products more promptly when prices are high and more hesitantly when prices are low. On the one hand, selling too fast could lead to missing the opportunity of selling stored goods at higher prices. On the other hand, farmers could experience losses due to decreasing prices if they waited too long (Mattos and Fryza, 2014). Mattos and Fryza (2014) empirically analyze Canadian farmers' selling behavior based on field data from the Canadian Wheat Board. While they detect a disposition effect in farmers' selling decisions, they cannot confirm that the farmers' behavior lead to lower profits.

Numerous studies in the context of finance and agriculture reveal the existence of a disposition effect based on field data. However, these studies do not contain information on decision-makers' expectations and decisions on an individual level, which are necessary for the examination of the disposition effect and its determinants (Weber and Camerer, 1998). This knowledge gap can be solved in experimental settings. Experiments can be conducted under conditions that are controlled and identical for all participants (Binswanger, 1982). Furthermore, the behavior of each participant can be observed individually (Yavas and Sirmans, 2005).

There are several experiments in which the disposition effect is analyzed for student samples. Weber and Camerer (1998) conduct an experiment in which the shares of risky assets can be traded. They find that students show a tendency to sell assets that gained in value and to keep assets that have dropped in value. In the context of financial and housing markets, Weber and Welfens (2006) reveal that learning and a greater trading experience lead to a mitigated disposition effect. Further experimental investigations of the disposition effect with student samples are carried out by Da Costa *et al.* (2008), Fischbacher *et al.* (2014), Rau (2014) and Rau (2015).

However, results based on experiments with students cannot be easily applied to other groups of participants in general (Belot *et al.*, 2015), entrepreneurs (Barr and Hitt, 1986; Haigh and List, 2005), or farmers (Maart-Noelck and Musshoff, 2014; Hermann and Musshoff, 2016). Furthermore, Bocqueho *et al.* (2013) state that students are a more homogenous group regarding socio-demographic characteristics such as age or education. In addition, Baur *et al.* (2016) find various differences between farmers and the overall population regarding their value orientation.

To the best of our knowledge, there is only one paper that examines farmers' grain selling decisions using an incentivized experiment to investigate a behavioral bias: Mattos and Zinn (2016) experimentally analyze the formation and adaption of reference prices of Canadian grain farmers. Using a historical time series, they find that the reference prices are mainly formed by the current market price, the highest price before the current marketing period, and the farmers' price expectations. Furthermore, their results indicate that the farmers tend to sell proportionally more grain when the current price exceeds the reference price. However, Mattos and Zinn (2016) do not explicitly investigate a disposition effect and do not control for the influencing factors of the observed behavior.

In this context, our objective is twofold: i) the investigation of a disposition effect in the decisions of farmers when selling stored goods and ii) the analysis of factors potentially influencing a disposition effect. Thus, we provide three contributions to the existing literature. First, we experimentally analyze whether or not farmers reveal a disposition effect in their decision to sell stored goods. While empirical studies – mainly based on aggregated price data – show evidence of a disposition effect in the selling behavior of farmers, only an experimental setting can control farmers' underlying beliefs regarding price developments. Second, we adjust the well-proven experimental setting of Weber and Camerer (1998) from financial economics to agricultural economics. This experimental design has not been applied in the agricultural context yet. Third, we investigate potentially influential factors on the disposition effect, especially *Prospect Theory* components and socio-economic variables.

Knowledge of the rationale behind farmers' selling behavior is important, especially for advisory offices seeking to improve their support to farmers. Furthermore, it is essential for farmers to realize behavioral biases in their selling decisions and learn about potential improvements, which could enhance their economic situation in the long-term. Thus, the farms' competitiveness could also be improved. For these reasons, we conduct an incentivized experiment with German farmers to investigate if there is a disposition effect in their selling behavior for stored good and, if it is the case, to determine the drivers of the disposition effect. Therefore, we elicit farmers' risk attitude, probability weighting, as well as their degree of loss aversion according to lotteries proposed by Tanaka *et al.* (2010) and Gächter *et al.* (2007).

In the following section 2, we describe the experimental design, including the experiments for the selling behavior and three lotteries. Thereafter, section 3 gives an overview of the socio-demographic characteristics of the participating farmers and the approach to data analysis is explained. The results are presented in section 4. The paper ends with the conclusions in section 5.

2 Experimental design

The selling behavior of farmers was examined using a computer-based online experiment. The whole experiment consisted of three parts. In the first part, farmers had the opportunity to sell stored products in two sub-experiments. We carried out two different sub-experiments on the disposition effect in order to receive robust information about the farmers' selling behavior. In addition, the diverging framework conditions of the two sub-experiments approximate to varying situations in reality. Our experimental design is quite defendable since it is based on well-proven experiments of Weber and Camerer (1998) as well as Weber and Welfens (2006). In the second part of the experiment, the farmers' risk attitude, probability weighting, and degree of loss aversion were measured using lottery tasks following Tanaka *et al.* (2010) (TCN) and Gächter *et al.* (2007) (GJH). The order of these tasks was randomised to control for potential order effects. In the last part, sociodemographic and farm-specific information was gathered. Figure 1 reveals the experimental procedure for each farmer. The experimental parts are described in detail in the following section. Furthermore, a more detailed description of the experimental instructions is given in the appendix.

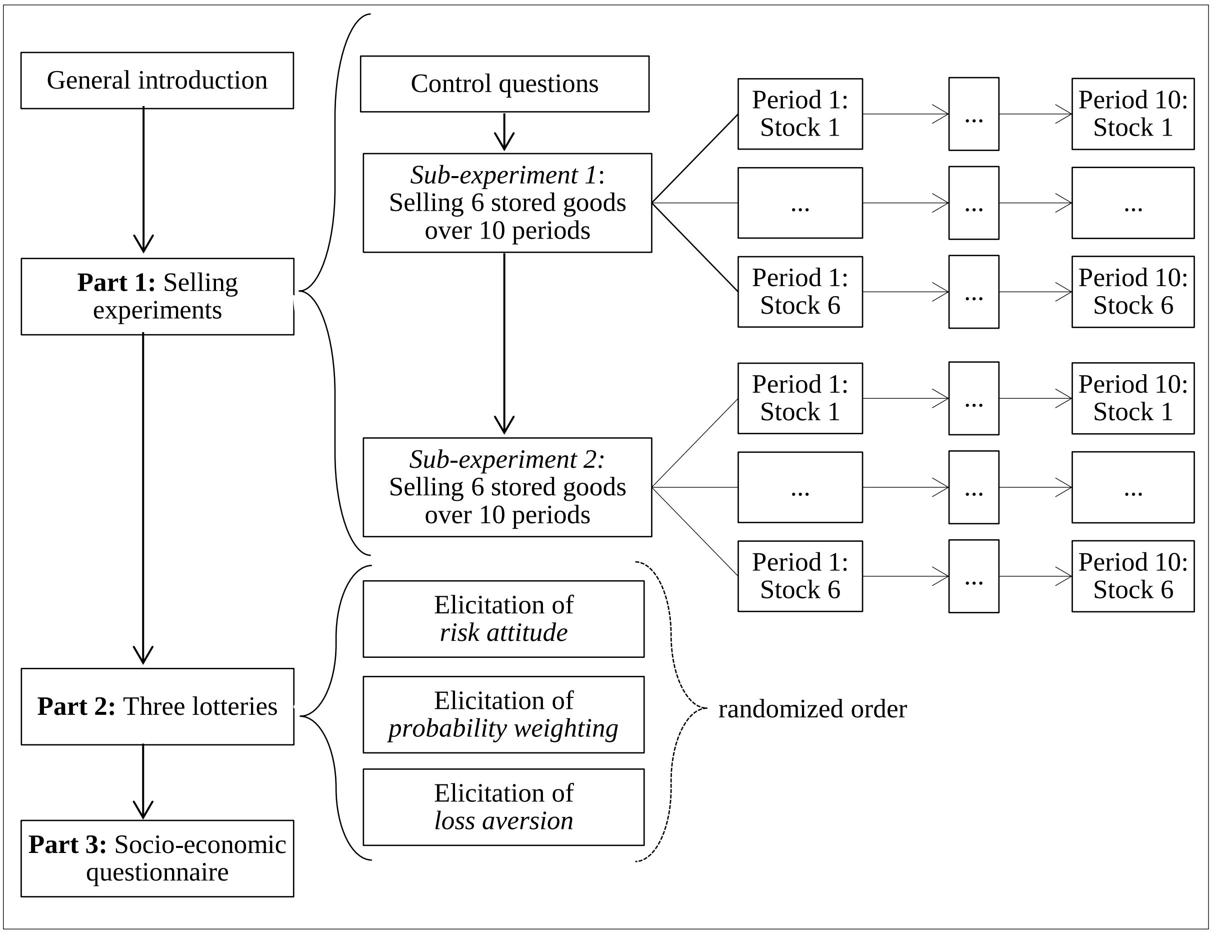

Figure 1. Visual description of the experiment

2.1 Structure of the sub-experiments of selling stored farming products

In two sub-experiments, farmers had to decide when to sell six farming products that had been stored in six stocks of an equal size. The farmers had to sell these stored products during a time span of 10 periods. Each of the six stocks was 100% full at the beginning of each sub-experiment. Beginning from period 1, farmers could sell distinct shares of the six goods in

10% intervals of the initial stocks. These shares could differ for the six goods and in every period. For example, farmers could sell 10% of the first good and 20% of the second good in period 1 and in the subsequent period 2, they could sell 20% of good 1 and 10% of good 2. The farmers were made aware that they had to sell all remaining stocks in the last period 10 in each sub-experiment. All shares that had not been sold until period 10 were automatically sold for the current price in period 10.[1] In addition, for reasons of simplicity, it was assumed that production costs for the six goods were equal and amounted to 15 € per decitonne (dt).[2] On the one hand, the consideration of production costs made the experiment more realistic; on the other hand, the production costs could be used by the farmers as a reference price for their selling decisions. This is important for the examination of the disposition effect. Furthermore, the farmers were informed that prices of the six goods developed independently from each other and accordingly with prescribed probabilities. These framework conditions were equal for both sub-experiments. However, there were differences regarding the price developments and information concerning these price developments in both sub-experiments.

The participating farmers' general understanding regarding the setup of the experiment was tested using control questions. They were only approved to take part in the experiment if they had answered all of the control questions correctly. In addition, the farmers had the opportunity to read the experimental instructions again during the whole experiment by clicking on a link. Lastly, the farmers could evaluate their success after finishing each sub-experiment. They were shown the average selling prices for the six goods resulting from their decisions.

2.1.1 Disposition effect sub-experiment 1

In the first sub-experiment, farmers observed the price development for the six farming activities over 14 periods altogether. Farmers had the possibility to compare the observed prices to their production costs to determine whether a sale resulted in a loss or gain. Furthermore, the amount of gains and losses was observed. This could serve as a rational basis for the selling decision. During the first four periods (-3 to 0), participants could only observe the price developments but they did not have the possibility to sell their goods. This way, farmers were provided historical information on the price developments of their goods.

Starting from a selling price of 15 €/dt for all six goods, prices changed from period to period by ± 0.50 €/dt, ± 1.50 €/dt or ± 2.50 €/dt. These three levels of price changes were equally

[1] To achieve more realistic framework conditions, stores had to be exhausted due to the beginning of the subsequent harvest period.
[2] Thus, our experiment has the advantage of equal portfolio costs compared to the stock experiment of Weber and Camerer (1998).

likely with a probability of 1/3 respectively. The levels of price changes occurred independently for the six products. Additionally to the level of price changes, the tendency of the price developments was determined by different probabilities of increasing prices across the goods. Two goods revealed positive price trends due to a probability of price increase of 65% ("++") and 55% ("+"). Two goods fluctuated around the starting price of 15 €/dt ("0") with a 50% probability of rising prices. Furthermore, two goods exhibited negative price trends with a probability of increasing prices of 45% ("-") and 35% ("--"). Since the prices never remained the same in the subsequent period, the probability of a price decrease amounted to one minus the respective probability of a price increase. These probabilities of price increase and decrease were constant for each good during all periods of the first sub-experiment. The prices for the six goods moved independently from each other. In addition, the probabilities of a price increase were not correlated with the level of a price change.

Although the farmers were made familiar with the probabilities for a price increase and a price decrease, they did not know which probability belonged to which good.[3] Nevertheless, the farmers could guess by counting and comparing the number of price increases in the previous periods. These guesses could be updated in every new period as new price information became available from period to period. In Figure 2, the total price developments of the goods in sub-experiment 1 are shown. These were not provided to the farmers; they were only able to see the former periods' prices. The order of the goods in Figure 2 corresponds to the order of goods in the experiment. The development of prices for the six goods was specified before the experiment started following Weber and Camerer (1998). This predetermination of price developments ensured that the framework conditions were equal for all farmers as they all faced the same price developments. This also facilitated the comparison of results across the farmers.

[3] The knowledge on the probabilities is a key feature of the experimental design of Weber and Camerer (1998) in order to provide controlled framework conditions for the beliefs and expectations of participants.

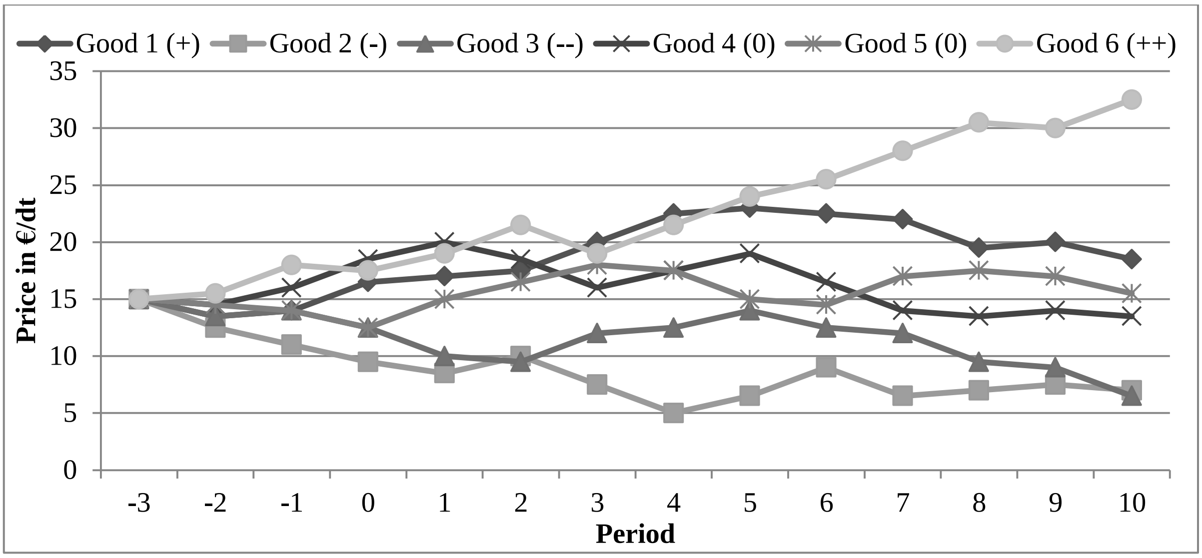

Figure 2. Price development of goods used in sub-experiment 1 for all participants

2.1.2 Disposition effect sub-experiment 2

In comparison to the first sub-experiment, the second sub-experiment revealed three substantial differences. First, farmers were not provided historical price information. Second, the level of price changes amounted to ± 1 €/dt instead of the three possible levels of the first sub-experiment. Third, price developments did not follow the types of sub-experiment 1 anymore. Instead, the prices for all six goods were equally likely to rise or fall in a specific period while these probabilities changed in every period. The probabilities for a price increase were provided to the farmers and they are shown in Table 1. The probability of a price increase diminished from period to period. Thus, the decision situation for the farmers can be described as follows: from period 0 to period 1, prices increased with a probability of 75%. If farmers decided not to sell the total stored goods in period 1, they moved on to period 2, where they knew that the probability of a price increase from period 1 to period 2 declined to 70%. This continued until a probability of a price increase of 30% in the last period. Following the argumentation of Weber and Welfens (2006), each period can be compared to a lottery with farmers gambling for a gain or loss with a certain probability. The gain or loss amounted to 1 €/dt; this was the value by which the price increased or decreased from period to period.

Despite the equal chances for a price increase of all six goods, the prices developed independently, resulting in different price movements for the six goods. The resulting price developments are shown in Table 1. As in sub-experiment 1, they were predetermined before the experiment started but not shown to the participants.

Table 1. Probabilities of price increases and price developments of goods in sub-experiment 2 for all participants

Period	0	1	2	3	4	5	6	7	8	9	10
Probability for a price increase from period to period		75%	70%	65%	55%	50%	48%	45%	40%	35%	30%
Good 1	15	16	15	16	15	14	13	14	13	14	15
Good 2	15	14	15	16	17	16	15	14	15	14	13
Good 3	15	14	13	14	15	16	15	14	13	14	15
Good 4	15	16	15	16	17	16	15	16	15	14	13
Good 5	15	14	15	16	17	16	17	16	15	16	15
Good 6	15	16	15	14	13	14	15	16	17	18	17

2.2 Structure of the three lotteries

The farmers' individual risk attitude, probability weighting, and degree of loss aversion were determined using the lotteries described in this section.

2.2.1 Tasks to elicit risk attitude and probability weighting

The first two lotteries were taken from Tanaka *et al.* (2010). Participants were asked to decide between a safer lottery A and a riskier lottery B (see Table 2) in each row. The 28 rows were divided into two independent series with 14 rows each.[4] In consecutive rows in both series, the winning probabilities remained constant. However, one of the two possible payout amounts in lottery B varied. Consequently, the expected values of lottery A remained constant within a series, whereas the expected values in lottery B varied from row to row.

Following Tanaka *et al.* (2010), it was assumed that the participating farmers' utility was defined as follows:

$$U(x_1, p, x_2, 1\text{-}p) = w(p)v(x_1) + [1 - w(p)]v(x_2) \qquad \text{with } x_1 \geq x_2 \geq 0, \qquad (1)$$

$$\text{where } v(x) = x^{\sigma} \qquad \text{and} \qquad (2)$$

$$w(p) = 1/\exp[\ln(1/p)^{\gamma}] \qquad \text{with } p \in (0, 1). \qquad (3)$$

Equation (1) depicts the utility function with monetary outcomes x_1 and x_2 with the corresponding probabilities p and $1\text{-}p$. A utility for gains was assigned by a power function (equation (2)). The parameter σ represents the curvature of the value function. It depicts the participating farmers' risk attitude with $\sigma > 1$ for risk-seeking behavior, $\sigma = 1$ for risk neutrality, and $\sigma < 1$ for risk aversion.

[4] We reduced the TCN method to two series instead of three series as in the original TCN method. The third series of the original TCN method considers loss aversion. For measuring the degree of loss aversion, we conducted the GJH task instead to provide the participants the opportunity to reject any loss if they preferred.

Probabilities were weighted with the probability weighting function $w(p)$ developed by Prelec (1998) as shown in equation (3). The parameter γ represents an estimate of probability weighting. If $\gamma < 1$, the probability weighting function is inverted s-shaped. This means that participants overweight small probabilities and underweight large probabilities. In the opposite case, $\gamma > 1$, participants underweight small probabilities and overweight large probabilities. If $\gamma = 1$, subjects weighted probabilities linearly as it is assumed in expected utility theory. Based on these assumptions, the farmers' switching points from lottery A to lottery B could be used to determine the participating farmers' individual risk attitude and probability weighting.[5]

Table 2. Payout matrix of the TCN task

	Lottery A	Lottery B	EV (A)[a)]	EV (B)[a)]
Series 1				
1	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 68	€ 19	€ 11.30
2	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 75	€ 19	€ 12.00
3	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 83	€ 19	€ 12.80
4	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 93	€ 19	€ 13.80
5	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 103	€ 19	€ 14.80
6	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 125	€ 19	€ 17.00
7	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 150	€ 19	€ 19.50
8	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 185	€ 19	€ 23.00
9	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 220	€ 19	€ 26.50
10	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 300	€ 19	€ 34.50
11	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 400	€ 19	€ 44.50
12	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 600	€ 19	€ 64.50
13	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 1,000	€ 19	€ 104.50
14	30% winning € 40 and 70% winning € 10	90 % winning € 5 and 10 % winning € 1,700	€ 19	€ 174.50
Series 2				
1	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 54	€ 39	€ 39.30
2	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 56	€ 39	€ 40.70
3	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 58	€ 39	€ 42.10
4	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 60	€ 39	€ 43.50
5	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 62	€ 39	€ 44.90
6	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 65	€ 39	€ 47.00
7	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 68	€ 39	€ 49.10
8	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 72	€ 39	€ 51.90
9	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 77	€ 39	€ 55.40
10	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 83	€ 39	€ 59.60
11	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 90	€ 39	€ 64.50
12	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 100	€ 39	€ 71.50
13	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 110	€ 39	€ 78.50
14	90% winning € 40 and 10 % winning € 30	30% winning € 5 and 70% winning € 130	€ 39	€ 92.50

[a)] This column was not shown to the participants.

[5] For detailed explanation, please refer to Liu (2013).

2.2.2 Task to elicit loss aversion

In lottery three, loss aversion was elicited using the GJH task. The general design of the GJH task is illustrated in Table 3. Farmers had to decide in each row whether they preferred to take part in the lottery or not. In all 10 lotteries, participants could experience a loss with a 50% chance or realize a gain of 60 € with a probability of 50%. The probabilities for losses and gains as well as the amount of gain (60 €) were constant across all lotteries. However, the potential loss increased from 12 € in the first lottery to 70 € in the last lottery.

Table 3. GJH task

Lottery	Loss with a probability of 50 %	Gain with a probability of 50 %	Accept	Reject	Range of loss aversion coefficient (λ) if switching to reject in this row [a)]
1	€ 12	€ 60	( )	( )	$5.00 \leq \lambda \leq \infty$
2	€ 15	€ 60	( )	( )	$4.00 \leq \lambda \leq 5.00$
3	€ 20	€ 60	( )	( )	$3.00 \leq \lambda \leq 4.00$
4	€ 25	€ 60	( )	( )	$2.40 \leq \lambda \leq 3.00$
5	€ 30	€ 60	( )	( )	$2.00 \leq \lambda \leq 2.40$
6	€ 35	€ 60	( )	( )	$1.71 \leq \lambda \leq 2.00$
7	€ 40	€ 60	( )	( )	$1.50 \leq \lambda \leq 1.71$
8	€ 50	€ 60	( )	( )	$1.20 \leq \lambda \leq 1.50$
9	€ 60	€ 60	( )	( )	$1.00 \leq \lambda \leq 1.20$
10	€ 70	€ 60	( )	( )	$0.86 \leq \lambda \leq 1.00$

[a)] This column was not shown to the participants. As in Gächter *et al.* (2007), the exponents σ and β as indicators for risk aversion in the gain (σ) and loss (β) domain are equated ($\sigma = \beta$) for deriving λ.

2.3 Financial incentives

Prior to the start of the two sub-experiments and the lotteries, the farmers were informed about the 10 % chance to earn a cash payout and its composition. Providing financial incentives improved the external validity of the experiment since it created more realistic framework conditions for the participants (Levitt and List, 2007; Roe and Just, 2009).

The cash payout consisted of three components that were added up: a payout from the two sub-experiments, a payout from one randomly chosen lottery, and a fixed payout of 70 €. The fixed payout was determined to ensure that the randomly drawn winners could not receive a negative payout from the lotteries in total.

The payout from the storage sub-experiments depended on the farmer's average selling prices of the six goods in both sub-experiments. The production costs of 15 € were subtracted from the average selling prices of the six goods. This difference was multiplied by 100 and rounded to whole Euros. In addition, the farmers were informed that if they had experienced losses in the two sub-experiments, they did not receive a payout from the storage experiment.

Additionally to the earnings from the storage experiments, participants received a cash payout from the lottery section. The potential earnings from one randomly chosen lottery arose from the task formulation. A random row of the drawn lottery was carried out to obtain the payout amount of this part. In total, payouts up to 2,027 € were possible.

3 Descriptive statistics and approach to data analysis

This section gives an overview of the sample of farmers and describes our approach to data analysis.

3.1 Descriptive statistics

The online experiment was conducted with German farmers in October 2016. In total, 112 farmers participated, with an average completion time of about 35 minutes. The descriptive statistics of the farmers and their farms are shown in Table 4.

Table 4. Descriptive statistics [a)]

Variable	Mean	Standard deviation	Minimum	Maximum
Farm land (ha) [b)]	220.95	350.48	0.00	2300.00
Share of rented farm land (%)	46.71			
Full-time farmer (%)	75.00			
Farm manager (%)	91.07			
Share of sold grain before harvest (%)	25.07			
Share of sold grain during harvest (%)	27.48			
Share of sold grain after harvest (%)	40.94			
Age [b)]	36.29	11.30	20.00	65.00
Male farmers (%)	91.96			
University degree (%)	62.50			
Switching point in GJH task	6.49	2.13	0.00	10.00
Loss aversion (λ)	1.88	0.82	0.68	5.50
Switching point in TCN task 1	7.39	2.95	0.00	14.00
Switching point in TCN task 2	7.04	3.74	0.00	14.00
Risk attitude (σ)	0.68	0.26	0.10	1.35
Probability weighting (γ)	0.71	0.22	0.05	1.45

[a)] $n = 112$

[b)] $n = 111$

The sample reveals a few differences in comparison to the German average. For example, the mean farm land of 220.95 ha exceeds the German average of 55.8 ha (Statistisches Bundesamt, 2011). On average, the farmers in the sample are 36.29 years old and are thus younger than the average German farmers (53 years old) (AgriDirect, 2013). The share of farmers with a university degree totals 62.50%, which exceeds the German share of 10% (Statistisches

Bundesamt, 2011). The large share of highly educated farmers and the low average age are typical characteristic of samples generated with online experiments. Access to the internet and the participation in online-experiments are, at least to some extent, linked to higher education and a younger age (Granello and Wheaton, 2004). In Table 4, the selling behavior of farmers in reality is also revealed. On average, 25.07% of grain is sold before harvest. During harvest, on average 27.48% is sold immediately, and 40.94% is sold during the year after harvest.

Afterwards, the results from the lottery are examined. The farmers reveal risk-averse behavior, which is shown with σ amounting to 0.68 on average. Furthermore, the coefficient for probability weighting (γ) amounts to 0.71, indicating that the participating farmers overweight small probabilities and underweight large probabilities. In addition, the degree of loss aversion (λ) is derived from the GJH amounting to 1.88 on average. This implies that farmers are loss-averse and perceive the negative utility from losses 1.88 times higher than the positive utility for gains of an equal amount.

3.2 Approach to data analysis

First, disposition effects were calculated assuming that farmers used the production costs as reference point. The analysis followed Odean (1998), Weber and Camerer (1998) and Rau (2015) in order to investigate farmers' tendency of realizing gains faster than losses. Therefore, we determined the proportion of gains realized (PGR) and the proportion of losses realized (PLR). The PGR (PLR) is the number of realized gains (losses) divided by the total number of possible gains (losses) that could have been sold. In accordance with Odean (1998), Weber and Camerer (1998) and Rau (2015) it can be defined as follows:

$$Proportion\ of\ Gains\ Realized\ (PGR) = \frac{Realized\ Gains}{Realized\ Gains + Paper\ Gains} \tag{4}$$

$$Proportion\ of\ Losses\ Realized\ (PLR) = \frac{Realized\ Losses}{Realized\ Losses + Paper\ Losses} \tag{5}$$

We calculated individual-level disposition effects (DE) for all farmers as the difference between the PGR and PLR:

$$DE = PGR - PLR \tag{6}$$

The DE measure is restricted to a range between −1 and 1. Farmers with DE = 1 (−1) realized all gains (losses) immediately, whereas they never realized losses (gains). For investors with DE = 0, PGR and PLR were equal.

4 Results

First, we analyze if farmers exhibit a disposition effect when selling stored goods. Each of the 112 participating farmers in both sub-experiments sold six goods over 10 periods. Thus, 6,720 decisions per sub-experiment are evaluated. Table 5 displays the results of this analysis. The respective indices refer to sub-experiments 1 and 2.

Table 5. Disposition effect of farmers in sub-experiments 1 and 2 [a,b)]

	Mean	Standard deviation	First quartile	Median	Third quartile	t-test p-value
DE_1	0.183	0.190	0.070	0.163	0.263	< 0.001***
PGR_1	0.330	0.170	0.231	0.292	0.380	
PLR_1	0.150	0.070	0.108	0.124	0.161	
DE_2	0.171	0.141	0.083	0.156	0.239	< 0.001***
PGR_2	0.270	0.130	0.199	0.260	0.320	
PLR_2	0.100	0.070	0.058	0.094	0.135	
H_0: $DE_1 = DE_2$						0.500

a) 6,720 selling decisions per sub-experiment

b) * p < 10%, ** p < 5%, *** p < 1%

In sub-experiment 1, the mean PGR_1 amounts to 0.330 and the mean PLR_1 is 0.150. This leads to an average individual-level DE of 0.183. A t-test indicates that the disposition effect is significantly different from zero ($p < 0.001$). As DE is found to be greater than zero, it can be stated that the farmers tend to realize gains more eagerly than losses. The results of sub-experiment 1 are furthermore verified by qualitatively equal results of sub-experiment 2. In this sub-experiment, an average individual-level disposition effect DE_2 of 0.171 is estimated. The hypotheses that the measurements are equal for both sub-experiments cannot be rejected for DE ($p = 0.346$).

Thus, the results of both sub-experiments provide evidence of a disposition effect in farmers' selling behavior. These results confirm qualitatively the findings of Mattos and Fryza (2014) who find an average DE-measure in farmers' behavior close to 0.02 based on panel data provided by a wheat marketer. Odean (1998) determine a PGR of 0.449 and a PLR of 0.281 for an entire year investigation of private investors. This leads to a DE of 0.168, which is quite close to our estimated value for DE.

After a disposition effect in farmers' behavior is verified, we further analyze the drivers of this effect using the DE-measure in a joint analysis for both sub-experiments. Moreover, we investigate the influencing factors on PGR and PLR jointly for both sub-experiments. The regression results of the linear regressions are presented in Table 6.

The results for the determinants of the DE-measure indicate that loss aversion (λ) has a significantly positive influence on the disposition effect. This means that more loss-averse farmers tend to show a more pronounced disposition effect. Rau (2014) also explains differences in the extend of the disposition effect with different levels of loss aversion. Taking into account the PGR measure, our results reveal that more loss-averse farmers sell those goods more often that yield in profits. In contrast, a significant influence of loss aversion on PLR could not be detected. This is surprising since a relation between PLR and loss aversion would appear obvious. However, looking at the Prospect Theory, it could also be argued that participants are risk-seeking in the loss domain while they are risk-averse in the gain domain. Therefore, missing profits may be more harmful for loss-averse farmers than realizing a higher loss when a loss already exists. Thus, the evaluation of losses might be dependent on the relative price of the stock. If the price of the stock exceeds the costs, a price decrease would be associated with a greater utility loss compared to a price decrease for stocks already in deficit.

Furthermore, the results show that older farmers exhibit a higher disposition effect indicated by a greater DE. This is reasoned with the significant positive influence of “age” on the PGR. Older farmers usually have higher experience with selling decisions. Also, in the context of socio-demographic variables, it is found that farmers who hold a university degree have a higher PLR, though an influence on the disposition effect is not found. In this case, a higher PLR means that educated farmers realize more losses than farmers who do not hold a university degree, which is a positive feature regarding the disposition effect.

Regarding farm-specific determinants, the results indicate that farmers who run a larger farm and farmers who have higher share of rented farm land reveal a higher tendency of realizing gains. Moreover, farmers who sell a higher share of their grain during the year on their farms reveal a lower disposition effect. This is caused by a lower tendency of selling at gains more often, i.e. PGR is lower. Therefore, our results are in line with insights from the literature since more experienced traders are found to expose a lower disposition effect (Shapira and Venezia, 2001; Dhar and Zhu, 2006; Weber and Welfens, 2006). However, in those studies, the inference was not made for farmers, but for individual and private investors as well as for students.

Furthermore, the dummy-variable “sub-experiment” does not show a significant effect on the disposition effect, but rather on PGR and PLR. Both PGR and PLR are less pronounced in sub-experiment 2. This underlines the results of the prior analysis (cf. Table 5).

Finally, the adjusted R^2 of 0.036 indicates that there are other main drivers of the disposition effect that we did not detect. Weber and Welfens (2006) as well as Dhar and Zhu (2006) also have a comparatively low R^2 for their regression on the DE-measure.

Table 6. Influencing factors on DE, PGR and PLR for both sub-experiments [a)]

	DE_{total}			PGR_{total}			PLR_{total}		
	Estimate	**Standard error**	**p-value**	**Estimate**	**Standard error**	**p-value**	**Estimate**	**Standard error**	**p-value**
Intercept	0.029	0.091	0.754	0.140	0.081	0.087*	0.111	0.041	0.007***
Loss aversion (λ)	0.028	0.015	0.063*	0.030	0.013	0.026**	0.002	0.007	0.769
Risk attitude (σ)	0.041	0.051	0.420	0.051	0.045	0.258	0.010	0.023	0.650
Probability weighting (γ)	0.072	0.052	0.171	0.065	0.047	0.167	-0.007	0.023	0.755
Male farmer [b)]	-0.046	0.043	0.279	-0.044	0.038	0.245	0.002	0.019	0.915
Age	0.003	0.001	0.003***	0.003	0.001	0.001***	$-1.254e^{-4}$	0.001	0.803
Study [b)]	0.002	0.025	0.938	0.021	0.022	0.346	0.019	0.011	0.087*
Farm land	$4.140e^{-5}$	$3.550e^{-5}$	0.245	$5.750e^{-5}$	$3.170e^{-5}$	0.071*	$1.610e^{-5}$	$1.580e^{-5}$	0.310
Share of rented land	0.001	$3.782e^{-4}$	0.145	0.001	$3.307e^{-4}$	0.080*	$3.970e^{-5}$	$1.682e^{-4}$	0.814
Share of sold grain during the year (in reality)	-0.001	$3.606e^{-4}$	0.069*	-0.001	$3.214e^{-4}$	0.073*	$7.940e^{-5}$	$1.604e^{-4}$	0.621
Share of sold grain before harvest (in reality)	$6.010e^{-5}$	$4.876e^{-4}$	0.902	$8.410e^{-5}$	$4.345e^{-4}$	0.847	$2.400e^{-5}$	$2.169e^{-4}$	0.912
Full-time farmer [b)]	0.038	0.029	0.189	-0.037	0.026	0.154	0.001	0.013	0.921
Farm manager [b)]	-0.046	0.045	0.304	-0.033	0.040	0.413	0.013	0.020	0.500
Sub-experiment [c)]	-0.010	0.022	0.648	-0.057	0.020	0.005***	-0.047	0.010	< 0.001***
	$R^2 = 0.093$; Adjusted $R^2 = 0.036$; F = 1.620 on 13 and 206 degrees of freedom, p-value = 0.082			$R^2 = 0.143$; Adjusted $R^2 = 0.090$; F = 2.650 on 13 and 206 degrees of freedom, p-value = 0.002			$R^2 = 0.128$; Adjusted $R^2 = 0.073$; F = 2.330 on 13 and 206 degrees of freedom, p-value = 0.007		

a) * p < 10%, ** p < 5%, *** p < 1%

b) Dummy variable; 1 = yes, 0 = no

c) Dummy variable; 1 = sub-experiment 2, 0 = sub-experiment 1

5 Conclusions

In agriculture, it is a common practice to store harvested goods and sell them during the year. For selling decisions, the literature of financial economics provides evidence of a disposition effect; a behavioral bias which harms the profit of investors. While the disposition effect has been analyzed through empirical and experimental research in finance and other sectors, it has not been investigated extensively yet in agriculture. To close this research gap, we conducted an online experiment in which we adapted an established experiment from financial economics to agricultural decision situations to examine the disposition effect among farmers. In an incentivized experiment, 112 farmers participated and decided when to sell their stored goods, while underlying characteristics of price movements were familiar to them. We also elicited risk aversion, probability weighting, and loss aversion to analyze a relation between these preferences and the selling behavior.

Our results show a robust disposition effect in farmers' selling decisions. This behavioral bias fundamentally affects the economic situation of farms and the whole agricultural sector. However, only a few determinants are found to influence the level of the disposition effect. Thus, we must be cautious when deriving direct implications for policy, advisory offices, and farmers. For instance, a university degree, i.e. higher education, does not significantly mitigate the effect. However, we found that loss aversion is one of the key drivers of the disposition effect, and thus determinants of financial loss aversion could be addressed in order to reduce the disposition effect in farmers' selling decisions. Due to its harmful financial consequences, we also argue that specific advisory services and education of farmers are required to mitigate the disposition effect, which could improve the economic situation of farms.

Particularly due to the importance of the disposition effect, further research should i) investigate additional factors that might influence the disposition effect of farmers. For instance, psychological factors, such as regret and pride as evaluated by Summers and Duxbury (2012), could be taken into account. ii) The determinants of financial loss aversion should be examined more extensively to provide helpful starting points to diminish the disposition effect. iii) Our results could be validated in further studies using different experimental designs or preference measures, and with farmers from other countries.

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Appendix. Detailed experimental instructions

Translation from German to English

Welcome to our experiment!

Dear farmer,

We welcome you to our experiment and are delighted that you are contributing to agricultural research with your participation.

The aim of this experiment is to gain insights into the decision-making behavior of agricultural entrepreneurs through the decisions you will make. We are interested in how sales decisions are made for stored farm products.

The experiment will take about 25 minutes and consists of three parts:

1. Two sub-experiments regarding the sale of stored farm products
2. Three lotteries
3. Short questionnaire on personal and farm characteristics

If you complete the entire experiment, you get the chance of winning a three-figure cash premium.

Of course, your data will be treated confidentially and analysed anonymously. *[…]*

General information

Suppose you have stored six different goods from the harvest. In the following two sub-experiments, you have the opportunity to sell these six goods and thus reduce your stocks. Each stock is 100% filled at the beginning of each sub-experiment. The six stored goods can be sold during a defined time span. During this time, the prices of the six goods fluctuate independently of one another and with given probabilities. At the end of each sub-experiment, all remaining stocks will be sold.

Chance of gaining a cash payout

Participation in the experiment is linked to financial incentives. At the end of the experiment, 10% of the participants will be randomly drawn to receive a cash payout. The cash premium consists of three parts:

1. Fixed payout of 70 €.
2. Payout from selling experiment

3. Payout from one randomly chosen lottery

The cash payout from the selling experiment depends on the average price you obtained for each of the goods at the end of each sub-experiment. This average price gives you an idea of how successfully you could sell the goods. The mean of these average prices again indicates how profitable you have sold your entire inventory. For this reason, you are paid according to the mean value of your average selling prices obtained for the stored goods. If you are randomly chosen to receive the cash payout, the difference between the average value of your price minus the production costs serves as the basis for calculating your premium. This amount will be multiplied by 100 for your bonus and paid to you after the experiment.

Example:

You sell your goods for average prices per decitonne (dt) of 10 €, 15 €, 15 €, 20 €, 20 € and 25 €. Thus, the average price amounts to (10 +15 + 15 + 20 + 20 +25)/6 = 17.50 €. The costs amount to 15 €. Therefore, you gain 17.50 € - 15 € = 2.50 €. This gain is multiplied by 100 and thus, you would receive 250 € if you were randomly chosen. *[…]*

Part 1 [Two sub-experiments regarding selling stored farm products]

Introduction to sub-experiment 1

Framework conditions

In the first part of the experiment, you observe the price for the stored goods over a period of 14 periods. There are four periods (-3 to 0) before harvest. This means that you have information on the past development of the prices for the six goods. In these periods, however, you cannot sell goods yet. Starting with period 1, you have the opportunity to sell your goods and reduce your stocks. In each period, you can sell any share of your six goods in 10% increments of the initial stock. You can sell the six goods independently from each other and you can sell different parts of the goods in the periods, e.g. 40% of good 1 and 20% of good 2. Evidently, you can sell your stocks only once: if you have already sold 40% of the stock of a good, only 60% of your initial stock is available and can be sold.

In your sales decisions, take into account that you have not produced the stored goods without expenditure. The production of the goods costs 15 €/dt and this is the same for each of the six stored goods.

Price development and selling decision

Prices for goods 1 to 6 will change in the beginning of each period. Price developments are independent from your selling decisions. In addition, selling decisions of other participants do not influence the goods' price developments. From period to period, prices increase or decrease by 0.50 €/dt, 1.50 €/dt or 2.50 €/dt with an equal probability of 33.33%, respectively.

Each of the goods follows a specific pattern type. The types differ since at the beginning of each period, prices increase or decrease with a different probability. The following table shows the pattern types and contains information on the probabilities of price increases and decreases for the six goods:

Type	Number of stored goods	Probability of a price increase	Probability of a price decrease
++	1	65%	35%
+	1	55%	45%
0	2	50%	50%
-	1	45%	55%
--	1	35%	65%

As it can be seen in the table, one of the price trends for stored goods (1-6) corresponds to the "++" type and one of the price developments for stored goods (1-6) complies with the type "+". For these two goods, the probability of a price increase is 65% and 55%, respectively. Two of the price trends correspond to the type "0", where the price increases with a probability of 50%. Moreover, one of the price trends for stocks (1-6) complies with "-" and one of the price trends for stocks (1-6) corresponds to "--". For these goods the price increases with a probability of 45% or 35%.

The order of the goods in the table does not correspond to the order of the goods in the experiment.

Example:

You suppose that price development of good X corresponds to type "++":

- In the beginning of each period, the probability of a price increase is 65%.
- In the beginning of each period, the probability of a price decrease is 35%.

Period 10 is the last period in which you can sell your goods. During this period, all remaining goods are automatically sold at the current price in period 10.

If you wish to read this introduction again during the experiment, please click on the "Tutorial to sub-experiment 1" in the header.

Control questions

1. What are the production costs of the stored goods? ___ €/dt
2. What is the last possible selling period? ___
3. What is the probability of a price increase or price decrease of 0.50 €/dt? Please round up your answer to a whole number. ___ %

[After answering all control questions correctly, the first sub-experiment starts.]

Example situation for period 1:

Price development

	Price in €/dt from period to period													
Good	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
1	15.0	13.5	14.0	16.5										
2	15.0	12.5	11.0	9.5										
3	15.0	13.5	14.0	12.5										
4	15.0	14.5	16.0	18.5										
5	15.0	14.5	14.0	12.5										
6	15.0	15.5	18.0	17.5										

Your decision in period 1

Good	Stock	Current price per dt	Decision: I sell …
1	100%	17.00 €	___%
2	100%	8.50 €	___%
3	100%	10.00 €	___%
4	100%	20.00 €	___%
5	100%	15.00 €	___%
6	100%	19.00 €	___%

[After finishing the ten periods, the farmers are given information on their average selling prices in the first sub-experiment. Afterwards, sub-experiment 2 starts.]

Introduction to sub-experiment 2

In the second part of the experiment, you are in a situation similar to that of sub-experiment 1. You still have six stored goods that you can sell. The cost of the stored goods (15 €/dt) and the number of sales periods are also the same. Again, period 10 is the last selling possibility. In this period, all remaining stocks are automatically sold at the current price in period 10.

However, the expected price developments have changed. In this sub-experiment, the price developments of the stored goods no longer follow the same pattern as in the previous sub-experiment.

Now all price developments of the stored goods are subject to the same probabilities of price changes. Nevertheless, different price movements will take place, since the prices develop independently of each other.

Over the periods in this sub-experiment, the probability of a price increase declines. The development of the probability of a price increase in each period is shown in the following table.

Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Probability for a price increase	75 %	70 %	65 %	55 %	50 %	48 %	45 %	40 %	35 %	30 %

From period to period, price will increase or decrease by 1 €/dt.

If you need to read this introduction again during the experiment, click on the "Tutorial to sub-experiment 2" in the header.

[Then, sub-experiment 2 starts.]

Example situation for period 1:

Price development

Good	Price in €/dt from period to period									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
Probability for a price increase	75%	70%	65%	55%	50%	48%	45%	40%	35%	30%

Your decision in period 1

Good	Stock	Current price per dt	Decision: I sell …
1	100%	16.00 €	___%
2	100%	14.00 €	___%
3	100%	14.00 €	___%
4	100%	16.00 €	___%
5	100%	14.00 €	___%
6	100%	16.00 €	___%

[After finishing the ten periods, the farmers are given information on their average selling prices in the first sub-experiment. Afterwards, the lotteries start.]

Part 2 [Three lotteries]

Lottery 1

Please choose the lottery you prefer in each row. Lottery A is identical for all rows. In lottery B, the payout amount varies in each row.

[Additionally, the participants were given the possibility to gather information on the potential cash payout from the lottery by clicking on a symbol.]

	Lottery A		Lottery B
1	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 68
2	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 75
3	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 83
4	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 93
5	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 103
6	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 125
7	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 150
8	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 185
9	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 220
10	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 300
11	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 400
12	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 600
13	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 1000
14	30% winning € 40 and 70% winning € 10	A ○ ○ B	90 % winning € 5 and 10 % winning € 1700

Lottery 2

Please choose the lottery you prefer in each row. Lottery A is identical for all rows. In lottery B, the payout amount varies in each row.

[Additionally, the participants were given the possibility to gather information on the potential cash payout from the lottery by clicking on a symbol.]

	Lottery A		Lottery B
1	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 54
2	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5and 70% winning € 56
3	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 58
4	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 60
5	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 62
6	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 65
7	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 68
8	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 72
9	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 77
10	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 83
11	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 90
12	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 100
13	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 110
14	90% winning € 40 and 10 % winning € 30	A ○ ○ B	30% winning € 5 and 70% winning € 130

Lottery 3

Please decide if you would like to take part in the lottery or not for each decision situation. With a probability of 50%, you either win 60 € or you lose a varying amount of money.

[Additionally, the participants were given the possibility to gather information on the potential cash payout from the lottery by clicking on a symbol.]

	Loss **with a probability of 50%**	***Gain*** **with a probability of 50%**	**Accept**	**Reject**
1	€ 12	€ 60	( )	( )
2	€ 15	€ 60	( )	( )
3	€ 20	€ 60	( )	( )
4	€ 25	€ 60	( )	( )
5	€ 30	€ 60	( )	( )
6	€ 35	€ 60	( )	( )
7	€ 40	€ 60	( )	( )
8	€ 50	€ 60	( )	( )
9	€ 60	€ 60	( )	( )
10	€ 70	€ 60	( )	( )

Part 3 [Farm-specific and socio-demographic information]

Part 3a [farm-specific information]

We would like to ask you some questions about your farm. All results of the survey will be analyzed in confidentiality and it will not be possible to draw any inferences from your farm.

How do you run your farm?

○ full-time ○ part-time

How many hectares do you cultivate?

____

What is your production method?

○ conventional ○ organic

Which types of farming do you practice?

○ arable farming

○ fodder production

○ animal farming

○ mixed branches

○ other

Which management position do you have on the farm?

○ farm manager

○ other

How many hectares do you cultivate?

arable land ____ grassland ____

What share of cultivated landed is rented?

arable land ____% grassland ____%

What share of your harvested products do you sell before harvest, during harvest and during the year after harvest?

before harvest ____% during harvest ____% after harvest ____%

Please state the first three numbers of your postal code.

____

Part 3b [personal information]

Finally, we would like to ask you some questions about personal details. All results of the survey will be analyzed in confidentiality. This means that no one can draw inferences concerning your person!

Please indicate your gender.

○ male ○ female

How old are you?

___

How many times have you participated in economic experiments?

○ 0 ○ 1 ○ 2 ○ 3 ○ >3

Please indicate your highest completed level of education.

○ no degree

○ certificate of secondary education

○ secondary school level I certificate

○ qualification for entrance to universities of applied sciences

○ general qualification for university entrance

○ university of applied sciences degree

○ university degree

○ other

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Georg-August-Universität, Göttingen

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Die Wurzeln der **Fakultät für Agrarwissenschaften** reichen in das 19. Jahrhundert zurück. Mit Ausgang des Wintersemesters 1951/52 wurde sie als siebente Fakultät an der Georgia-Augusta-Universität durch Ausgliederung bereits existierender landwirtschaftlicher Disziplinen aus der Mathematisch-Naturwissenschaftlichen Fakultät etabliert.

1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Lehrstühlen zu den folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

Georg-August-Universität Göttingen
Department für Agrarökonomie und Rurale Entwicklung
Platz der Göttinger Sieben 5
37073 Göttingen
Tel. 0551-39-4819
Fax. 0551-39-12398
Mail: biblio1@gwdg.de
Homepage : http://www.uni-goettingen.de/de/18500.html